

# Servo Pump Deferred Reverse

## Addendum to

FLOware® Software User Guide - PN 22100080D

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*Available as of FLOware software version 2.9.3P*

This addendum includes content destined for the *FLOware Software User Guide*, PN 22100080D in the following sections:

- *Using FLOware Software:*
  - *Programming - Keys to Success - Servo Pump Deferred Reverse*
  - *Programming Basics - Dispense Parameters - Parameter Definitions*
- *References - Windows & Fields:*
  - *Mounts/Material Editor*
  - *Program Detail*

## Using FLOware Software

### Programming - Keys to Success

#### Servo Pump Deferred Reverse

***IN EFFECT AS OF FLOware software version 2.9.3P***

Pump reverse for **servo pumps** may be specified by time rather than waiting for position to be achieved.

When compared to normal pump operation, use of Servo Pump Deferred Reverse delays pump reversal. Pump reversal occurs after a time delay rather than a forced wait until the suckback operation.

#### Normal Pump Operation

Pump reversal typically begins after the end of the line/arc/move and as the needle is lifted clear of the shape. Normally, the pump is turned off at the end of a shape (Line/Arc/Move) in relation to the end of the operation. For example the pump may be turned off 1 mm before the end of the line but the reverse does not start until the end of the shape has actually been achieved and the gantry begins the vertical motion, raising the needle tip.

#### Deferred Pump Reverse Operation with 30 ms delay

Deferred reverse begins 30 ms after pump stops, regardless of needle position.

#### Features

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- Applies to Lines, Arcs, Move
- Applies only to servo driven pumps (NCM pumps are not affected)
- Allows you to specify the beginning of pump reversal in terms of time *after the pump is turned off* without regard to the actual end of the shape.
- Any subsequent pump commands (start/stop/etc.) will cancel a pending (deferred) command.



- Once the gantry achieves the top of the depart motion (departing the shape), an explicit pump stop command is issued which ensures that an unreasonably long deferred reverse command will not occur long after it should.

### **Activating Servo Pump Deferred Reverse**

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To activate the Servo Pump Deferred Reverse feature:

- Locate the Pinch Delay parameter in either the Valve Settings selectable panel of the Mounts/Material Editor window or the Extra Control selectable panel of the Program Detail window.
- Enter a value greater than 0.0 in Pinch Delay.
- Click APPLY to save your input.

# Using FLOware Software

## Programming Basics

### Dispense Parameters

#### Parameter Definitions

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This list of parameter definitions is only a *starter kit* of the most commonly used dispense parameters. It is by no means a complete listing of all available dispense parameters.

#### Move Velocity

Coordinated XYZ axis movement to the next dispense location at Settle Z height. Typically, the default for system velocity is used for increased production throughput even though this is a programmable parameter.

#### Approach Velocity

Speed of needle movement from Settle Z height to Start Z height. Used to minimize the Z axis from overshooting the Start Z value.

#### Settle Z

Distance from Start Z at which the needle/gantry settles and then only Z axis motion begins moving toward the board surface at Approach Velocity. Used to avoid running the needle into tall board elements. Can be used in conjunction with Snap Off Z to maintain a high needle height during movement to the next dispense location.

#### Valve Prime

Time the valve turns on prior to reaching Start Z height. Used to prime the needle tip with material so material is ready to flow from the tip when the needle reaches Start Z height.

#### Start Z

Initial needle height above the substrate surface. This is the starting point for the program.

#### Start Z Pause

When the system reaches Start Z height, the valve turns on and pauses for the set time prior to needle movement. Used to wet material to the substrate surface in order to prevent voids in the material at the beginning of the dispense.

#### On Time

(does not apply to Micro-Dot valve) Time the valve is on. Main control of dispensed volume.

#### MicroValve Steps

(for Micro-Dot valve) The number of motor counts. Main control of dispensed volume.

#### Dispense Velocity

Speed at which the needle travels from one location to the next. Dispense Velocity is the speed between segments of a coordinated move. The move between locations (dot-to-dot) is controlled by the Move Velocity. Used to achieve smooth, consistent material flow for line dispenses and area fills.

**End Z**

Upward dispense motion of only the Z axis above Start Z. Used to create taller dot profiles (pillars). Also used with Start Delay for puddled or angled (ramped) lines.

