Software

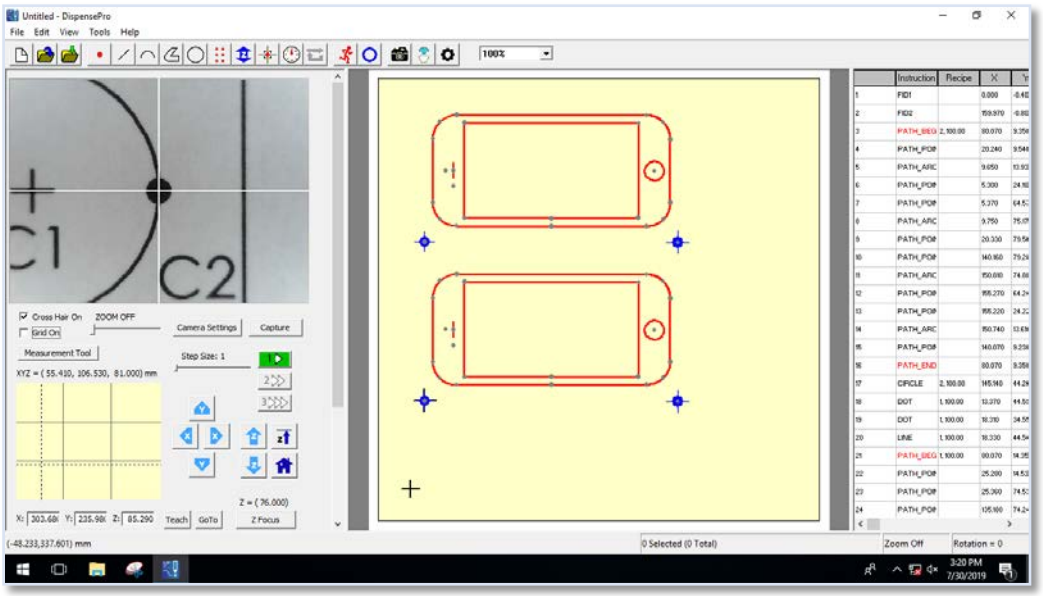
UniXact® Automated Jet Dispense System

3A5914B

EN

Diaphragm-Jet™ Technology

DispensePro™ Software P/N 17X741
For non-contact dispensing of viscous or hotmelt material in industrial environments.
For professional use only.



Important Safety Instructions
Read all warnings and instructions in this manual and all related manuals before using this equipment. Save these instructions.

Table of Contents

Table of Contents

Table of Contents

Table of Contents

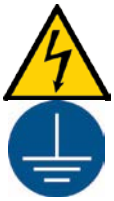
Related Manuals

Manuals are available at www.graco.com. Component manuals below are in English:

3A6244	HV-2100 Jet Setup and Operation
3A6266	HV-2100C Jet Controller Setup and Operation
3A6327	HM-2600 Hotmelt Jet Setup and Operation
3A6166	HM-2600C Hotmelt Jet Controller Setup and Operation
3A5937	Jet Dispensing Parameters Supplement
3A5913	UniXact® Automated Jet Dispense System - Installation
3A6674	UniXact® Automated Jet Dispense System - Parts

Warnings

The following warnings are for the setup, use, grounding, maintenance, and repair of this equipment. The exclamation point symbol alerts you to a general warning and the hazard symbols refer to procedure-specific risks. When these symbols appear in the body of this manual or on warning labels, refer back to these Warnings. Product-specific hazard symbols and warnings not covered in this section may appear throughout the body of this manual where applicable.

⚠ WARNING	
	**MOVING PARTS HAZARD** Moving parts can pinch, cut or amputate fingers and other body parts. ▪ Keep clear of moving parts. ▪ Do not operate equipment with protective guards or covers removed. ▪ Equipment can start without warning. Before checking, moving, or servicing equipment, disconnect all power sources. ▪ Do not load or unload parts or material while the robot is running.
	**ELECTRIC SHOCK HAZARD** This equipment must be grounded. Improper grounding, setup, or usage of the system can cause electric shock. ▪ Turn off and disconnect power cord before servicing equipment. ▪ Connect only to grounded electrical outlets. ▪ Use only 3-wire extension cords. ▪ Ensure ground prongs are intact on power and extension cords.
	**TOXIC FLUID OR FUMES HAZARD** Toxic fluids or fumes can cause serious injury or death if splashed in the eyes or on skin, inhaled, or swallowed. ▪ Read Safety Data Sheets (SDSs) to know the specific hazards of the fluids you are using. ▪ Store hazardous fluid in approved containers and dispose of it according to applicable guidelines.
	**BURN HAZARD** Equipment surfaces and fluid that is heated can become very hot during operation. To avoid severe burns: Do not touch hot fluid or equipment.
	**PERSONAL PROTECTIVE EQUIPMENT** Wear appropriate protective equipment when in the work area to help prevent serious injury, including eye injury, hearing loss, inhalation of toxic fumes, and burns. Protective equipment includes but is not limited to: ▪ Protective eyewear, and hearing protection. ▪ Respirators, protective clothing, and gloves as recommended by the fluid and solvent manufacturer.

Warnings, continued

⚠ WARNING

EQUIPMENT MISUSE HAZARD

Misuse can cause death or serious injury.

- Do not operate the unit when fatigued or under the influence of drugs or alcohol.
- Do not exceed the maximum working pressure or temperature rating of the lowest rated system component. See Technical Specifications in all equipment manuals.
- Use fluids and solvents that are compatible with equipment wetted parts. See Technical Specifications in all equipment manuals. Read fluid and solvent manufacturer's warnings. For complete information about your material, request Safety Data Sheets (SDSs) from distributor or retailer.
- Check equipment daily. Repair or replace worn or damaged parts immediately with genuine manufacturer's replacement parts only.
- Do not alter or modify equipment. Alterations or modifications may void agency approvals and create safety hazards.
- Make sure all equipment is rated and approved for the environment in which it is used.
- Use equipment only for its intended purpose. Contact your distributor for information.
- Route hoses and cables away from traffic areas, sharp edges, moving parts, and hot surfaces.
- Do not kink or over bend hoses or use hoses to pull equipment.
- Keep children and animals away from work area.
- Comply with all applicable safety regulations.

1. DispensePro Home Screen

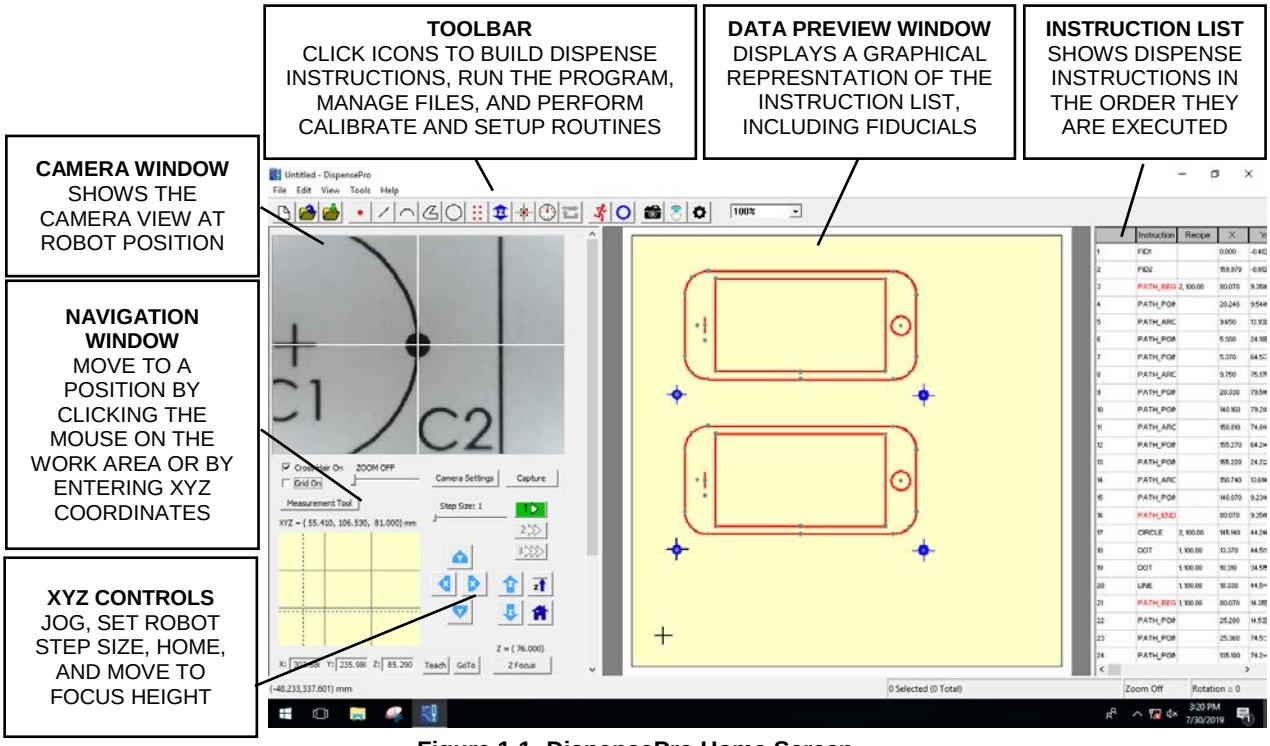


Figure 1-1: DispensePro Home Screen

2. Starting Up DispensePro

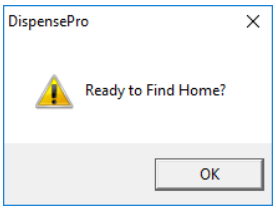
1. Verify that all of the system components are properly installed, including power, pneumatic, and cable connections.

   See the UniXact Automated Dispense System Installation manual (3A5913) for detailed instructions on installation and connections.

2. Power on the system components in this order:
   - Robot (includes camera)
   - Advanjet Controller
   - Monitor
   - (Wait thirty seconds)
   - PC (includes wireless transmitter for keyboard and mouse)

3. From the PC home screen, click the **DispensePro** shortcut icon to start the program.

4. A screen prompt asks for permission to move the XY table.



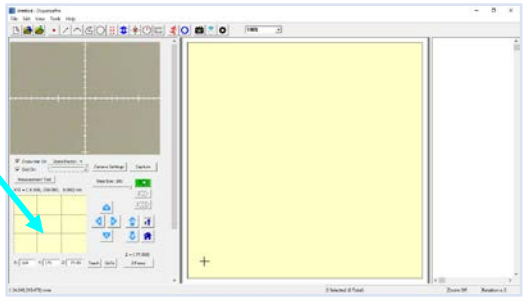
   - The XY table will not move until permission is granted. Click **OK**.
   - The robot moves to the XYZ home position at the left rear corner of the table.

5. In the navigation window of the DispensePro home screen, click a point in the work surface area to move the robot. The robot should move to that location.

6. Install a diaphragm and nozzle plate on the jet before proceeding with system calibration and programming.

   See the HV-2100 Jet manual (3A6244) or the HM-2600 Hotmelt Jet manual (3A6226).

CLICK A POINT ON THE NAVIGATION WINDOW



3. Camera and Navigation

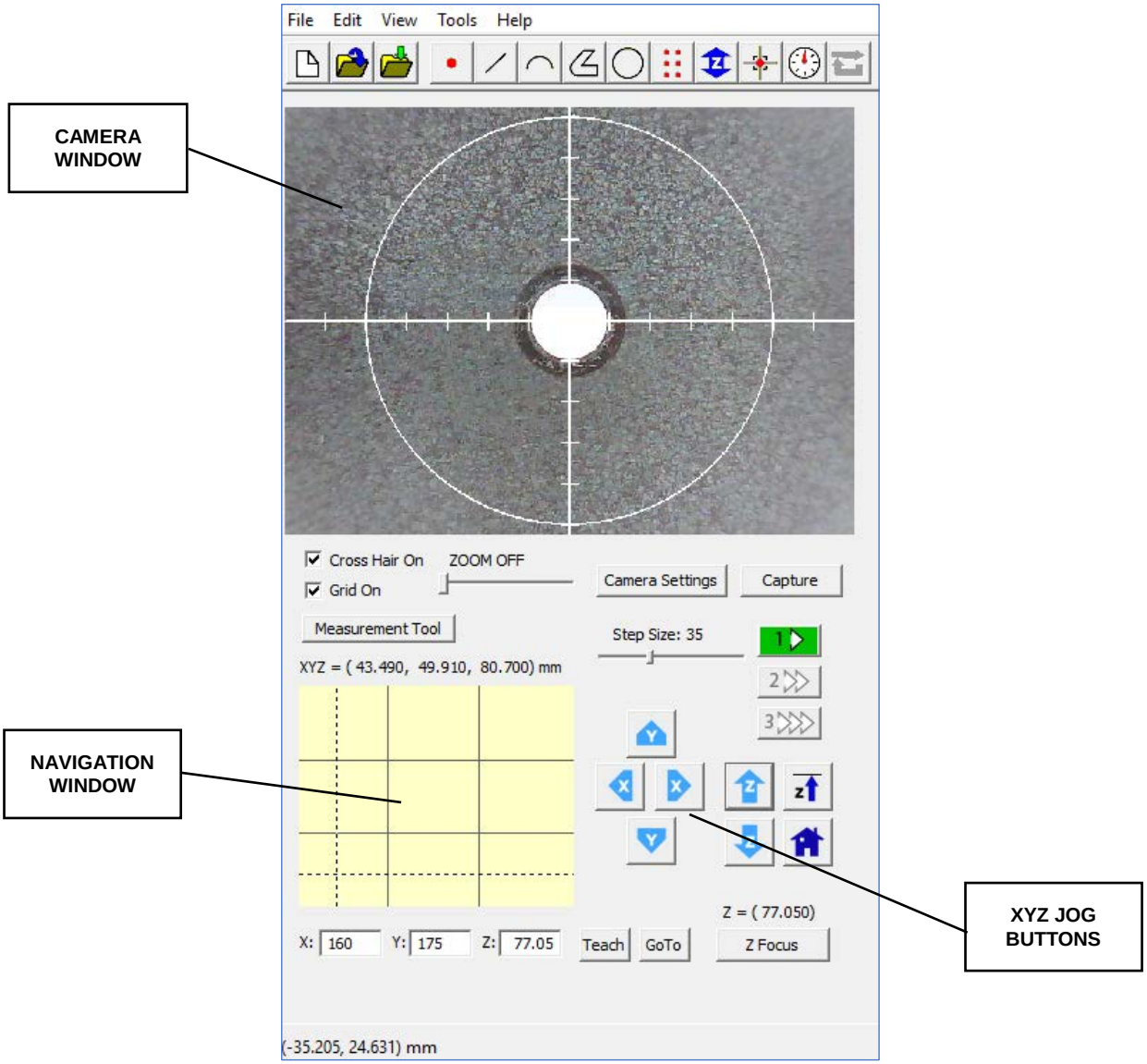


Figure 2-1: DispensePro Vision Window, Navigation Window, and XYZ Jog Buttons

The Camera Window, Navigation Window, and XYZ Jog Buttons are the basic elements of DispensePro motion control.

- Click anywhere in the Camera Window to move to the desired portion of the image. Zoom in, set the colors, or capture the image.
- Click anywhere in the Navigation Window to move to the corresponding location on the work space.
- Enter the XYZ coordinates to quickly move to a known location.
- Click the XYZ jog buttons for fine motion control at adjustable step sizes.
- Move quickly to Home or the Z Up position with one quick click.

3.1 Camera Window

3.1.1 Field of View

The Camera Window shows exactly what the camera sees. The size of the Camera Window is the **Field of View** (FOV). The **Camera Calibration** process sets the FOV at about 14 mm x 10.6 mm

See Section 5.2 - Calibrate the Camera.

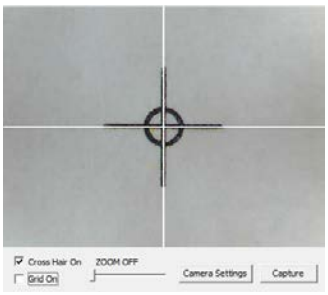


Figure 3-2: Camera Window

3.1.2 View Options

Click the mouse in the Camera Window to move the robot to the corresponding location on the work space. Figure 3-3 shows Camera Window viewing options.

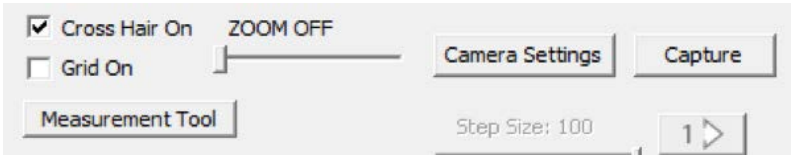


Figure 3-3: View Options

- Select **Cross Hair** to show the X and Y axis lines.
- Select **Grid** to provide a reference for width and height. Grid tics are spaced one millimeter apart. The number of tics across the horizontal and vertical axes is set by **FOV** in the camera calibration procedure.
- **Zoom** provides four camera magnification levels.
- Click **Capture** to save the Camera Window image as a file.

3.1.3 Camera Controls

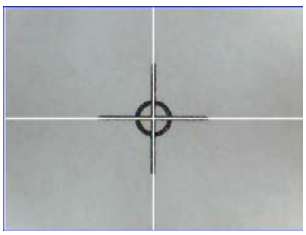


Image with Cross Hair ON

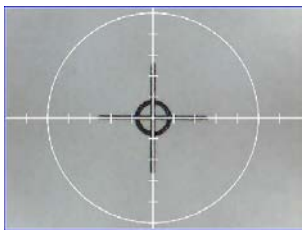


Figure 3-4:
Image with Cross Hair and Grid ON

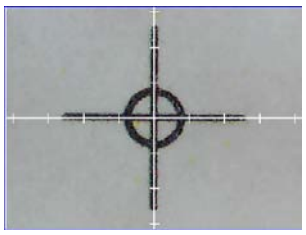


Image with Zoom Set to 2

Click **Camera Settings** for the **Camera Controls** window, shown in Figure 3-5. The camera model, current pixel size, and current FOV are displayed. Use the Red, Green and Blue controls to adjust the image color as needed.

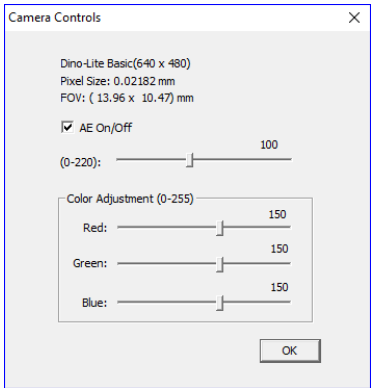


Figure 3-5: Camera Controls Window

3.1 Camera Window, continued

3.1.4 Measurement Tool

Click **Measurement Tool** to impose a circle, horizontal bar, or vertical bar in the center of the Camera Window for measuring the diameter of circles or thickness of lines on the workpiece.

Figure 3-6: Measurement Tool Window

For example, select a circle with a radius of 1200 microns to create a 2.4 mm diameter circle. Move the camera to the Z focus height and over the element to measure.

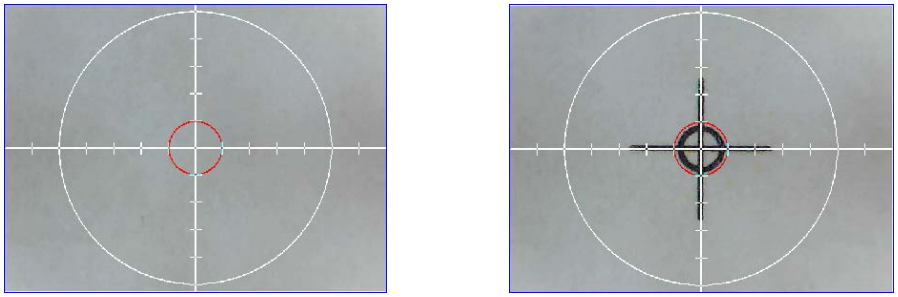


Figure 3-7: 1200 Micron Circle Measuring Tool (L); Measuring Tool Over a Fiducial (R)

Set the horizontal bar width to 500 to create a bar with a thickness of 500 microns. Move the camera to the Z focus height and over the line to measure.

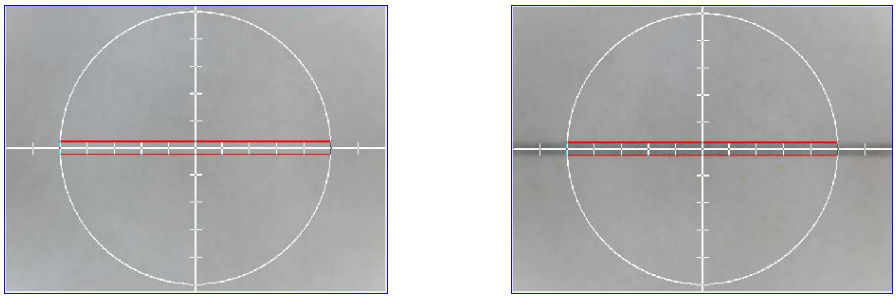


Figure 3-8: 500 Micron Horizontal Bar Measuring Tool (L); Measuring Tool Over a Fiducial (R)

3.2 Navigation Window

The Navigation Window shows the position of the robot on the work space. Clicking the mouse anywhere inside the Navigation Window moves the robot to the corresponding location on the work space.

3.2.1 X-Y Location

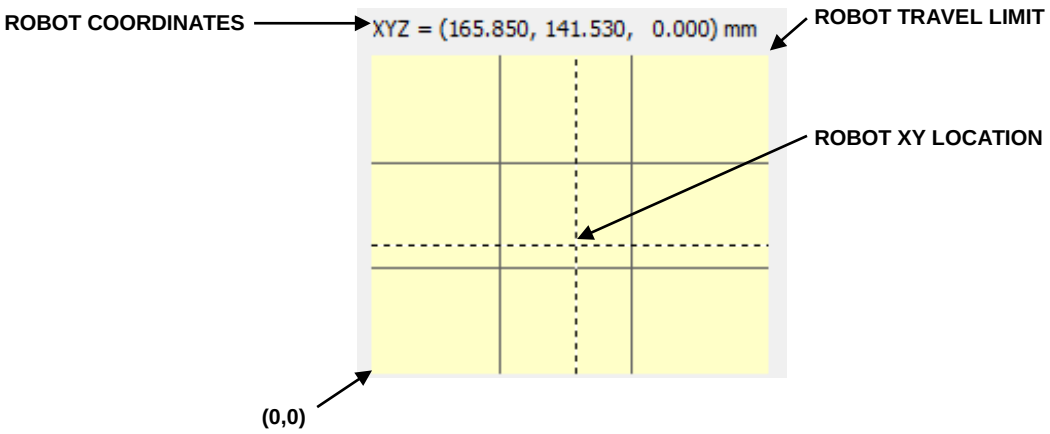
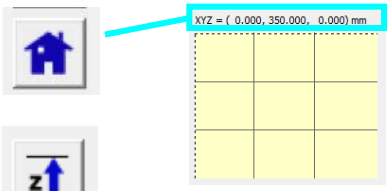


Figure 3-9: Navigation Window

Dashed cross grids mark the current robot XY location. The coordinate values for that position are displayed above the Navigation Window, using the bottom left corner of the window as (0,0) and the top right corner as the travel limit of the robot.

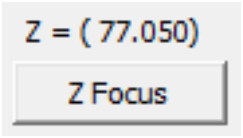
3.2.2 Quick Locations

Home: Click the **Home** icon to home the robot axes.



Z Up: Click the **Z Up** icon to move the Jet to the Z height of zero (0).

Z Focus: Click the **Z Focus** button to move the Jet to the Z focus height displayed above the button.



3.2.3 XYZ Jog Buttons

The mouse provides quick navigation. For fine and precise robot movement, use the **XYZ Jog Buttons**.

- Click the X Jog Buttons to move the robot left or right.
- Click the Y Jog Buttons to move the robot forward or back.
- Click the Z Jog Buttons to raise or lower the Jet.
- One click moves the robot one step.
- Click and hold for longer continuous motion.

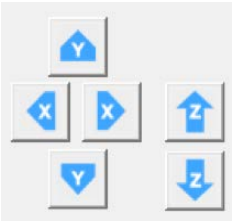


Figure 3-10: XYZ Jog Buttons

3.2.4 Step Controls

XYZ step travel is defined by **Step Size**. Three **Step Size** options are available:

- **Step 1** moves the robot 1 millimeter for each XYZ button click.
- **Step 2** moves the robot 5 millimeters for each XYZ button click.
- **Step 3** moves the robot 10 millimeters for each XYZ button click.

Figure 3-11: Step Speeds

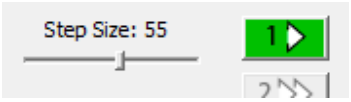


Figure 3-12: XYZ Step Size Set To 0.55 mm

When **Step 1** is selected, the **Step Size** can be fine-tuned in 0.01-millimeter increments from 1 to 100. A Step Size of 1 is a 0.01-millimeter step; a Step Size of 100 is a 1.0-millimeter step.

3.2.5 Go To a Location

When the coordinates of a desired position are known, those values can be entered in the corresponding fields.

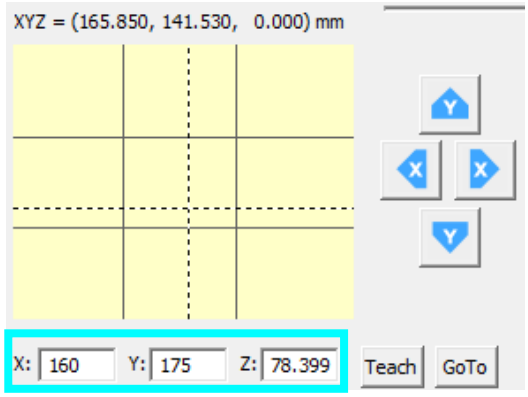


Figure 3-13: Enter the Go To Coordinates

For example, to move the robot to (160,175,78.399):

- Enter 160, 175, and 78.399 in the respective X, Y, and Z fields as shown in Figure 3-13.
- Click **Go To** to move the robot to those coordinates.
- To record the current position for later use, click **Teach**. The current X, Y, and Z values will be loaded into the XYZ fields.

3.2 Navigation Window, continued

3.2.6 Z Focus

Clicking **Z Focus** moves the robot to the **Z Focus Height**.

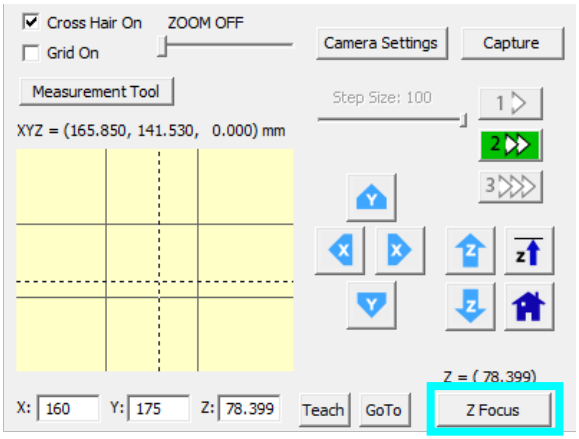


Figure 3-14: Z Focus Height Button

The Z-axis position corresponds to the “magnification” of the viewing image. Z Focus Height is the robot’s Z-axis position when the camera image is in focus. This is the most accurate and consistent position for teaching and viewing the workpiece.

The Z Focus Height is set by the procedures in Section 5.2 - Calibrate the Camera and Section 5.3 - System Calibration Step 2: Height Sensor to Work Surface. Any change to the workpiece thickness affects the accuracy of the Z Focus Height, and the Height Sensor to Work Surface procedure must be repeated.

It is very important that the Robot Z head is at the Z Focus Height before teaching the dispense instruction locations. See Section 7.1, Z Focus Position for a more detailed explanation.

3.3 Data Preview Window Size

On the toolbar, click **View** to select the magnification of the Data Preview Window, up to 400%.

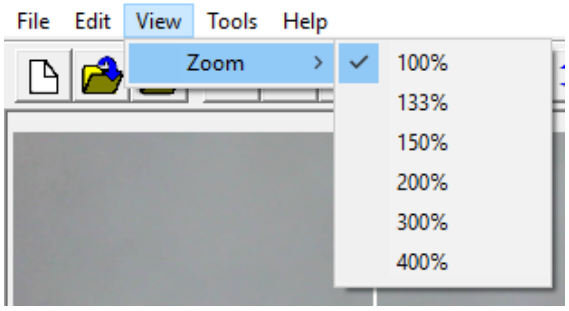


Figure 3-15: Use View to Select the Data Preview Window Magnification

4. Toolbar Overview

FILE MANAGEMENT		
	**NEW**	Creates a new empty job file.
	**OPEN**	Opens an existing job file.
	**SAVE**	Saves the current job file to disk.
VIEW		
	**VIEW**	Selects Data Preview Window magnification up to 400%.
DISPENSE INSTRUCTIONS		
	**DOTS**	Adds dots by entering X and Y coordinates of desired location(s).
	**LINES**	Adds a line by entering the start point and end point.
	**ARCS**	Adds an arc path by entering three points: a start point, an end point, and another point of the arc between start and end.
	**PATHS**	Adds a path by entering a series of points that define connected lines and arcs.
	**CIRCLES**	Adds a round shape by entering its center point and an outer point on the radius.
	**PALETTE OF DOTS**	Adds dots of a specified spacing in a row by column pattern.

Toolbar Overview, continued

PROGRAMMING		
	**Z-MOTION**	Inserts an instruction to set a new dispense gap, with options to use the height sensor at a given location or to apply a delta change to the current dispense gap.
	**FIDUCIALS**	Stores the image and coordinates of two fiducials which are used to adjust XY placement and rotation as necessary for skewed parts.
	**TIMER**	Inserts a pause in the dispensing program.
	**STEP & REPEAT**	Duplicates the instruction list in a grid layout.
DISPENSING		
	**RUN**	Executes the program using the coordinates and options in the Run window.
	**JET CONTROLLER**	Displays the controller settings for each of six recipes. Timing parameters for controlling dispensing can be specified.
SETUP		
	**SYSTEM SETUP**	Stores the locations of the prime cup, tactile sensor, and camera fiducial marker. Selects height sensor type, sets language, and displays firmware version.
	**CALIBRATE CAMERA**	Calibrates the FOV (Field of View) and Z Focus Height for the camera.
	**PRIME/PURGE**	**Priming** removes air from the nozzle tip and fluid chamber during installation of nozzle and feed tube. **Purge** cleans the nozzle tip by vacuum and jets material into the priming cup before starting the dispense run.
	**SYSTEM CALIBRATION**	The system calibration routines perform the measurements required to calculate dispense height: safe Z height; work surface height, nozzle tip height, XY offset of height sensor to camera, and XY offset of camera to jet.

5. B300 System Setup Routines

5.1 System Setup

Click the **Tools** tab and select **System Setup**.

5.1.1 Robot Travel Limits

The robot's XYZ travel limits depend on the size of the robot. These values are acquired from the robot when powering on.

5.1.2 Prime Cup, Tactile Switch, Camera Fiducial

When the dispense system is assembled at the factory, the XY locations of the Prime Cup, Tactile Switch, and Camera Fiducial Marker are taught. These factory-set coordinates should be verified.

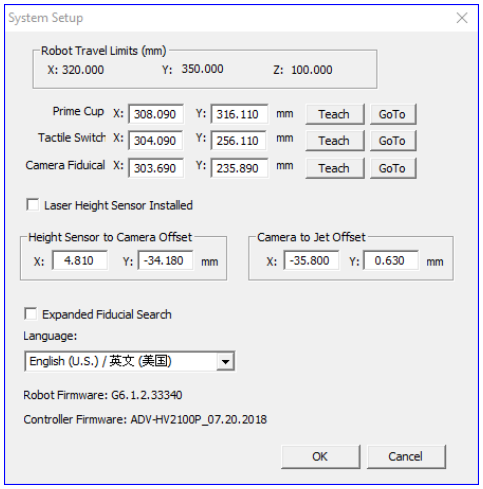


Figure 5-1: System Setup Window

Verify the Prime Cup Location:

- Click Go To. The Camera Window crosshairs should be centered on the center of the Prime Cup, although the cup will not be in focus, as shown in Figure 5-2.
- In the Camera Window, select Grid On. Use the Z motion control button to zoom in closer, then use the X and Y buttons to surround the center of the Prime Cup with the grid circle. The shape should measure 10 millimeters across (10 grid tics; 5 grid tics from center each way), as shown in Figure 5-3.
- Click **Teach** to save. The saved location will be used for the Prime/Purge function.

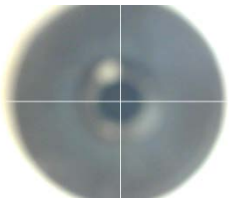


Figure 5-2: Go To Prime Cup Image

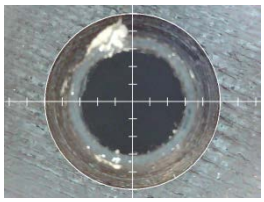


Figure 5-3: Prime Cup Center Enclosed by Grid

Verify the Tactile Switch Location:

- Click **Go To**. The Camera Window crosshairs should be centered on the center of the Tactile Switch, although the switch will not be in focus, as shown in Figure 5-4.
- In the Camera Window, select **Grid On**. Use the X and Y motion control buttons to surround the Tactile Switch with the grid circle. The shape should measure 10 millimeters across (5 grid tics from center each way), as shown in Figure 5-5.
- Click **Teach** to save. The saved location will be used for the System Calibration function (Nozzle Tip to Tactile Switch).

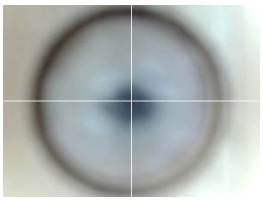


Figure 5-4: Tactile Switch Go To Image

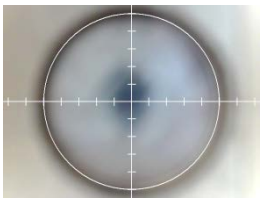


Figure 5-5: Tactile Switch Enclosed by Grid

5.1.2 Prime Cup, Tactile Switch, Camera Fiducial, continued

Verify the Camera Fiducial Location:

- Click **Go To**. The Camera Window crosshairs should be centered on the center of the Camera Fiducial Marker, as pictured in Figure 5-6.
- In the Camera Window, select **Grid On**. The shape should measure 2 millimeters across (1 grid tic from center each way), as shown in Figure 5-7. Use the Z jog buttons to adjust as the image size as needed.

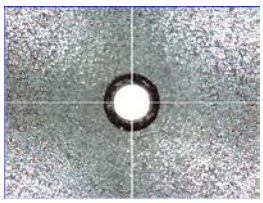


Figure 5-6: Camera Fiducial

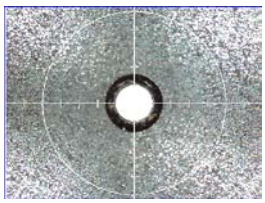


Figure 5-7: Camera Fiducial with Grid

- Click **Teach** to save. The saved location will be used for the Calibrate Camera function to setup the FOV and focus height, and also for the System Calibration function.

5.1.3 Laser Height Sensor

The estimated height sensor to camera offsets differ depending on what type of height sensor is installed. If a laser height sensor is installed, this option must be selected; if a mechanical height sensor is installed, do not select the **Laser Height Sensor Installed** option.

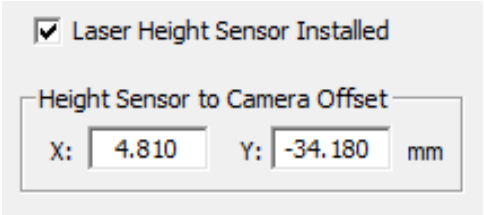


Figure 5-8: Laser Height Sensor Installed

5.1.4 Expanded Fiducial Search

If fiducial compensation is selected from the dispensing **Run** menu, the camera moves to an XY location where the fiducial has been taught. When the **Expanded Fiducial Search** option is selected, the area around the fiducial is searched if a match is not found at the taught location.

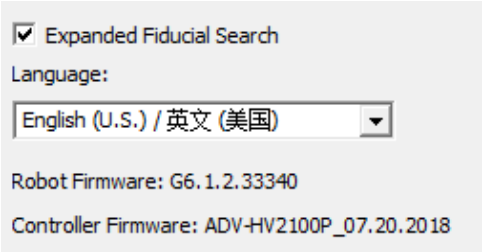


Figure 5-9: Expanded Fiducial Search, Language, and Version Options

5.1.5 Language

The languages supported by DispensePro are listed. Currently, U.S. English and Simplified Chinese are supported. To change the language, select the new language and restart the program.

5.1.6 Version

Robot Firmware: Displays the latest robot firmware version.
Controller Firmware: Displays the latest controller firmware version.

5.2 Calibrate the Camera

Note: *System values changed when calibration routines are performed are not saved to the DispensePro.def file until the DispensePro program is closed. In the event that DispensePro must be rebooted (power to controller is accidentally switched off, E-Stop button is pushed, communication failure requires a restart, etc.), any system values changed since starting DispensePro will be lost. Therefore, it is important to save new calibration settings by exiting DispensePro.*

This routine calibrates the Field of View (FOV) of the camera using the tooling plate camera fiducial marker as the target image. If the workpiece is significantly higher than the tooling plate, select a target marker on the workpiece that will ensure that the fiducials will be in focus.

1. Click the **Calibrate Camera** toolbar button.

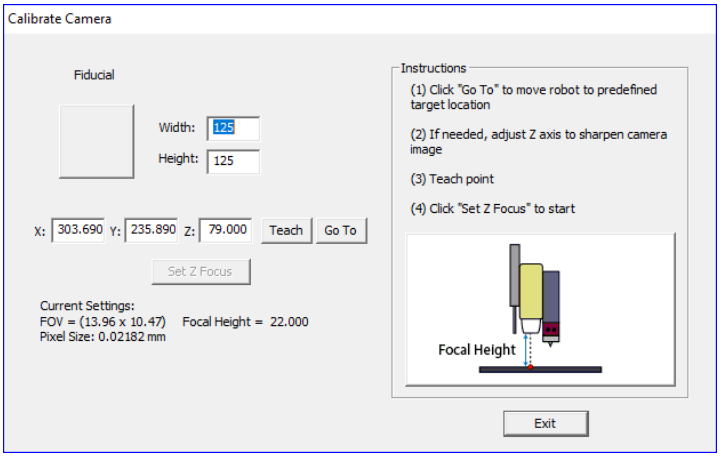


Figure 5-10: Calibrate Camera Window

2. Click **Go To** to move the camera to the fiducial marker location on the XY table.

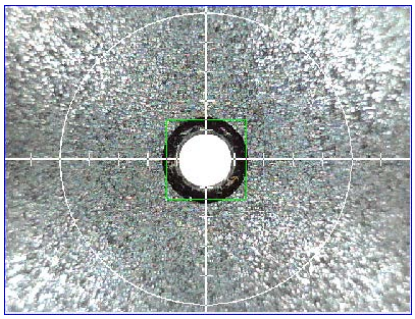


Figure 5-11: Green Box Tightly Encloses Fiducial Marker

- The green box should enclose the fiducial marker with minimal extra space around the marker diameter.
- Adjust the Z axis to sharpen the camera image as needed.
- Adjust Width and Height values to change the green box dimensions as needed.

3. Click **Teach** to capture the fiducial image.

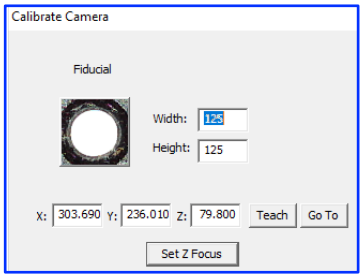


Figure 5-12: Saved Fiducial Image

4. Click **Set Z Focus** to start the routine.

   The calibration process starts to measure and calculate the Field of View (FOV) and pixel size for the camera settings.

   When the calibration process is completed, a prompt to save the new FOV is displayed.

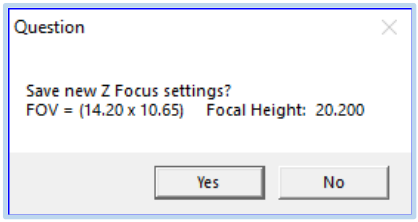


Figure 5-13: New Z Focus Settings

5. Click **OK** to save the settings.

Note: *Factory installation calibrates the camera settings to have a FOV of about 14-14.5 mm*

Recommended Camera Settings	
Field of View (FOV)	14 – 14.5 millimeters (X axis)
Pixel Size	0.0210 – 0.0230 millimeters

5.3 System Calibration

Notes:
The System Calibration routines utilize the mechanical height sensor, which requires air pressure to the robot to be ON for operation.

*The steps of the System Calibration routine should be performed in sequence. Therefore, only the fields for the current step are available at that step. To access fields for another step, start at the beginning and click **Skip** to reach the desired step.*

System values changed when calibration routines are performed are not saved to the DispensePro.def file until the DispensePro program is closed. In the event that DispensePro must be rebooted (power to controller is accidentally switched off, E-Stop button is pushed, communication failure, etc.), any system values changed since starting DispensePro will be lost. Therefore, it is important to save new calibration settings by exiting DispensePro.

Step 1: Teach Safe Z Height

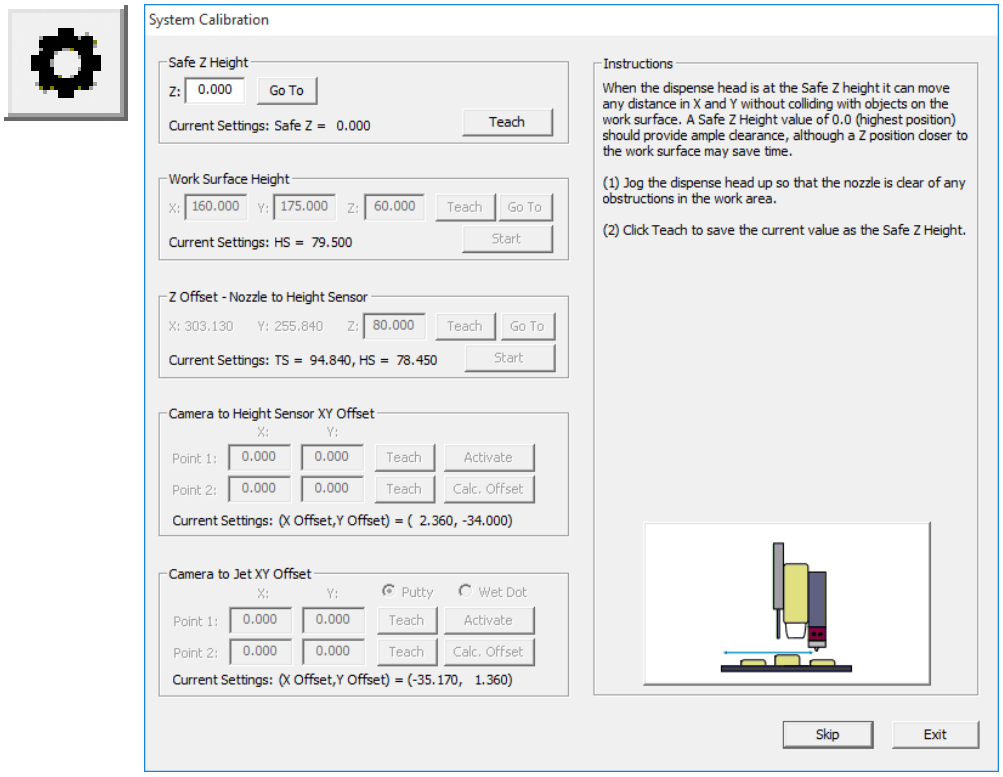
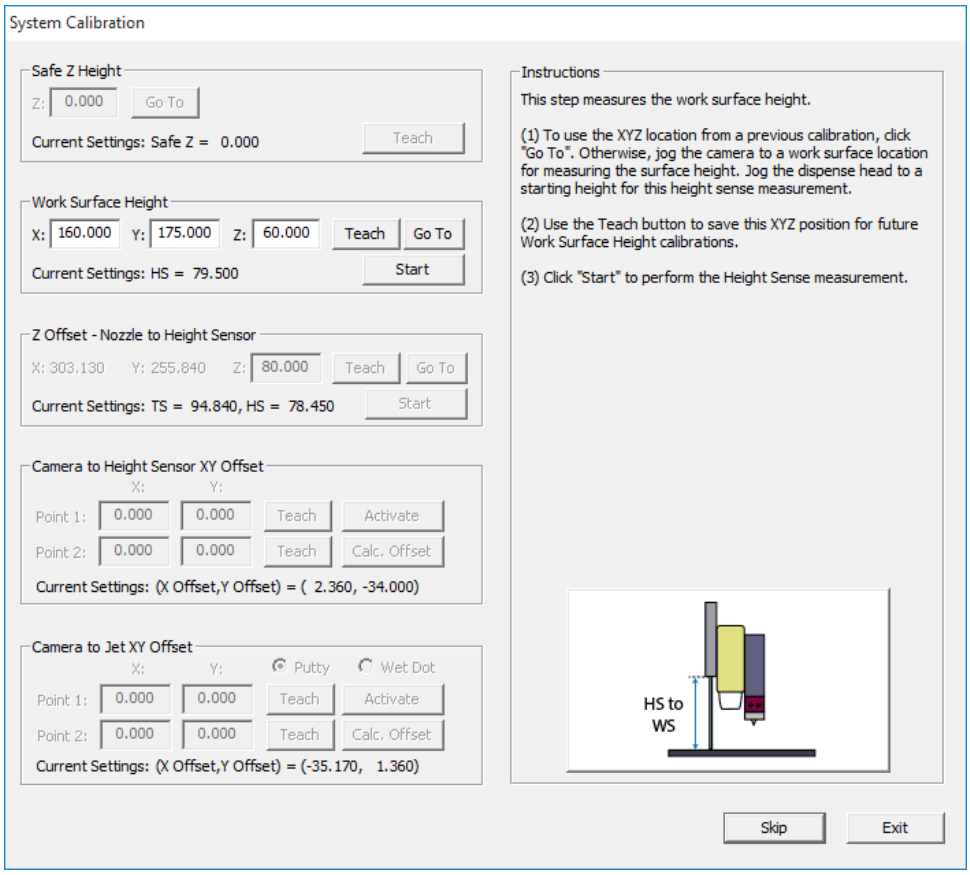


Figure 5-14: Teach Safe Z Height

1. Click the **System Calibration** toolbar button. The default Safe Z Height is 0.000.
2. Raise the nozzle high enough to clear any obstructions in the work area.
3. Click **Teach** to save the current value as the **Safe Z Height**.
   The routine continues to the next calibration procedure.

Step 2: Work Surface Height

This step uses the Height Sensor to measure the Work Surface Height, which is the essential starting value for the rest of the system calibration calculations.



1. Click **Go To** to move to the last saved XY location, or move to a location on the work surface away from a hole or edge.
2. Use the **Safe Z Height** just taught.
3. Click **Teach** to save the new XYZ values.
4. Click **Start** to perform the Height Sense measurement.

   Mechanical Height Sensor: The tip extends until it touches the surface, and then retracts to the position just before touching. This Z position is saved as Work Surface Height.

   Laser Height Sensor: The red laser light activates and moves down until it triggers the laser sensor. This Z position is saved as Work Surface Height.
5. A verification prompt displays the height sense measurement results. Click **Yes** to save or **No** to cancel.

   The routine continues to the next calibration procedure.

Step 2: Work Surface Height, continued

Important Note:

The height sensing algorithm uses the HS position calculated in this step as the starting Z position to look for the sensor switch. The sensor switch position is then used to set the dispense gap. This HS value is also used to set the Z Focus value.

The thickness of the workpiece determines the HS position:

WORKPIECE IS 1 MM THICK	WORKPIECE IS 10 MM THICK
	
HEIGHT SENSOR Z POSITION = 77.850	HEIGHT SENSOR Z POSITION = 68.850
Z FOCUS HEIGHT = 79.00	Z FOCUS HEIGHT = 70.00

If the workpiece is switched to one with a different thickness, it is very important to repeat the Height Sensor to Work Surface calibration so that the image is in clear focus and the Z Focus value is updated. Failure to do so increases the time required by the height sensing algorithm to calculate the Dispense Gap value in the Run Program and Z Move instructions, which could result in a Height Sensor failure.

Step 3: Z Offset

NOTICE

In this procedure, the jet touches down on the tactile switch. To avoid damage to the nozzle insert, the jet must be properly installed. The B300 has notches for proper positioning of the jet mounting bracket.

NOTCHES FLAT NOZZLE 3 MM NOZZLE 6 MM NOZZLE

For flat nozzles, the bottom of the bracket is aligned to the bottom of the robot. For 3 mm nozzle tips, raise the bracket to the first notch. For 6 mm nozzle tips, raise the bracket to the second notch.

Verify that the mounting bracket for the jet dovetail is tightly secured to the robot. To avoid damage to the nozzle tip, this step must be repeated if the nozzle tip is changed from a flat nozzle tip to a 3 mm nozzle tip, or from a 3 mm tip to a 6 mm tip.

This step determines the Z Offset, which is the difference between the Z distance from the nozzle to a surface (the tactile switch) and the Z value of a height sense measurement of that surface. The Z Offset is used with the Dispense Gap to calculate the Z axis position for dispensing.

1. Click **Go To** to move the camera to the tactile switch location. Use the jog buttons to adjust the location.

   Note: *The Z Height value shown in Figure 5-16 is the default value for a flat nozzle tip.*

2. Click **Start**. The jet lowers until the tactile switch is detected. The touch position is refined, and a height sense measurement is performed on the tactile switch. The resulting Z values for the tactile switch and the height sense measurement are displayed. Click **Yes** to accept the new values. The routine continues to the next calibration procedure.

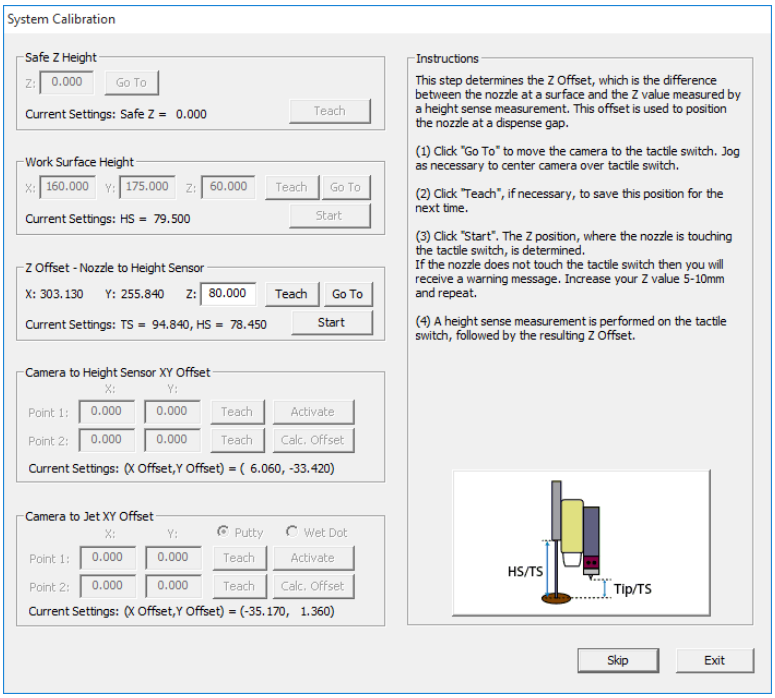


Figure 5-16: Nozzle Tip to Tactile Switch

Step 4: Camera to Height Sensor XY Offset

Step 4A: Camera to Mechanical Height Sensor XY Offset

This step determines the Height Sensor to Camera offset, which is needed to perform a height sensing operation at the camera position. This offset is also used when a height sensing location is taught. The procedure requires Alignment Putty, P/N 25E796, shown in Figure 5-17.

Figure 5-17: Alignment Putty

1. Prepare a disc of putty about 20 x 20 x 5 mm and place it on the work surface.
2. Move the camera to center the crosshairs over the putty approximately 20 mm above the putty surface.
3. Click **Teach** to save the putty location as Point 1.
4. Click **Activate**. The Height Sensor moves to the putty and drops the probe to make a slight impression in the putty.

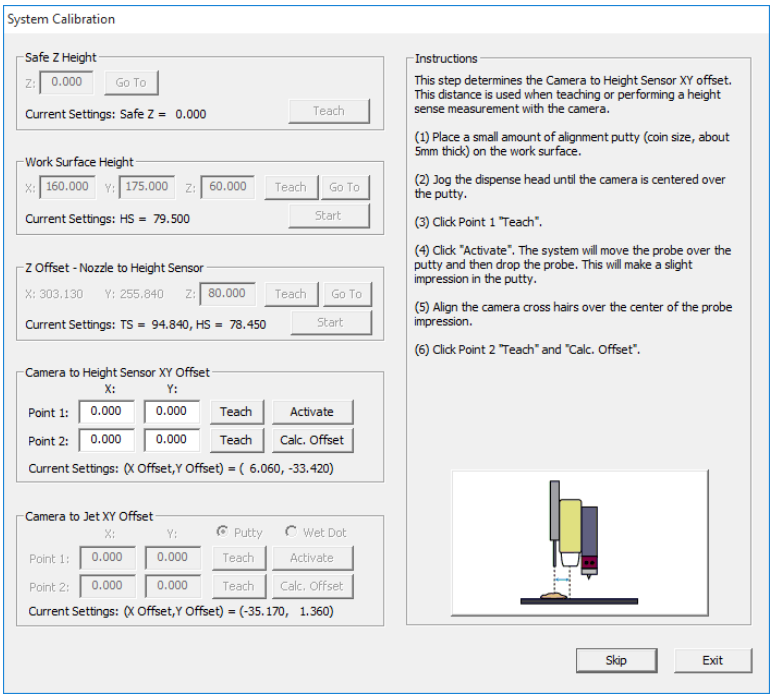


Figure 5-18: Mechanical Height Sensor to Camera Offset

5. Move the camera to center the crosshairs over the probe impression.
6. Click **Teach** to save the impression as Point 2.

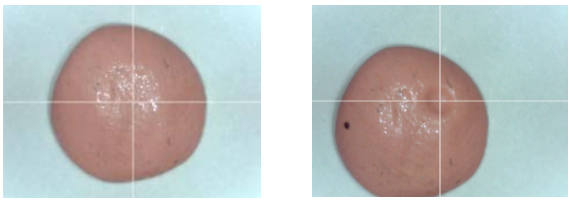


Figure 5-19:
(Left) Point 1: Crosshairs Centered Over Algnment Putty
(Right) Point 2: Crosshairs Centered Over Impression

7. Click **Calculate Offset** to calculate the Height Sensor to Camera Offset.

   The routine continues to the next calibration procedure.

Step 4: Camera to Height Sensor XY Offset, continued

Step 4B: **Camera to Laser Height Sensor XY Offset**

If a Laser Height Sensor has been installed in the System Setup (See Section 5.1.3), the procedure references the laser height sensor instead of the mechanical height sensor.

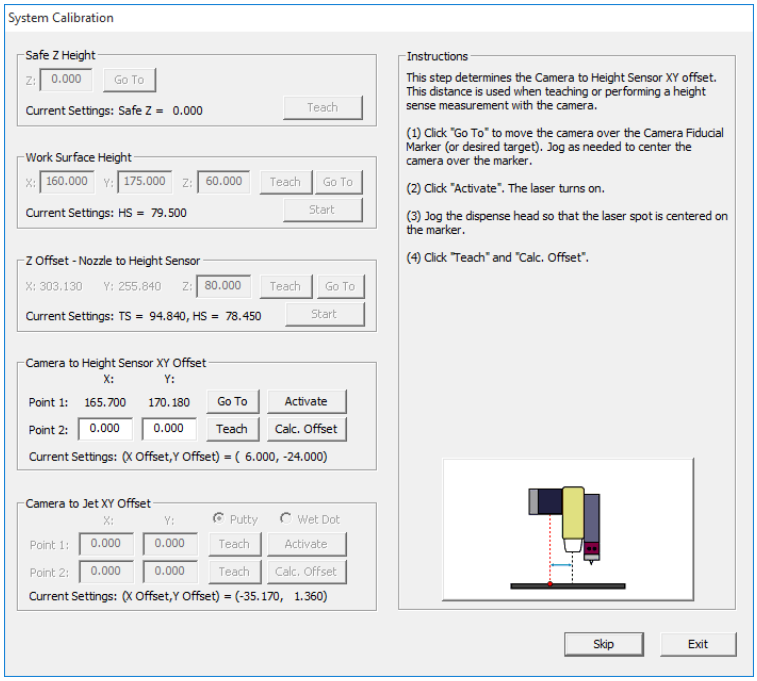


Figure 5-20: Laser Height Sensor to Camera Offset

Note: This routine uses the Camera Fiducial Marker as the target; any identifiable mark can be used.

1. Click **Go To** to move the camera over the Camera Fiducial Marker (or desired target). Use the jog buttons as needed to center the camera over the marker.
2. Click **Activate**. The laser turns on and a red dot appears near the center of the marker as shown in Figure 5-21 (dot enlarged for illustrative purposes).
3. Use the jog buttons (small step recommended) to center the laser spot on the marker.

Figure 5-21: Laser Dot on Fiducial Marker

4. Click **Teach** and **Calculate Offset**.
5. The calculated XY offset values will be displayed. Click **Yes** to accept the new values. The routine continues to the next calibration procedure.

Step 5: Camera to Jet XY Offset

Note: *To achieve accurate results, the Camera to Jet Offset procedure should be performed any time there is a change of nozzle, such as from a flat nozzle to a 3 mm or 6 mm nozzle.*

This step determines the Camera to Jet Offset, which is the X-Y difference between the camera location and the jet nozzle tip. There are two different methods for calculating the offset:

- The **Alignment Putty Method** compares the location when the nozzle tip makes an indentation in a disc of alignment putty to the location when the camera is positioned over that indentation. Use this method if a fluid syringe has not been installed. Alignment Putty (P/N 25E796) is required for this method.
- The **Wet Dot Method** compares a specified location to where the camera is when a dot is jetted at that location.

Before using the Wet Dot Method, the following procedures must be completed:

- A fluid syringe must be installed. See the HV-2100 Jet Setup and Operation manual (3A6244) or HM-2600 Jet Setup and Operation manual (3A6327) for detailed instructions.
- The timing values for jetting a sample drop must be saved as Recipe#1 in the controller menu. See the Advanjet Jet Dispensing Parameters Supplement (3A5937) for an explanation of timing recipe parameters. See the Advanjet HV-2100C Jet Controller manual (3A6266) or the HM-2600C Hotmelt Jet Controller manual (3A6166) for a detailed explanation of the controller settings.

Step 5: Camera to Jet Offset, continued

Alignment Putty Method

Prepare a disc of putty about 20 x 20 x 5 mm. Move the jet to the center of the XY table and position the putty under the nozzle.

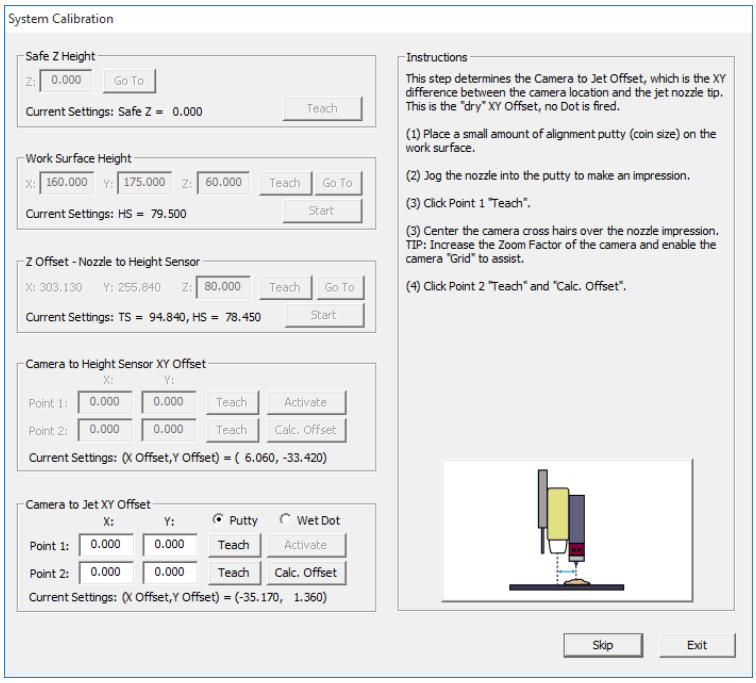
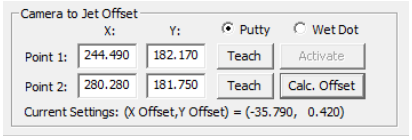


Figure 5-22: Camera to Jet Offset (Putty)

1. Click **Putty.**
2. Use the Z jog buttons to lower the nozzle and make an impression in the putty. Raise the nozzle and check that the impression is distinct, as pictured; smooth out the putty and repeat as needed.
3. Click **Teach** to save the Putty location as Point 1.
4. Center the crosshairs over the impression. Use **Zoom** and **Grid On** to assist with centering.

Note: Camera positioning uses the last known XY Offset values

5. Click **Teach** to save the location in the crosshairs as Point 2.



Click **Calc. Offset**. The values for Point 1 and Point 2 are used to calculate Camera to Jet Offset.

Wet Dot Method

Install a fluid syringe on the jet and select a recipe on the controller appropriate for dots. Move the jet to the center of the XY table and position a piece of paper under the nozzle.

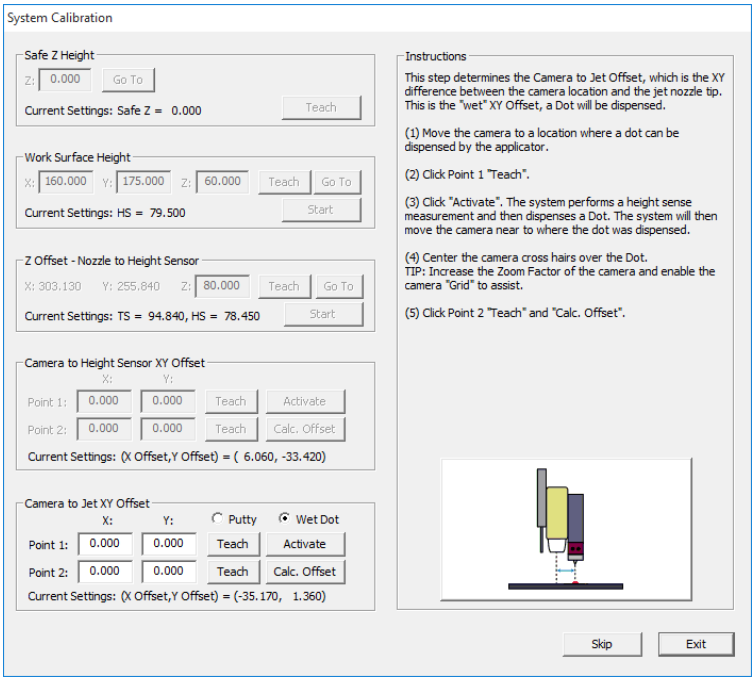
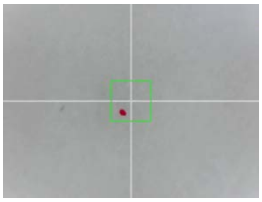


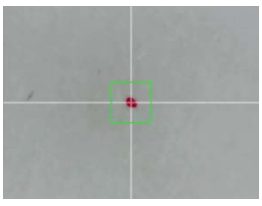
Figure 5-23: Camera to Jet Offset (Wet Dot)

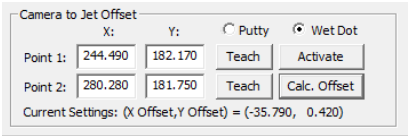
1. Click **Wet Dot** .
2. Center the crosshairs over the piece of paper. Click **Teach** to save the location as Point 1.
3. Click **Activate**.

   The jet moves to Point 1 and dispenses a dot using Recipe #1 settings. The camera closes in on the jetted dot.



4. Center the crosshairs on the jetted dot. Use **Zoom** and **Grid On** to assist with centering.
5. Click **Teach** to save the location in the crosshairs as Point 2.





   Click **Calc. Offset**. The values for Point 1 and Point 2 are used to calculate Camera to Jet Offset.

5.4 Prime, Purge, or Vacuum the Jet

***Note**: Priming or Purging the jet requires installation of the diaphragm, nozzle plate, and fluid syringe with new feed tube. See the HV-2100 Jet manual (3A6244) or the HM-2600 Hotmelt Jet manual (3A6226).*

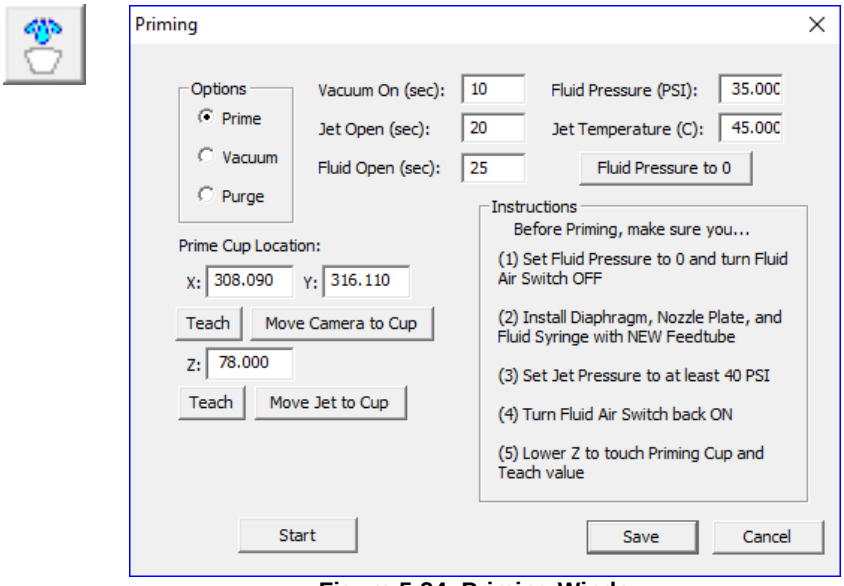


Figure 5-24: Priming Window

5.4.1 Overview of the Priming Process

The **Prime**, **Vacuum**, and **Purge** process removes any residual air bubbles from the fluid chamber and nozzle tip for consistent dispensing results.

- After teaching the XY location and Z height of the Prime Cup, the jet positions the nozzle on top of the prime cup.
- During **Vacuum On**, the vacuum valve is opened, and air is vacuumed from the cup.
- After **Vacuum On** is completed, **Jet Open** opens the jet valve, and the vacuum just created in the cup removes any air inside the jet nozzle chamber and feed tube.
- Finally, **Fluid Open** applies fluid pressure. The vacuumed air is replaced with fluid, which flows through the feed tube into the Prime Cup.

The DispensePro default values for Fluid Pressure, Jet Temperature, Vacuum On, Jet Open, and Fluid Open represent a good starting point for most fluids. However, each fluid dispensing application will determine the settings for Fluid Pressure and Jet Temperature. Depending on the fluid, Vacuum On, Jet Open, and Fluid Open may also need adjusting.

***Note:** Before beginning the priming or purging process, the controller's PV (Present Value) temperature is compared to the Jet Temperature value. If necessary, the process waits until the Jet Temperature value has been reached.*

5.4 Prime, Purge, or Vacuum the Jet, continued

5.4.2 Install the Prime Cup

Position a clean Prime Cup as shown in Figure 5-24.

Figure 5-25: Position the Prime Cup

5.4.3 Teach the Prime Cup Location

1. Click **Move Camera to Cup.** Make sure the XYZ Priming Cup location is correct.

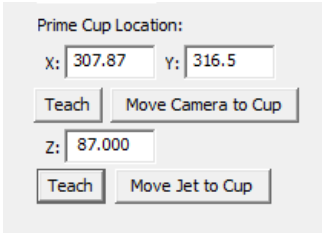


Figure 5-26: Prime Cup Location

2. If re-centering is necessary, click the center of the Prime Cup in the Camera Window as shown in Figure 5-26Figure 5-24, or use the X-Y Jog Buttons. Click **Teach** to save the Prime Cup XY location.

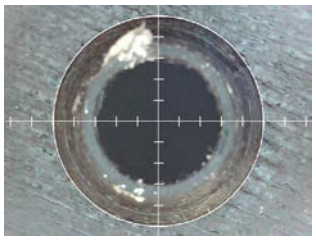


Figure 5-27: Crosshairs Centered on Priming Cup

5.4.3 Teach the Prime Cup Location, continued

3. Click **Move Jet to Cup**. The jet moves to the saved Prime Cup XY location, and the nozzle tip is lowered to the Z height value displayed in the Priming window.

Note: *Z Height value depends on the nozzle tip.*
The Z Height value might need to be adjusted for a different tip configuration.

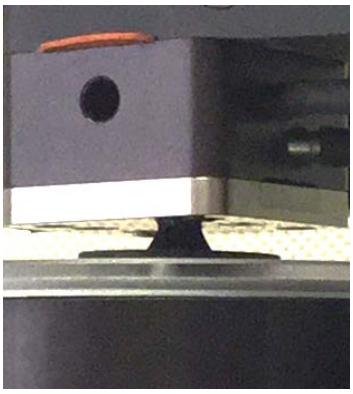


Figure 5-28: Jet Nozzle Tip Positioned on Prime Cup

4. On the motion control panel, select a small step size and low speed. Use the Z Jog Buttons to position the jet so that the nozzle tip rests on the top of the Prime Cup. Click **Teach** to save this Z value.

5.4.4 Enter the Controller Settings

1. On the controller front panel, turn the **Fluid Air** switch OFF.
2. In the Priming window, click **Fluid Pressure to 0**. The controller turns off the fluid pressure and the home screen displays a Fluid Pressure value of 0.0, as shown in Figure 5-29.

Figure 5-29: Turn Fluid Air OFF.

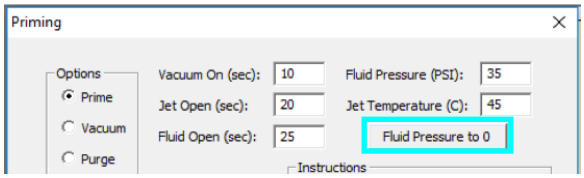


Figure 5-30: Click Fluid Pressure to Zero (0) in Priming Window; Controller Shows Fluid Pressure of Zero (0)

3. Set Jet **Pressure** on the controller to at least 40 psi (depending on the fluid).
4. When all these conditions are met, switch the **Fluid Air** back ON.

Figure 5-31: Set Jet Pressure to 40 psi.

5.4 Prime, Purge, or Vacuum the Jet, continued

5.4.5 Prime the Jet

Whenever a new fluid syringe is installed, priming the jet nozzle removes any residual air bubbles from the fluid path. This ensures consistent dispensing results.

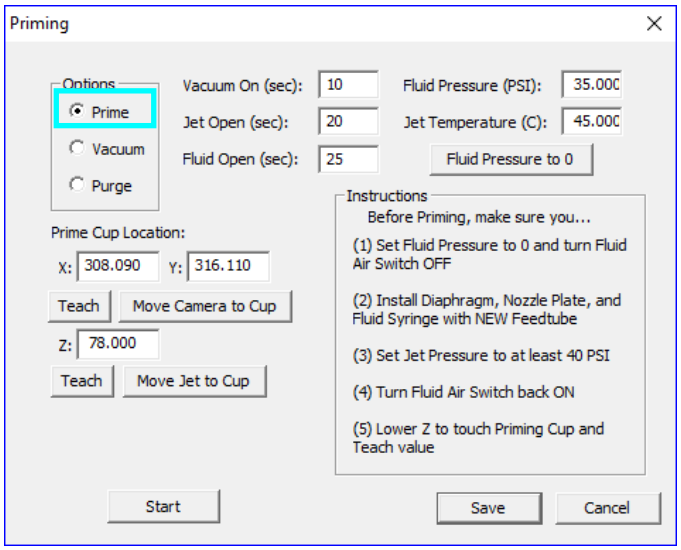


Figure 5-32: Prime Settings

1. Follow the procedures in sections 5.4.2 - Teach the Prime Cup Location, 5.4.3 - Teach the Prime Cup Location, and 5.4.4 - Enter the Controller Settings.
2. In the Priming window, select the **Prime** option.
3. Enter the times for **Vacuum On**, **Jet Open**, and **Fluid Open**. The time for each step depends on the fluid being dispensed; the DispensePro default values are suitable for most applications.
4. Enter the **Fluid Pressure** and **Jet Temperature** settings from the dispensing recipe.
5. Click **Start**. The jet moves to the Prime Cup location and begins the priming process (Vacuum On, Jet Open, Fluid Open).

Note: Before beginning the priming or purging process, the controller's PV (Present Value) temperature is compared to the Jet Temperature value. If necessary, the process waits until the Jet Temperature value has been reached.

5.4 Prime, Purge, or Vacuum the Jet, continued

5.4.6 Purge the Jet

Purging the jet nozzle is sometimes necessary before starting a dispensing run, especially when the jet has been idled for a while. Depending on the fluid, a long idle time might change the viscosity of the fluid in the nozzle chamber. This might cause missed dots or accumulation of fluid on the tip.

The purge process dispenses the idled material into the prime cup using the Recipe ID number and Drop Count. **AutoPurge** uses this procedure before each Run. The Purge procedure is also used in the **Run Program** menu if the **Purge Timer** option is selected.

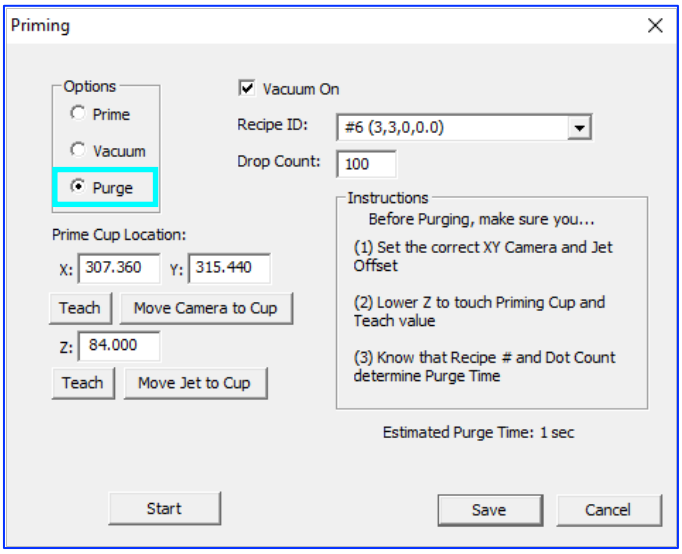


Figure 5-33: Purge Settings

1. Follow the procedures in sections 5.4.2 - Teach the Prime Cup Location, 5.4.3 - Teach the Prime Cup Location, and 5.4.4 - Enter the Controller Settings.
2. In the Priming window, select the **Purge** option.
3. Select the **Recipe ID** for the purge process.
4. Enter number of drops to dispense while purging in Drop Count. The Estimated Purge Time varies with the dispensing recipe timing parameters and the Drop Count.
5. Select the **Vacuum On** option if vacuum air is desired during purging.
6. Click **Move Jet to Cup** to move the jet to the Prime Cup location. Verify that the stored Z height allows the jet to touch the prime cap.
7. Click **Start** to begin the purging process.

5.4 Prime, Purge, or Vacuum the Jet, continued

5.4.7 Vacuum the Jet

Use the vacuum process to remove material around the nozzle tip and clean the inside the cap of the prime cup.

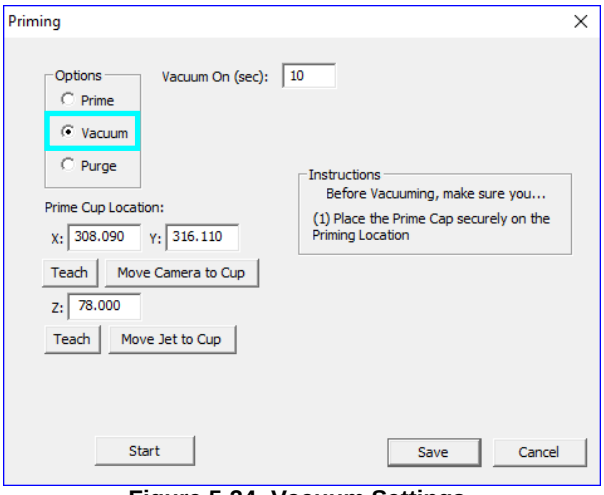


Figure 5-34: Vacuum Settings

1. Follow the procedures in sections 5.4.2 - Teach the Prime Cup Location, 5.4.3 - Teach the Prime Cup Location, and 5.4.4 - Enter the Controller Settings.
2. In the **Priming** window, select the **Vacuum** option.
3. Enter **Vacuum On** time in seconds.
4. Click **Move Jet to Cup** to move the jet to the Prime Cup location. Verify that the stored Z height allows the jet to touch the prime cap.
5. Click **Start** to begin the vacuum process.
6. The vacuum valve is opened, and vacuum from the cup removes material from outside the nozzle and inside the cap of the priming cup.

5.5 Set Up the Controller

Note: See Section 20 - Jet Controller for more explanation of the Controller window.

Click the **Controller** toolbar button for the **Jet Controller** window.

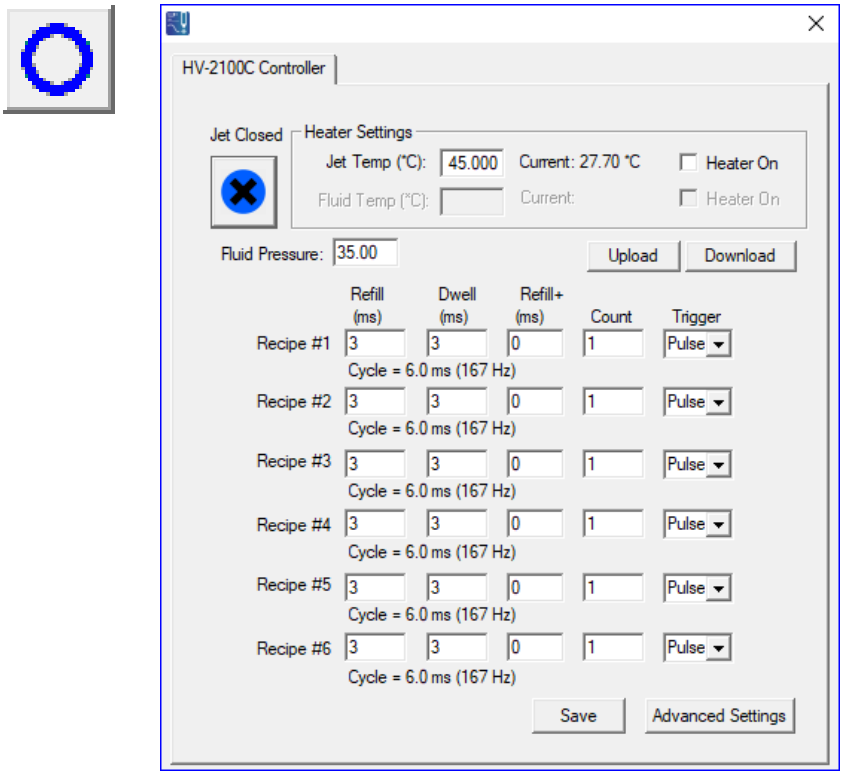


Figure 5-35: Jet Controller Window

5.5.1 Open and Close the Jet Valve

The large indicator button in the top left corner shows the Jet Valve status. An 'X' in the middle of the button indicates that the **Jet** is **Closed**, and an 'O' in the middle of the button indicates that the **Jet** is **Open.**

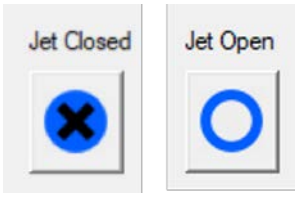


Figure 5-36: Jet Valve Closed/Open

To open/close the jet, click **Jet** in the Controller window or tap the **Jet** field on the Advanjet controller home screen and tap **<** or **>**. Listen for air bursts when the valve closes and opens.