**Valve Off**

The distance before reaching the end of the dispense (End Z) at which the valve turns off. Used to prevent material tailing by turning the valve off before the dispense is complete. The final portion of the dispense action relies on dissipation of material pressure inside the needle.

**Snap Off Z**

Distance the needle moves from the last dispense height after dispense is completed. Used to separate the needle from the material.

**Snap Off Velocity****Snap Off Acceleration**

Speed at which the needle performs snap off. Used to control material tailing

**Pinch Delay*****IN EFFECT AS OF FLOware software version 2.9.3P***

The value of the Pinch Delay parameter determines whether normal pump operation or **deferred pump reverse** operation will occur. The difference between the two operations occurs immediately after the servo pump is turned OFF at or near the end of a Line/Arc/Move operation. For additional detail, refer to *Servo Pump Deferred Reverse* in the *Programming - Keys to Success* section of *Using FLOware Software* in the *FLOware Software Guide*.

**Pre Snap-Off Delay**

Delay time after the dispense that the needle remains at dispense height prior to performing snap off. Used to allow material to fall away from the needle prior to leaving the current position.

**Post Delay**

Delay after Snap Off Z is performed. Used to allow materials to cleanly separate from the needle before proceeding to the next operation.

***IN EFFECT AS OF FLOware software version 2.9.1***

All operations using a PostDelay value greater than zero will await completion of the SnapOffZ motion and then begin the Post Delay delay. If Post Delay is less than or equal to zero, the wait for motion complete will not occur.

***IN EFFECT PRIOR TO FLOware software version 2.9.1***

All operations using a Post Delay value wait for SnapOffZ position to be achieved before beginning Post Delay time ONLY when the head type is an Etch, Rout, Drill, or Pickup tool. All other head types do not wait for SnapOffZ to be achieved. The Post Delay is the sum of the Pinch Delay value and the Post Delay value beginning near the beginning of the SnapOffZ motion. Operation sequence is as follows:

- 1 - Move to SnapOffZ.
- 2 - If head type is Etch/Rout/Drill/Pickup, wait for motion complete.
- 3 - Operate SuckBack, if appropriate.
- 4 - Delay - PinchDelay (from Mount info).
- 5 - Delay by one of following (controlled by ValveControlFromDetail):
  - \* PostDelay (from detail line).
  - \* PostDelay (from mount info).

## References

### Windows & Fields

#### Mounts/Material Editor

**Table 53: Mounts/Material/Editor windows**

Element	Description
<b>MATERIAL DESCRIPTION</b>	
Mount Position	Mount location for this valve/tool. If this information is omitted, the first mount location is automatically assigned.
Panel Selection	A pull down menu of choices, each of which will display a different set of fields in the right-hand side of the window: Valves, Process Defaults, Warning Limits, Scale Parameters, Temperatures, Calibration Dot, X-Y Calibration, and Observation.  For details, refer to the subsequent Panel Selection subsections in this table.
Material	Name of the material to be dispensed. May be up to 32 characters long. If present, this name must match the name of the material in the Materials library; if it does not match, the program will be rejected.
Group	Group of the material; copied from the Materials library. May be up to 32 characters long.
Color	Color of the material; copied from the Materials library. May be up to 32 characters long.
Needle	Gauge of the needle used with this valve.
Valve/Tool	Name of the valve/tool to mount. May be up to 18 characters long. This name must match the tool/valve name in the Heads library; if it does not match, the program will be rejected.
Gantry	Gantry identification code for use with multi-gantry systems.
Description	Optional comment field of up to 250 characters.
Pattern Name	Name of the pattern used with this valve/tool. This name can be up to 24 characters long.
Auto Clean	Activates or deactivates automatic needle cleaning at the material level, making the Auto Clean setting the default in every program using the current material.  When Auto Clean is activated and the system is configured with a needle cleaner device, a needle can be cleaned online automatically as part of a program run.  When Auto Clean is deactivated, the system will stop when appropriate and wait for the operator to clean the needle before continuing with normal operations.
Manual Calibration	Activates or deactivates a forced manual calibration. When this field is deactivated, the camera is not used to find the calibration dot; this is particularly useful for use with clear materials.
Skip Calibration	Controls omission of all calibration for this valve/tool; enables/disables the ability to choose calibration at the start of a program.
Feature ID	Not yet functional. Name of a feature, up to 12 characters long. This field is used to describe the record as part of a discernible feature on the board.
Inspect Delay	Minimum time (ms) for operation during inspection.