5.5 Set Up the Controller, continued

Note: See the Advanjet HV-2100C Jet Controller manual (3A6266) or the HM-2600C Hotmelt Jet Controller manual (3A6166) for a detailed explanation of the controller settings. See the Advanjet Jet Dispensing Parameters Supplement (3A5937) for a detailed explanation of the timing recipe parameters.

5.5.2 Verify Advanjet Controller Front Panel Settings

The settings displayed in DispensePro Controller window correspond to the settings on the front panel of the Advanjet controller.

- **Fluid Pressure**: The value for Fluid Syringe Pressure shown at the top of the Advanjet controller touch screen. The default Fluid Pressure unit is psi.
- **Jet Temp (°C)**: The Set Value (SV) jet temperature on the Advanjet controller temperature regulator (green numbers). The HM-2600C controller has a second temperature controller for Fluid Temperature.
- **Current**: The Present Value (PV) of the temperature regulator (red numbers).
- **Heater On**: A ✓ next to **Heater On** indicates that the Heater is ON.

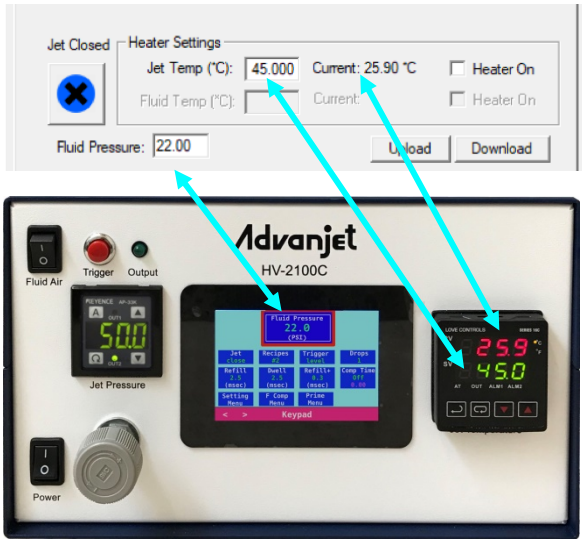


Figure 5-37: Controller Settings

- **Recipes**: The DispensePro Controller window shows the six recipes stored on the Advanjet controller, corresponding to the timing values displayed on the Advanjet controller Home Screen for that recipe. Figure 5-37 shows Recipe #2 on both.

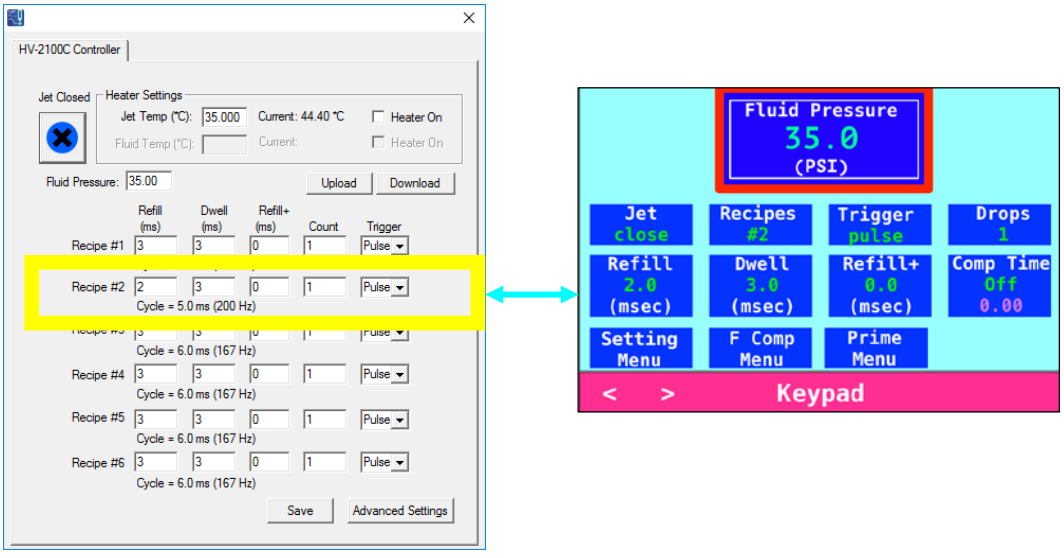
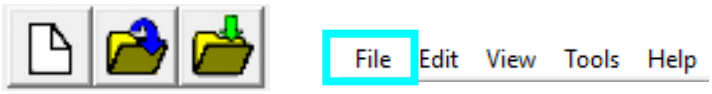


Figure 5-38: Timing Recipe Settings for Recipe #2 Displayed on DispensePro Controller Window and Advanjet Controller Touch Screen

6. File Management



6.1 New File

To create a new dispense program:

- Click on the **New File** toolbar button, or
- Select **File** and **New** from the top menu, or
- Type **Ctrl** + **N**.

6.2 Open File

To open a previously saved dispense program:

- Click on the **Open File** toolbar button, or
- Click on **File** and select **Open**, or
- Type **Ctrl** + **O**.

Dispense Programs are stored in Documents\DispensePro\Job Files. Click the file to select.

6.3 Save File

To save the current dispense program:

- Click on the **Save File** toolbar button.
- Click on **File** and select **Save**.
- Type **Ctrl** + **S**.

Dispense Programs are saved as .job files. For example, the dispense program used in the tutorial named DEMO is saved as DEMO.job. Verify that the path is Documents\DispensePro\Job Files. To rename a file, Click on **File**, select **Save As**, and enter the new name.

6.4 Fiducial Files

Fiducials are assigned the names of fid1 and fid2 along with the Fiducial ID name taught with the object location. For example, if Fiducial #1 is named SQUARE1 and Fiducial #2 is named SQUARE2, they are saved as fid1_SQUARE1 and fid2_SQUARE2.

All Fiducials are stored together in the Documents\DispensePro\FidImages folder. Fiducial ID names are not tied to their job file, so choose names exclusive to the job file.

During the dispense run, only the Documents\DispensePro\FidImages folder is searched for fiducial files. Do not move the fiducial files to another folder.

See Section 16.5.1 - Fiducial ID for more information about naming fiducials.

6.5 Saving and Transferring Controller Recipe Settings

6.5.1 The Save Command

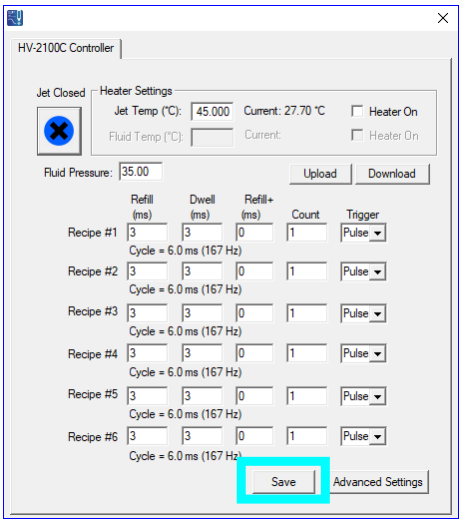


Figure 6-1: Click Save to Update the DispensePro Program

For every DispensePro job, six dispensing recipes are saved as part of the job file. Dispensing recipes contain the jet timing parameters, the fluid pressure, and the jet temperature (and the fluid temperature for the HM-2600). Each dispensing instruction in the job specifies which one of these six recipes the jet should use to dispense that instruction.

The recipe settings are editable in the Controller window, which is accessed from the Controller icon on the DispensePro toolbar or the Controller tab within the Run window. Clicking **Save** in the Controller window updates the recipe settings saved with the DispensePro but does not change the recipe settings in the Advanjet Controller.

6.5.2 The Download Command

The jet receives dispensing instructions from the Advanjet controller, not the robot. The controller uses the settings last stored for the six recipe numbers. DispensePro recipe modifications must be saved to the Advanjet controller. This is done using **Download**.

The **Download** command sends recipe settings for the currently (open) DispensePro program to the controller. Those recipe settings will be downloaded even if they haven't been saved to the job file using the **Save** command. Downloaded settings from DispensePro overwrite any existing controller settings.

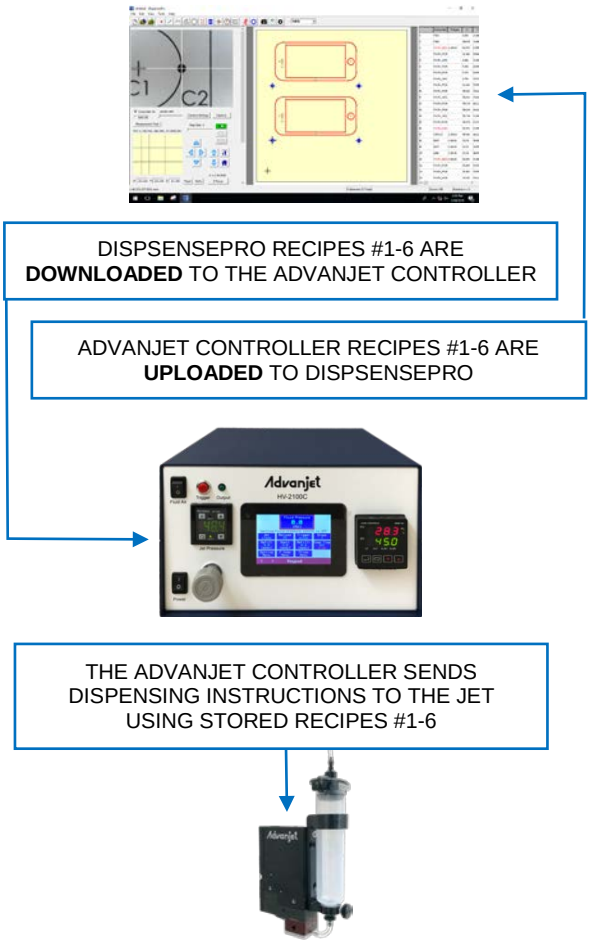


Figure 6-2: The Jet Dispenses the Recipes Stored in the Advanjet Controller

6.3.2 The Download Command, continued

There are multiple ways to download DispensePro Controller window recipes to the Advanjet controller:

- Click the **Controller** icon and then click **Download**.
- From the **Run** window, click the **Controller** tab, and then click **Download**.
- From the **Run** window, select the **Download Controller Options** box.

6.5.3 The Upload Command

Just as the **Download** command sends the current DispensePro job recipe settings to the Advanjet controller, the **Upload** command sends the current Advanjet controller recipe settings to the DispensePro job. Uploaded settings from the Advanjet controller overwrite the current recipe settings of the open DispensePro job.

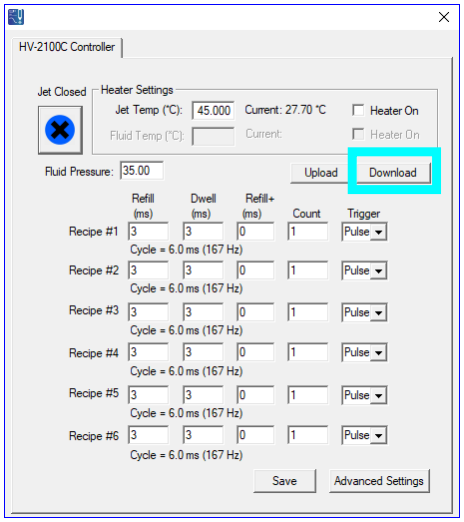


Figure 6-3: Click Download in the Controller Window

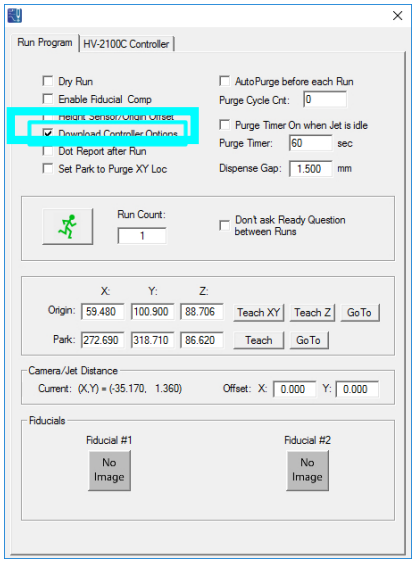


Figure 6-4: Select Download Controller Options in the Run Window

7. Program Anchors

Before creating dispensing instructions for a program, there are essential reference positions that must be established. The **Z Focus Height** and the **Data Origin** provide operating anchors for the dispensing instructions so that the taught locations are executed correctly. Because they are reference points, the Data Origin must be taught before any XY locations are added, and the Z axis must be at the Z Focus position for every taught location, including the Data Origin.

7.1 Z Focus Height

To set the camera focus position and pixel size, the Camera Calibration routine uses the Z–axis “magnification” height—the height where the camera image is clear and the Field of View is in focus, as depicted in Figure 7-1.

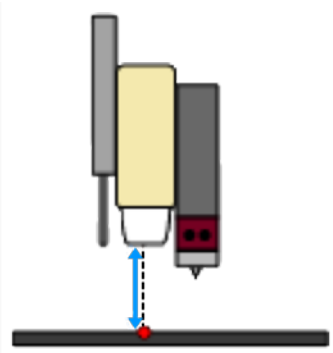


Figure 7-1: Z Focus Height is the Z-Axis Position When the Camera Image Is In Perfect Focus

The Z Focus height is the most accurate and consistent position for viewing the workpiece and teaching locations. To illustrate, Figure 7-2 shows an image when Z is in focus and the same image when Z is not in focus. Note the XYZ coordinates of the two images.

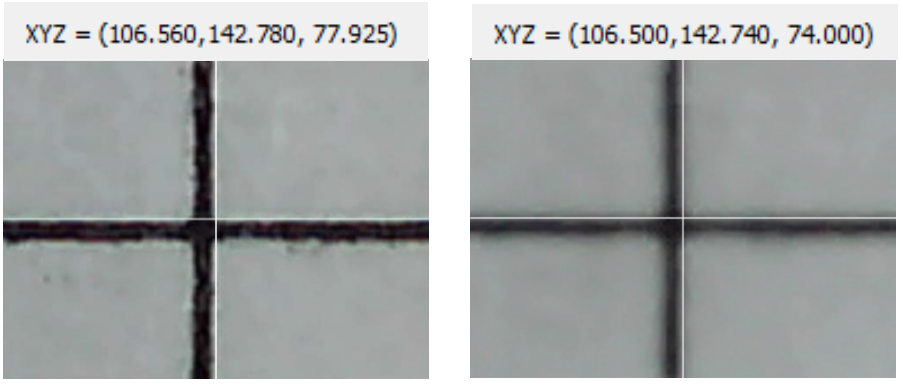


Figure 7-2: Robot’s Z In Z Focus Position (L); Robot’s Z Not In Z Focus Position (R)

The XY location when Z is at Z Focus Height is slightly different than when Z is not at Focus Height. Although the difference in XY position is very small (less than 0.1 millimeter), it can affect the accuracy and position of the dots and lines during dispensing.

7.1 Z Focus Position, continued

To ensure accurate positioning of all dispense instructions, the robot should be at the camera's Z Focus position before an XYZ coordinate location is added to a dispense instruction. Teaching the data at the wrong Z height leads to inaccurate programming and dispensing results. If the robot is not at Z-Focus position when a dispense instruction location is taught, A prompt is issued:

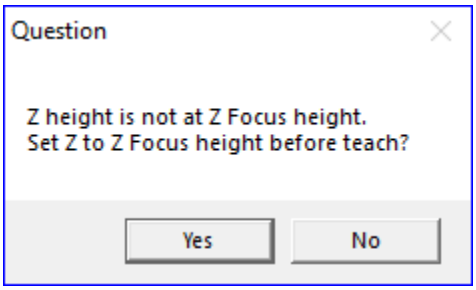


Figure 7-3: Prompt to Set Z Position to Z Focus Height Before Teaching

In the Navigation window, the current Z Focus position is displayed above the Z Focus button. The Z value of the XYZ coordinates displayed above the Navigation Window should be the same value. If the two values for Z do not match, click the **Z Focus** button to bring the robot to the correct Z height.

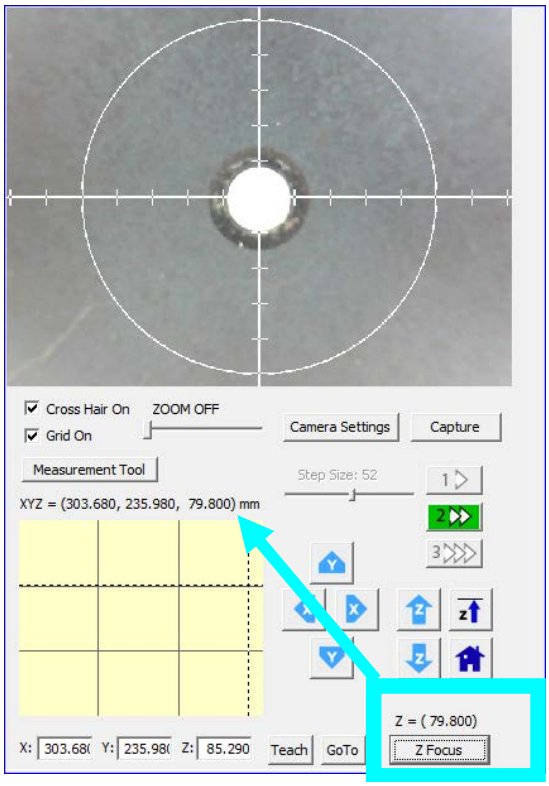


Figure 7-4: Z Focus Position Should Match Z Value of XYZ Coordinates Displayed Above Navigation Window

7.2 Data Origin

See Tutorial 2: Data Origin for a detailed explanation of the Data Origin.

The Data Origin is an XY location on the workpiece used as a reference point for the dispense instructions. Mapping the dispense instructions to the Data Origin gives the program flexibility. If the workpiece placement changes after the data origin has been taught, the XY locations move with the workpiece, and the dispense instructions are executed at the correct locations without having to reteach or edit the data coordinates.

In a new file, the default Data Origin is (0,0). If a dispense instruction is taught without establishing a unique Data Origin location, the XY location saved for the dispense location is the same as the XY location shown in the navigation window. For example, if the Data Origin is (0,0), the dispense instruction location for a dot taught at (20,20) would also be (20,20).

From the Top Menu, select **Edit** and **Data Origin** for the Data Origin window shown in Figure 7-4.

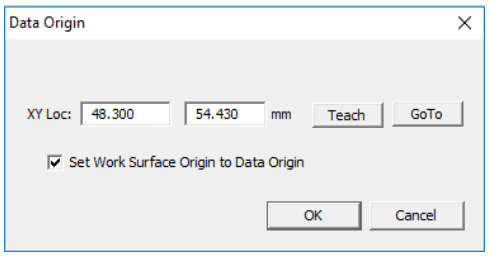


Figure 7-5: Data Origin Window

When a unique Data Origin location has been taught, the XY value of each data coordinate in the dispense instructions is taught relative to that Data Origin location. If the XY location represented in Figure 7-5 is taught as the Data Origin, then 48.300 is subtracted from every X value and 54.430 is subtracted from every Y value before the location is added to the instruction list.
The **Run Program** window provides an opportunity to **Go To** the Work Surface Origin and re-teach if needed before running the program.

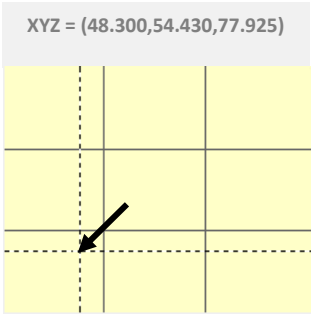


Figure 7-6:
XY Location (48.300,54.430)

See Section 19.2 - Run Program Options.

8. Common Procedures for Adding Dispense Instructions

The Dispense Instructions share several common components and procedures for building the job file.

8.1 Teach at Z Focus Height

As discussed in Section 7.1, the Z Focus height is the most accurate and consistent position for viewing the workpiece and teaching locations. Teaching the data at the wrong Z height leads to inaccurate programming and dispensing results.

- If the robot is not at Z Focus height when teaching an XY location, DispensePro issues the prompt in Figure 8-1.
- Click **Yes** to set the robot to the correct Z height before teaching the location.

Note: See Section 7.1 - Z Focus Position and Section 5.2 - Calibrate the Camera.

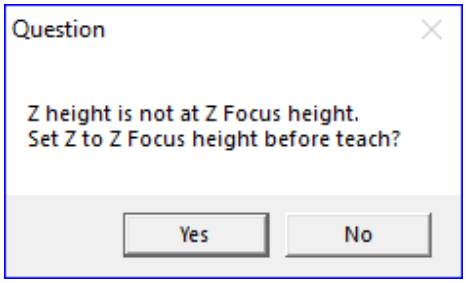


Figure 8-1: Prompt for Z Focus Height Position

8.2 Set the Data Origin

As discussed in Section 7.2, all dispense instruction locations are relative to the Data Origin. In a new DispensePro program, the default Data Origin is always (0,0). Before entering any dispense instructions for a new program, adding new dispense instructions to an existing program, or if the position of the workpiece has changed, the Data Origin must be set (or reset).

- Click **Edit** and select **Data Origin** to define the Data Origin for the new program.
- Verify that the **Set Work Surface Origin to Data Origin** option is selected

Note: See Section 7.2 - Data Origin and Tutorial 2: Data Origin.

8.3 Choose the Timing Recipe

In every Instruction List window (Add Dots, Add Lines, etc.) the **Recipe** field shows the recipe number and parameters for the six timing recipes stored in the controller.

- For each dispense instruction, a timing recipe number must be selected before teaching and adding the XY Location to the instruction list.
- The **Recipe** field displays the timing recipe number and timing parameters last used. Click the **Recipe** list to select a recipe.
- Dot, Line, Arc, Path, and Circle set the trigger and number of dots as part of the instruction.
- Timing recipe parameters cannot be edited from the Instruction List windows. Click the **Controller** button to edit the recipe parameters.

Note: See the Advanjet HV-2100C Jet Controller manual (3A6266), the HM-2600C Hotmelt Jet Controller manual (3A6166), or the Advanjet Jet Dispensing Parameters Supplement (3A5937) for a detailed explanation of the timing recipe parameters.

9. Dots

> ***Reminder:*** *Before teaching an XY Location:*
> ✓ *Enter the Recipe, Speed, and other instruction-specific parameters.*
> ✓ *Verify that the Data Origin has been set.*
> ✓ *Verify that the robot is at the camera's Z Focus position.*

9.1 Adding Dots

The **Dots** instruction adds a dot to the instruction list by entering the X and Y coordinates of the desired dot location.

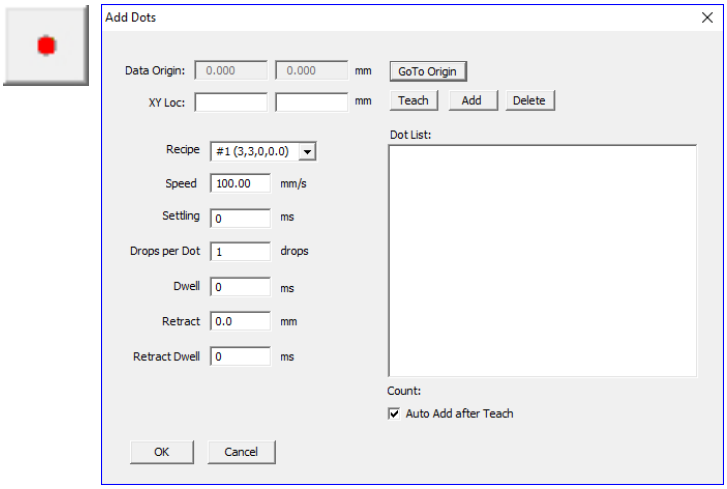
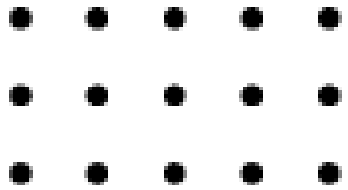


Figure 9-1: Dots Window

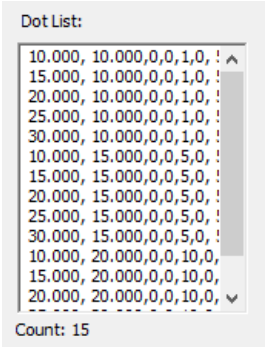
1. Enter the coordinates or click and **Teach** the XY location for XY Loc.
2. Choose the **Recipe** for dispensing the dots.
3. Enter the robot **Speed** for moving to this dot location.
4. Enter the **Settling** time in milliseconds; default time is zero (0). The Robot waits at the XY location for (**Settling** time) before dispensing.
5. Enter the number of **Drops per Dot** for this XY location.
6. Enter the **Dwell** time in milliseconds; default time is zero (0). The Robot waits for (**Dwell** time) after dispensing.
7. Enter the **Retract** distance in millimeters; default distance is zero (0). The Robot moves up (**Retract** distance) after dispensing.
8. Enter the **Retract Dwell** time in milliseconds; default time is zero (0). The Robot waits at the **Retract** position for (**Retract Dwell** time) before moving to the next position.
9. If coordinates are entered or if **Auto Add** is not enabled for **Teach**, click **Add** to save the coordinates and recipe values to the Dot List.
10. If there are additional dots, move the camera to the next dot position and repeat from Step 1.
11. Click **OK** to save the Dot List to the Instruction List.

9.2 Dots Programming Examples

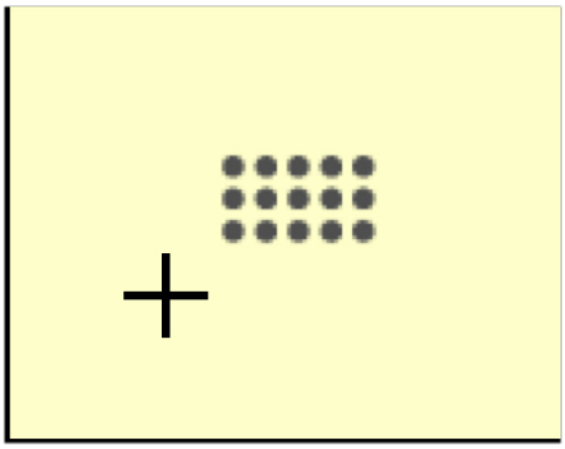
SAMPLE DOT PROGRAM



CORRESPONDING DOT LIST FOR SAMPLE DOT PROGRAM



DATA PREVIEW OF SAMPLE DOT PROGRAM



INSTRUCTION LIST FOR SAMPLE DOT PROGRAM

	Instruction	Recipe	X	Y
1	DOT	1, 50.00	10.000	10.000
2	DOT	1, 50.00	15.000	10.000
3	DOT	1, 50.00	20.000	10.000
4	DOT	1, 50.00	25.000	10.000
5	DOT	1, 50.00	30.000	10.000
6	DOT	1, 50.00	10.000	15.000
7	DOT	1, 50.00	15.000	15.000
8	DOT	1, 50.00	20.000	15.000
9	DOT	1, 50.00	25.000	15.000
10	DOT	1, 50.00	30.000	15.000
11	DOT	1, 50.00	10.000	20.000
12	DOT	1, 50.00	15.000	20.000
13	DOT	1, 50.00	20.000	20.000
14	DOT	1, 50.00	25.000	20.000
15	DOT	1, 50.00	30.000	20.000

DOT SIZES IN DROPS PER DOT

9.3 Dots Programming Notes

The Dispensing **Recipe**, **Speed**, **Drops per Dot**, **Settling**, **Dwell**, **Retract**, and **Retract Dwell** parameters specified in the Add Dots window apply only to the current dot being added at the XY Location displayed. For each new dot, enter the recipe parameters before teaching and adding the location. This makes it possible to combine dots with varying dispensing parameters in the same Instruction List.

For example, in order to specify one drop for the first dot and two drops for the second dot, the **Drops per Dot** must be set to 1 before teaching the first dot, and then set to 2 before teaching the location of the second dot.

10. Lines

> ***Reminder:*** *Before teaching an XY Location:*
> ✓ *Enter the Recipe, Speed, and other instruction-specific parameters.*
> ✓ *Verify that the Data Origin has been set.*
> ✓ *Verify that the robot is at the camera's Z Focus position.*

10.1 Adding Lines

The **Lines** instruction adds a line as a continuous dispense between a start point and end point.

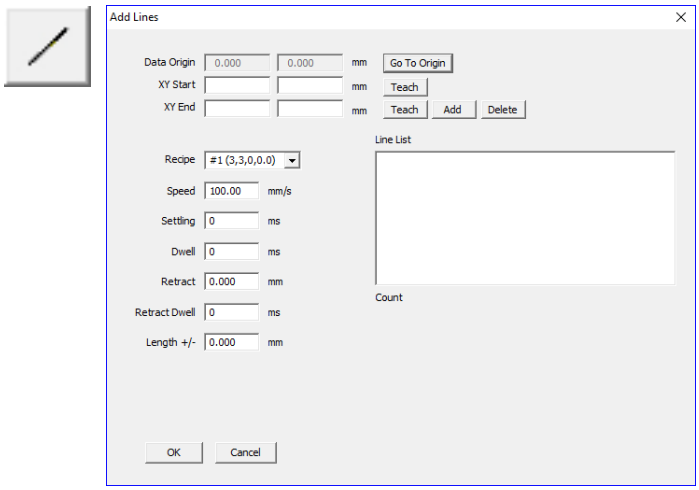
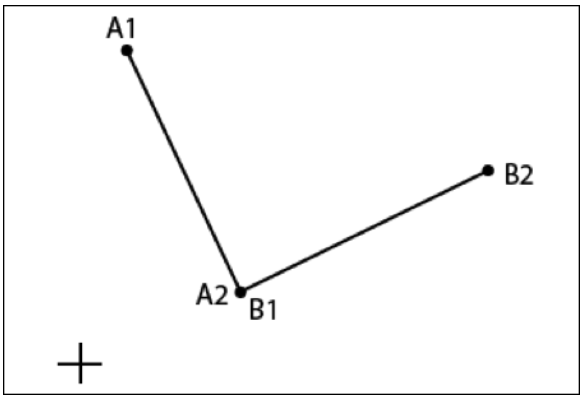


Figure 10-1: Lines Window

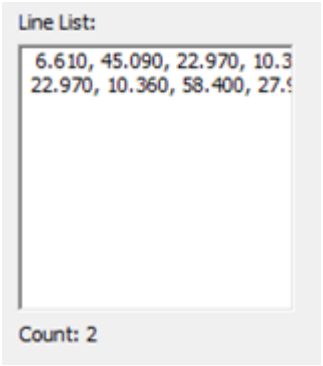
1. Enter the coordinates or click and **Teach** the XY locations for **XY Start** and **XY End**.
2. Choose the **Recipe** for dispensing the line.
3. Enter the robot **Speed** for moving from the starting point to the ending point.
4. Enter the **Settling** time in milliseconds; default time is zero (0). The Robot waits at the XY location for (**Settling** time) before dispensing.
5. Enter the **Dwell** time in milliseconds; default time is zero (0). The Robot waits for (**Dwell** time) after dispensing.
6. Enter the **Retract** distance in millimeters; default distance is zero (0). The Robot moves up (**Retract** distance) after dispensing.
7. Enter the **Retract Dwell** time in milliseconds; default time is zero (0). The Robot waits at the **Retract** position for (**Retract Dwell** time) before moving to the next position.
8. Enter the line length adjustment in the **Length +/-** field.
9. Click **Add** to save the coordinates and recipe values to the Line List. The Auto Add option is not available for Lines.
10. If there are additional lines, move the camera to the starting point of the next line and repeat from Step 1.
11. Click **OK** to save the Line List to the Instruction List.

10.2 Lines Programming Examples

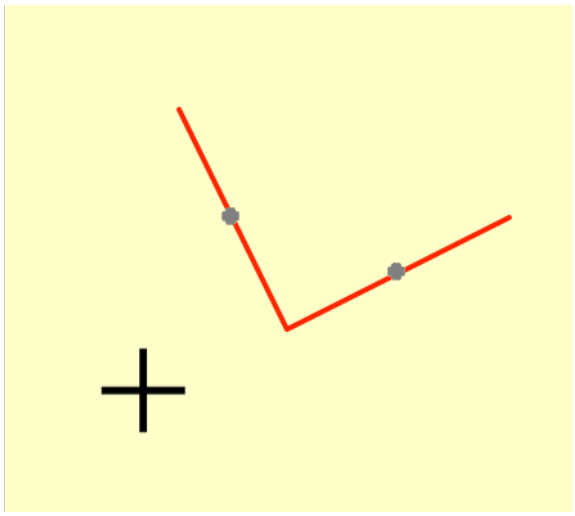
SAMPLE LINE PROGRAM



CORRESPONDING LINE LIST FOR SAMPLE LINE PROGRAM



DATA PREVIEW OF SAMPLE LINE PROGRAM



INSTRUCTION LIST FOR SAMPLE LINE PROGRAM

	Instruction	Recipe	X	Y
1	LINE	2, 100.00	14.790	27.725
2	LINE	2, 100.00	40.685	19.155

10.3 Lines Programming Notes

The Dispensing **Recipe** and **Speed** parameters specified in the Add Lines window apply only to the current line being added at the XY Start and XY End locations displayed. For each new line, enter the recipe parameters before teaching and adding the location. This makes it possible to combine lines with varying dispensing parameters in the same Line List.

For example, in order to specify dispensing for one line at 50 mm/s and another at 100 mm/s, Speed must be set to 50 mm/s before teaching the XY Start and XY End locations of the first line, and then set to 100 mm/s before teaching the second line.

11. Arcs

> ***Reminder:*** *Before teaching an XY Location:*
> ✓ *Enter the Recipe, Speed, and other instruction-specific parameters.*
> ✓ *Verify that the Data Origin has been set.*
> ✓ *Verify that the robot is at the camera's Z Focus position.*

11.1 Adding Arcs

The **Arcs** instruction adds a curved path by teaching the Start, Midpoint, and End points that define the arc.

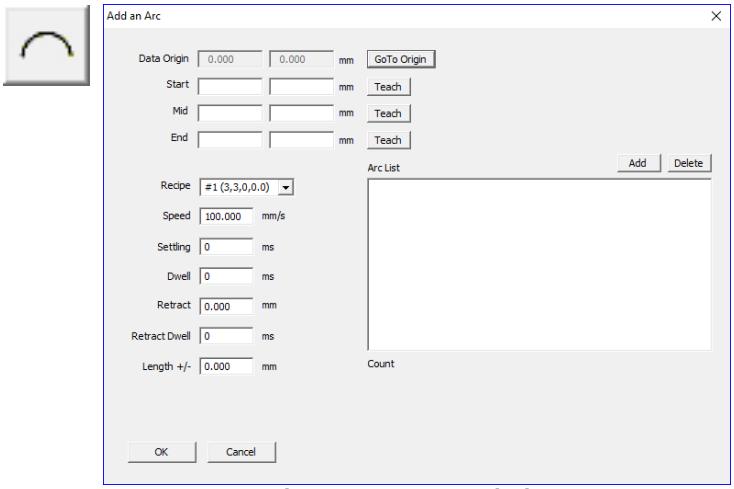
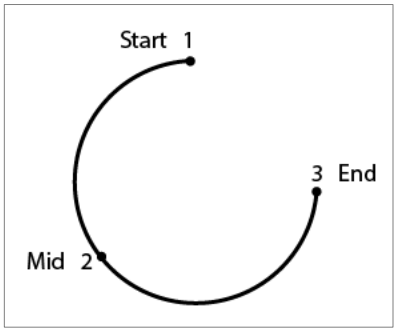


Figure 11-1: Arcs Window

1. Enter the XY coordinates or click and **Teach** the XY locations for the Start, Middle, and End locations.
2. Choose the **Recipe** number for dispensing the arc.
3. Enter the robot **Speed** for moving between the arc points.
4. Enter the **Settling** time in milliseconds; default time is zero (0). The Robot waits at the XY location for (**Settling** time) before dispensing.
5. Enter the **Dwell** time in milliseconds; default time is zero (0). The Robot waits for (**Dwell** time) after dispensing.
6. Enter the **Retract** distance in millimeters; default distance is zero (0). The Robot moves up (**Retract** distance) after dispensing.
7. Enter the **Retract Dwell** time in milliseconds; default time is zero (0). The Robot waits at the **Retract** position for (**Retract Dwell** time) before moving to the next position.
8. Enter the line length adjustment in the **Length +/-** field.
9. Click **Add** to save the coordinates, recipe and speed values to the Arc List. The Auto Add option is not available for Arcs.
10. If there are additional arcs, move the camera to the next arc position and repeat from Step 1.
11. Click **OK** to save the Arc List to the Instruction List.

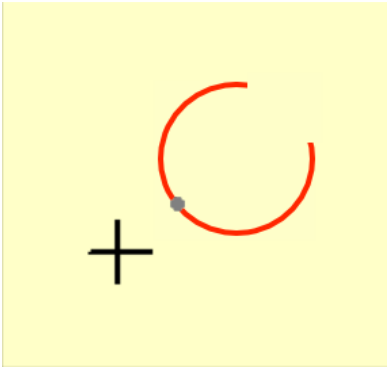
11.2 Arcs Programming Examples

SAMPLE ARC PROGRAM



CORRESPONDING ARC LIST FOR SAMPLE ARC PROGRAM

DATA PREVIEW OF SAMPLE ARC PROGRAM



INSTRUCTION LIST FOR SAMPLE ARC PROGRAM

	Instruction	Recipe	X	Y
1	ARC	2, 100.00	12.670	9.890

11.3 Arcs Programming Notes

The Dispensing **Recipe** and **Speed** parameters specified in the Add Arcs window apply only to the current arc being added at the XY Start, Middle, and End locations displayed. For each new arc, enter the recipe parameters before teaching and adding the location. This makes it possible to combine arcs with varying dispensing parameters in the same Instruction List.

For example, in order to specify dispensing for one arc at 50 mm/s and another at 100 mm/s, Speed must be set to 50 mm/s before teaching the before teaching XY Start and XY End locations of the first arc, and then set to 100 mm/s before teaching the second arc.

12. Paths

> ***Reminder:*** *Before teaching an XY Location:*
> ✓ *Enter the Recipe, Speed, and other instruction-specific parameters.*
> ✓ *Verify that the Data Origin has been set.*
> ✓ *Verify that the robot is at the camera's Z Focus position.*

12.1 Adding Paths

The **Paths** instruction adds an irregular shape that contains lines and arcs, such as a gasket. Two points for Lines or three points for Arcs are taught for each path segment. In the instruction list, the line and arc segments are connected as a continuous path.

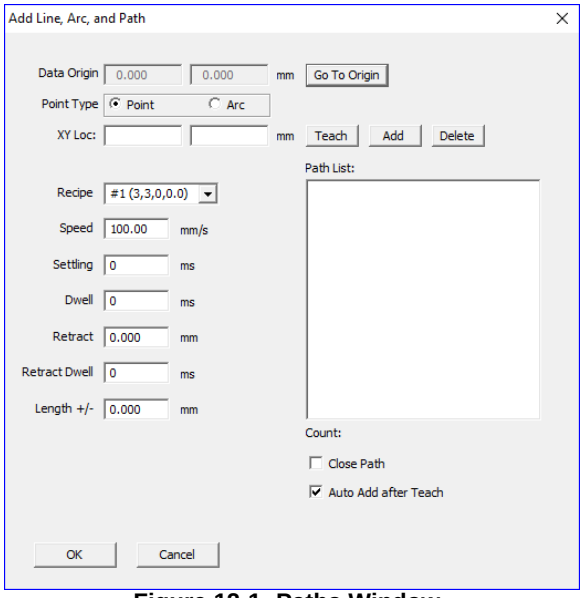
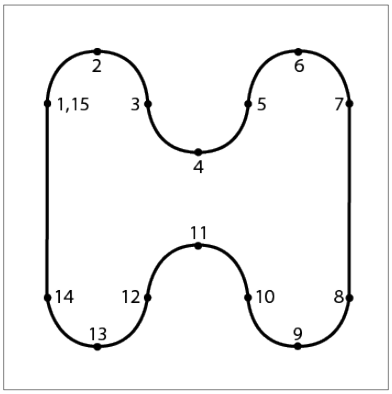


Figure 12-1: Paths Window

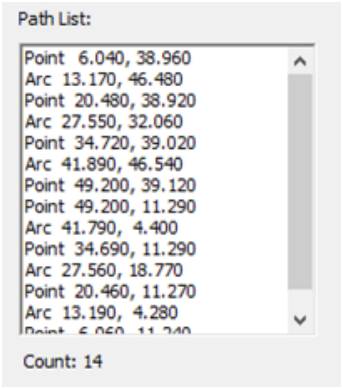
1. Choose Point Type **Point** or **Arc**.
2. Enter the XY coordinates or click and **Teach** the XY locations for all of the path points. The best XY location for an Arc Point Type is the midpoint of the arc.
3. Choose the **Recipe** number for dispensing the entire path.
4. Enter the robot **Speed** for moving between the path points.
5. Enter the **Settling** time in milliseconds; default time is zero (0). The Robot waits at the XY location for (**Settling** time) before dispensing.
6. Enter the **Dwell** time in milliseconds; default time is zero (0). The Robot waits for (**Dwell** time) after dispensing.
7. Enter the **Retract** distance in millimeters; default distance is zero (0). The Robot moves up (**Retract** distance) after dispensing.
8. Enter the **Retract Dwell** time in milliseconds; default time is zero (0). The Robot waits at the **Retract** position for (**Retract Dwell** time) before moving to the next position.
9. Enter the line length adjustment in the **Length +/-** field.
10. If coordinates are entered or Auto Add is not enabled for **Teach**, click **Add** to save the coordinates to the Path List.
11. Move the camera to the next coordinate on the path and repeat from Step 1.
12. After the last path point is taught, select **Close Path**. An instruction is automatically created that connects first and last points in the path list.
13. Click **OK** to save the Path List to the Instruction List.

12.2 Paths Programming Examples

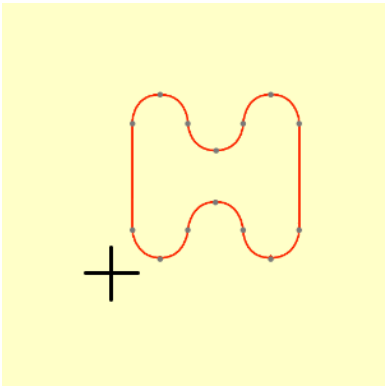
SAMPLE PATHS PROGRAM



CORRESPONDING LIST FOR SAMPLE PATHS PROGRAM



DATA PREVIEW OF SAMPLE PATHS PROGRAM



INSTRUCTION LIST FOR SAMPLE PATHS PROGRAM

	Instruction	Recipe	X	Y
1	PATH_BEGIN	2, 100.00	6.040	38.960
2	PATH_ARC		13.170	46.480
3	PATH_POINT		20.480	38.920
4	PATH_ARC		27.550	32.060
5	PATH_POINT		34.720	39.020
6	PATH_ARC		41.890	46.540
7	PATH_POINT		49.200	39.120
8	PATH_POINT		49.200	11.290
9	PATH_ARC		41.790	4.400
10	PATH_POINT		34.690	11.290
11	PATH_ARC		27.560	18.770
12	PATH_POINT		20.460	11.270
13	PATH_ARC		13.190	4.280
14	PATH_POINT		6.060	11.240
15	PATH_END		6.040	38.960

The sample Paths program shows six arc midpoints (2, 4, 6, 9, 11, 13) and eight connected points (1, 3, 5, 7, 8, 10, 12, 14). On the Instruction List, those points are labeled PATH_ARC.

Point 14 was the last point taught before saving the Path List to the Instruction List. On the Instruction List, the first location taught (1) is now PATH_BEGIN, and after the last location taught (14), a PATH_END instruction has been added (15). PATH_END is the same location as PATH__BEGIN, as shown on the sample program diagram.

12.3 Paths Programming Notes

The **PATH_BEGIN** and **PATH_END** labels in the Instruction List define the beginning and end of a continuous path. The **PATH_POINT** or **PATH_ARC** instructions that are between **PATH_BEGIN** and **PATH_END** define the shape of the continuous path.

13. Circles

> ***Reminder:*** *Before teaching an XY Location:*
> ✓ *Enter the Recipe, Speed, and other instruction-specific parameters.*
> ✓ *Verify that the Data Origin has been set.*
> ✓ *Verify that the robot is at the camera's Z Focus position.*

13.1 Adding Circles

The **Circles** instruction adds an open round shape by entering its center point and radius.

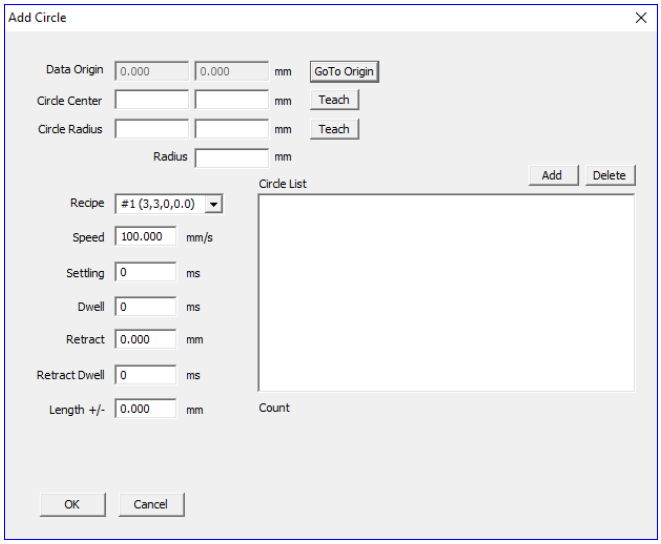
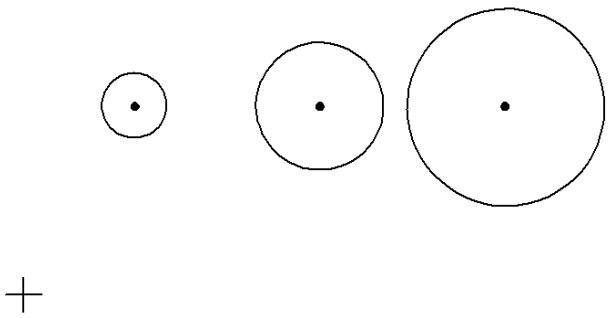


Figure 13-2: Circles Window

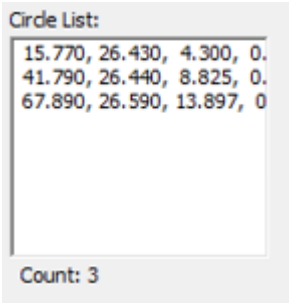
1. Enter the XY coordinates or click and **Teach** the XY locations for circle center and circle radius (any point on the circumference). After the center and radius locations are taught, the **Radius** value is calculated automatically.
2. Choose the **Recipe** number for dispensing the circle.
3. Enter the robot **Speed** for dispensing this circle.
4. Enter the **Settling** time in milliseconds; default time is zero (0). The Robot waits at the XY location for (**Settling** time) before dispensing.
5. Enter the **Dwell** time in milliseconds; default time is zero (0). The Robot waits for (**Dwell** time) after dispensing.
6. Enter the **Retract** distance in millimeters; default distance is zero (0). The Robot moves up (**Retract** distance) after dispensing.
7. Enter the **Retract Dwell** time in milliseconds; default time is zero (0). The Robot waits at the **Retract** position for (**Retract Dwell** time) before moving to the next position.
8. Enter the line length adjustment in the **Length +/-** field.
9. Click **Add** to save the XY locations, recipe and speed values to the Circle List. The Auto Add option is not available for Circles.
10. If there are additional circles, move the camera to the start of the next circle and repeat from Step 1.
11. Click **OK** to save the Circle List to the Instruction List.

13.2 Circles Programming Examples

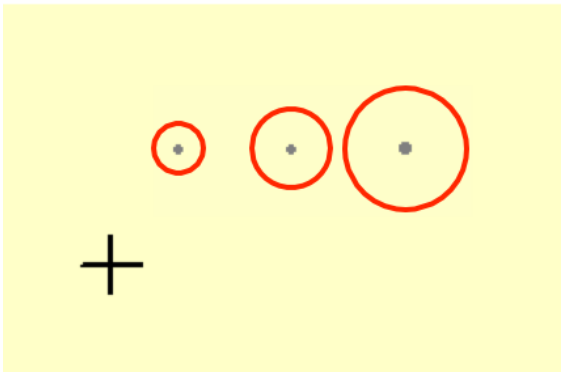
SAMPLE CIRCLES PROGRAM



CORRESPONDING CIRCLE LIST FOR SAMPLE CIRCLE PROGRAM



DATA PREVIEW OF SAMPLE CIRCLE PROGRAM



INSTRUCTION LIST FOR SAMPLE CIRCLE PROGRAM

	Instruction	Recipe	X	Y
1	CIRCLE	2, 100.00	15.770	26.430
2	CIRCLE	2, 100.00	41.790	26.440
3	CIRCLE	2, 100.00	67.890	26.590

14. Palette of Dots

> ***Reminder:*** *Before teaching an XY Location:*
> ✓ *Enter the Recipe, Speed, and other instruction-specific parameters.*
> ✓ *Verify that the Data Origin has been set.*
> ✓ *Verify that the robot is at the camera's Z Focus position.*

14.1 Adding a Palette of Dots

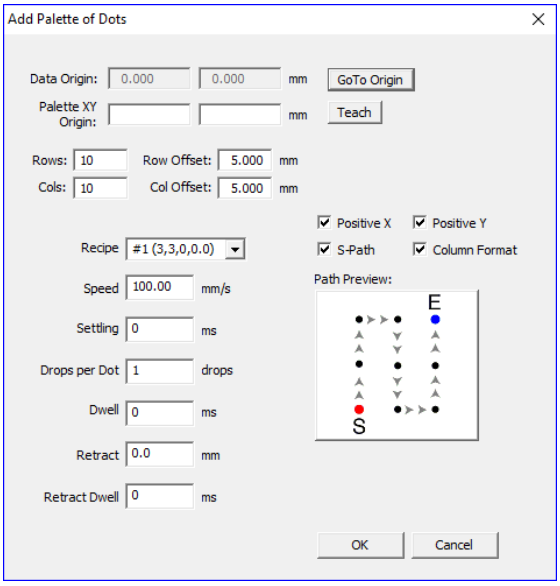


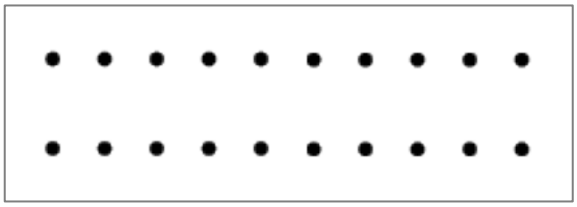
Figure 14-1: Palette of Dots Window

The Palette of Dots instruction adds a palette of evenly spaced dots to the instruction list, offering an alternative to adding each dot one at a time. Enter the XY coordinates or click and **Teach** the XY location for the lower left (LL) corner of the Palette XY Origin.

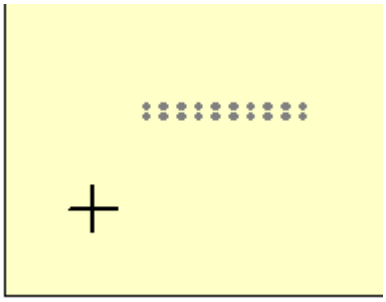
1. Enter the number of **Rows** and **Columns**, and the **Row Offset** and **Column Offset** values (distance between rows or columns).
2. Choose the dot path format options:
   - **Positive X** travels left to right
   - **Positive Y** travels bottom to top
   - **S-Path** alternates positive/negative travel
   - **Column Format** dispenses in columns
3. Choose the **Recipe** number for dispensing this palette.
4. Enter the robot **Speed** for moving between the palette points.
5. Enter the **Settling** time in milliseconds; default time is zero (0). The Robot waits at the XY location for (**Settling** time) before dispensing.
6. Enter the number of **Drops** per dot.
7. Enter the **Dwell** time in milliseconds; default time is zero (0). The Robot waits for (**Dwell** time) after dispensing.
8. Enter the **Retract** distance in millimeters; default distance is zero (0). The Robot moves up (**Retract** distance) after dispensing.
9. Enter the **Retract Dwell** time in milliseconds; default time is zero (0). The Robot waits at the **Retract** position for (**Retract Dwell** time) before moving to the next position.
10. Click **OK** to save the palette to the Instruction List.

14.2 Palette of Dots Programming Examples – Rows

SAMPLE PALETTE OF DOTS PROGRAM



DATA PREVIEW OF
SAMPLE PALETTE OF DOTS PROGRAM

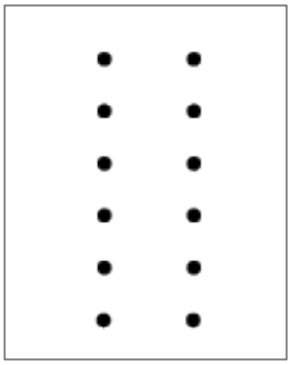


INSTRUCTION LIST FOR
SAMPLE PALETTE OF DOTS PROGRAM

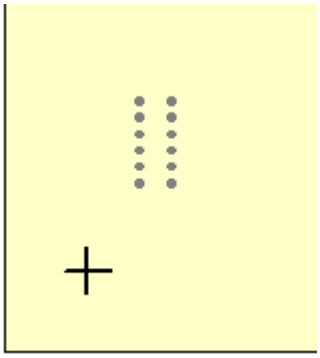
	Instruction	Recipe	X	Y
1	DOT	1, 100.00	15.780	26.370
2	DOT	1, 100.00	20.780	26.370
3	DOT	1, 100.00	25.780	26.370
4	DOT	1, 100.00	30.780	26.370
5	DOT	1, 100.00	35.780	26.370
6	DOT	1, 100.00	40.780	26.370
7	DOT	1, 100.00	45.780	26.370
8	DOT	1, 100.00	50.780	26.370
9	DOT	1, 100.00	55.780	26.370
10	DOT	1, 100.00	60.780	26.370
11	DOT	1, 100.00	60.780	36.370
12	DOT	1, 100.00	55.780	36.370
13	DOT	1, 100.00	50.780	36.370
14	DOT	1, 100.00	45.780	36.370
15	DOT	1, 100.00	40.780	36.370
16	DOT	1, 100.00	35.780	36.370
17	DOT	1, 100.00	30.780	36.370
18	DOT	1, 100.00	25.780	36.370
19	DOT	1, 100.00	20.780	36.370
20	DOT	1, 100.00	15.780	36.370

14.3 Palette of Dots Programming Examples – Columns

SAMPLE PALETTE OF DOTS PROGRAM



DATA PREVIEW OF
SAMPLE PALETTE OF DOTS PROGRAM

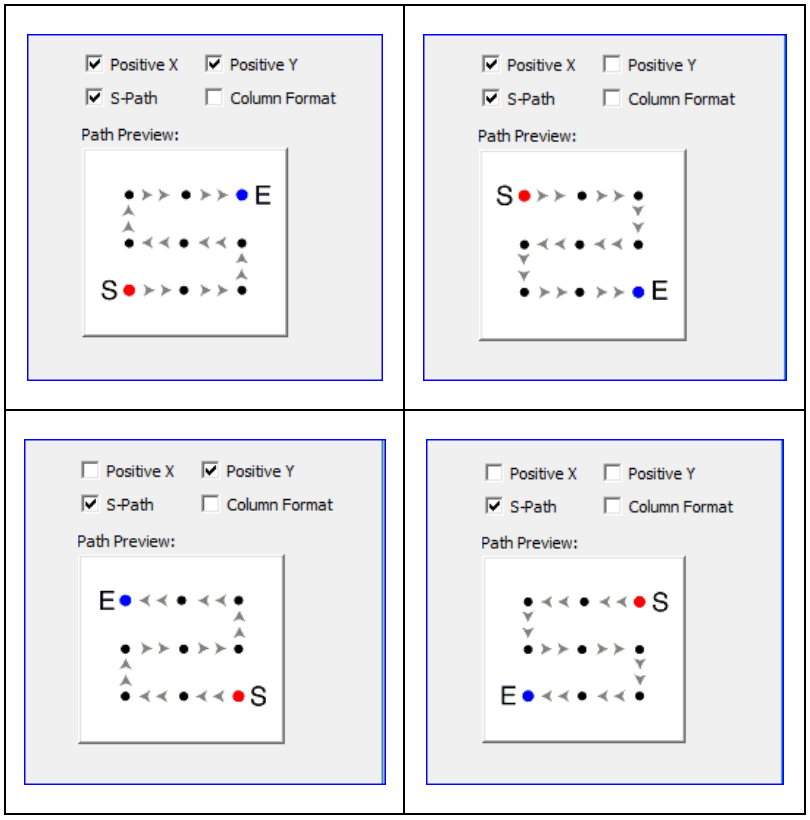


INSTRUCTION LIST FOR
SAMPLE PALETTE OF DOTS PROGRAM

	Instruction	Recipe	X	Y
1	DOT	1, 100.00	15.780	26.370
2	DOT	1, 100.00	15.780	31.370
3	DOT	1, 100.00	15.780	36.370
4	DOT	1, 100.00	15.780	41.370
5	DOT	1, 100.00	15.780	46.370
6	DOT	1, 100.00	15.780	51.370
7	DOT	1, 100.00	25.780	51.370
8	DOT	1, 100.00	25.780	46.370
9	DOT	1, 100.00	25.780	41.370
10	DOT	1, 100.00	25.780	36.370
11	DOT	1, 100.00	25.780	31.370
12	DOT	1, 100.00	25.780	26.370

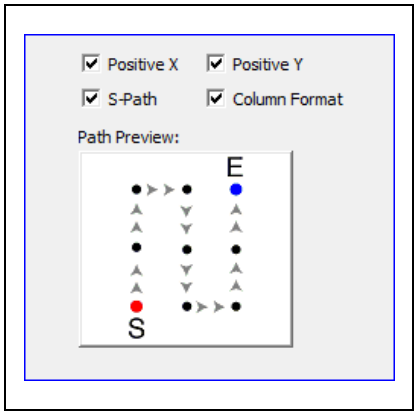
14.4 Row Format Paths

The diagrams demonstrate the path the robot follows for various **Row Format** combinations of **Positive X** and **Positive Y**. **Column Format** is always **OFF**, and **S-Path** is always **ON**. The path start point is red and the path end point is blue.



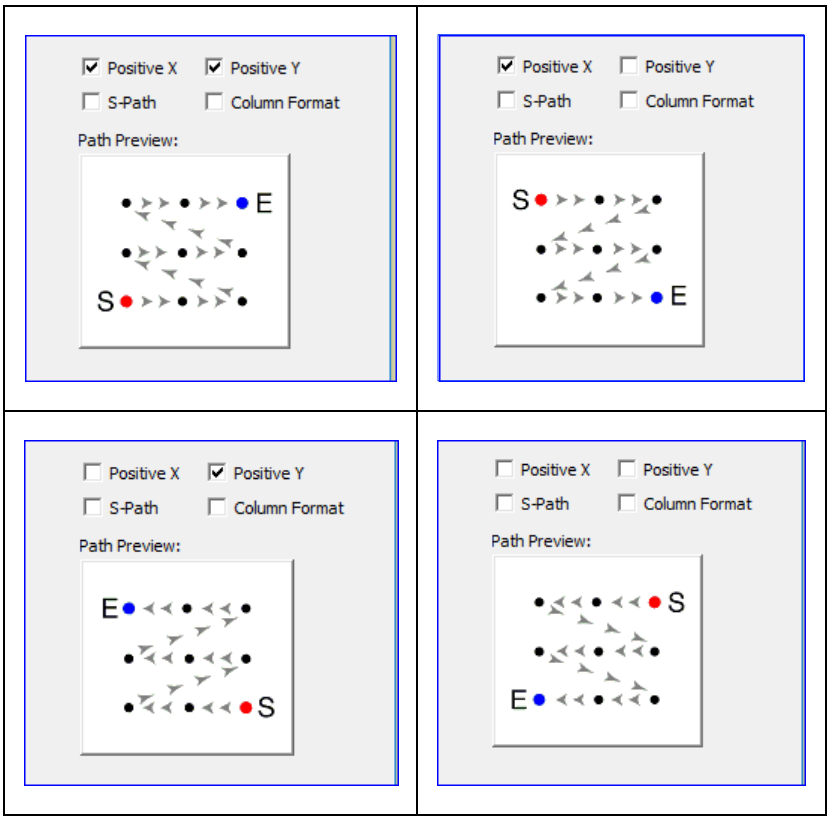
14.5 Column Format Paths

In **Column Format** paths, the robot starts the path in the Y direction instead of in the X direction. **Column Format** is always **ON**, and **S-Path** is always **ON**. The path start point is red and the path end point is blue.



14.6 Path Format with S Path OFF

Deselecting the **S Path** option results in a zigzag path that increases the travel time from row to row or column to column. For example, to dispense rows with Positive X, Positive Y, and **S-Path ON**, the robot dispenses the first row left to right, then travels up, and then dispenses the second row right to left. With **S-Path OFF**, the robot dispenses each row left to right, traveling diagonally up and left between rows, as shown below. The path start point is red and the path end point is blue.



15. Add Z Motion

Note: It is important that the settings in System Calibration Step 2: Height Sensor to Work Surface and Step 3: Nozzle Tip to Tactile Switch are properly set before adding the Z Motion instructions.

When the dispensing run starts, a height sensing operation is performed. DispensePro calculates $\mathbf{Z_i}$, the initial Z position, using a combination of this height measurement, the values saved for nozzle tip detection in the calibration routine, and the dispense gap specified in the **Run Program** window.

Throughout the dispensing run, DispensePro maintains a current nozzle tip Z position, $\mathbf{Z_C}$. The starting value for $\mathbf{Z_C}$ is the same as $\mathbf{Z_i}$ at the start of the run. The **Add Z Motion** instruction adjusts the dispense gap at a specified XY location during the run, with or without performing a height sensing measurement at that location. This is helpful in accommodating irregular workpieces. Add Z Motion instructions can be inserted at any point in the instruction list, and as many as needed.

15.1 Calculation of Current Z Position

Figure 15-1 shows how Z_C is calculated using the height sensor at Add Z Motion locations (X_1,Y_1), (X_2,Y_2), and (X_3,Y_3), given corresponding dispense gaps of +2 mm, +5 mm, and +3 mm, and height sensing measurements at each Add Z Motion location.

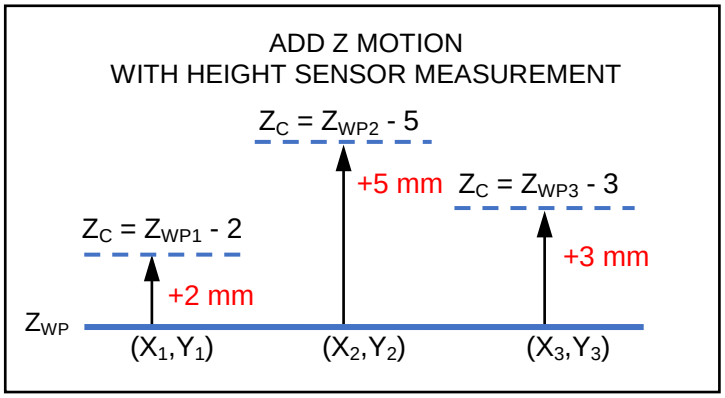


Figure 15-1: Height Sensor Measurement Performed at (X_1Y_1), (X_2Y_2), and (X_3Y_3)

- $\mathbf{Z_{HS}}$ is the height of the workpiece found by the height sensor at the XY Location specified in the Add Z Motion settings.
- $\mathbf{Z_{WP}}$ is the height where the nozzle tip touches the workpiece. The value of Z_{WP} is calculated using Z_{HS} and the saved value of Nozzle Tip to Tactile Switch offset.
- $\mathbf{Z_C}$ is the corrected Z gap between the nozzle tip and the workpiece. The value of Z_C is Z_{WP} adjusted by the Dispense Gap specified in the Add Z Motion settings.

15.1 Calculation of Current Z Position, continued

Figure 15-2 shows how Z_C is calculated at Add Z Motion locations (X_1,Y_1), (X_2,Y_2), and (X_3,Y_3), given corresponding dispense gap adjustments of +2 mm, +5 mm, and -3 mm. Height sensing measurements are not performed at the Add Z Motion locations; the calculation of Z_C uses only the **Dispense Gap** adjustment value for that location.

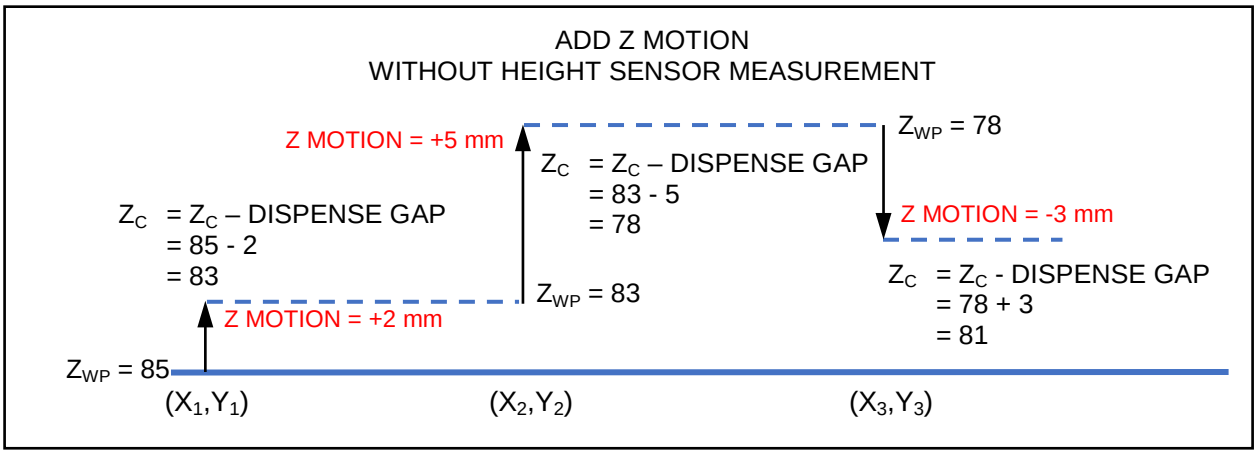


Figure 15-2: Dispense Gap Adjusted at (X_1Y_1), (X_2Y_2), and (X_3Y_3)

- For this example, the starting **Z_{WP}** for (X_1Y_1) is 85.
- Since no height sensor measurement is performed, the value of Z_C is the last used Z_C + the Dispense Gap adjustment specified in the Add Z Motion settings, making the dispense gap adjustments to Z_C cumulative. Accordingly, the starting **Z_{WP}** for (X_2Y_2) is the Z_C from (X_1Y_1), and the starting **Z_{WP}** for (X_3Y_3) is the Z_C from (X_2Y_2).

15.2 Add Z Motion Using the Height Sensor

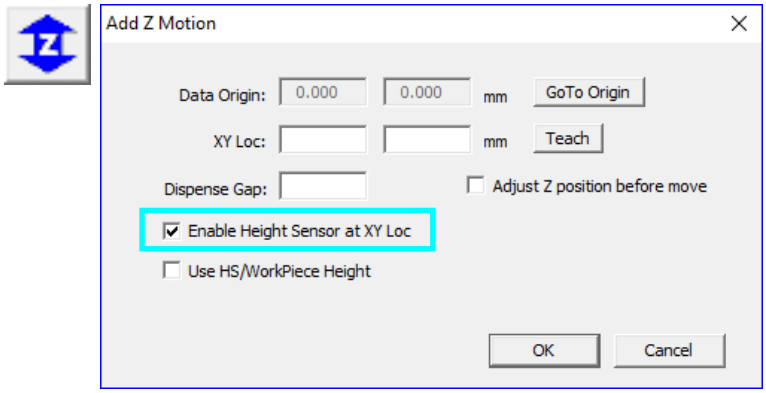


Figure 15-3: Add Z Motion Using the Height Sensor

1. Enter the coordinates or click and **Teach** the XY location for the **XY Loc**. This is the location where the height sensing measurement is performed.
2. Enter the desired adjustment value for **Dispense Gap**. A dispense gap must be specified, even if it is the same gap as the current Run Program value.
3. Select **Height Sensor at XY Location** to use the height sensor to detect the workpiece height.
4. By default, the Add Z Motion instruction enables both the **Use HS/Workpiece Height** and **Enable Height Sensor at XY Location** options. The **Use HS/Workpiece Height** option assumes that the current surface height is similar, and the height sensor will perform the measurement from the Z position last used.

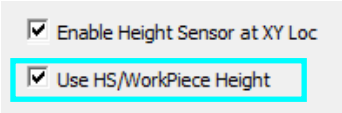


Figure 15-4: Use HS/Workpiece Height

However, a workpiece with varying surface levels presents a risk of the jet hitting workpiece objects while traveling from one location to another. In this case, do not select the **Use HS/Workpiece Height** option. The Z axis is raised to the **Home** position and the height sensor searches from Z = 0. Moving to **Home** position increases the time it takes to perform the height sensing operation, but it also prevents workpiece collision.

Note: See Section 5.3 - System Calibration for an explanation of the Height Sensor to Work Surface offset.

5. Do not select the **Adjust Z Position Before Move** option; it is ignored if the **Enable Height Sensor at XY Loc** option is selected.

15.3 Add Z-Motion Without Using the Height Sensor

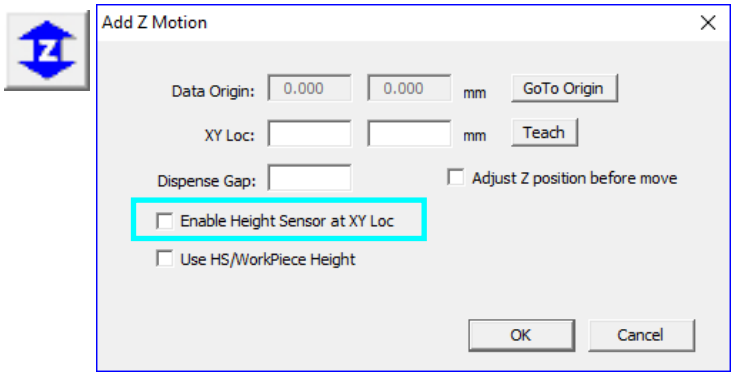


Figure 15-5: Height Sensor Option Not Used

1. Enter the coordinates or click and **Teach** the XY location for the **XY Loc**. This is the location where the Z Motion is added.
2. Enter the desired adjustment value for **Dispense Gap**. A dispense gap adjustment value must be specified, even if it is zero (no change).
3. Do not select the **Height Sensor at XY Location** or **Use HS/Workpiece Height** options.
4. When the Add Z Motion instruction is executed, Z_C is normally adjusted after moving to the specified XY Location. If the **Adjust Z position before move** option is selected, Z_C is adjusted before moving to the specified XY Location.

16. Fiducials

16.1 Adding Fiducials

The Fiducials feature stores the image and position of two fiducials for the workpiece. These two fiducials are used to calculate any translation and/or rotation from the **Work Surface Origin** location. During the run, this fiducial calculation is used to align the XY locations as the instruction list is executed.

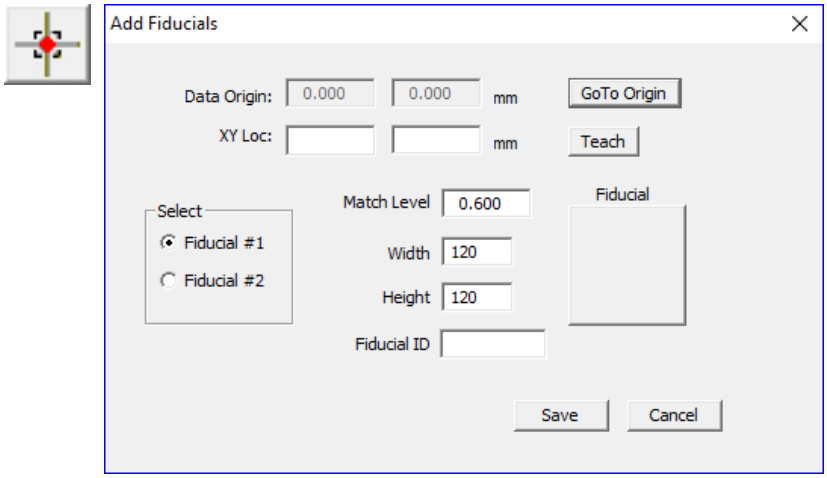


Figure 16-1: Add Fiducials Window

1. Click the **Add Fiducials** toolbar button.
2. Verify that **Fiducial #1** is selected.
3. Move to the object intended as Fiducial #1 and center the camera crosshairs over the object.
   - Enclose the object with the green box as tightly as possible.
   - White space around the object can make it less accurate.
   - If needed, enter new values for **Width** and **Height** to change the size of the green box.
4. Click **Teach** to capture the fiducial image.
5. Enter a name for the **Fiducial ID**.
6. Click **Save** to save the image file and location for Fiducial #1.
7. Click the **Fiducials** toolbar button again and repeat the process for Fiducial #2.

16.2 Fiducials Programming Example

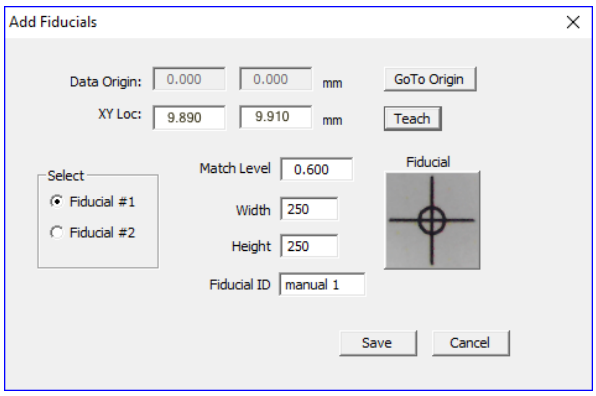


Figure 16-2: Image Saved for Fiducial #1

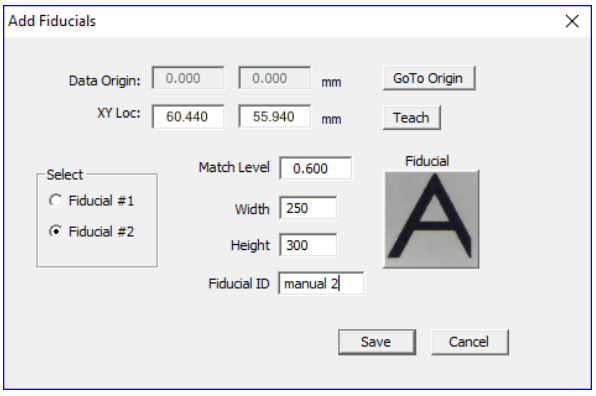


Figure 16-3: Image Saved for Fiducial #2

	Instruction	Recipe	X	Y
1	FID1		9.890	9.910
2	FID2		60.440	55.940

Figure 16-4: Instruction List for Fiducials; Fiducial #1 is FID1 and Fiducial #2 is FID2

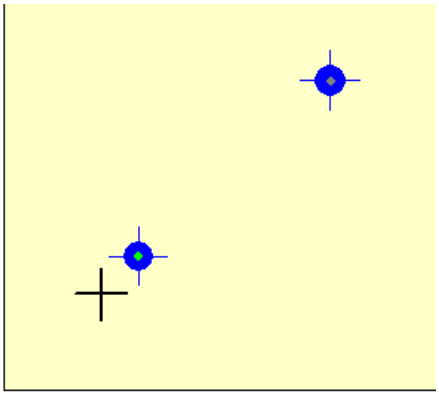


Figure 16-5: Fiducials Shown in Data Preview Window

16.3 Manual Teach of a Failed Fiducial

If a fiducial fails to be found during the execution of a job, a Run Status message provides the option to manually teach the fiducial location or abort the job. The manually taught fiducial location is used only for this run of the job. The system will return to an automatic search for the stored fiducial the next time the job is executed.

1. Click the **Manual** button.

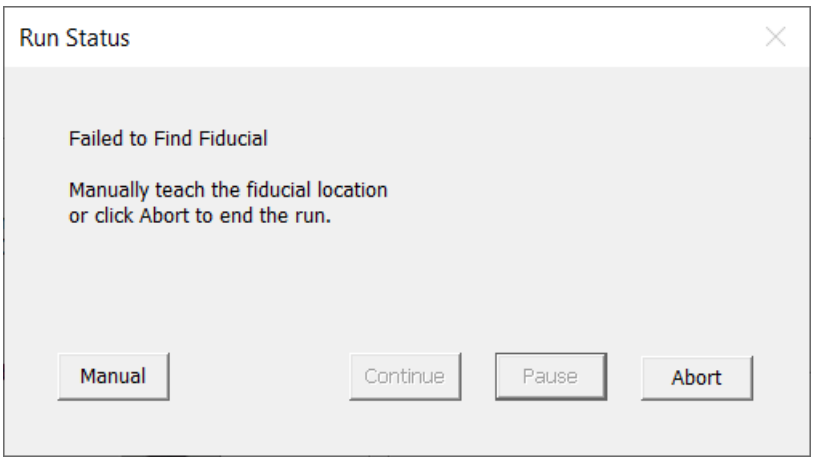


Figure 16-6: Failed to Find Fiducial

2. The Teach window is displayed. Jog the machine to center the camera crosshairs on the intended fiducial, then click **Teach**.

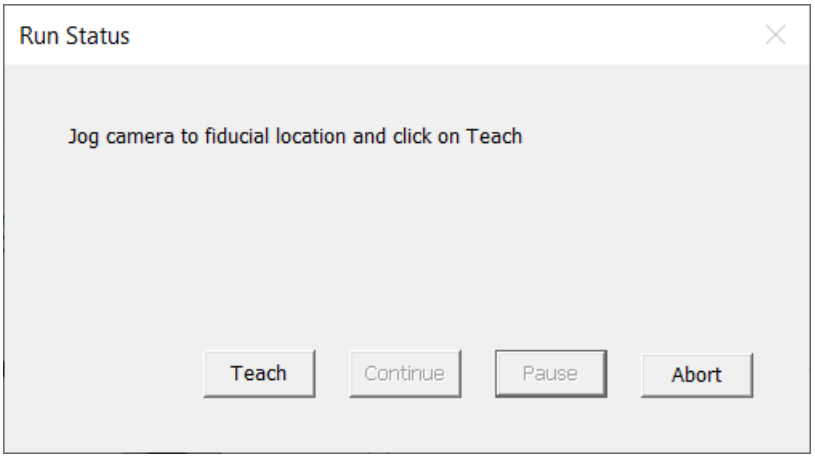


Figure 16-7: Manually Teach Failed Fiducial

16.4 Tolerance of Distance between Fiducials

When fiducials are found during the execution of a job, the distance found between the two fiducials is compared to the distance “expected” (or taught) between the two fiducials. If the difference between the found distance and the expected distance is greater than 1%, a Run Status message provides the option to ignore the error and continue dispensing or abort the job. Ignoring the tolerance error may be acceptable if one or both fiducials had to be manually taught after failing to be found.

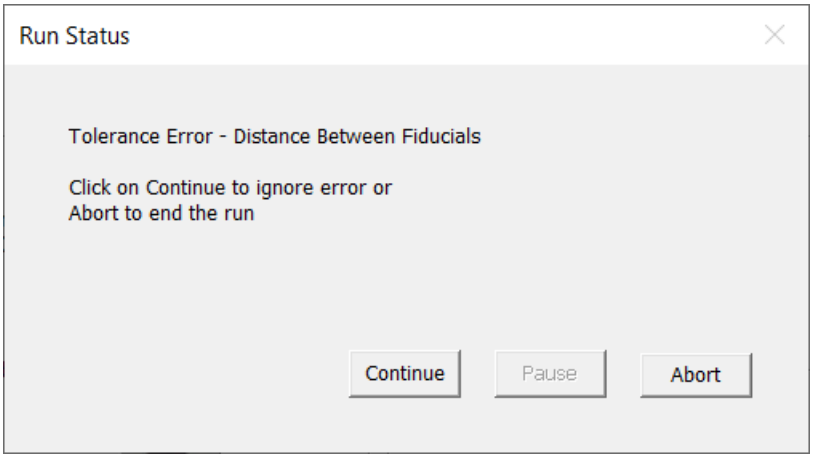


Figure 16-8: Distance Between Fiducials Exceeds Tolerance

16.5 Fiducials Programming Notes

16.5.1 Fiducial ID

For Fiducial #1, the **Fiducial ID** name is saved as a file named **fid1_[Fiducial ID]**. For Fiducial #2, the **Fiducial ID** name is saved as a file named **fid2_[Fiducial ID]**.