Element	Description
COPY	The Copy button is only active for certain selectable panels and allows, for example, copying data from the XY Calibration selectable panel to the Observation selectable panel.  For the Mounts/Material Editor - MOUNT window, the Copy button allows copying the entire controls panel from one mount location to another.

**SELECTABLE PANEL - VALVE SETTINGS**

Auger Speed	Percent of velocity for variable speed auger valve.
Auger Idle	Total time delay; the time between turning off an auger valve and starting the reverse suck-back action. This field will not display if the system is configured for a non-contact jetting pump rather than an auger valve.
Auger Reverse	Total time the auger valve will run in reverse to suckback material. This only applies to the LX Auger Valve and other valves with similar control. This field will not display if the system is configured for a non-contact jetting pump.
NCM Close Time	Total time delay; the time between closing and opening a non-contact jetting pump. All fields using the <i>seconds</i> measurement unit change to 4 place values (0.0000 rather than 0.000).
NCM Open Time	Total time the non-contact jetting pump will remain open. This only applies to the NCM5000 pump and other pumps with similar control. All fields using the <i>seconds</i> measurement unit change to 4 places values (0.0000 rather than 0.000).
Micro Valve Reverse	Number of Micro-Dot valve suckback steps.
Minimum Shut-off	Minimum time (ms) after dispenser stops and before valve shut off is activated.NCM
Snap Off Z	Distance (mm) to move the valve/tool up during snap off action to prevent tailing.
Pinch Delay	<p><b>IN EFFECT AS OF FLOWare software version 2.9.3P</b></p> <p><b>Normal Pump Operation</b> - If the Pinch Delay parameter is less than or equal to 0.0, normal pump reverse (suckback) applies.</p> <p><b>Deferred Pump Reverse Operation</b> - If the Pinch Delay parameter is greater than 0.0, the pump reverse is configured to execute after the Pinch Delay amount of time using the normal pump reverse parameters. After Pinch Delay seconds has passed, the pump reverse begins.</p>
Micro Valve Speed	Micro-Dot valve speed (encoder uses steps per second).
Micro Valve Acceleration	Micro-Dot valve acceleration/change of velocity.
Pre SnapOff Delay	Time (ms) to delay after dispense but before beginning snap off.
Post Delay	Post operation delay (ms).
Snap Off Velocity	Snap off velocity (mm/sec).
Snap Off Acceleration	Snap off acceleration/change of velocity.

**SELECTABLE PANEL - PROCESS DEFAULTS**

Air Pressure	Value in kPa for syringe air pressure. Pressure is automatically regulated via the system for MicroMax dispenser, but requires manual adjustment for DS Series dispensers.
Air Control	Determines the way air pressure is handled.  <b>Auto</b> - Air pressure turns on/off as operations dictate. <b>On</b> - If the machine is equipped with automatic air pressure control, the valve air pressure is set to the value of Air Pressure at the start of a program. <b>Off</b> - If the machine is equipped with manual air controls, the value in Air Pressure is informational only - it is displayed for the operator who must make a manual adjustment to set the air pressure.

Element	Description
Minimum Air Time	Minimum time (ms) to apply air pressure to the valve. This suppresses the constant on/off pressure to the valve.
Purge Time	Time (ms) to operate the valve for automatic purge.
Standard Acceleration	Speed (mm/sec/sec) at which the gantry moves for any operation with an acceleration value not otherwise specified.
Dispense Pressure	Force (gm) applied to MV valve during dispense.
Idle Pressure	Force (gm) applied to MV valve when idle.

**SELECTABLE PANEL - WARNING LIMITS**

Operation Limit	Counts dots; limit for the number of operations (dots to dispense) before the operator is warned (at product change) to refresh the material or replace the drill bit. Implies that material is low or drill has become dull.
On Time Limit	Limit (ms) of total valve on time before operator is warned (at product change) to refresh the material.
Idle Limit	Limit (ms) of valve/tool idle time before operator is warned of needed material purge.
Run Time Limit	Limit (ms) of elapsed run time before operator is warned to refresh the material.
Re-calibrate Operation Limit	Number of (program) operations after which a valve is recalibrated with the scale. Weight calibration is repeated after this number of operations have run.
Re-calibrate Board Count	Limit for number of boards to process before repeating weight calibration.
Re-calibrate Time	Elapsed time (ms) after which a valve is recalibrated with the scale. Weight calibration is repeated after this time has elapsed.
Limit Override	Number of boards allowed after low material has been sensed.