The Fiducial ID names for Fiducial #1 and Fiducial #2 can be the same or different.

> **Identical name:** "MyTest_12.12" is entered for both Fiducial #1 and Fiducial #2. A file named "fid1_MyTest_12.12.bmp" is saved for Fiducial #1 and another file named "fid2_MyTest_12.12.bmp" is saved for Fiducial #2.
>
> **Different name:** "MyTest_12.12A" is entered for Fiducial #1, and "MyTest_12.12B" is entered for Fiducial #2. A file named "fid1_MyTest_12.12A.bmp" is saved for Fiducial #1 and another file named "fid2_MyTest_12.12B.bmp" is saved for Fiducial #2.

The fiducial files are stored in the Documents\DispensePro\FidImages folder.

- During the dispense run, the FidImages folder is the only location DispensePro searches for fiducial files.
- Do not save fiducial files in the Job Files folder.
- Do not move these fiducial files to another folder.

Important:
When copying a job file to another system, remember to copy the fiducial files and save them to the Documents\DispensePro\FidImages folder in the new system.

16.5.2 Match Level

The **Match Level** option defines the amount of error allowed during the fiducial match process from 0.3 to 0.95, where 0.95 is the strictest match. If a failed match is reported even though the fiducial image is within the Z Focus camera view, select a different object for the fiducial image, or try a lower value for the Match Level. Color images usually require a lower Match Level option.

16.5 Fiducials Programming Notes, continued

16.5.3 Guidelines for Selecting Fiducials

1. **Select a unique object.** It is important to select a unique object within the Z Focus camera view.

   In Figure 16-9, the camera crosshairs are centered over a solid circle. However, the surrounding circles cause confusion; one of the other circles might be selected as the fiducial, causing a misalignment of the dispense job.

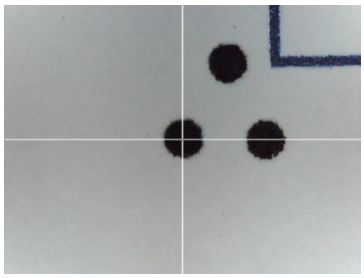


Figure 16-9: Poor Fiducial Selection; Surrounding Circles Cause Confusion

   In Figure 16-10, the camera crosshairs are centered over a solid square. The solid square is a unique image and can be easily identified as the correct fiducial.

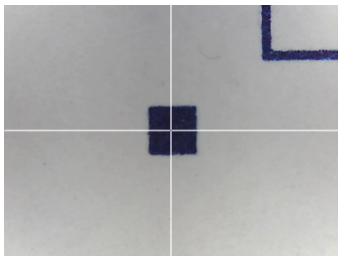


Figure 16-10: Good Fiducial Selection; Image is Unique

2. **Expanded Fiducial Search.** To search for the fiducials in the surrounding area when the initial attempt to find a fiducial match fails, select the **Expanded Fiducial Search** option in **Tools > System Setup**. Expanded searching is helpful when the workpiece has been substantially translated or rotated from the Work Surface Origin location.

17. Wait Timer

17.1 Adding Wait Timer

The **Wait Timer** feature inserts a pause instruction in the dispensing program.

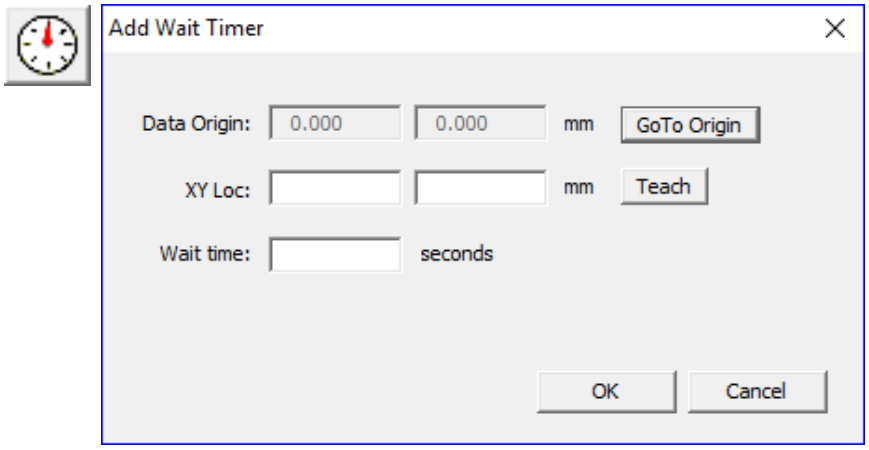


Figure 17-1: Add Wait Timer Window

1. Enter the XY coordinates or click and **Teach** the XY location for XY Loc.
2. Enter a **Wait time** value.
3. Click **OK** to save the Wait instruction to the Instruction List.

17.2 Wait Timer Programming Example

An XY Location (**XY Loc**) can be specified as a place to wait. **Wait time** duration is entered in seconds. After the wait time has elapsed, the dispense run continues to the next instruction in the list. Figure 17-2 shows a three-second Wait (#8) between instruction #7 and instruction #9; that Wait instruction is shown as the white circle in Figure 17-3.

	Instruction	Recipe	X	Y
1	RECT	2, 100.00	13.210	18.210
2	DOT	1, 50.00	20.000	20.000
3	DOT	1, 50.00	22.000	20.000
4	DOT	1, 50.00	24.000	20.000
5	DOT	1, 50.00	26.000	20.000
6	DOT	1, 50.00	28.000	20.000
7	DOT	1, 50.00	30.000	20.000
8	WAIT		30.000	20.000
9	DOT	1, 50.00	20.000	24.000
10	DOT	1, 50.00	22.000	24.000
11	DOT	1, 50.00	24.000	24.000
12	DOT	1, 50.00	26.000	24.000
13	DOT	1, 50.00	28.000	24.000
14	DOT	1, 50.00	30.000	24.000

Figure 17-2: Instruction List Showing Wait Instruction

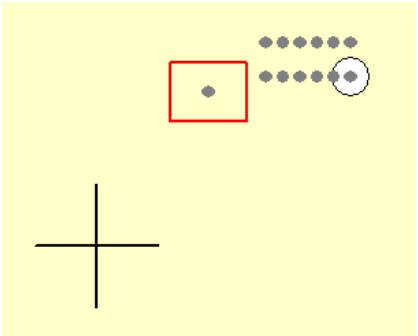


Figure 17-3: Data Preview Window Shows Wait Location

18. Step and Repeat

The **Step and Repeat** function copies and duplicates instructions to make **patterns**, or multiple instances of the entire instruction list. The size and placement of the pattern can be specified, as well as the number of patterns for the workpiece (rows by columns).

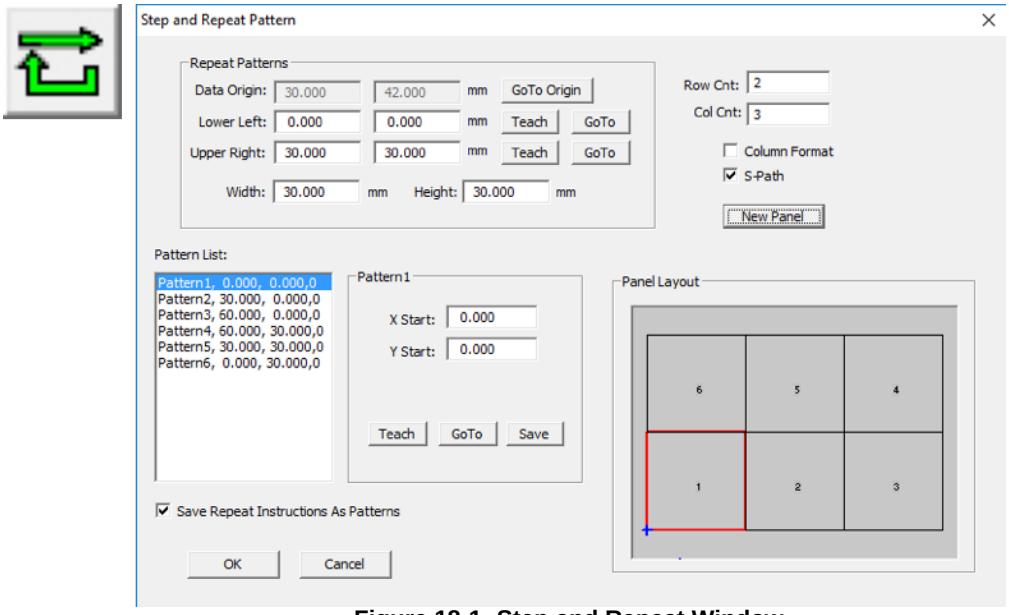


Figure 18-1: Step and Repeat Window

18.1 Defining the Step and Repeat Pattern

1. Enter the XY coordinates or click and **Teach** the XY locations for the lower left (LL) and upper right (UR) boundary points for a pattern. The width and height fields of the rectangular area are calculated automatically after LL and UR are taught.
2. The initial width and height values appearing in the fields are estimated dimensions using the limits of the instructions in the list.
3. Enter the number of rows and columns desired for duplicating the pattern.
   - By default, the patterns dispense along the X axis in rows from left to right for each row.
   - To dispense the patterns along the Y axis as columns, select **Column Format**.
   - Selecting **S-Path** alternates dispense directions for every other row or column, resulting in a fluid S-shaped path.
4. Selecting **New Panel** displays a preview of the order of the patterns in the Panel Layout window of the Step and Repeat Window. Selecting **New Panel** also updates the Pattern List, showing the lower left origin points of each pattern in numerical order.

5. Selecting the **Save Repeat Instructions As Patterns** option keeps each pattern as its own instruction in the list. The number in parentheses next to the instruction number is the pattern number to which it belongs.
6. The **Pattern List** displays all the patterns in the Panel Layout. Each entry shows the origin location of each pattern.
7. (Optional) the X and Y coordinates for the origin point of the selected pattern in the Pattern List can be taught or changed using the **Pattern[Number]** window. Enter the X Start and Y Start values and click **GoTo**, or move to the XY location, **Teach**, and **Save**.

   The window in Figure 18-2 shows the original origin point for Pattern5 changed from (30,30) to (30,50) and the resulting arrangement in the Panel Layout window.

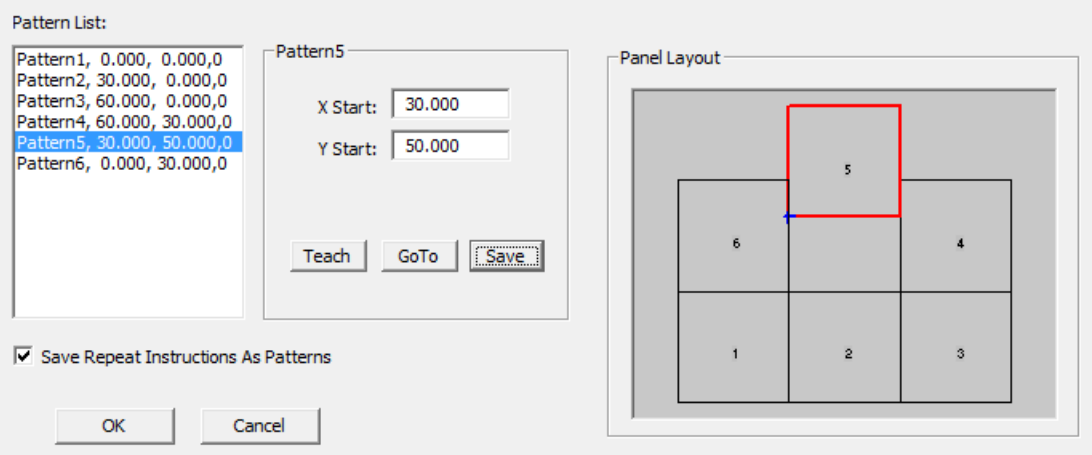
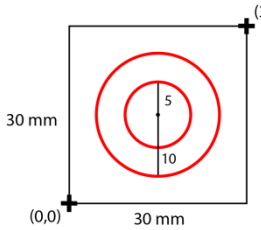


Figure 18-2: Start Point of Pattern5 Changed from (30,30) to (30,50)

8. Click **OK** to save the Step and Repeat patterns to the Instruction List.

18.2 Step and Repeat Programming Example

The following example creates a step and repeat of a two-circle pattern. The inner circle has a radius of 5 millimeters and the outer circle has a radius of 10 millimeters.



	Instruction	Recipe	X	Y
1	CIRCLE	2, 100.00	20.000	20.000
2	CIRCLE	2, 100.00	20.000	20.000

Figure 18-3: Two-Circle Pattern and Corresponding Instruction List

The workpiece in this example has two rows and three columns of the repeated pattern, totaling six patterns in all. Each pattern is 30 millimeters in width and 30 millimeters in height.

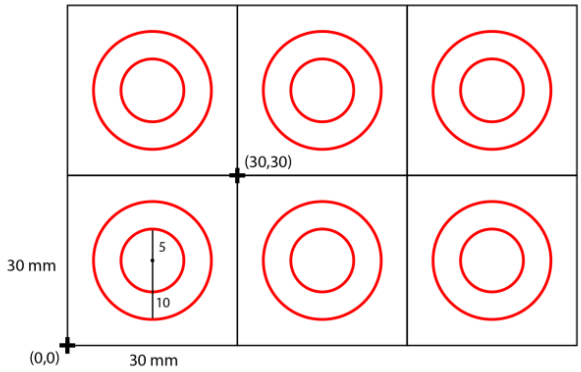
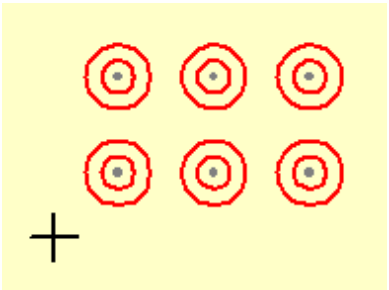
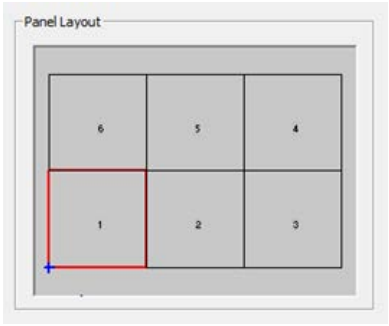


Figure 18-4: Two Rows and Three Columns of the Two-Circle Pattern

After teaching the Lower Left position at (0,0) and the Upper Right position at (30,30), a width of 30 and a height of 30 is calculated. Alternatively, entering the height and width values as 30 achieves the same result.

The two rows and three columns have been specified to run in an S-Path. After clicking **New Panel**, the Panel Layout window shows the order of the program, the resulting dispensed pattern and instruction list, as shown in Figure 18-5.





	Instruction	Recipe	X	Y
1	CIRCLE	2, 100.00	20.000	20.000
2	CIRCLE	2, 100.00	20.000	20.000
3 (2)	CIRCLE	2, 100.00	50.000	20.000
4 (2)	CIRCLE	2, 100.00	50.000	20.000
5 (3)	CIRCLE	2, 100.00	80.000	20.000
6 (3)	CIRCLE	2, 100.00	80.000	20.000
7 (4)	CIRCLE	2, 100.00	80.000	50.000
8 (4)	CIRCLE	2, 100.00	80.000	50.000
9 (5)	CIRCLE	2, 100.00	50.000	50.000
10 (5)	CIRCLE	2, 100.00	50.000	50.000
11 (6)	CIRCLE	2, 100.00	20.000	50.000
12 (6)	CIRCLE	2, 100.00	20.000	50.000

Figure 18-5: Data Preview Window, Panel Layout, and Instruction List

19. Dispensing

19.1 Run

The **Run** menu contains the **Run Program** window and **Controller** window. The **Run Program** window shows the options available for the dispensing run. Options for fiducial compensation, height sensing, dispense gap, purging, placement location for the workpiece on the work surface, and others can be specified before the run.

The **Controller** window shows the options for recipe parameters, fluid temperature and pressure settings before starting the run. The Controller tab in the Run window offers a shortcut to the controller menu (see Section 20 - Jet Controller).

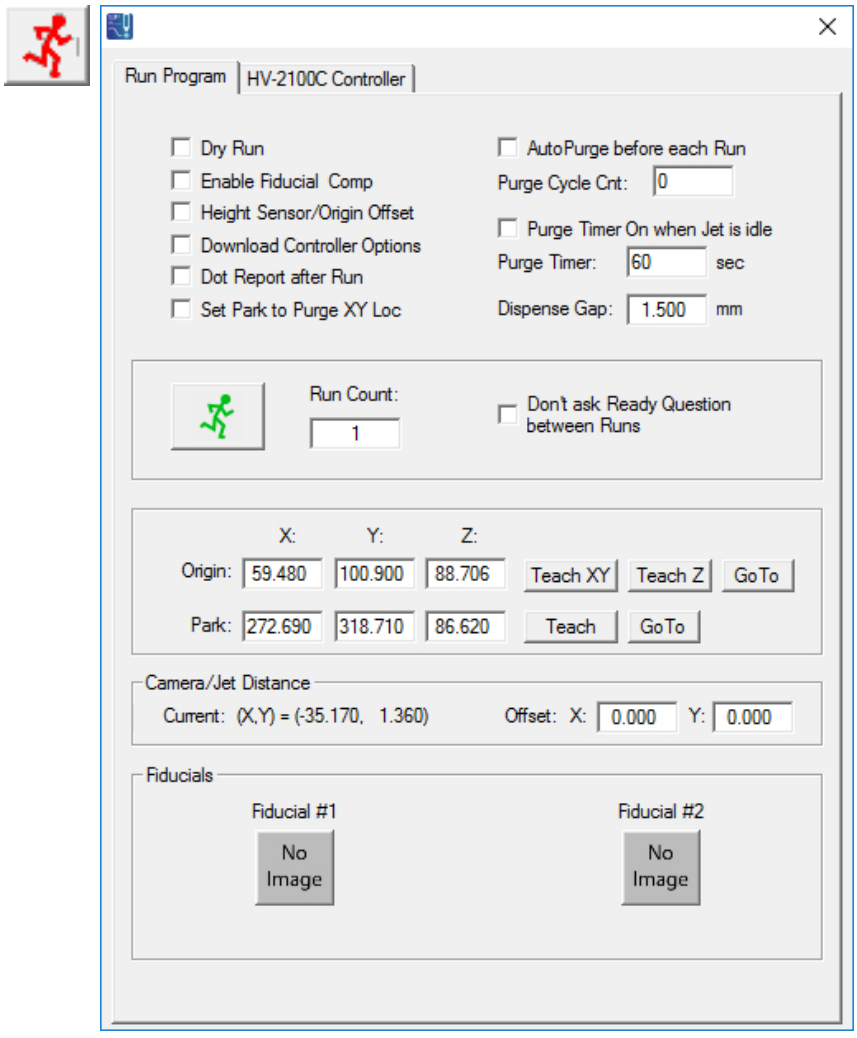


Figure 19-1: Run Program Window

19.2 Run Program Options

At the top of the Run Program window, there are multiple options that can be selected for the dispense program run.

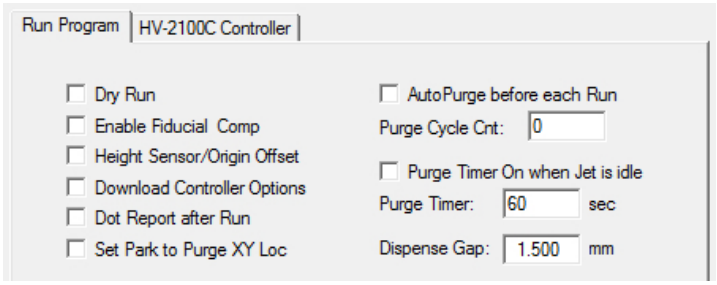


Figure 19-2: Run Options

19.2.1 Dry Run

Select this option to preview the dispensing positions in the instruction list without dispensing drops. During **Dry Run**, the center of the camera moves to the dot positions and traces the outline for line paths, arcs and circles. **Dry Run** can be used to verify the accuracy of the fiducial transformations.

19.2.2 Enable Fiducial Comp

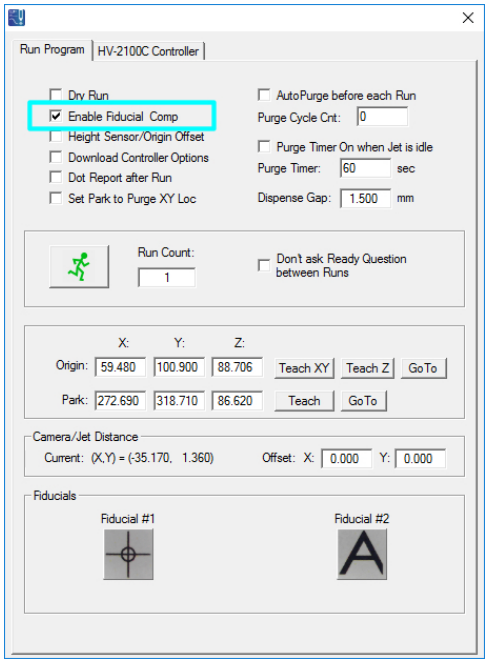


Figure 19-3: Enable Fiducial Comp Option

Select this option to enable the fiducial search and matching function. The fiducial images and associated file names for FID1 and FID2 instructions are displayed as Fiducial #1 and Fiducial #2 icons.

If FID instructions for this program are not found in the instruction list, then a “No Image” icon is shown for Fiducial #1 and Fiducial #2.

See Section 16 for more instructions on programming and using fiducials. For system-level fiducial settings, see Section 5.1.4 - Expanded Fiducial Search.

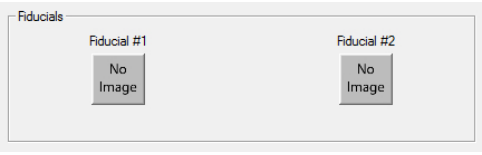


Figure 19-4: No Fiducial Instructions Found

19.2 Run Program Options, continued

19.2.3 Height Sensor/Origin Offset

This option uses the height sensor to calculate Z_i, defined as the initial Z position. When the dispensing run starts, a height sensing test is performed. The Z_i value is calculated from a combination of this height value, the values saved for the nozzle tip detection, and the desired dispense gap between the nozzle tip and the workpiece. The calculated Z_i value also updates the Z value of the Work Surface Origin.

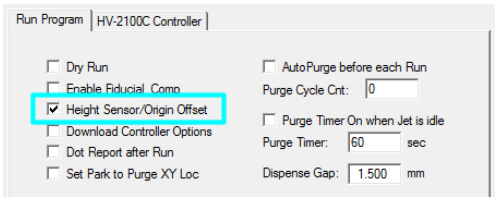


Figure 19-5: Height Sensor/Origin Offset Option

To use a specific Z_i, do not select the Height Sensor/Origin Offset option. A height sensing test will not be performed to determine Z_i. Enter or teach the Z value in the Work Surface Origin fields. The Work Surface X and Y values and the Dispense Gap values are ignored.

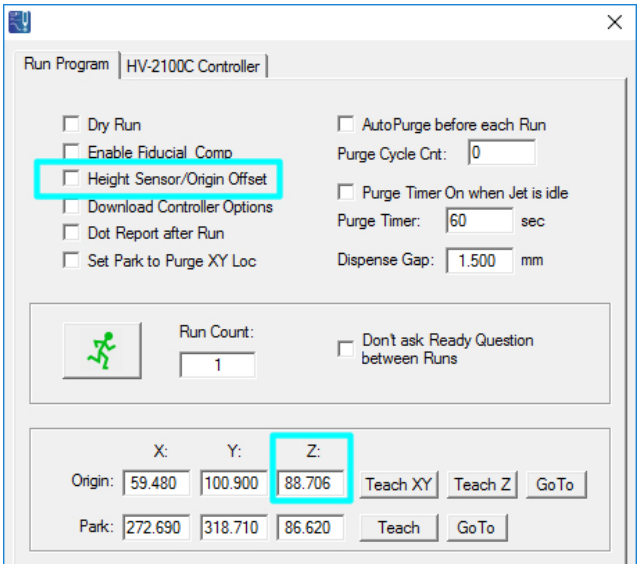


Figure 19-6: Height Sensor/Origin Offset Option Not Used

Figure 19-6 shows that the Height Sensor/Origin Offset option is not selected. Instead, a value of 88.706 is entered for the Work Surface Origin Z. At start of the dispense run, the value of Z_i will be 88.706 mm.

*Note: During the dispensing run, a current Z position is maintained, defined as Z_C. The value of Z_C is set by Z_i. This Z_C position can be adjusted using the **Add Z Motion** instructions. See Section 15 - Add Z Motion.*

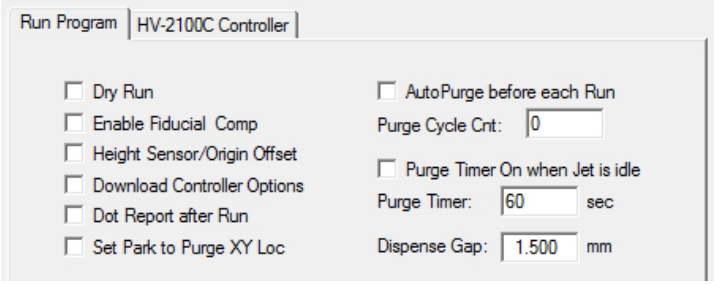


Figure 19-7: Run Program Options

19.2.4 Download Controller Options

Select this option to download the timing, temperature and fluid pressure settings for all six recipes saved in the DispensePro Controller menu to the Advanjet controller before the dispense run.

19.2.5 Dot Report after Run

Select this option to show the number of drops dispensed and execution time for the run.

19.2.6 Set Park to Purge XY Location

Select this option to use the prime cup location defined in the Priming menu as the **XYZ Park location**.

See Section 5.4.3 - Teach the Prime Cup Location.

19.2.7 Auto Purge Before Each Run

Select this option to purge the jet nozzle before each run. The purge settings for recipe selection and the number of drops to purge are specified in the Priming menu.

See Section 5.4 - Prime, Purge, or Vacuum the Jet.

19.2.8 Purge Cycle Count

This option specifies how often to perform the purge process. For a **Run Count** greater than one, Purge Cycle Count of P means a purge is performed every P program runs. For example, when Run Count is set to 10 and Purge Cycle Count is set to 2, the purge process occurs at the start of the first run, third run, fifth run, and so forth.

See Section 5.4 - Prime, Purge, or Vacuum the Jet.

19.2.9 Purge Timer on When Jet is Idled

Select this option to enable periodic purging while the jet is idled.

19.2.10 Purge Timer

This option sets the time for the **Purge Timer when Jet is Idled** option in the main Run Program menu. The purge timer defines how long the jet can idle before a purge is required. **Purge Timer** value is entered in seconds, with a maximum of 100 seconds.

19.3 Run Count

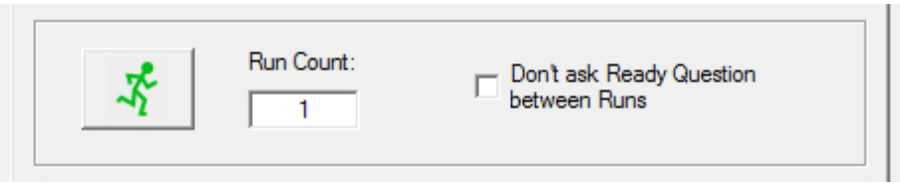


Figure 19-8: Run Count

The **Run Count** specifies the number of times to run the instruction list.

When the value of **Run Count** is zero (0), the instruction list will run indefinitely; click **Abort** to stop the run.

When the value of **Run Count** is greater than one, a "Ready…?" prompt is issued between runs. Select the **Don't Ask Ready Question Between Runs** option to disable the Ready prompt.

19.4 Work Surface Origin

When the dispense run starts, the **Work Surface Origin XY location** is used as the start origin for the instruction list. All XY locations in the instruction list are relative to this start origin.

When a Data Origin location has been taught for the workpiece, the Work Surface Origin uses the Data Origin XY by default. Click **GoTo** to move the camera to the Data Origin XY location. If the workpiece placement has changed, find the new Work Surface Origin location with the camera crosshairs and click **Teach XY** to save the new XY location.

If the Height Sensor/Origin Offset option is not selected, the **Work Surface Origin Z location** is used for the initial Z position, Z_i.

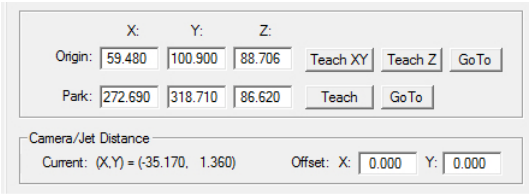


Figure 19-9: Work Surface Origin and Park Options

19.5 Park

The jet moves to the **Park** XYZ location after the dispensing run has completed.

19.6 Dispense Gap

The **Dispense Gap** is the Z-axis distance between the nozzle tip and the workpiece. For example, a 1.5 millimeter dispense gap positions the nozzle tip 1.5 millimeters above the workpiece. The height sensor is used to calculate the Z_i (initial Z position of the nozzle tip) based on this specified dispense gap.

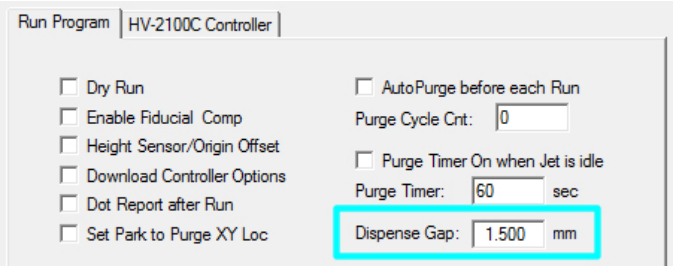


Figure 19-10:
Dispense Gap Set to 1.5 mm

19.7 Camera/Jet Distance

The Camera to Jet Distance (Offset) is set in the System Calibration routine. The Run Program window shows these values as **Current (X,Y)**. Enter new X or Y offset values to adjust if necessary.

Figure 19-11:
Camera to Jet Distance (Offset)

20. Jet Controller

The **Jet Controller** window displays the controller settings from the Advanjet HV-2100C or HM-2600C controller, including the jet valve status, jet temperature (and fluid temperature for the HM-2600C), fluid pressure, and timing parameters for all six recipes.

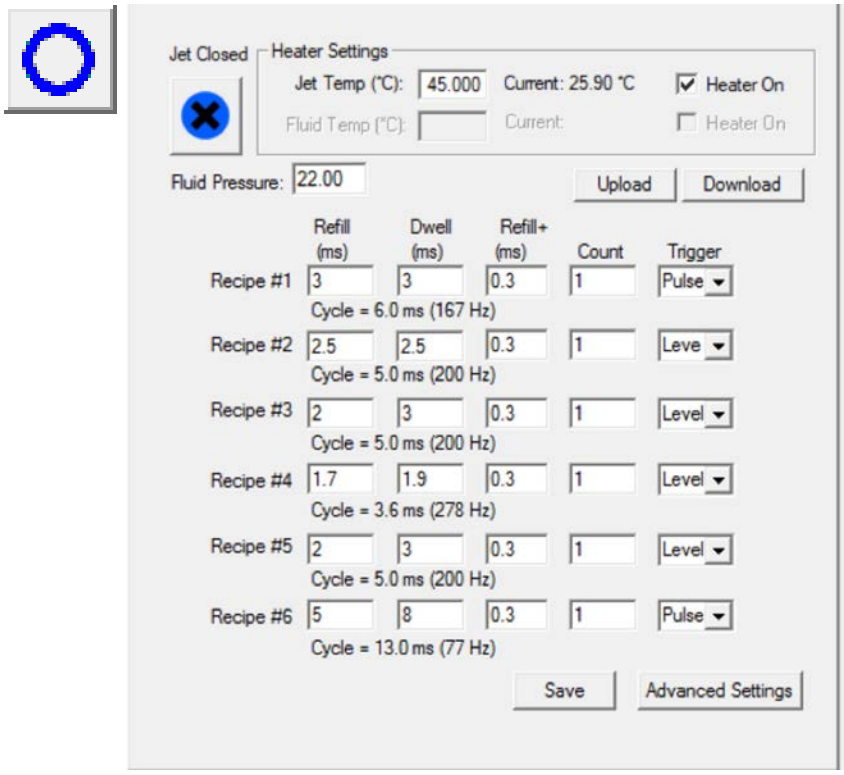


Figure 20-1: Controller Window

20.1 Jet Valve Status

The large indicator button in the top left corner shows the Jet Valve status.

- An 'X' in the middle of the button indicates that the **Jet** is **Closed,** and fluid flow is blocked. The Jet is closed by default at startup.
- An 'O' in the middle of the button indicates that the **Jet** is **Open,** and fluid can flow freely through the nozzle tip.

Figure 20-2: Jet Valve Open/Close

The Jet must be opened or closed manually while changing the fluid syringe, diaphragm, and/or nozzle plate. Click **Jet** in the Controller window to open/close the jet. This is equivalent to tapping the **Jet** field on the Advanjet controller home screen and tapping **<** or **>**.

20.2 Temperature Settings

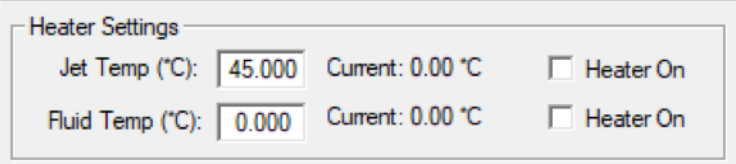


Figure 20-3: Temperature Settings

Jet Temp °C is the SV (Set Value) of the jet temperature according to the Advanjet controller temperature regulator.

Fluid Temp °C (B300-HM only) is the SV of the fluid melter temperature according to the Advanjet HM-2600C controller temperature regulator. The HM-2600C includes a separate temperature regulator for the fluid melter.

Current Temperature is the PV (Present Value) jet/fluid temperature according to the Advanjet controller temperature regulator.

A ✓ in the **Heater On** box indicates that the corresponding temperature regulator is ON.

Note: *The temperature settings depend on the dispensing fluid and the nature of the dispensing application. The HV-2100C maximum jet (nozzle) temperature is 70 °C (158 °F). For the HM-2600-C, the maximum jet (nozzle) temperature is 150 °C (302 °F); the maximum fluid (melter) temperature is 150 °C (302 °F), depending on the maximum syringe temperature.*

20.3 Fluid Pressure

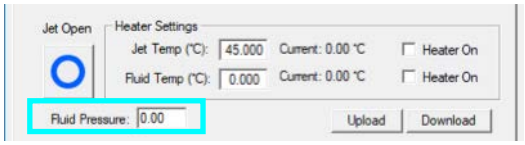


Figure 20-4: Fluid Pressure

Fluid Pressure is the fluid (syringe) air pressure. The default Fluid Pressure unit is psi. To use MPa, tap the **Settings** field on the Advanjet controller Home screen (red border means the field is active). On the Settings screen, tap the **F Units** field and **<** or **>**.

Note: *The fluid pressure setting depends on the dispensing fluid and the dispensing application. The maximum fluid pressure for both the Advanjet HV-2100 jet and HM-2600 jet is 60 psi (0.41 MPa).*

Figure 20-5: Use Advanjet Controller to Change Pressure Units

20.4 Recipe Timing Parameters

Note: *For a detailed explanation, refer to the Timing Recipes and First Drop Compensation sections of the HV-2100C and HM-2600C Setup and Operation manuals (3A6266A and 3A6166A) and also the Advanjet Jet Dispensing Parameters supplement (3A5937).*

Up to six timing recipes can be programmed and stored in the controller. The timing recipe parameters determine set the size and volume of the jetted drop.

Recipe #1-6: Corresponds to the six recipes stored in the Advanjet controller.

Refill: Refill time is the amount of time that the jet valve is OPEN while material flows into the nozzle after a drop is ejected. Refill time is set in milliseconds with 0.1 msec resolution.

Dwell: Dwell time is the amount of time that the jet valve is CLOSED while material flows out of the nozzle and forms a drop. Dwell time is set in milliseconds with 0.1 msec resolution.

Cycle: Cycle time is calculated by DispensePro as the sum of Refill and Dwell time, displayed in milliseconds and hertz (drops per second). In Figure 20-6, Recipe #3 shows a Cycle time of 5 msec or 200 Hz, calculated from the Refill time of 2 msec and Dwell time of 3 msec.

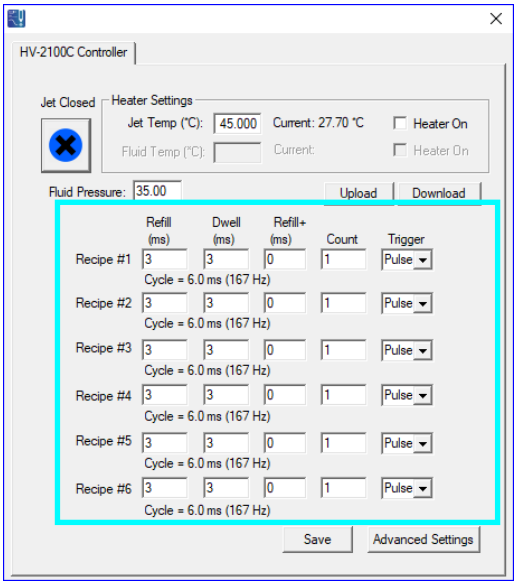


Figure 20-6: Timing Recipe Parameters

Refill+: Refill+ time is added to Refill time if first drop compensation is required. Refill+ time does not contribute to Cycle time. Refill+ time is set in milliseconds with 0.1 millisecond resolution. In PULSE mode, Refill+ time is added to every drop; in LEVEL mode, Refill+ time is added only to the first drop.

Count: The Drop Count is the number of drops to be dispensed. To dispense a single drop, specify a Count value of one (1). To dispense multiple drops, use a number from 2 to 999. Note that dispense instructions Dot, Line, Arc, Path, Circle and Palette of Dots specify the number of drops inside the instruction, ignoring the current drop count value in the Controller.

Trigger: The Trigger signal tells the jet to dispense. There are two Trigger modes:

- In **PULSE** mode, when the Trigger signal is received, the jet dispenses the number of drops specified in Count.
- In **LEVEL** mode, the Count is ignored. When the Trigger signal is received, the jet dispenses drops nonstop until the Trigger signal is removed.

Note that the Trigger mode is set by the dispense instruction (Dot, Line, etc.) so the current Trigger mode in the Controller is ignored.

20.5 Advanced Settings

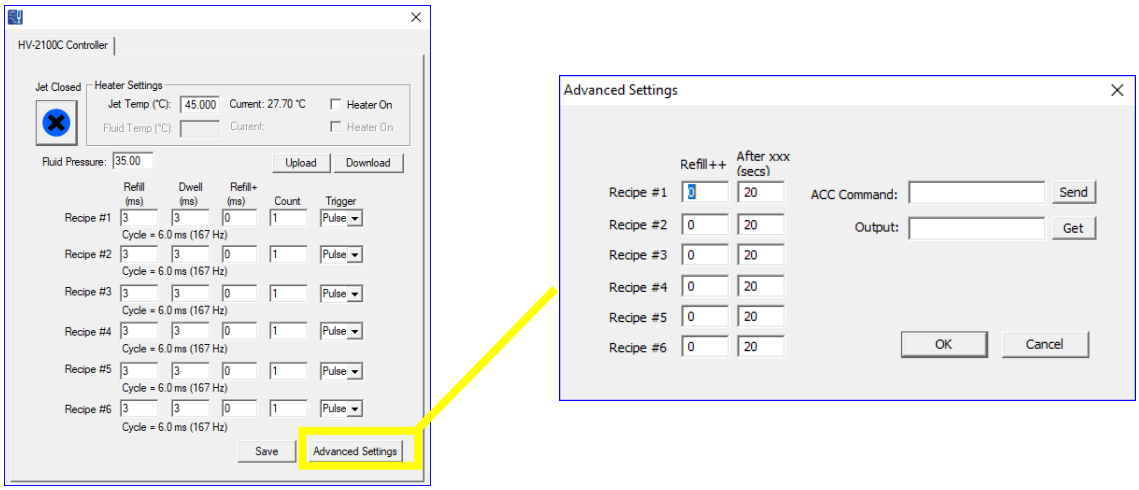


Figure 20-7: Advanced Settings on the Controller Window

Click the **Advanced Settings** button on the bottom right of the Controller window to access additional controller settings.

REFILL++: As another method of first drop compensation, **Refill++** time is added to **REFILL** time only after the jet is idled for a defined number of seconds. **Refill++** time applies to just the first drop in both PULSE and LEVEL modes. **Refill++** time is set in milliseconds with 0.1 msec resolution.

AFTER: This parameter specifies the amount of jet idle time associated with the **Refill++** time. If the jet has been idled for **After** time, the **Refill++** time is added to the recipe **Refill** time. **After** time is set in seconds.

20.6 Saving and Transferring Recipe Settings

The temperature, fluid pressure, and settings for all six recipes can be transferred between DispensePro and the Advanjet controller.

- Click **Upload** to retrieve recipe settings from the Advanjet controller. The uploaded controller settings will overwrite the existing DispensePro settings.
- Click **Save** to save the recipe settings displayed in the DispensePro Controller window to the current DispensePro Program.
- Click **Download** to send the DispensePro program settings (saved or not) to the Advanjet Controller. The downloaded DispensePro settings will overwrite the existing controller settings.

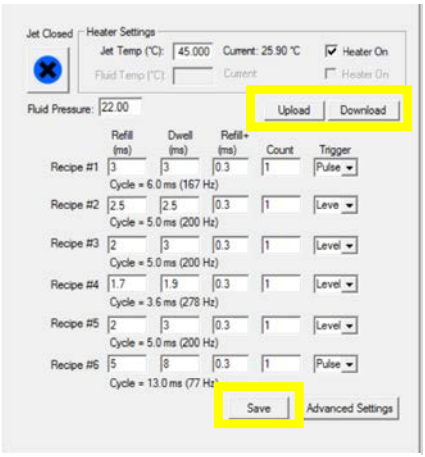


Figure 20-8: Transferring Controller Settings Between DispensePro and the Advanjet Controller

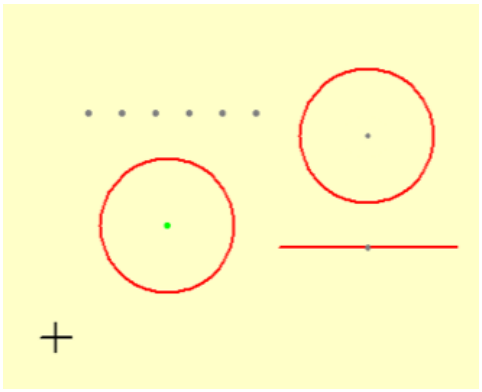
21. Program Editing

After building and saving the Instruction List for a dispense program, instructions can be modified, added, or deleted as needed. Edit single or multiple instructions by clicking anywhere on the Instruction List or the Data Preview Window.

21.1 Select a Single Instruction

The center location of each dispense instruction (dot, line, circle, etc.) is represented by a gray dot in the Data Preview Window. Each of those instructions is also shown as an instruction entry (DOT, LINE, CIRCLE, etc.) in the Instruction List.

To select an instruction, single-click the gray dot in the Navigation Window or the instruction entry in the Instruction List. The gray dot turns green to indicate it is selected and the corresponding instruction in the Instruction List is highlighted.



	Instruction	Recipe	X	Y
1	CIRCLE	2, 100.00	50.000	50.000
2	LINE	2, 100.00	140.000	40.000
3	CIRCLE	2, 100.00	140.000	90.000
4	DOT	1, 50.00	15.000	100.000
5	DOT	1, 50.00	30.000	100.000
6	DOT	1, 50.00	45.000	100.000
7	DOT	1, 50.00	60.000	100.000
8	DOT	1, 50.00	75.000	100.000
9	DOT	1, 50.00	90.000	100.000

Figure 21-1: Edit a Single Instruction

21.2 Select Multiple Instructions

Use Edit Options Menu or keyboard combinations to select multiple entries from the Instruction List.

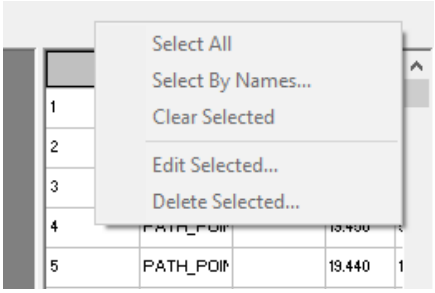


Figure 21-2: Edit Options Menu

- Right-click anywhere on the Instruction List for the **Edit Options Menu**.
- The **Edit Options Menu** can also be accessed by selecting an instruction and clicking the **Edit** button on the top menu.

21.2 Select Multiple Instructions, continued

21.2.1 Select All

From the Edit Options Menu, choose **Select All** to select all of the instructions in the list.

21.2.2 Select By Names

From the Edit Options Menu, choose **Select By Names** to edit all instructions of the selected type.

21.2.3 Clear Selected

From the Edit Options Menu, **Clear Selected** deselects the currently selected instruction. This is different from deleting; the Instruction List does not change.

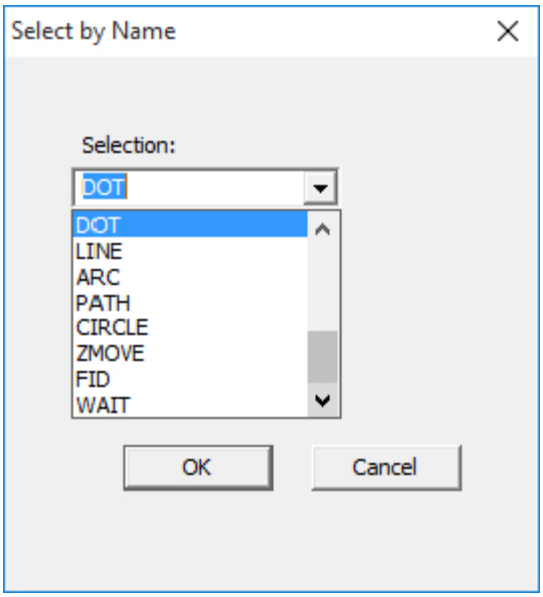


Figure 21-3: Select By Names

21.2.4 Edit Selected Parameters

On the Edit Options Menu, select **Edit Selected** to change the **Recipe** Selection, robot **Speed**, and the **XY Offset** for the location of points in the selected instruction(s).

- Select the instruction and right-click for the **Edit Options Menu**.
- Choose the **Edit Selected** option.
- To enter new values for Recipe number or Speed, choose the new recipe number or enter the new speed. Click the **Update** verification and click **OK** to save the changes to the Instruction List. If the **Update** box is not checked, any changes made to that field will not be saved.
- Enter a value for xOffset or yOffset to adjust the current XY position by the value entered. Offset values of 0.000 mm represent no change to the XY position. There is no **Update** verification for the X and Y Offsets.
- Click **OK** to save the changes.

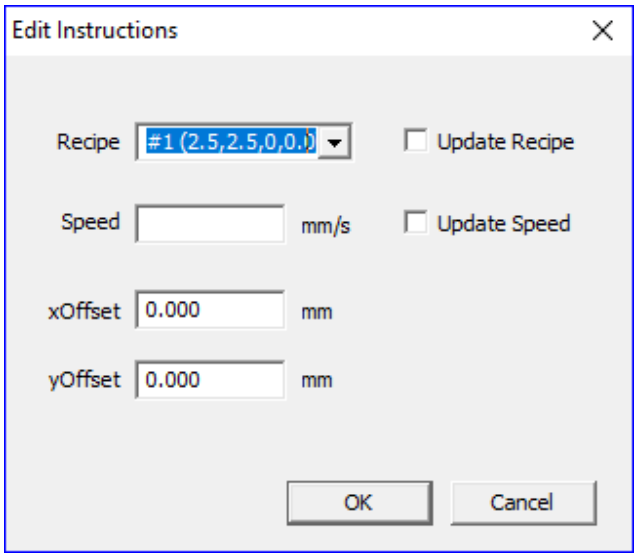


Figure 21-4: Edit Selected Instructions Window

21.2 Select Multiple Instructions, continued

21.2.5 Delete Selected

Note: The Delete key on the keyboard is not enabled for the Edit Options Menu window. Use this Delete Selected procedure.

From the Edit Options Menu, choose **Delete Selected**. A window prompts for confirmation. Click **Yes** to delete the dispense instruction(s).

21.2.6 Select Multiple Consecutive Instructions

To select a block of multiple consecutive instructions, use **Shift+Click**:

- To select from the Instruction List, hold down the **Shift** key while clicking the first and the last instructions of the block.
- To select from the Data Preview Window, hold down the **Shift** key while clicking the gray dots.

21.2.7 Select Multiple Non-Consecutive Instructions

To select multiple non-consecutive instructions, use **Ctrl+Click**:

- To select from the Instruction List, hold down the **Ctrl** key while clicking the desired instructions.
- To select from the Data Preview Window, hold down the **Ctrl** key while clicking the gray dots.
- To deselect an instruction, **Ctrl+Click** that instruction or point again.

21.3 Edit Window for a Single Instruction

To edit a single instruction, single-click to select the item. To use the Edit [Element] window, **double-click** the gray dot on the Data Preview Window or the instruction entry in the Instruction List and enter new dispense parameters for that instruction.

Figure 21-5 shows an Instruction List for two circles and a line, and the resulting graphic represenaton in the Data Preview Window.

	Instruction	Recipe	X	Y
1	CIRCLE	2, 100.00	50.000	50.000
2	LINE	2, 100.00	140.000	40.000
3	CIRCLE	2, 100.00	140.000	90.000
4	DOT	1, 50.00	15.000	100.000
5	DOT	1, 50.00	30.000	100.000
6	DOT	1, 50.00	45.000	100.000
7	DOT	1, 50.00	60.000	100.000
8	DOT	1, 50.00	75.000	100.000
9	DOT	1, 50.00	90.000	100.000

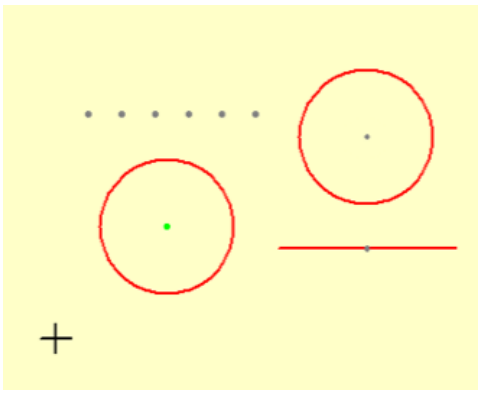


Figure 21-5: Select the Circle for Editing

1. To select just the lower circle, single-click the gray dot inside the lower circle on the Data Preview Window or single-click the first **CIRCLE** entry in the Instruction List. When the circle is selected, the gray dot turns green and the **CIRCLE** entry is highlighted.

2. To use the **Edit Circle** window, double-click on the first **CIRCLE** instruction in the Instruction List or on the dot inside the lower left circle on the Data Preview Window.

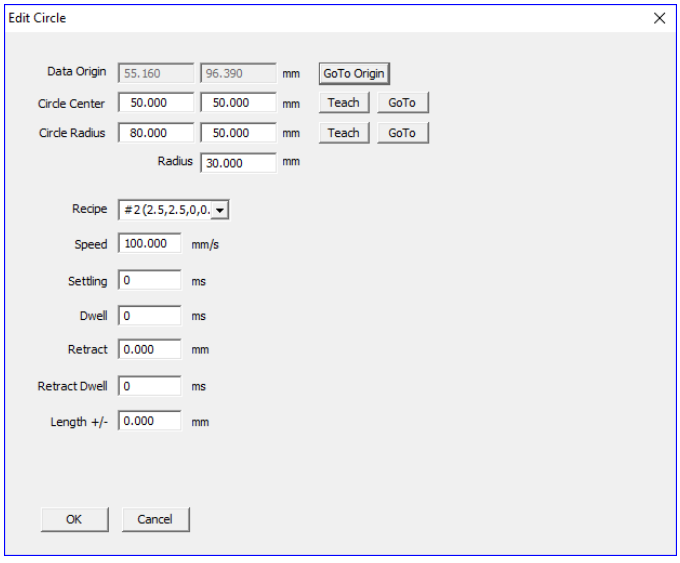


Figure 21-6: Edit Circle Window

21.3 Edit Window for a Single Instruction, continued

4. Edit the circle parameters as needed.
   - To make the circle smaller, enter a smaller number in the **Radius** field.
   - It is not necessary to teach a new coordinate for **Circle Radius**; the calculation is based on the circle center and the radius length.
5. Click **OK** to save the edited parameters to the Instruction List. Figure 21-7 shows the circles before and after editing.

BEFORE: RADIUS = 30.00 MM

AFTER: RADIUS = 15.00 MM

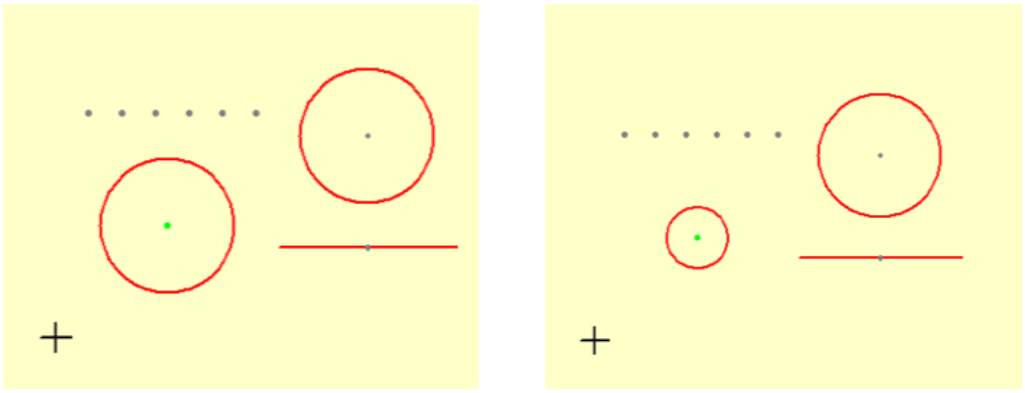
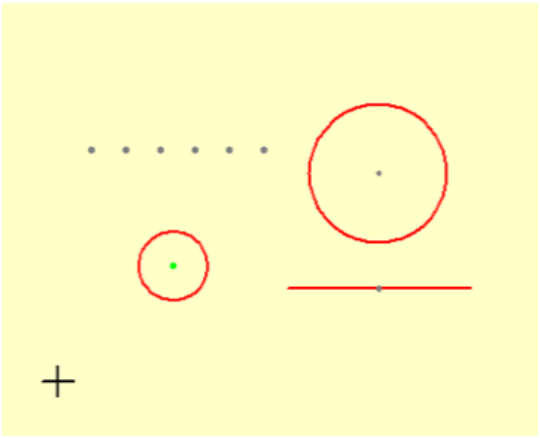


Figure 21-7: (Left) Original Circle and (Right) Edited Circle

21.4 Edit Window for Multiple Instructions

To edit dispense parameters for multiple instructions at once, select the instructions using the **Select All**, **Select By Name, Shift+Click**, or **Ctrl+Click**, methods described in section 21.2. Right-click any of the selected instructions and use the **Edit Selected** window to edit recipe, speed, or offset values for all instructions selected.

Continuing the example, the Instruction List in Figure 21-8 shows the line at XY location (140.000,40.000) and the upper circle at XY location (140.000,90.000). Both have a Speed of 100.00 millimeters per second.



	Instruction	Recipe	X	Y
1	CIRCLE	2, 100.00	50.000	50.000
2	LINE	2, 100.00	140.000	40.000
3	CIRCLE	2, 100.00	140.000	90.000
4	DOT	1, 50.00	15.000	100.000
5	DOT	1, 50.00	30.000	100.000
6	DOT	1, 50.00	45.000	100.000
7	DOT	1, 50.00	60.000	100.000
8	DOT	1, 50.00	75.000	100.000
9	DOT	1, 50.00	90.000	100.000

Figure 21-8: Edit the Line and the Circle

1. To select the upper circle right and the line, **Shift+Click** the gray dots inside the upper circle and in the center of the line in the Data Preview Window, or **Shift+Click** the second CIRCLE and LINE instructions in the Instruction List. When the instructions are selected, the gray dots turn green and the entries are highlighted.
2. Right-click for the **Edit Selected** window.

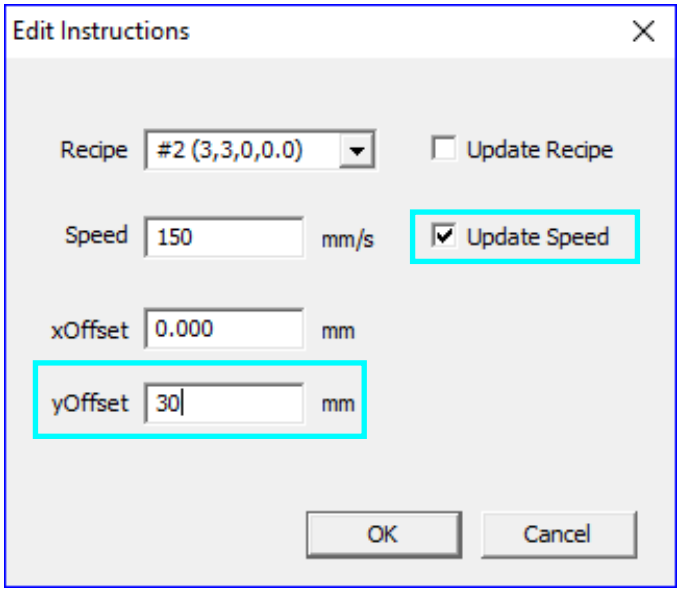
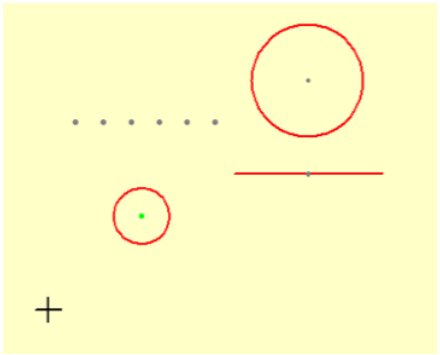


Figure 21-9: Update Speed

3. To increase the speed for both elements to 150 mm/sec, enter **150** in the Speed field and click the **Update Speed** box.
4. To move both elements up by 30 mm, enter **30** in the **yOffset** field.
5. Click **OK** to save the edited parameters to the Instruction List.
6. In Figure 21-10, the Data Preview Window shows the circle and line moved upward, and the Instruction List shows the updated value for speed following the **Recipe** number.



	Instruction	Recipe	X	Y
1	CIRCLE	2, 100.00	50.000	50.000
2	LINE	2, 100.00	140.000	70.000
3	CIRCLE	2, 100.00	140.000	120.000
4	DOT	1, 50.00	15.000	100.000
5	DOT	1, 50.00	30.000	100.000
6	DOT	1, 50.00	45.000	100.000
7	DOT	1, 50.00	60.000	100.000
8	DOT	1, 50.00	75.000	100.000
9	DOT	1, 50.00	90.000	100.000

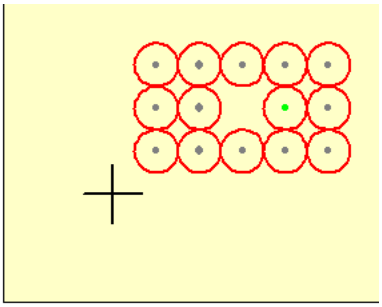
Figure 21-10: Edited Circle and Line

21.5 Inserting an Instruction

An instruction can be added at any point in an existing program.

21.5.1 Insert a Missing Shape

Figure 21-11 shows a group of circles with a circle missing from the middle row. If the circle instruction was added at the end of the list, it would be dispensed after the other circles have been dispensed, which would not be time-efficient.



	Instruction	Recipe	X	Y
1	CIRCLE	2, 100.00	10.000	10.000
2	CIRCLE	2, 100.00	20.000	10.000
3	CIRCLE	2, 100.00	30.000	10.000
4	CIRCLE	2, 100.00	40.000	10.000
5	CIRCLE	2, 100.00	50.000	10.000
6	CIRCLE	2, 100.00	10.000	20.000
7	CIRCLE	2, 100.00	20.000	20.000
8	CIRCLE	2, 100.00	40.000	20.000
9	CIRCLE	2, 100.00	50.000	20.000
10	CIRCLE	2, 100.00	10.000	30.000
11	CIRCLE	2, 100.00	20.000	30.000
12	CIRCLE	2, 100.00	30.000	30.000
13	CIRCLE	2, 100.00	40.000	30.000
14	CIRCLE	2, 100.00	50.000	30.000

Figure 21-11: Group of Circles with One Circle Missing

The instruction before the missing circle is **CIRCLE 8**. To insert the added circle, select **CIRCLE 8**, define the circle, and use the **Insert Before Instruction** option. This positions the instruction so that it is dispensed at its location in the pattern.

1. Select the **CIRCLE 8** instruction by single-clicking the gray dot inside the circle on the Data Preview Window, or by clicking **CIRCLE 8** in the Instruction List. When the circle is selected, the gray dot turns green and the **CIRCLE 8** entry is highlighted.
2. Click the **Circles** toolbar button.

   (Assume that a template with the circle pattern is positioned on the work surface for reference.)
3. Move the camera to the location of the missing circle and **Teach** the required points.
4. Select **Insert Before Instruction** and enter **8** to insert the new instruction before Instruction 8.
5. Click **OK** to save the Circle List to the Instruction List and exit the window.

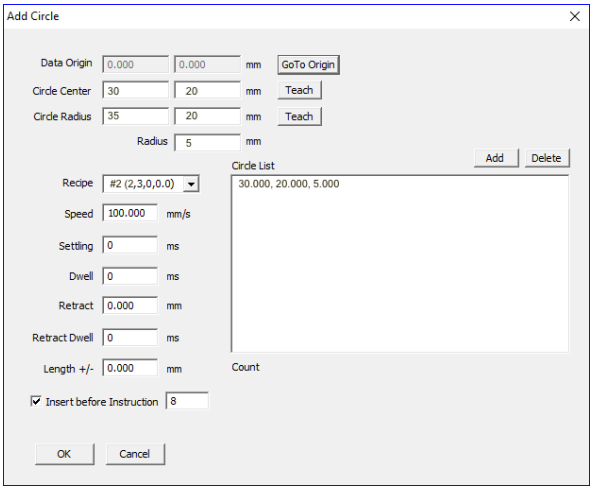


Figure 21-12: Add Missing Circle Before Instruction #8

6. Figure 21-13 shows the circle inserted in place. In the Instruction List, what was previously Instruction 8 is now Instruction 9. That instruction line and its corresponding data point on the data preview window remain highlighted.

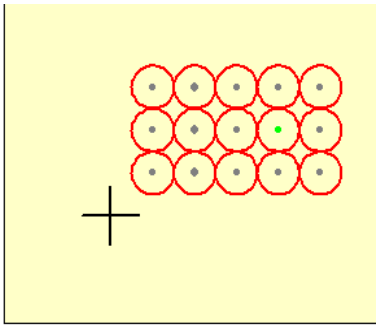


Figure 21-13: Missing Circle Inserted in Place

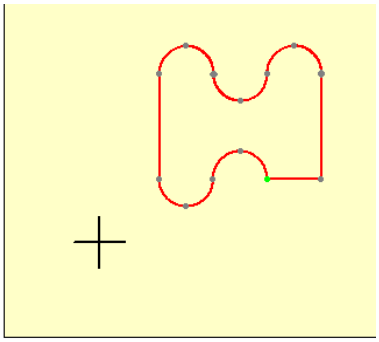
	Instruction	Recipe	X	Y
1	CIRCLE	2, 100.00	10.000	10.000
2	CIRCLE	2, 100.00	20.000	10.000
3	CIRCLE	2, 100.00	30.000	10.000
4	CIRCLE	2, 100.00	40.000	10.000
5	CIRCLE	2, 100.00	50.000	10.000
6	CIRCLE	2, 100.00	10.000	20.000
7	CIRCLE	2, 100.00	20.000	20.000
8	CIRCLE	2, 100.00	30.000	20.000
9	CIRCLE	2, 100.00	40.000	20.000
10	CIRCLE	2, 100.00	50.000	20.000
11	CIRCLE	2, 100.00	10.000	30.000
12	CIRCLE	2, 100.00	20.000	30.000
13	CIRCLE	2, 100.00	30.000	30.000
14	CIRCLE	2, 100.00	40.000	30.000
15	CIRCLE	2, 100.00	50.000	30.000

21.5.2 Insert a Missing Point

The option to insert an instruction is particularly useful after discovering a missing point in a complicated shape. Instead of starting over and reprogramming the entire shape, the missing point is inserted in the Instruction List.

Figure 21-14 shows a gasket-shaped path that is missing the bottom right arc. (For illustrative purposes, assume that a template with the gasket pattern is positioned on the work surface.) The Path instruction before the missing arc is PATH_POINT 9. To insert the missing arc, select PATH_POINT 9, and define an arc. This positions the instruction so that the added arc is dispensed at its location in the pattern.

1. Select the **PATH_POINT 9** instruction by single-clicking the gray dot on the path in the Data Preview Window, or by clicking **PATH_POINT 9** in the Instruction List. When the point is selected, the gray dot turns green and the **PATH_POINT 9** entry is highlighted.
2. Click the **Paths** toolbar button.
3. Move the camera to the missing point of the gasket. Click on its corresponding line in the instruction list. Select point type **Arc** and **Teach** the location of the missing arc point.
4. Select **Insert Before Instruction** and enter **9**.



	Instruction	Recipe	X	Y
1	PATH_BEGIN	2, 100.00	15.880	44.420
2	PATH_ARC		23.010	51.860
3	PATH_POINT		30.320	44.340
4	PATH_ARC		37.450	37.410
5	PATH_POINT		44.580	44.400
6	PATH_ARC		51.710	51.960
7	PATH_POINT		59.050	44.450
8	PATH_POINT		58.980	16.650
9	PATH_POINT		44.530	16.650
10	PATH_ARC		37.430	24.140
11	PATH_POINT		30.190	16.650
12	PATH_ARC		22.990	9.560
13	PATH_POINT		15.850	16.560
14	PATH_END		15.880	44.420

Figure 21-14: Gasket Shape with Missing Arc

21.5 Inserting an Instruction, continued

5. Click **OK** to save the Path List to the Instruction List and exit the window.

6. The Data Preview Window shows that the path is complete. In the Instruction List, the line that was previously Instruction 9 has become Instruction 10. That instruction and the corresponding data point remain highlighted.

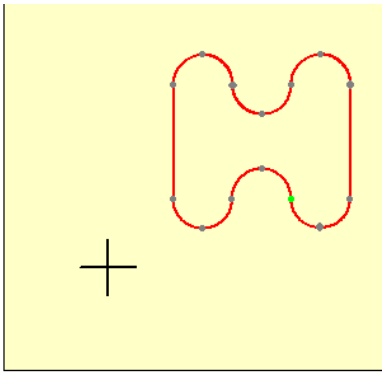


Figure 21-15: Missing Arc Inserted in Place

	Instruction	Recipe	X	Y
1	PATH_BEGIN	2, 100.00	15.880	44.420
2	PATH_ARC		23.010	51.860
3	PATH_POINT		30.320	44.340
4	PATH_ARC		37.450	37.410
5	PATH_POINT		44.580	44.400
6	PATH_ARC		51.710	51.960
7	PATH_POINT		59.050	44.450
8	PATH_POINT		58.980	16.650
9	PATH_ARC		51.630	9.700
10	PATH_POINT		44.530	16.650
11	PATH_ARC		37.430	24.140
12	PATH_POINT		30.190	16.650
13	PATH_ARC		22.990	9.560
14	PATH_POINT		15.850	16.560
15	PATH_END		15.880	44.420

Tutorial 1: DispensePro Programming

As a way of presenting the basic elements of the DispensePro software, this tutorial provides guided instructions for building a sample program containing basic shapes for dispensing.

Using a smartphone screen assembly as a tracing template, the tutorial begins with step-by-step instructions for programming the series of dots, lines, and shapes that comprise the pattern. After dispensing the pattern over the template, the tutorial concludes with instructions for adding fiducials and replicating the pattern.

Part 1: Programming Shapes
- Manage files using the **New**, **Open**, and **Save** toolbar functions
- Set the **Data Origin**
- Build the outline shape using the **Paths** instructions
- Build the inner shapes using **Circles**, **Dots**, and **Lines** (optional)

Part 2: Running the Program
- Verify the **Run** menu settings and options
- Use the **Controller** menu to set and store the jetting parameters for the timing recipe
- Run the job

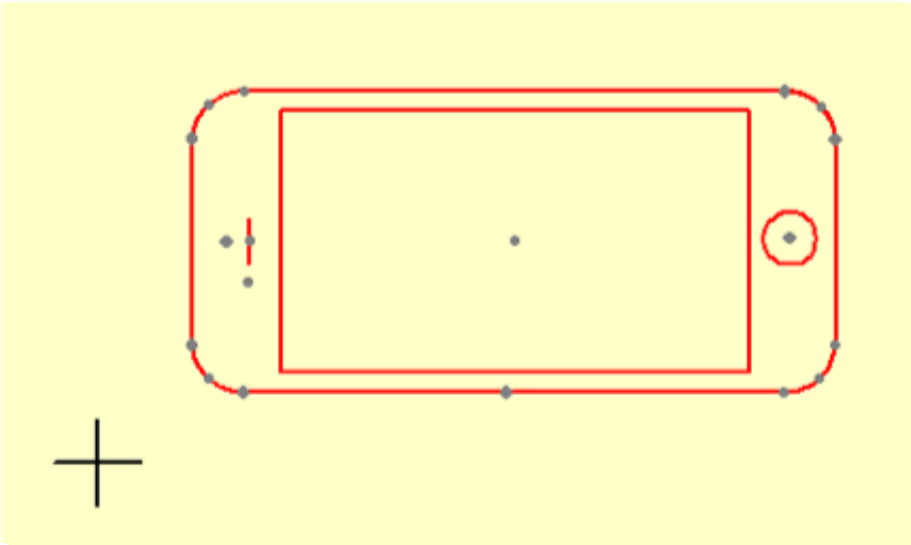
Part 3: Fiducials
- Use **Fiducials** to program two fiducial images
- Observe the correction provided by the fiducials by running the job after moving the workpiece

Part 4: Step and Repeat
- Use **Step and Repeat** to replicate the pattern
- Run the resulting job that dispenses two instances of the pattern

Tutorial Part 1: Set Up for Programming

1.1 Tutorial Pattern

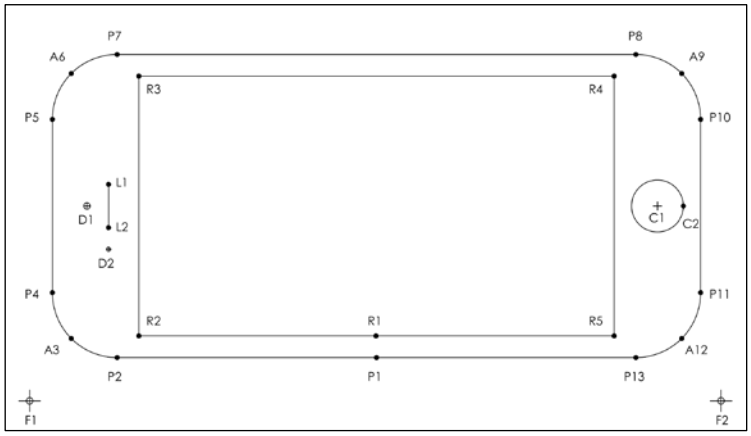
Using a smartphone screen assembly as a tracing template, this tutorial builds a dispensing program for the outline of the shape using the **Paths** instruction. The inner shapes can be added using **Circles**, **Dots**, and **Lines** if desired.



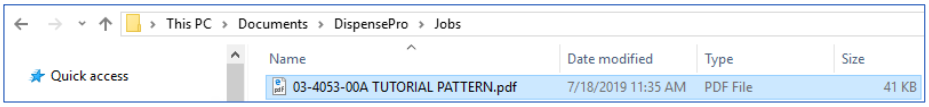
DispensePro Tutorial 1: "Smartphone Screen Assembly" Pattern

1.2 Tutorial Template

To assist in programming the dispensing instructions, the tutorial uses a template that is positioned and taped to the XY table. In the Camera Window, zoom and click on the template points to build the pattern.

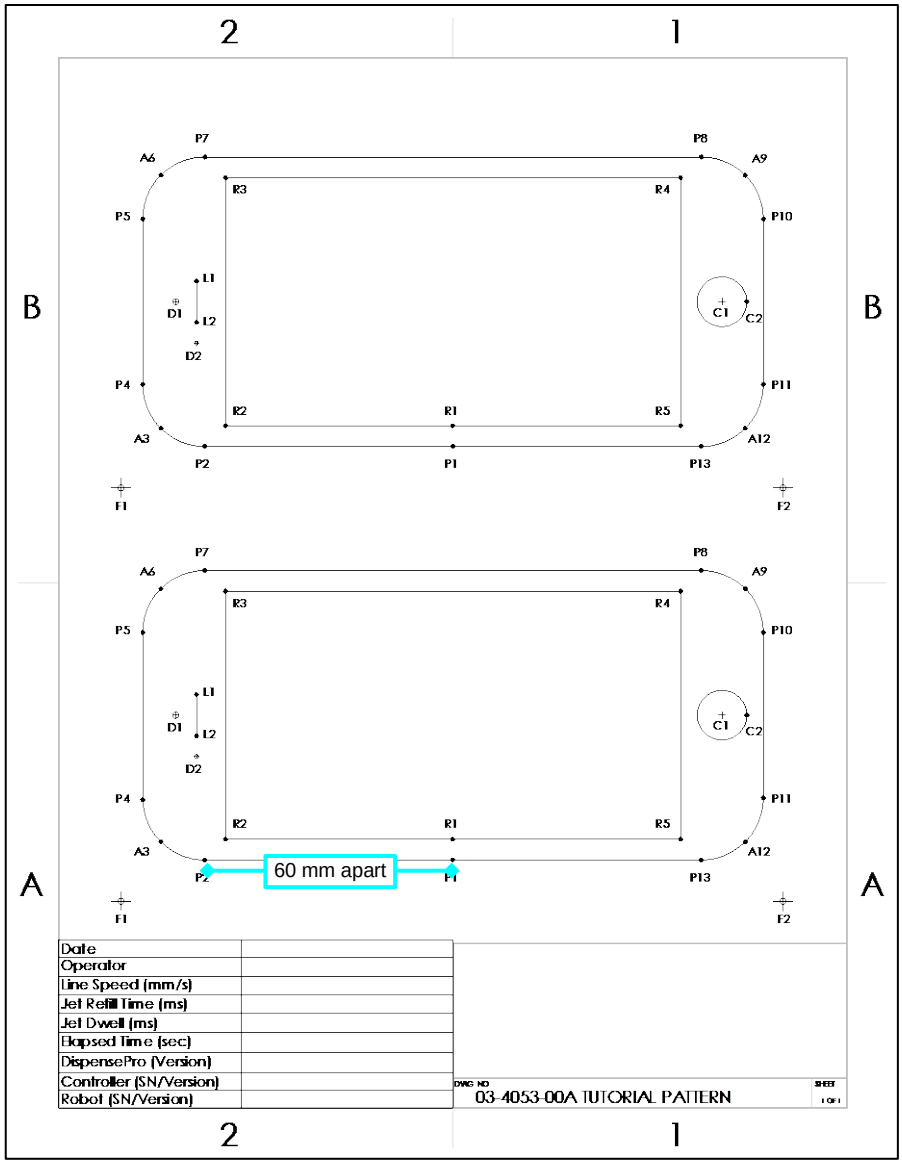


DispensePro Tutorial 2:
"Smartphone Screen Assembly" Point-By-Point Template



DispensePro Tutorial 3: Tutorial Pattern Template File Location

The filename for the template is 03-4053-00A TUTORIAL PATTERN.pdf. Use File Explorer to find the template in **This PC > Documents > DispensePro > Jobs**.

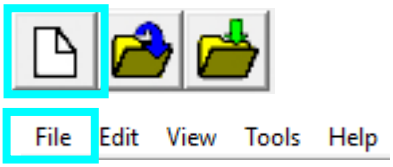


DispensePro Tutorial 4: Tutorial Pattern Template (Not Shown To Scale)

The template is designed to be printed at 100% on US Letter size paper (8.50 x 11.00 inches). When printed at the proper scale, the distance between dots P1 and P2 is 60 millimeters.

1.3 Open a New File

- Click the **New File** toolbar button to create a new job file, or
- Select **File** and **New** from the top menu



1.4 Prepare the "Workpiece"

1.4.1 Make copies of the Tutorial Pattern page. Because the image will be used for a dispensing work surface as well as a tracing template, it is recommended to print at a high resolution to maximize fiducial finding. Verify that dots P1 and P2 are 60 millimeters apart.

1.4.2 Place a copy of the image on the work surface so that the "phone's home button" is on the right. Align the bottom edge of the paper with the front edge of the work surface tooling plate and lightly tape in place.

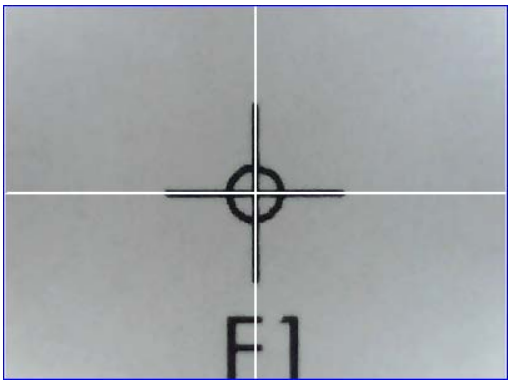
1.4.3 Even if the edge of the paper is exactly aligned, the image may have become slightly rotated during copying. To verify proper positioning of the template, start at the bottom left corner of the outer frame and click the X Jog Button to move straight to the right. The horizontal crosshair line should align with the bottom edge of the frame. Adjust as needed and verify X-axis alignment again.

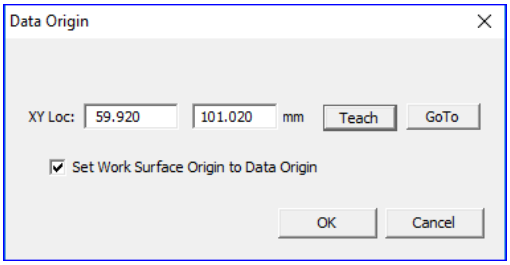
1.5 Set the Data Origin

1.5.1 From the top menu, select **Edit** and **Data Origin**.

1.5.2 Verify that the **Set Work Surface Origin to Data Origin** option is selected. The data coordinates taught for the dispense instructions are all relative to this Data Origin position. If this option is selected when the job file is run, the Work Surface Origin is set to the Data Origin. This provides flexibility if the placement of the workpiece has changed.

1.5.3 Click **Teach** to store the location.





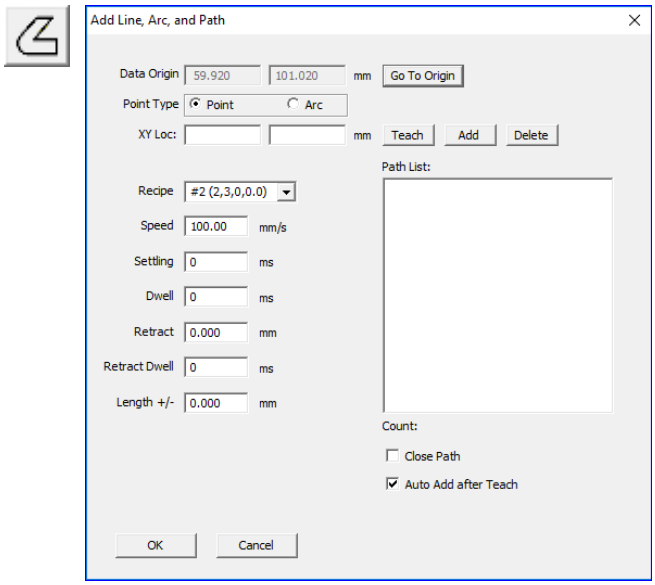
DispensePro Tutorial 5: Set the Data Origin (sample coordinates shown; actual values will vary)

Tutorial Part 2: Programming Shapes

Note: The tutorial template has two identical patterns;
for this section of the tutorial, use only the bottom pattern.