**SELECTABLE PANEL - SCALE PARAMETERS**

Weighing On Time	Time (ms) for valve operation to perform a weight calibration.
Target Weight for On Time	Amount (grams) of material expected from Weighing On Time.
Tolerance for Weight	Tolerance (grams) within which Target Weight for On Time will not change Weighing On Time and Dispense Velocity (for 1 or 2 part valves) values.
Scale Settle Time	Time (ms) allowed for the scale to settle after dispensing.
Maximum Scale Adjust	Maximum percent of weight variation allowed before operator is notified.
Maximum Scale Retry	Maximum number of consecutive re-weighing (weight calibration retries) before operation notification.
Multiple Dot Count	Not currently functional. Maximum number of dots to dispense before repeating weight calibration.
On Times from Program	Time (ms) obtained from the [uniquely defined] program. On = obtains the On times from the first six active program lines. Off = the On times will be used as they are entered.
Skip Weighing	Activates (Y) or deactivates (N) precision weighing for this valve/tool.
Scale Jog Z	Distance (mm) to jog above scale after dispensing.

**SELECTABLE PANEL - TEMPERATURES**

Material Temperature	Temperature (degrees C) at which the material (tube or reservoir) is to be maintained.
Material Temp Range	Temperature (degrees C) range plus or minus adjacent to the specified material temperature.
Material Heater On	Determines whether or not the temperature control is used.

Element	Description
Material PID Name	PID name for material temperature control.
Needle Temperature	Temperature (degrees C) at which the needle is to be maintained.
Needle Temp Range	Temperature (degrees C) range plus or minus adjacent to the specified needle temperature.
Needle Heater On	Determines whether or not the needle temperature control is used.
Needle PID Name	PID name for needle temperature control.

**SELECTABLE PANEL - CALIBRATION DOT PARAMETERS**

On Time	Main control of dispensed volume; value of the total time (ms) a valve is on to dispense a dot during calibration.
Approach Velocity	The speed (mm/sec) at which the Z axis moves from Settle Z (where the gantry settles before calibration) to Start Z (the Z location where dispensing or other operation takes place) during the calibration.
Valve Prime	Time (ms) to start valve operation before reaching Start Z (the Z location where dispensing or another operation takes place) during calibration; this is used to prime a valve prior to reaching target.
Start Z	Distance (mm) above the board where dispensing or other operation is to take place during calibration; a negative value will drill into a drill pad.
SnapOff Z	Height above Start Z to move the valve after a dispense is complete and during snap-off action to prevent tailing.
Move Velocity	Speed (mm/sec) at which the system moves the gantry during calibration operations.
Dot on Chip	Indicates whether a material dot is to be placed on a chip rather than on paper.
Settle Z	Distance (mm) above Start Z (the Z location where dispensing or other operation takes place) where the gantry settles before the move to Start Z.
Snap Off Velocity	Speed (mm/sec) at which snap off action occurs to prevent tailing.
Snap Off Acceleration	Acceleration (mm/sec/sec) of motion during snap off action to prevent tailing. Typically faster than standard acceleration to emphasize snapping motion.
Post Delay	Delay time (ms) after the valve/tool has turned off and reach Snap Off Z (snap off height). Used to assist in material-to-needle separation for stringy materials.
Micro Valve Steps	Number of encoder steps for a Micro-Dot valve to dispense a calibration dot.
Micro Valve Speed	The speed at which the Micro-Dot valve turns to dispense the calibration dot in cts/s.
Micro Valve Reverse	Number of reverse steps for a Micro-Dot valve to perform suckback action.
End Z	End Z distance for calibration dot.
Pre Snap Delay	Time (ms) to delay after dispense and before beginning snap off of calibration dot.