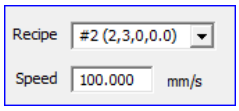
2.1 Build the Outer Outline

2.1.1 Click the **Paths** toolbar button. Select **Auto Add After Teach**.



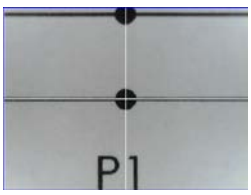
DispensePro Tutorial 6: Add Path Window

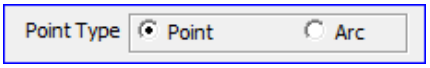
2.1.2 In the **Recipe** list, select **Recipe #2** and set Robot speed to 100 mm/sec for this path.



DispensePro Tutorial 7:
Select Dispensing Recipe and Enter Robot Speed

2.1.3 On the template, the points are labeled by Point Type (P = point; A = Arc) and instruction number. Move the camera to P1 by clicking the P1 dot in the Camera Window. Center the crosshairs on the center of the dot. The default Point Type is **Point**. Click **Teach** to store Point 1.

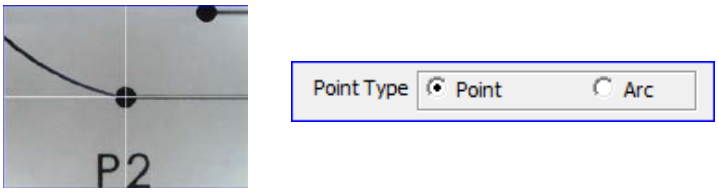




DispensePro Tutorial 8: Teach Point 1

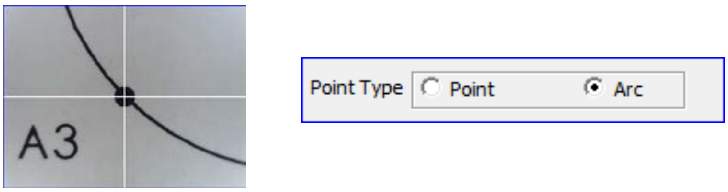
2.1 Build the Outer Outline, continued

2.1.4 Move to Point 2 and click **Teach**.



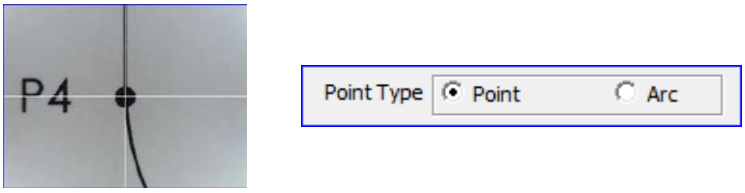
DispensePro Tutorial 9: Teach Point 2

2.1.5 Move to Point 3. Change Point Type to **Arc**. An Arc point serves as the midpoint of the curved path defined by points before and after it. **Teach** Point 3.



DispensePro Tutorial 10: Teach Point 3

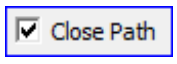
2.1.6 Move to Point 4. Point is the default point type, so even though the point type just taught was Arc, the next point type is always **Point**. **Teach** Point 4.



DispensePro Tutorial 11: Teach Point 4

2.1.7 Continue to **Teach** Points 5 through 13.

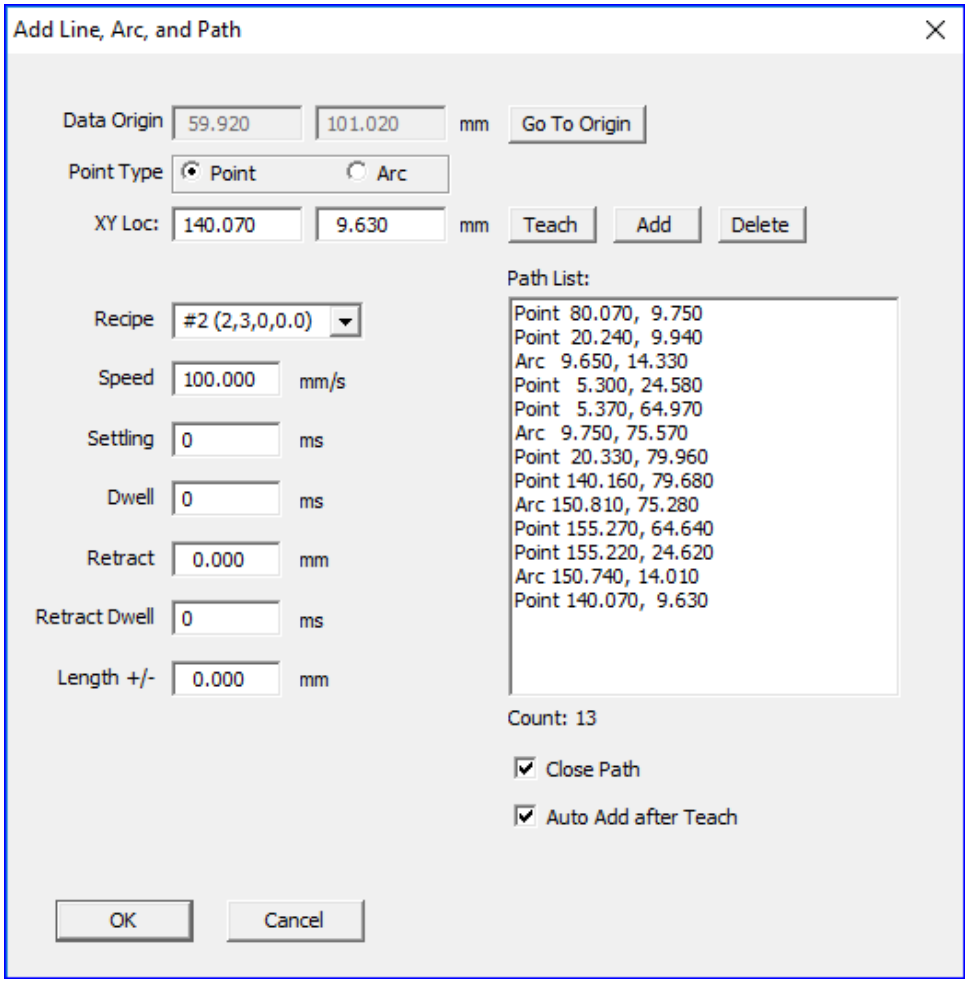
2.1.8 After teaching Point 13, select **Close Path** to close the path between Points 13 and 1.



DispensePro Tutorial 12:
Close Path Connects Last Point to First Point

2.1 Build the Outer Outline, continued

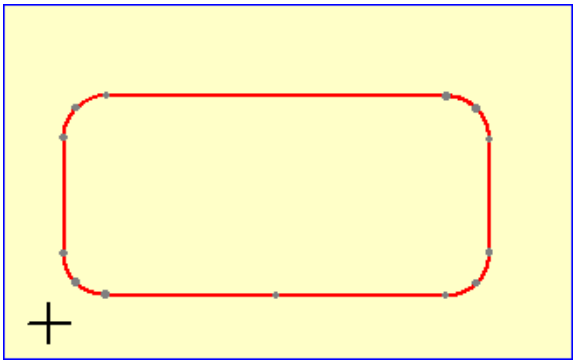
2.1.9 The **Path List** with point type and XY coordinate values is shown. Total **Count** of points is listed below the Path List. Note that the XY values are a general guideline for the coordinates of each point relative to the Data Origin.



DispensePro Tutorial 13: Path List in the Paths Window

2.1 Build the Outer Outline, continued

2.1.10 Click **OK** to save the Path List. The Data Preview Window shows how the Path List would appear when dispensed. The size and placement are scaled to the Data Preview Window.



DispensePro Tutorial 14:
Data Preview Window Shows Outline Shape

2.1.11 The Instruction List shows the instructions in the Path List.

The numbers in the **Recipe** column are the recipe number and speed. The recipe applies to the entire path but is only displayed for the first instruction.

In the shape just taught, the first instruction shown is Point 1, and it is now labeled PATH_BEGIN.

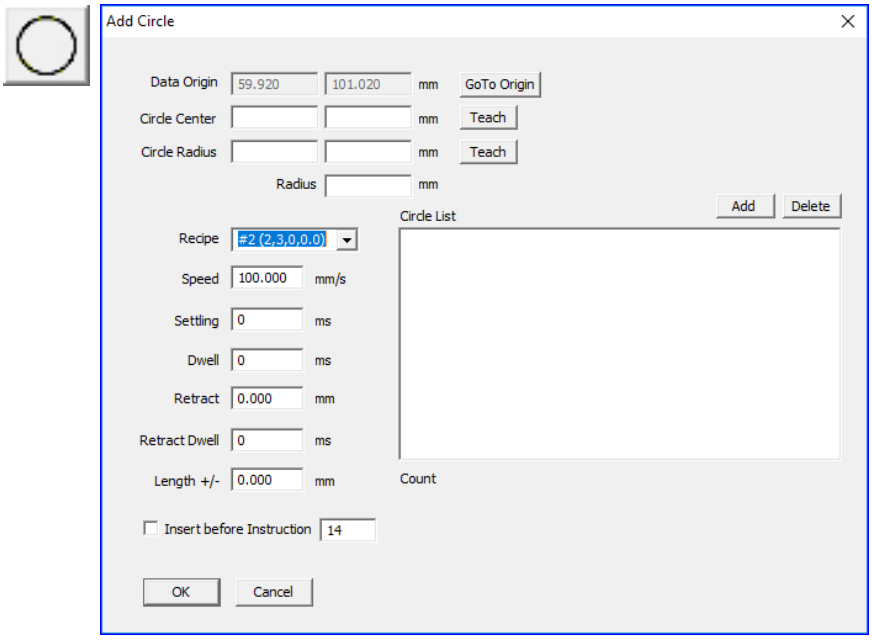
The successive instructions correspond to the rest of the points in the Path List.

Instruction 14 is now labeled PATH_END and shows the same XY coordinates as PATH_BEGIN.

	Instruction	Recipe	X	Y
1	PATH_BEG	2, 100.00	80.070	9.750
2	PATH_POIN		20.240	9.940
3	PATH_ARC		9.650	14.330
4	PATH_POIN		5.300	24.580
5	PATH_POIN		5.370	64.970
6	PATH_ARC		9.750	75.570
7	PATH_POIN		20.330	79.960
8	PATH_POIN		140.160	79.680
9	PATH_ARC		150.810	75.280
10	PATH_POIN		155.270	64.640
11	PATH_POIN		155.220	24.620
12	PATH_ARC		150.740	14.010
13	PATH_POIN		140.070	9.630
14	PATH_END		80.070	9.750

DispensePro Tutorial 15:
Instruction List for Path List

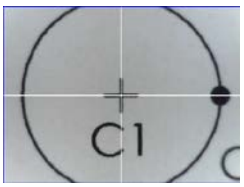
2.2 Add Inner Features: Circle



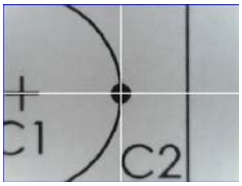
DispensePro Tutorial 16: Add Circle Window

2.2.1 Click the **Circle** toolbar button.

2.2.2 Move the camera to the circle shape on the right of the template. Center the crosshairs on the center point of the circle (C1). Click **Teach** to store this point as the **Circle Center** coordinates.

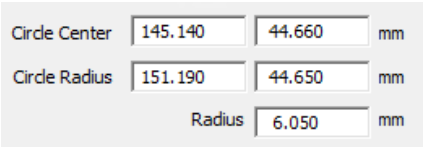


DispensePro Tutorial 17: Teach Circle Center



DispensePro Tutorial 19: Teach Circle Center

2.2.3 Move to the point on the circle's edge (C2) and click **Teach** to store this point as the **Circle Radius** coordinates. The **Radius** for the circle is calculated based on the distance between these two points.



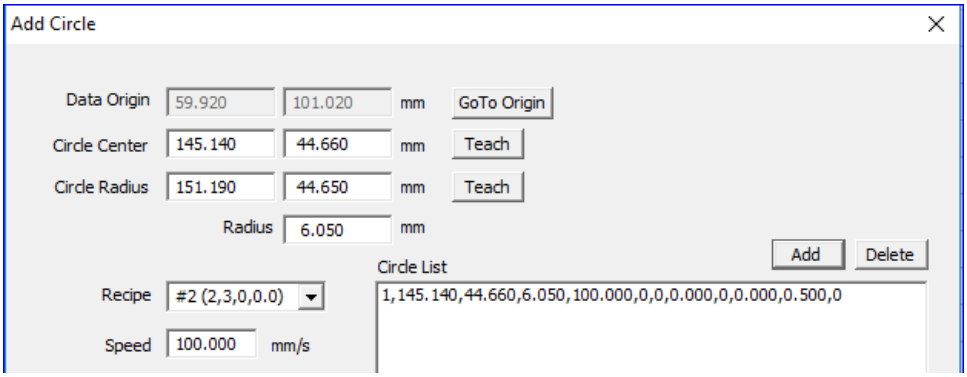
DispensePro Tutorial 18: Circle Radius Calculated from Center and Outer Edge Points

2.2 Tutorial Part 2: Programming Shapes, continued

Add Inner Features: Circle, continued

2.2.4 Select **Recipe #2** and dispense speed 100 mm/sec.

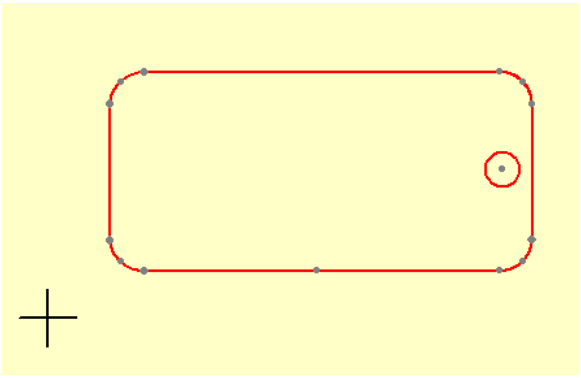
2.2.5 Click **Add** to add the circle parameters to the Circle List.



DispensePro Tutorial 20: Circle Parameters Added to Circle List

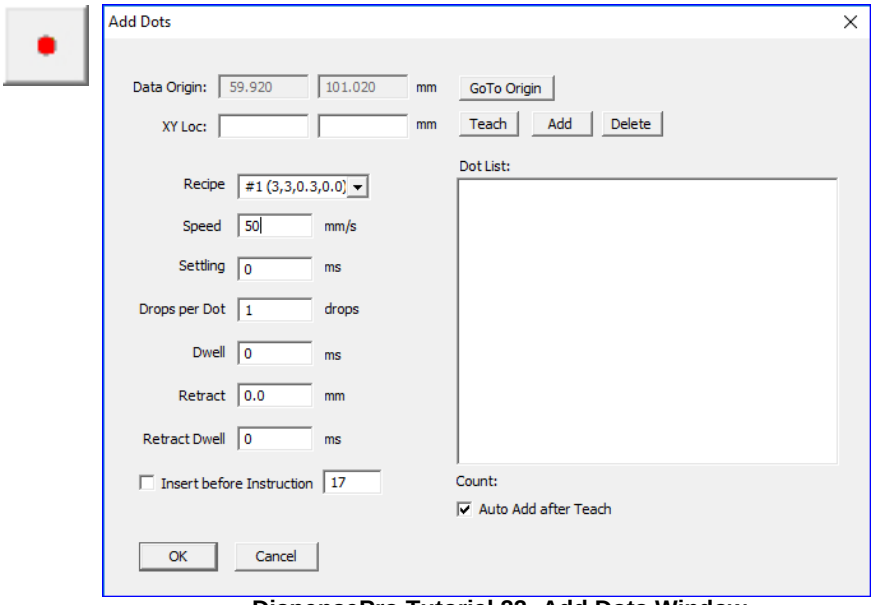
2.2.6 Click OK to save the Circle List to the Instruction List.

2.2.7 The Data Preview Window shows the circle added to the shape.



DispensePro Tutorial 21:
Data Preview Window Shows Circle Added to Outline Shape

2.3 Add Inner Features: Dots

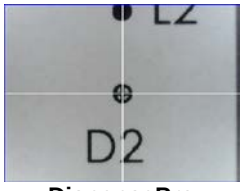


DispensePro Tutorial 22: Add Dots Window

2.3.1 Click the **Dots** toolbar button. Select **Auto Add After Teach**.

2.3.2 Select **Recipe #1** and dispense speed 50 mm/sec.

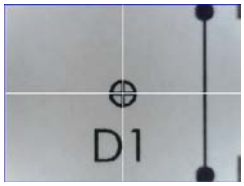
2.3.3 Set **Drops per Dot** to 5. Move the camera to the large dot (D1) on the left side of the template. Center the crosshairs on the dot and **Teach** this point.



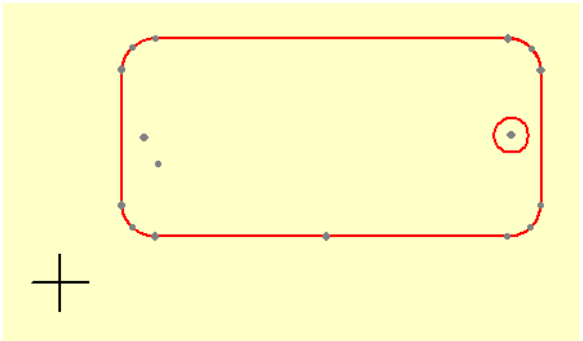
DispensePro Tutorial 23: Two Drops Per Dot

2.3.4 Set **Drops per Dot** to 2. Move to the smaller dot (D2) slightly below and to the right of the point. Center the crosshairs on the dot and **Teach** this second point.

2.3.5 Click **OK** to save the Dot List to the Instruction List. The dots will use Recipe #1 and dispense at a speed of 50 mm/sec. The Data Preview Window shows the dots added to the outer outline and circle.

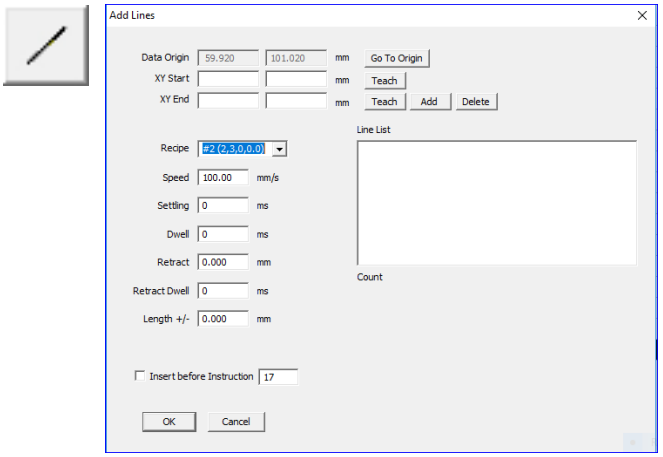


DispensePro Tutorial 25: Five Drops Per Dot



DispensePro Tutorial 24: Data Preview Window Shows Dots Added to Outline and Circle

2.4 Add Inner Features: Lines



DispensePro Tutorial 26: Add Lines Window

2.4.1 Click the **Lines** toolbar button.

2.4.2 Select **Recipe #2** and dispense speed 100mm/sec.

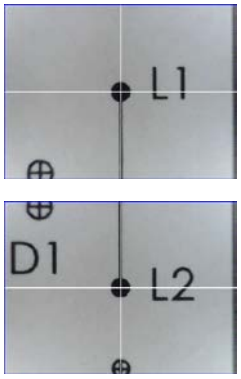
2.4.3 Move the camera to the top point of the line (**L1**) next to the large dot. Center the crosshairs on the dot and **Teach** this point.

2.4.4 Move the camera down to the bottom point of the line (**L2**). Center the crosshairs on the dot and **Teach** this second point.

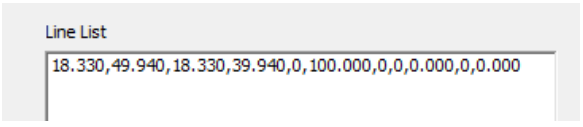
2.4.5 Click **Add** to add the point coordinates to the Line List.

2.4.6 Click **OK** to save the Line List to the Instruction List.

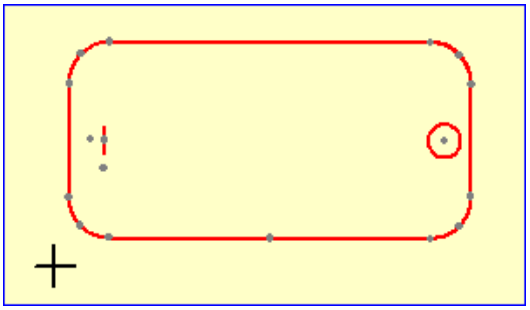
The Data Preview Window shows the line added to the outer outline, circle, and dots.



DispensePro Tutorial 27: Teach Line Points

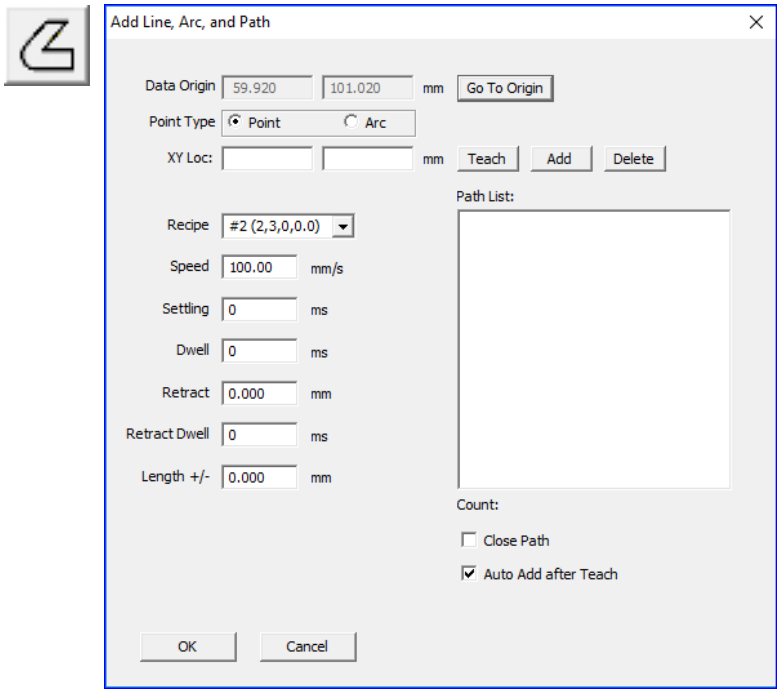


DispensePro Tutorial 29: Line List Saved to Instruction List



DispensePro Tutorial 28: Data Preview Window Shows Line Added to Outline, Circle, and Dots

2.5 Add Inner Features: Rectangular Path



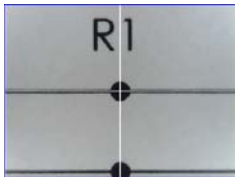
DispensePro Tutorial 30: Add Paths Window

2.5.1 Click the **Paths** toolbar button. Select **Auto Add After Teach**.

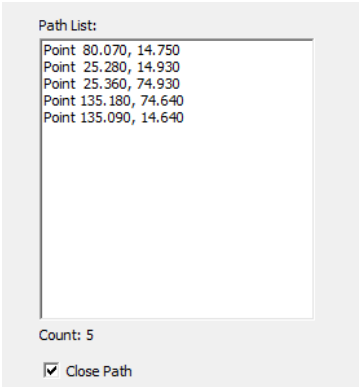
2.5.2 Select **Recipe #2** and dispense speed 100mm/sec.

2.5.3 Move the camera to the center point of the bottom of the rectangle (**R1**). Center the crosshairs on the dot and **Teach** this point.

2.5.4 Continue to teach points **R3**, **R4**, and **R5**. After teaching **R5**, select **Close Path** to close the path between R5 and R1.



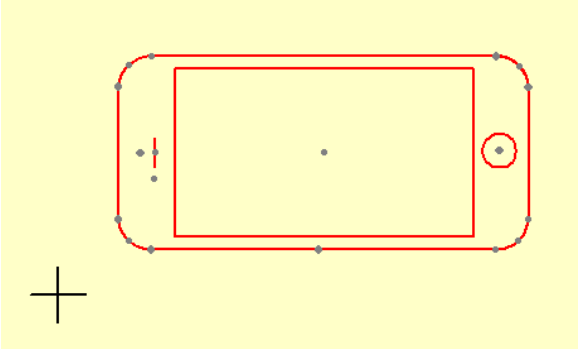
DispensePro Tutorial 31: Point R1 on Rectangular Path



DispensePro Tutorial 32: Rectangular Path Added to Path List

2.5 Add Inner Features: Rectangular Path, continued

2.5.5 Click OK to save the Path List to the Instruction List. The Data Preview Window shows the completed shape.



DispensePro Tutorial 33: Data Preview Window Shows Rectangle Added to Outline, Circle, Dots, and Line

2.6 Save the File

Save the file before continuing:

- Click on the **Save File** toolbar button, or
- From the top menu, select **File** and **Save**, or
- Type **Ctrl** + **S**.

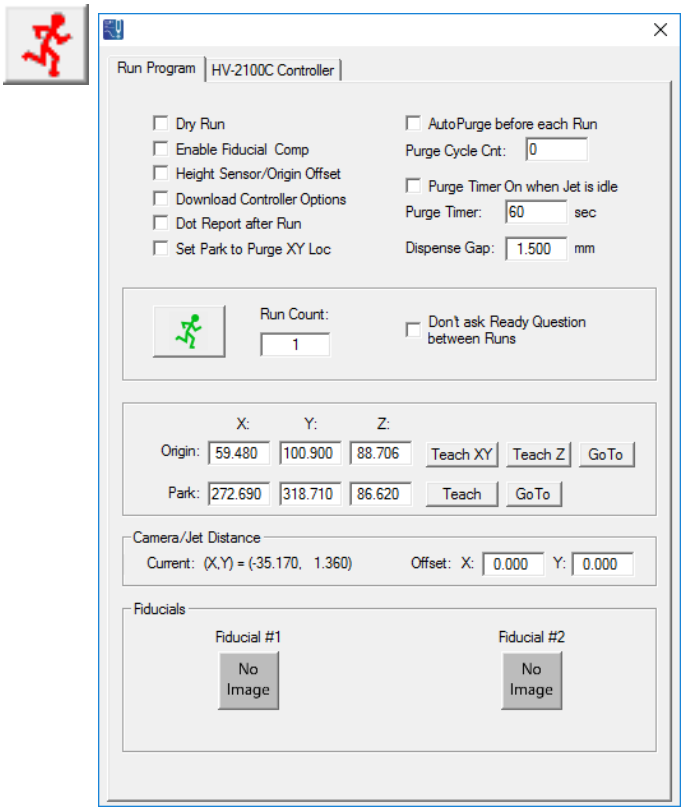
Name the file **Demo1.job**.

Tutorial Part 3: Run the Program

This section reviews the settings and options for running the program.

3.1 Select the Run Options

3.1.1 Click the **Run** toolbar button and select the **Run Program** tab.



DispensePro Tutorial 34: Run Program Window

3.1.2 The Work Surface Origin should be the same as the Data Origin.

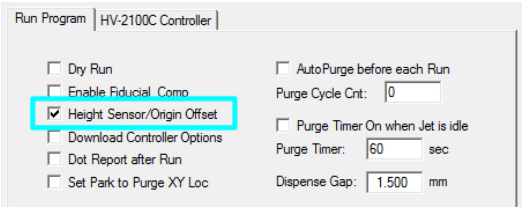
From the top menu, select **Edit** and **Data Origin**; verify that the Work Surface Origin values in the Run Window match the Data Origin values. Click **Cancel** to exit the Data Origin window.

Note: See Section 7.2 for a detailed explanation of the Data Origin and Work Surface Origin.

Tutorial Part 3: Run the Program, continued

3.1 Select the Run Options, continued

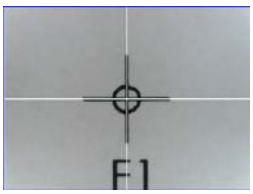
3.1.3 Select the Height Sensor/Origin Offset option.



DispensePro Tutorial 35: Height Sensor/Origin Offset Option

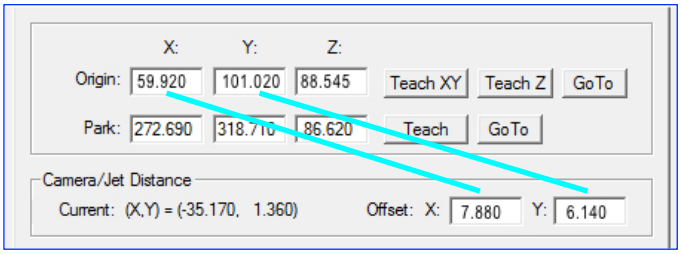
3.1.4 In the HS-to-Workpiece Offset section:

- Enter Dispense Gap height of 2.000.
- Center the camera crosshairs on the bottom left fiducial location (**F1**) and click **Teach**.



DispensePro Tutorial 36:
Teach a Point on the Work Surface

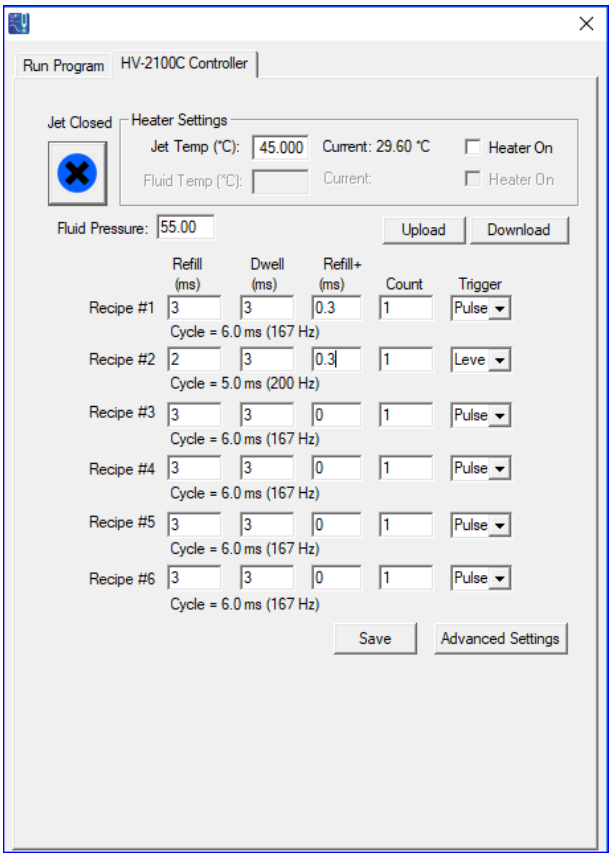
- For this example, the **HS/Workpiece Origin** location has been set to (7.880,6.140). The XY offset position can be changed by teaching other locations.
- At the start of the dispense run, the robot moves to a XY location set by combining the **Work Surface Origin** and **HS/Workpiece Origin** (59.920 + 7.880, 101.020 + 6.140). The value from a height sensing operation is used to calculate a Z Height that results in the 2.000 mm Dispense Gap specified.



DispensePro Tutorial 37: XY of Work Surface Origin
Will Be Adjusted By the XY of Height Sensor/Workpiece Offset

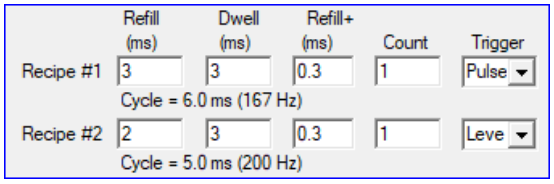
3.2 Jet Settings

3.2.1 Click the **Controller** tab to display the Jet settings. The Advanjet controller name is shown; HV-2100C is the standard diaphragm jet controller and HM-2600C is the hotmelt jet controller.



DispensePro Tutorial 39: Controller Tab in Run Window

3.2.2 The **Dot** instruction uses Recipe #1, and the **Paths, Circle,** and **Rectangular Path** instructions use Recipe #2. Verify that these values are entered for Recipe #1 and Recipe #2.

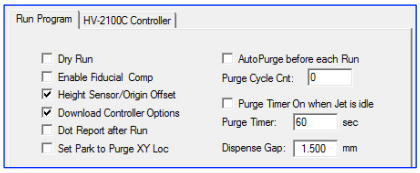


DispensePro Tutorial 40: Verify Recipe Values

3.3 Run the Program

3.3.1 Click the **Run Program** tab to return to the Run window.

3.3.2 Select **Download Controller Options** to send the recipe settings to the controller.

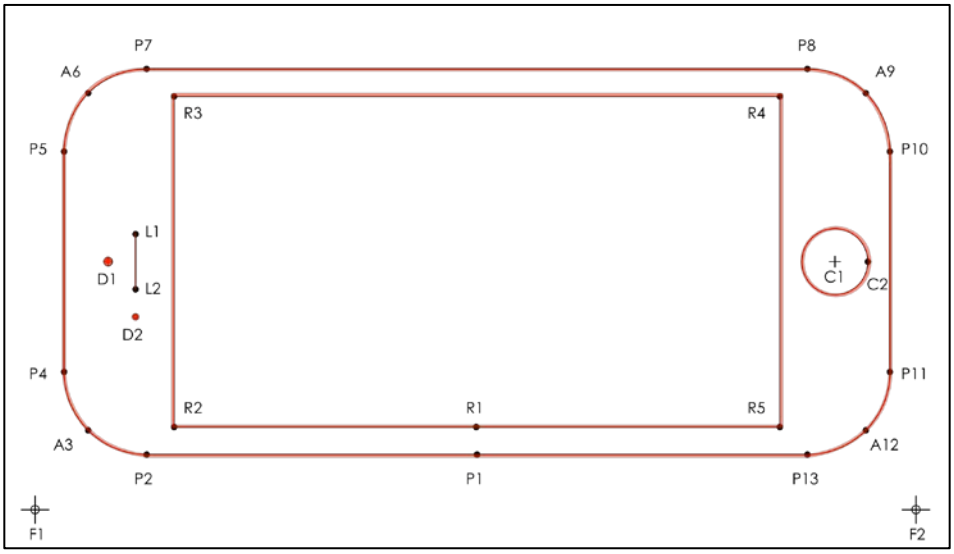


DispensePro Tutorial 41:
Download Controller Options Box

3.3.3 Enter a run count of 1.

3.3.4 Click **Run** to start dispensing the program.

The jet dispenses the Instruction List in the order listed.



DispensePro Tutorial 42: Dispensed Instruction List

Tutorial Part 4: Fiducials

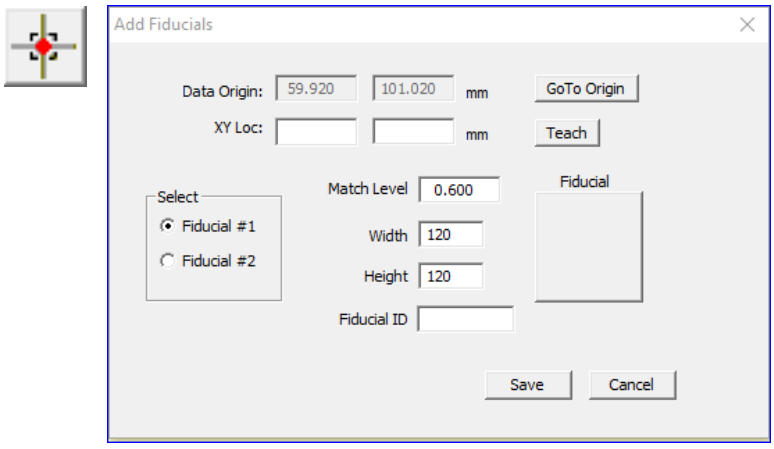
The purpose of setting fiducial images is to provide the vision system a means for evaluating the placement of each workpiece. This section shows how fiducials are used as references for positional accuracy.

During the run, the robot moves to the fiducial positions on the workpiece, takes a picture, and determines whether the picture is a match with the saved fiducial image. This information is used to calculate the distance the workpiece has been moved or rotated from the **Work Surface Origin** location in the **Run** menu. During the run, the XY locations are adjusted in the instructions as necessary.

There are two fiducials on the tutorial template at the left and right bottom corners. This section adds these fiducials to the dispensing program.

4.1 Program the Fiducials

4.1.1 Click the **Fiducials** toolbar button.

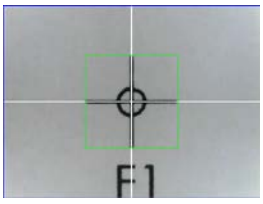


DispensePro Tutorial 43: Add Fiducials Window

4.1.2 Verify that **Fiducial #1** is selected.

4.1.3 Move to the bottom left fiducial (F1) and center the crosshairs on the center of the image.

- Position the green box in the Camera Window as close as possible to the outer edges of the image. Space around the image makes it less accurate.
- If needed, new values for the box width and height can be entered.

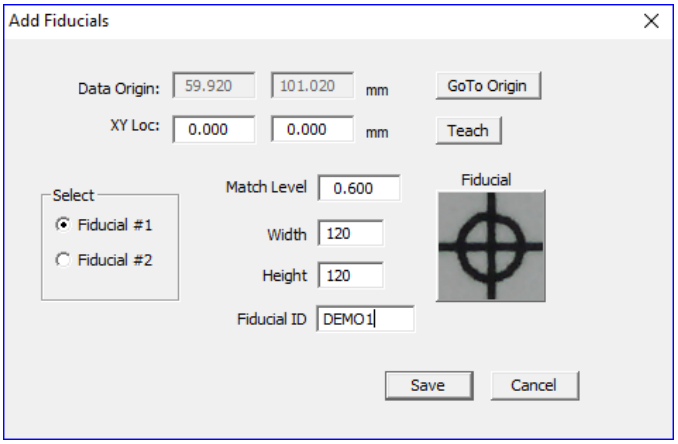


DispensePro Tutorial 44: Position Green Box Very Close to the Outer Edges of the Image

4.1 Program the Fiducials, continued

4.1.4 Enter a name for the **Fiducial ID**. For this tutorial, use **DEMO1**

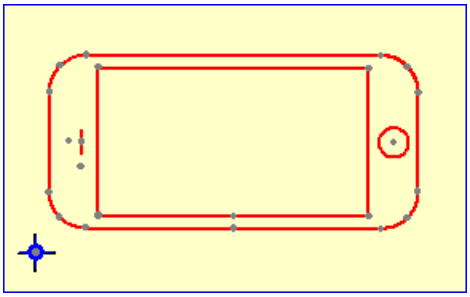
4.1.5 Click **Teach** to enter the location of Fiducial #1.



DispensePro Tutorial 45: Teach Fiducial #1

- The window shows the XY location and the image of the fiducial.
- **Match Level** defines the degree of similarity required between the workpiece fiducial image and the saved fiducial image. Use the default value of 0.600.

4.1.6 Click **Save** to save Fiducial #1. The Fiducial #1 image is added to the Data Preview Window at its stored location, and the Fiducial #1 XY coordinates are added to the top of the instruction list as **FID1**.



	Instruction	Recipe	X	Y
1	FID1		0.000	0.000
2	PATH_BEG	2, 100.00	80.070	9.750
3	PATH_POI		20.240	9.940
4	PATH_ARC		9.650	14.230

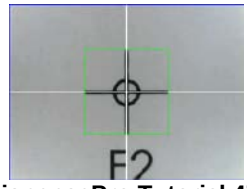
DispensePro Tutorial 46: Fiducial #1 in Data Preview Window and Instruction List

4.1 Program the Fiducials, continued

4.1.7 Click the **Fiducials** toolbar button again for Fiducial #2.

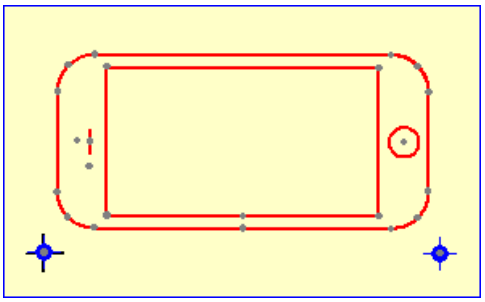
4.1.8 Verify that **Fiducial #2** is selected.