**SELECTABLE PANEL - X-Y CALIBRATION**

Gain	Camera gain (0-255) for dispensed or drilled dot calibration. A value of -1 disables change.
Offset	Camera offset (0-255) for dispensed or drilled dot calibration. A value of -1 disables change.
Tuning	Camera tuning (1-1000) for dispensed or drilled dot calibration.
Zoom	Focal length (0.0 to 1.0) for a programmable focus lens camera for dispensed or drilled dot calibration.
Focus	Focus (0.0 to 1.0) for a programmable focus lens camera for dispensed or drilled dot calibration.

Element	Description
f-stop	f-stop (0.0 to 1.0) for a programmable focus lens camera for dispensed or drilled dot calibration.
Light Level	Level of camera light intensity for dot calibration. Only functional when machine is configured for the Multi-Axis Illumination option.
Light on Dark	<b>On</b> - Enables camera to see <i>light</i> dot on <i>dark</i> background for dot calibration. <b>Off</b> - Enables camera to see <i>dark</i> dot on <i>light</i> background for dot calibration.
Light Color	Controls the light color for dot calibration. Used to enhance fiducial or pattern identification when vision is affected by surface colors or textures.  Choose a color (typically Red or Blue) when the system is configured with the Intensity Control option.  OR  Choose a lighting configuration (typically Ring Light or Diffuse On Axis Light) when the system is configured with the Multi-Axis Illumination option.
JOG	Opens a Jog window.
TEACH VISION	Adjusts the camera to the settings defined on this screen.
ADJUST VISION	Changes the settings on this screen to match the settings to which the camera is set.
Max Pixel Count	Maximum pixel count for dot calibration.
Min Pixel Count	Minimum pixel count for dot calibration.
Dot Volume	Volume of dot for dispensed dot calibration.
Backlight	<b>On</b> - Visually enhances the calibration dot for the camera. Turns off the camera light and turns on the calibration station backlight while the camera is looking at the calibration dot. <b>Off</b> - Not used.

**SELECTABLE PANEL - OBSERVATION**

Gain	Camera gain (0-255) for fiducial and dot inspection on the board. A value of -1 disables change.
Offset	Camera offset (0-255) for dot inspection on the board. A value of -1 disables change.
Tuning	Camera tuning (1-1000) for dot inspection on the board.
Zoom	Focal length (0.0 to 1.0) for a programmable focus camera for dot/fiducial inspection.
Focus	Focus (0.0 to 1.0) for a programmable focus camera for dot inspection on the board.
f-stop	f-stop (0.0 to 1.0) for a programmable focus camera for dot inspection on the board.
Light Level	Level of camera light intensity for dot inspection. Only functional when machine is configured for the Multi-Axis Illumination option.
Light on Dark	<b>On</b> - Enables camera to see <i>light</i> dot on <i>dark</i> background for dot inspection on the board. <b>Off</b> - Enables camera to see <i>dark</i> dot on <i>light</i> background for dot inspection on the board.
Light Color	Controls the light color for dot inspection. Used to enhance fiducial or pattern identification when vision is affected by surface colors or textures.  Choose a color (typically Red or Blue) when the system is configured with the Intensity Control option.  OR  Choose a lighting configuration (typically Ring Light or Diffuse On Axis Light) when the system is configured with the Multi-Axis Illumination option.

Element	Description
JOG	Opens a Jog window.
TEACH VISION	Adjusts the camera to the settings defined on this screen.
ADJUST VISION	Changes the settings on this screen to match the settings to which the camera is set.
Max Pixel Count	Maximum pixel count for dot inspection.
Min Pixel Count	Minimum pixel count for dot inspection.
Dot Volume	Volume of dot for dispensed dot inspection.