4.1.9 Move to the bottom right fiducial image (F2) and center the crosshairs on the center of the image.



DispensePro Tutorial 47: Position the Green Box Around Fiducial #2

4.1.10 Repeat the process of positioning the green box tightly around the image. For **Fiducial ID**, use **DEMO1**. Click **Teach** to enter the location of Fiducial #2. Click **Save** to save Fiducial #2. The Data Preview Window shows both fiducials in their respective locations. The instructions for **FID1** and **FID2** are at the top of the Instruction List.



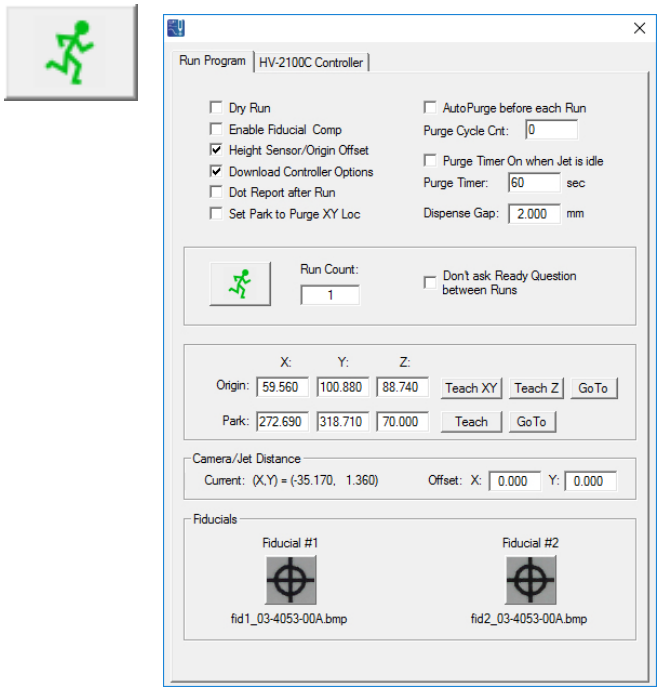
	Instruction	Recipe	X	Y
1	FID1		7.070	5.510
2	FID2		109.980	58.270
3	PATH_BEG	2, 100.00	57.500	10.250
4	PATH_POI		20.550	10.220

DispensePro Tutorial 48: Fiducial #1 and #2 in Data Preview Window and Instruction List

Note: *DispensePro saves the first fiducial as a file named "fid1_DEMO1" and the second fiducial as "fid2_DEMO1". These two files are stored in Documents/DispensePro/FidImages.*

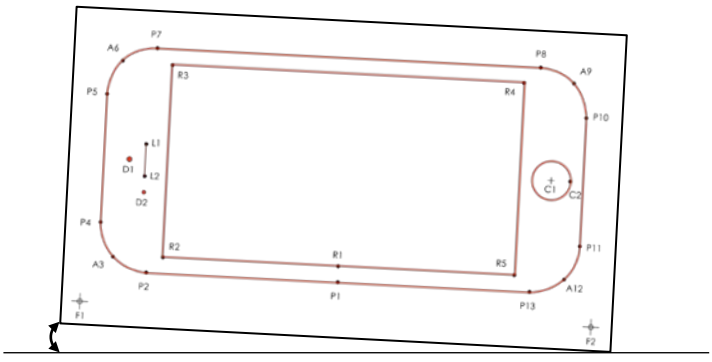
4.2 Run the Program with Fiducial Finding

4.2.1 Click the **Run** toolbar button. The fiducial images are displayed in the **Fiducials** window.



DispensePro Tutorial 49: Run Program Window Showing Saved Fiducial Images

4.2.2 Move the template page slightly away and tilted from the original Workpiece Origin position as shown.



DispensePro Tutorial 50: Tilt Template Page Slightly

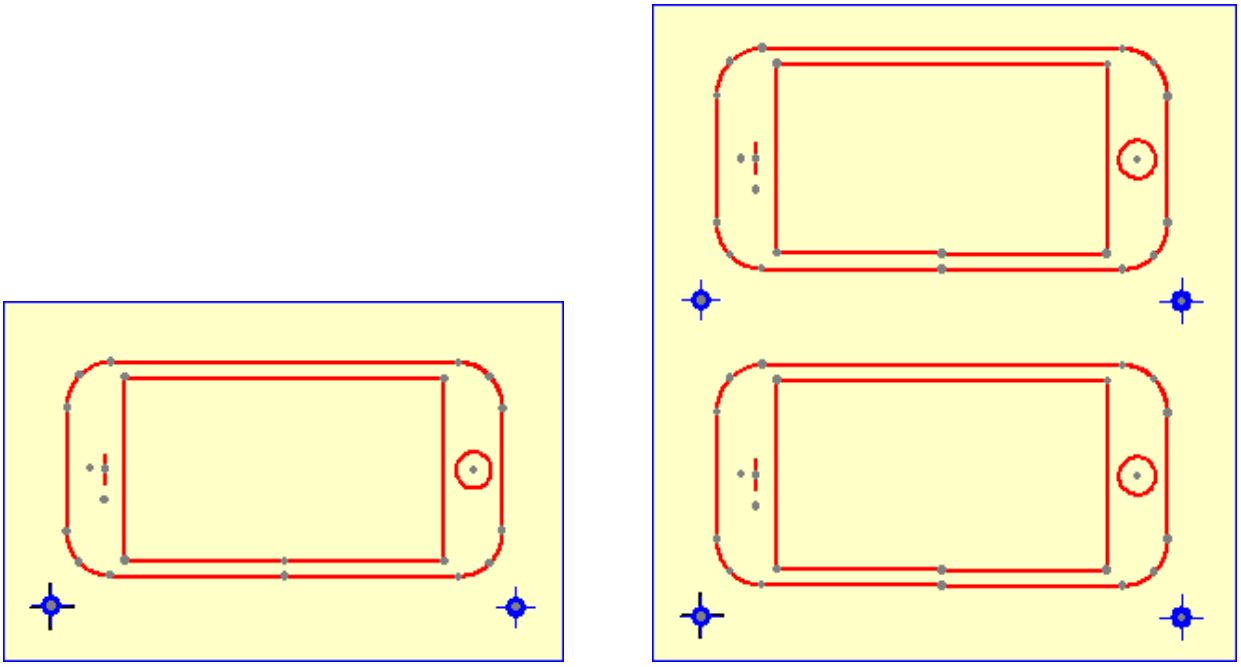
4.2.3 Select Enable Fiducial Comp.

4.2.4 Click **Run** to start dispensing the program.

With the fiducials correcting for the new template page position, the pattern is dispensed as if the workpiece had not moved at all.

Tutorial Part 5: Step and Repeat

This section shows how to use Step and Repeat to replicate a pattern for repeated dispensing. The tutorial concludes by dispensing two instances of the smartphone pattern on a single page using this template.

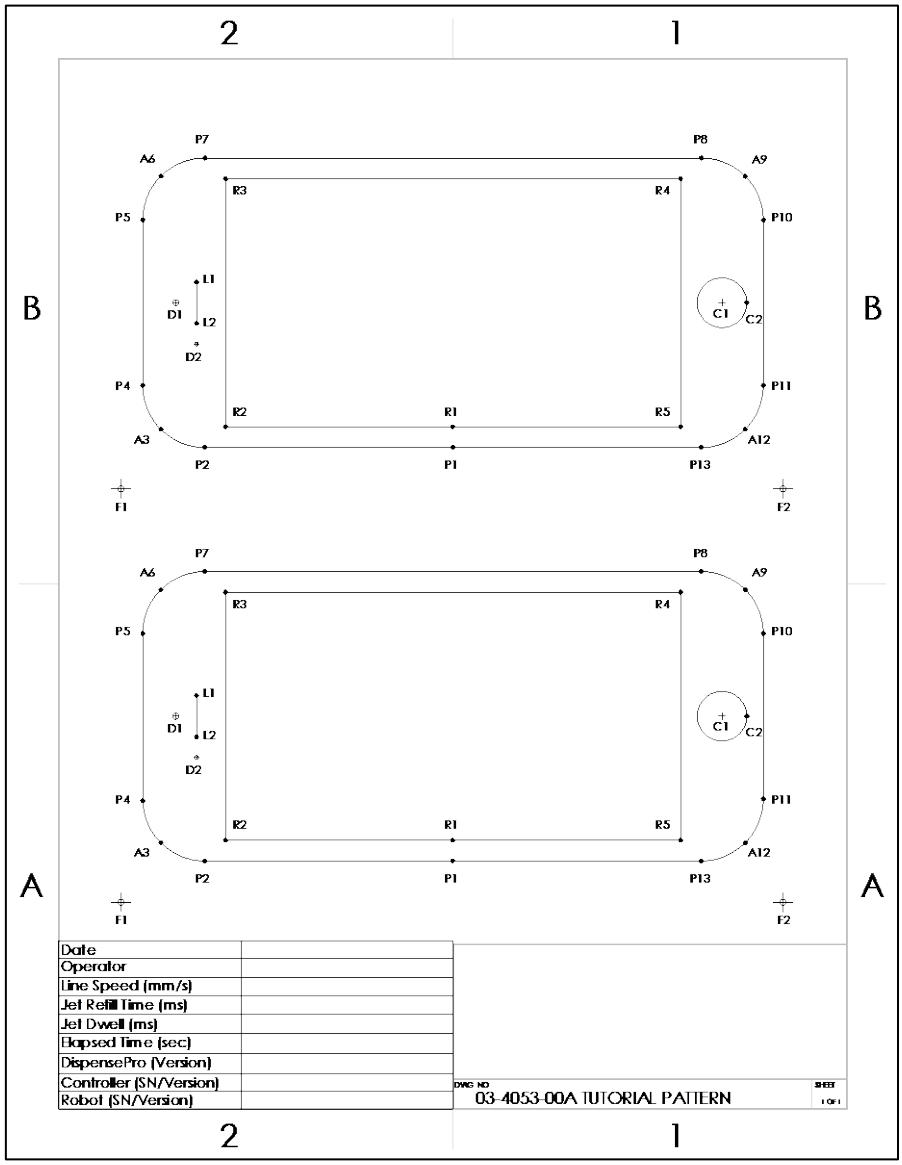


DispensePro Tutorial 51:
Pattern From Tutorial Part 2; Step and Repeat Two Instances of the Pattern

Tutorial Part 5: Step and Repeat, continued

5.1 Step and Repeat Template

Use the same 03-4053-00A TUTORIAL PATTERN.pdf from the previous sections (**This PC > Documents > DispensePro > Jobs)**. Align and attach a clean paper template as instructed in Tutorial section 1.2.



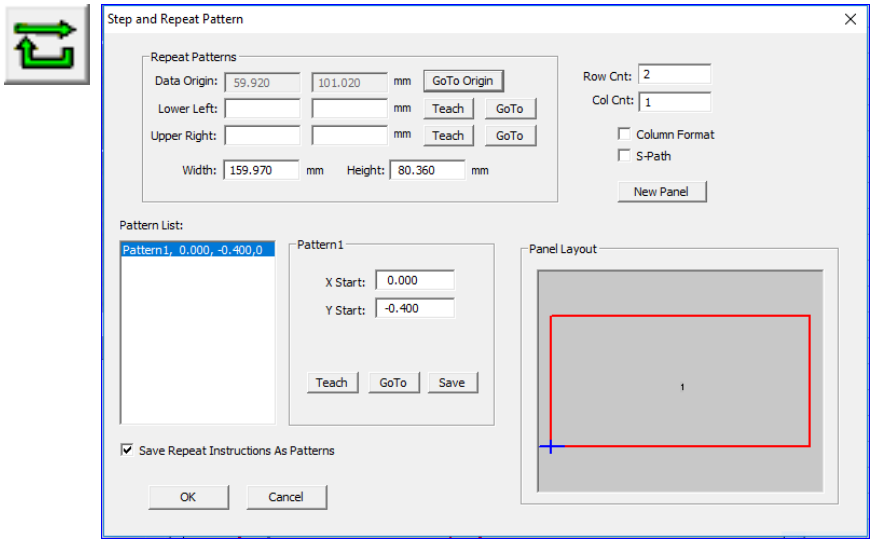
DispensePro Tutorial 52: Tutorial Pattern Template (Not Shown To Scale)

The Step and Repeat tutorial uses both the top and bottom patterns. Point numbering is the same for both patterns; Step and Repeat border instructions specify the **A** pattern (bottom of page) or the **B** pattern (top of page).

5.2 Define the Repeat Panel

5.2.1 **Open** the file “Demo1.job” that was saved from Tutorial Part 2: Programming Shapes.

5.2.2 Navigate to the Data Origin (point F1 in the bottom left corner of the **A** pattern). Since this is a new template paper, select **Edit** and **Data Origin** from the top menu and reteach the Data Origin.

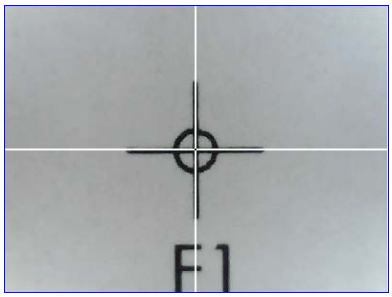


DispensePro Tutorial 53: Step and Repeat Window

5.2.3 Click the **Step and Repeat** toolbar button.

5.2.4 The **Row Count** is the number of horizontal panels; the **Column Count** is the number of vertical panels. For this tutorial, enter a **Row Count** of **2** and **Column Count** of **1**.

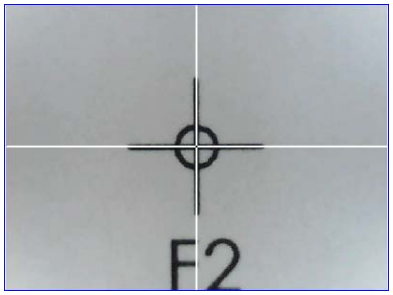
5.2.5 The **Lower Left** corner of Step and Repeat border should be the same as the pattern Origin Point (point **F1** on the **A** pattern that was just taught). In the navigation pane, click **GoTo Origin** to move the camera to the F1 area. Adjust the crosshairs if necessary and **Teach** those XY coordinates as **Lower Left**.



DispensePro Tutorial 54: Lower Left Corner of Step and Repeat Border

5.2 Define the Repeat Panel, continued

5.2.6 The Step and Repeat border includes the margin between patterns. For a vertical repeat, the Upper Right corner of the Step and Repeat border is the bottom right corner of the next panel up. On the tutorial template, this is the point **F2** on the **B** pattern. **Teach** those XY coordinates as **Upper Right**. As the Lower Left and Upper Right corner point coordinates are entered, the values displayed for Width and Height change accordingly.



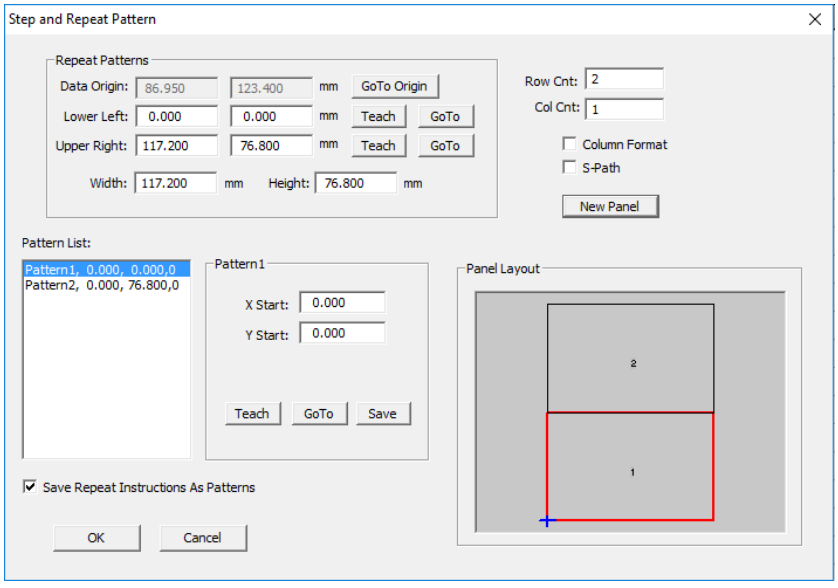
DispensePro Tutorial 55: Upper Right Corner of Step and Repeat Border

5.2.7 Click **New Panel** to create the new panels with the specified Row/Column Count and Lower Left/Upper Right corners just taught.

The **Panel Layout** window shows a preview of the new layout, showing two vertically stacked instances of the pattern.

The **Pattern List** is updated showing the coordinates of the pattern instances:

- Pattern 1 (first instance of the pattern) is at the Workpiece Origin coordinates (X = 0.000, Y = 0.000).
- Pattern 2 (second instance of the pattern) is lined up with the X value of Pattern 1 (X = 0.000).

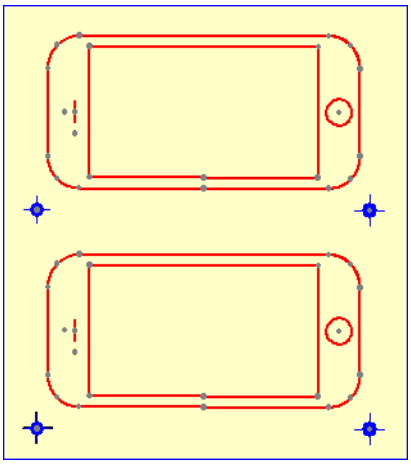


DispensePro Tutorial 56: Step and Repeat Pattern List and Panel Layout

5.2 Define the Repeat Panel, continued

5.2.8 Click **OK** to save the new panels.

- The Data Preview Window shows the repeated panels.



DispensePro Tutorial 57: Data Preview Window Shows Repeated Panels

- The Instruction List shows each instruction in each instance.
- The saved fiducials are inserted before the beginning of every instance of the pattern.
- After the first instance of the pattern, the Instance Count (2 in this example) is in parentheses next to each repeated instruction number.

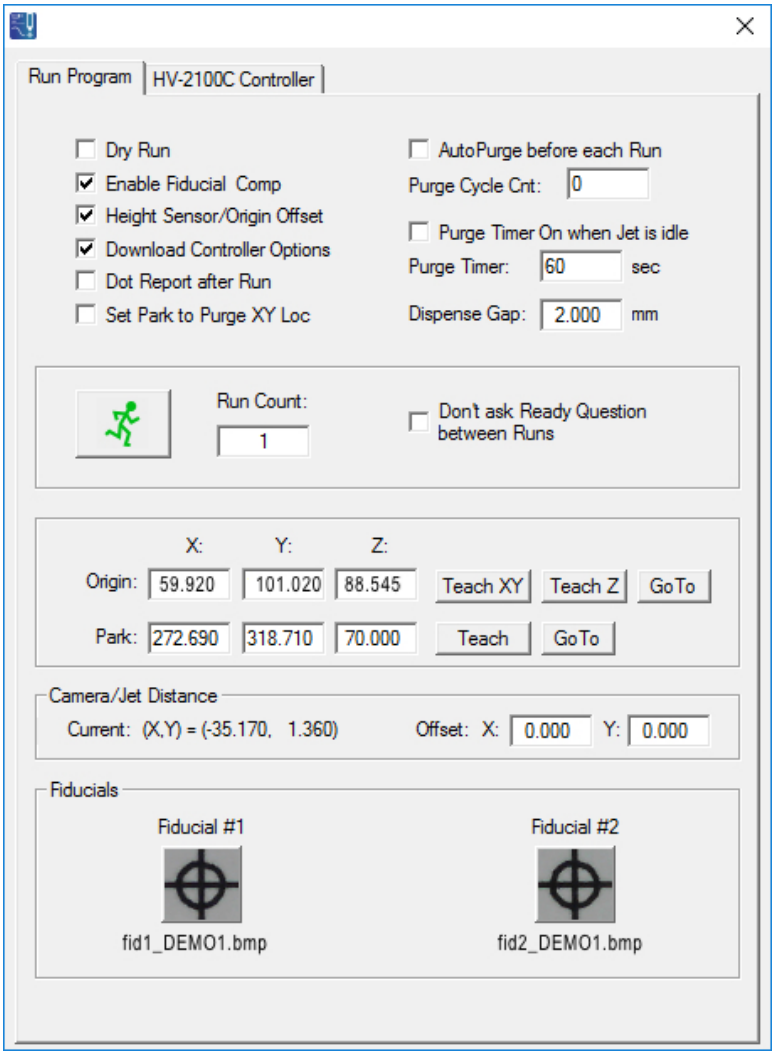
	Instruction	Recipe	X	Y
1	FID1		0.000	-0.400
2	FID2		159.970	-0.800
3	PATH_BEG	2, 100.00	80.070	9.350
4	PATH_POIN		20.240	9.540
5	PATH_ARC		9.650	13.930
6	PATH_POIN		5.300	24.180
7	PATH_POIN		5.370	64.570
8	PATH_ARC		9.750	75.170
9	PATH_POIN		20.330	79.560
10	PATH_POIN		140.160	79.280
11	PATH_ARC		150.810	74.880
12	PATH_POIN		155.270	64.240
13	PATH_POIN		155.220	24.220
14	PATH_ARC		150.740	13.610
15	PATH_POIN		140.070	9.230
16	PATH_END		80.070	9.350
17	CIRCLE	2, 100.00	145.140	44.260
18	DOT	1, 100.00	13.370	44.590
19	DOT	1, 100.00	18.310	34.550
20	LINE	1, 100.00	18.330	44.540
21	PATH_BEG	1, 100.00	80.070	14.350
22	PATH_POIN		25.280	14.530
23	PATH_POIN		25.360	74.530
24	PATH_POIN		135.180	74.240
25	PATH_POIN		135.090	14.240
26	PATH_END		80.070	14.350
27 (2)	FID1		0.000	99.980
28 (2)	FID2		159.970	99.580
29 (2)	PATH_BEG	2, 100.00	80.070	109.730
30 (2)	PATH_POIN		20.240	109.920
31 (2)	PATH_ARC		9.650	114.310
32 (2)	PATH_POIN		5.300	124.560
33 (2)	PATH_POIN		5.370	164.950
34 (2)	PATH_ARC		9.750	175.550
35 (2)	PATH_POIN		20.330	179.940
36 (2)	PATH_POIN		140.160	179.660
37 (2)	PATH_ARC		150.810	175.260
38 (2)	PATH_POIN		155.270	164.620
39 (2)	PATH_POIN		155.220	124.600
40 (2)	PATH_ARC		150.740	113.990
41 (2)	PATH_POIN		140.070	109.610
42 (2)	PATH_END		80.070	109.730
43 (2)	CIRCLE	2, 100.00	145.140	144.640
44 (2)	DOT	1, 100.00	13.370	144.970
45 (2)	DOT	1, 100.00	18.310	134.930
46 (2)	LINE	1, 100.00	18.330	144.920
47 (2)	PATH_BEG	1, 100.00	80.070	114.730
48 (2)	PATH_POIN		25.280	114.910
49 (2)	PATH_POIN		25.360	174.910
50 (2)	PATH_POIN		135.180	174.620
51 (2)	PATH_POIN		135.090	114.620
52 (2)	PATH_END		80.070	114.730

DispensePro Tutorial 58: Step and Repeat Instruction List

5.3 Run the Step and Repeat Program

Click the **Run** toolbar button.

- The fiducial images saved in Fiducials are shown in the **Fiducials** window. The Step and Repeat process searches and corrects for these fiducials before starting each instance of the pattern.
- Select the options for **Enable Fiducial Compensation**, **Height Sensor/Origin Offset**, and **Download Controller Options**.



DispensePro Tutorial 59: Run the Step and Repeat Program

Click **Run** to start the job. 

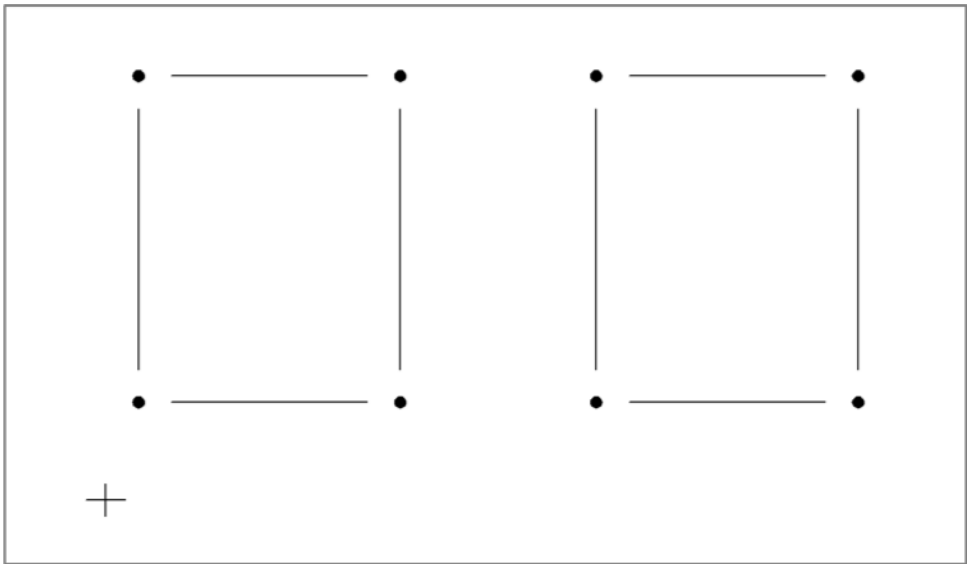
Notes

Tutorial 2: Data Origin

The following sections show how use the Data Origin to map XY locations in an instruction list:

- A “workpiece” tracing template is used for teaching the shapes.
- A slight change is made to the position of the workpiece on the work surface
- In the Run menu, re-teach the Work Surface Origin location to adjust the program to the new workpiece position during dispensing.

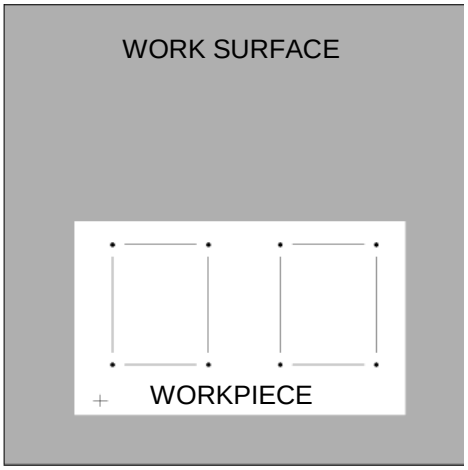
Sample Workpiece Template



Tutorial Part 1: Prepare the Sample Workpiece

Complete these setup tasks before continuing:

1. Copy the **Sample Workpiece Template** on the preceding page.
2. Fold or trim the paper as needed to fit the work surface, being careful to keep a straight and uniform bottom edge.
3. Position the “workpiece” toward the bottom of the work surface as shown, with the edges of the workpiece aligned squarely with the X and Y axes of the work surface. Avoid any skew or rotation.

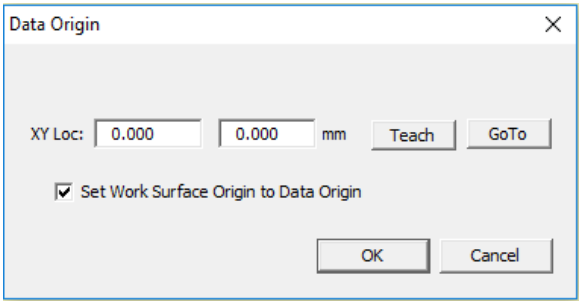


Data Origin Tutorial 1: Position the Sample Workpiece Template on the Work Surface

4. Use the positioning guidelines in section 1.4 - Prepare the “Workpiece” of the DispensePro Programming tutorial. Proper positioning provides better accuracy for teaching and programming the shapes.
5. Tape the template to the work surface to hold it in position.

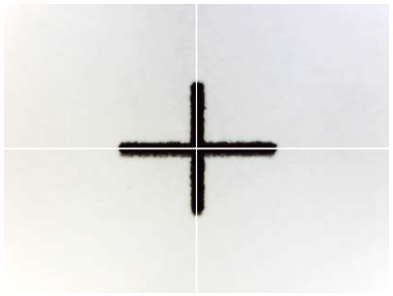
Tutorial Part 2: Teach the Data Origin

1. Select **Edit** and **Data Origin** from the top menu. When a new dispense program is started, the default Data Origin value is (0,0).



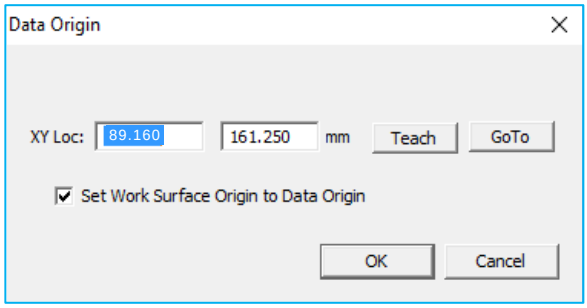
Data Origin Tutorial 2: Data Origin Window With Program Default Location of 0.000, 0.000

2. Center the camera crosshairs on the Data Origin position on the workpiece.



Data Origin Tutorial 3: Teach Workpiece Data Origin Position

3. Click **Teach** to save the XY location as the Data Origin position. The new Data Origin coordinates are displayed (values shown are for illustrative purposes). When **Set Work Surface Origin to Data Origin** is selected for running the job, these Data Origin values are saved as the Work Surface Origin.

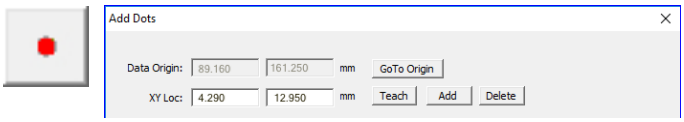


Data Origin Tutorial 4: New Data Origin Coordinates Saved as Work Surface Origin

Tutorial Part 3: Applying the Data Origin to Dispense Instructions

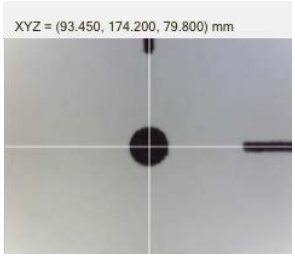
Continuing the example, this section shows how the XY locations are adjusted by the Data Origin as they are taught and added to the dispense instructions.

1. Click the **Dots** toolbar button.

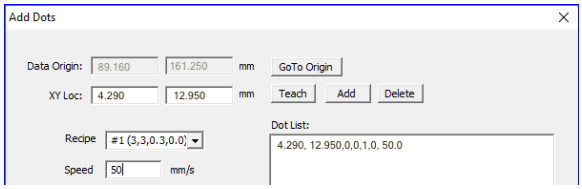


Data Origin Tutorial 5: Data Origin XY Values Previously Taught

2. The Data Origin fields show the X and Y values (89.160, 161.250) that were taught in Tutorial Part 2: Teach the Data Origin. The gray fields indicate that the values cannot be edited in this window.
3. Move to the bottom left area of the **Sample Workpiece Template** and center the crosshairs on the lower left dot as shown. (The XYZ location shown is for illustrative purposes, continuing the example.)
4. Click **Teach** to calculate the dot location and add it to the Dot List.



Data Origin Tutorial 6: Center Crosshairs on Bottom Left Dot on Template



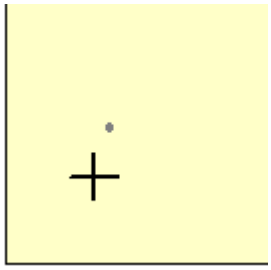
Data Origin Tutorial 7: Teach Dot Location

5. The XYZ location of the dot is adjusted by the Data Origin to calculate the relative XY Location. These relative XY coordinates are added to the Dot list.

	XYZ LOCATION	-	DATA ORIGIN	=	(RELATIVE) XY LOCATION
X	93.450	-	89.160	=	4.290
Y	174.200	-	161.250	=	12.950

Data Origin Tutorial 8: XYZ Location Adjusted by Data Origin

6. Data Preview Window shows the Data Origin (the black crosshairs) and the dot just added.

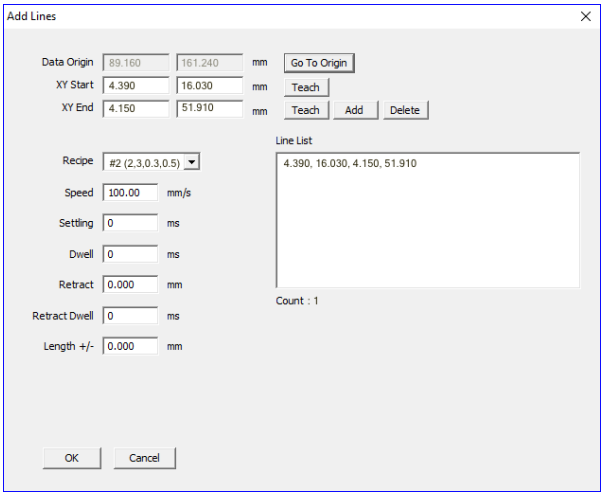


Data Origin Tutorial 9: Data Preview Window Shows Data Origin and Dot

7. Click the **Lines** toolbar button.

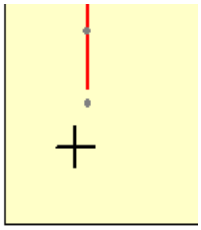
Data Origin Tutorial 10:
Teach the Line Start (L) and Line End (R) Locations

8. Move the crosshairs to the start and end points of the line and click **Teach** to calculate the line start and end coordinates.
9. The Line List shows the **XY Start** and **XY End** values adjusted for the Data Origin. (The locations shown are for illustrative purposes, continuing the example.) Click **Add** to add the adjusted XY Start and End coordinates to the Line List.



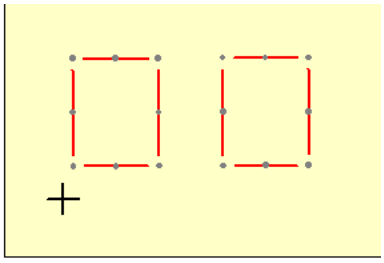
Data Origin Tutorial 11:
Line Coordinates Adjusted for Data Origin

10. Click OK to save the Line List. The Data Preview Window shows the line above the dot and the Data Origin point.



Data Origin Tutorial 12:
Data Preview Window Shows Data Origin and Dot

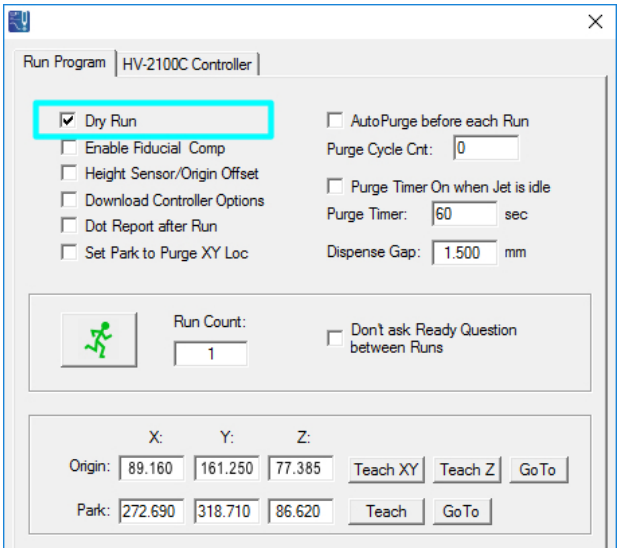
11. Continue to **Teach** and **Add** points for the rest of the dots and lines on the workpiece template. When completed, the instruction list shows the eight dots and lines, and the Data Preview Window image resembles the workpiece template.



	Instruction	Recipe	X	Y
1	DOT	1, 50.00	4.620	14.010
2	LINE	2, 100.00	4.480	37.355
3	DOT	1, 50.00	4.340	60.700
4	LINE	2, 100.00	22.965	60.820
5	DOT	1, 50.00	41.580	60.870
6	LINE	2, 100.00	41.755	37.505
7	DOT	1, 50.00	41.870	14.150
8	LINE	2, 100.00	23.235	14.075
9	DOT	1, 50.00	69.740	14.270
10	LINE	2, 100.00	69.665	37.660
11	DOT	1, 50.00	69.480	61.050
12	LINE	2, 100.00	88.105	61.135
13	DOT	1, 50.00	106.720	61.190
14	LINE	2, 100.00	106.840	37.765
15	DOT	1, 50.00	106.930	14.410
16	LINE	2, 100.00	88.385	14.405

Data Origin Tutorial 13: Completed Image in Data Preview Window and Instruction List

12. Click the **Run** button on the toolbar.
13. Because the **Set Work Surface Origin to Data Origin** feature was selected when the Data Origin location was taught, the **Work Surface Origin** values are the same as the **Data Origin** values.
14. Select the **Dry Run** option to execute the instruction list without dispensing fluid.
15. Click the green **Run** button in the Run window. The Robot moves through the instruction list and the camera crosshairs follow the centers of the dots and outlines of the lines.

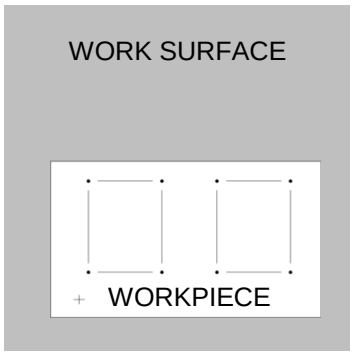


Data Origin Tutorial 14: Work Surface Origin Matches Data Origin

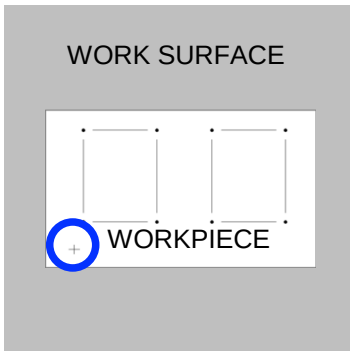
Tutorial Part 4: Reteach Work Surface Origin

The flexibility of including a Data Origin is most apparent when the workpiece position has changed after the instruction list locations have been taught. Accommodating the new workpiece position during a dispensing run is a simple matter of re-teaching the Work Surface Origin as part of the Run menu.

To demonstrate, remove the tape securing the “workpiece” template and move it to a different location on the work surface as shown. Keep the workpiece aligned with the X and Y axes of the work surface, avoiding any skew or rotation. Replace the tape.



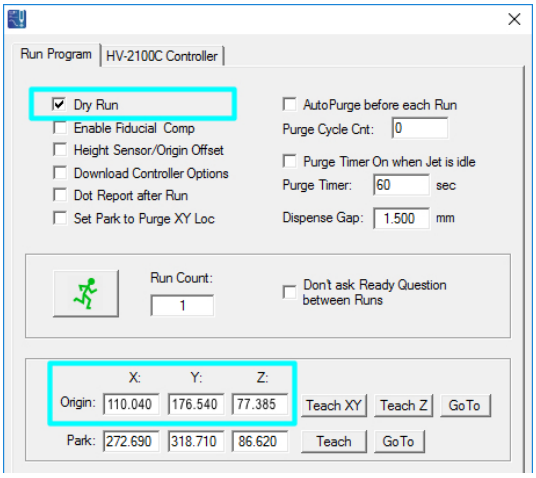
ORIGINAL WORKPIECE LOCATION



WORKPIECE MOVED TO A DIFFERENT PLACE ON WORK SURFACE

Data Origin Tutorial 15: Move The Workpiece

1. Click the **Run Program** button on the toolbar.
2. Center the camera crosshairs on the new Data Origin on the workpiece.
3. Click **Teach XY** to save the new XY as the Work Surface Origin position.
4. Click the green **Run** button. The Robot moves through the instruction list and the camera crosshairs follow the centers of the dots and outlines of the lines at their new locations.



Data Origin Tutorial 16: Work Surface Origin Adjusted for Different Workpiece Position

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Graco Headquarters: Minneapolis
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GRACO INC. AND SUBSIDIARIES • P.O. BOX 1441 • MINNEAPOLIS MN 55440-1441 • USA

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