## Program Detail

**Table 63:** Program Detail window

Element	Description
<b>ICONS</b>	
Cut	Cut one program line.
Copy	Copy one program line.
Icons	<p>Use these icons to insert a primitive operation below the currently highlighted program line. The set of icons represent primitive operations: Line, Dot, Move, Arc, Rectangle, Circle, Calibrate, Delay, Operate, Partition, Shape, None, and Setup.</p> <p>Click an icon to insert that primitive operation below the currently highlighted program line. The ShList icon brings up a list of all currently available (non-class filtered) shapes.</p>
<b>PROGRAM LINE</b>	
Program	Name of the currently selected program.
Gantry	Gantry identification code.
Partition	Partition/Shape name, up to 12 characters long. This usually appears only on a Partition or Shape record and is allowed to default on subsequent records. Embedded shapes use this field to define the shape name.
program lines	The partition lines and shape lines that make up the program.
<b>PROGRAM LINE DETAIL</b>	
Comment	Any text, up to 72 characters long, describing this line for documentation purposes. Typically used when converting pick-and-place data to dispenser input format.
Operation	Name of the operation to perform for the current program line. May be up to 12 characters long, and may be the name of one of the primitive operations (DOT, LINE, RECTANGLE, etc.) or it may be the name of a shape. (The shape must exist before running a program using the shape.)
Valve/Tool n	Dictates which head will be used during the operation for the current program line. May be up to 18 characters long. This usually appears only for a Partition record. A head must be selected for each program line or else it will default to NONE. (This name should match the name of the valve/tool in the Mounts library; if it does not, the program will not run.)
Part Number	Optional part number up to 36 characters long. This field is usually filled in when converting pick-&-place data to dispenser input format. Import uses this field to determine the operation type from the cross reference library.
FIND LINE	Allows a specific program line to be found within the current program by jogging to the physical location associated with the program line.
Sub Op	List of sub operations from which to select. The choices displayed are dependent upon the operation used in the Operation field.
Panel Selection	A pull down menu of choices, each of which will display a different set of fields in the right-hand side of the window. Refer to the following definition tables for details about the choices: Dispense, Extra Control, Array & Track, Operate, Vision, Blobs, and Service.
<b>STANDARD VALUES</b>	
X	Location where this operation is to occur relative to the board reference point.
Y	
Theta	Rotation (radians) of the fourth axis for this head.

Element	Description
Object Rotation	<p>Rotation of a feature about (X, Y). Rotation is counterclockwise for a positive value. This angle applies to the shape, line, rectangle, etc. defined by the Operation field.</p> <p><b>NOTE:</b> Rotation, rather than Object Rotation, should be used to rotate an array because Rotation rotates the array, not the individual items within the array.</p>
Size X Size Y	<p>X-size of a line/rectangle or the start diameter of a circle. Y-size of a line/rectangle or the start diameter of a circle.</p>  <p>The first diagram shows a line segment starting at point (X, Y) with a length labeled 'Size X' and a perpendicular height labeled 'Size Y'. The second diagram shows a rectangle centered at (X, Y) with a width labeled 'Size X' and a height labeled 'Size Y'. The third diagram shows a circle with a radius labeled 'Start diameter' and a diameter labeled 'End diameter'.</p>
Fill Spacing	For filled features such as circles and rectangles, this field defines spacing between successive lines of the fill in units of needle diameters. A typical value is 1.5 needle diameters.
Fill Spacing	Alternate value of Fill Spacing in millimeters rather than needle diameters.
Move Ctrl On/Off Ctrl	<p>Most operations are performed in 3 stages:</p> <p>FIRST stage - the gantry moves to the point (X, Y, Start Z + Settle Z) where the Z coordinate is the distance to the board. It then moves vertically to a Z coordinate Start Z, turning the valve on and performing additional operations while moving.</p> <p>SECOND stage - the gantry performs the function at the target point, such as filling a rectangle or dispensing a dot.</p> <p>THIRD stage - the gantry moves to a Z coordinate of Start Z + End Z + Snap Off Z at high speed and acceleration, turning the valve off and performing additional operations while moving.</p> <p>To function continuously across several operations (e.g., when drawing a pattern), these stages must be performed independently. Move Ctrl and On/Off Ctrl are integer controls allowing the moves and on/off operations to be performed separately:</p> <ul style="list-style-type: none"> <li>0 = Complete - perform all three stages. (this is the default).</li> <li>1 = Start - perform first and second stages only.</li> <li>2 = Middle - perform second and third stages only.</li> <li>3 = End - perform second stage only.</li> <li>4 = No Operation - for On/Off control, perform none of the stages.</li> </ul>
Feature ID	Any name up to 12 characters long associated with this program line. Typically, this is a board location (C10, U15, R25, etc.). Describes a discernible feature on the board to allow selection or rejection of program lines by Feature ID. A feature ID can be assigned to any program line. Any program line without a feature ID (blank) will always run.
ENABLED/DISABLED	Toggle button indicates whether this detail line is to be used. Any program line can be easily enabled and disabled.
FIND FEATURE	Allows a specific program line to be found within the current program by typing the name of the Feature ID associated with the program line.

#### SELECTABLE PANEL - DISPENSE

Settle Z	Distance above Start Z (the Z location where dispensing or other operation takes place) where the gantry settles before the move to Start Z.
Start Z	Distance above the board where initial dispensing or other operation is to take place for this feature; a negative value will drill into a drill pad.

Element	Description
End Z	Final dispense height distance above/below Start Z (the Z location where dispensing or other operation takes place) for a dot (pillar) or three dimensional coordinated motion. This value is non-zero to create pillars or to dispense along an angle to the plane of the board. Use a zero value if no motion is desired.
Approach Velocity	Speed at which the Z-axis moves from Settle Z (where the gantry settles before the operation) to Start Z (the Z location where dispensing or other operation takes place).
Dispense Velocity	Speed at which the gantry moves during any motion required during a constant dispense operation (e.g., Z velocity while building a pillar, or coordinated motion velocity while drawing a line).
Valve Prime	Used to start valve material flow prior to reaching the target. The time between turning the valve on and reaching Start Z (target).
Start Z Pause	This allows for the creation of a puddle; it is a position pause/delay after reaching Start Z. After this delay, the head moves at Dispense Velocity until the specified On Time has elapsed. To be effective, Start Z Pause must be less than On Time.
On Time	The main control of dispensed volume. The total time a head remains on during dispense, delay time, or any other time value required to perform an operation.
Valve Reverse	Number of encoder counts to dispense desired dot size with a Micro-Dot valve. If dispensing any shape other than dots, enter a value based on the length of time required by the program to dispense the shape. This value is ignored if the valve used is not a Micro-Dot valve.
NCM Open Time	Total time the non-contact jetting pump will remain open. This field does not display if the system is not configured for a non-contact jetting pump.
Micro Valve Steps	Number of encoder counts to dispense a dot with a Micro-Dot valve. If dispensing any shape other than dots, enter a value based on the length of time required by the program to dispense the shape.
Micro Valve Reverse	Reverses auger direction for the specified number of encoder counts. Used primarily to relieve pressure built up inside the needle and hub and can also be used to pull material back up into the needle.  This technique, commonly known as <i>suck-back</i> , is used to help prevent drip when using low viscosity materials, help control dot repeatability by controlling the amount of residual material on the tip, and it improves snap-off for some materials.
Valve Off	Distance before the end of a constant fill (line, circle, rectangle) where the dispenser turns off. Used mainly with fluid materials to control drooling. When performing a fill, a needle may dribble unwanted material at the end of the operation. To prevent this, the valve is turned off Valve Off mm before the fill ends. When this applies only to the last line or circle of the fill, make sure the length of the last line/circle allows this.
Snap Off Z	Helps avoid material tailing. Distance to move the valve/tool up during the snap-off action to prevent tailing. Height above End Z (after Start Z) to which the dispenser moves after a dispense is complete.

**SELECTABLE PANEL - EXTRA CONTROL**

Element	Description
Fill Width	<p>The wall dimension (the width of each side) of a hollow rectangle. The pattern is covered in increments of Fill Spacing needle diameters and motion is at vector speed Dispense Velocity, and turning the vale off Valve Off needle diameters before completion of movement for each line.</p> <p>Fill Width applies only to spiral rectangle fill. It is ignored for serpentine rectangular fills.</p> <p>If Fill Width is 0, the entire rectangle is filled. Conversely, a hollow rectangle can be created by specifying a non-zero Fill Width; spiral lines are drawn toward the center or away from the center of the defined rectangle until pattern width reaches Fill Width.</p>
Move Velocity	Speed at which the gantry moves between two consecutive points.
Micro Valve Speed	Micro-Dot valve velocity.
Reverse Dead Time	Allows a specified delay between stopping the auger and reversing its direction. Use this action to wet to a surface with material prior to material suck-back.
NCM Close Time	Allows a specified delay between closing and opening a non-contact jetting pump. This field does not display if the system is not configured for a non-contact jetting pump.
Pinch Delay	<p><b>IN EFFECT AS OF FLOWare software version 2.9.3P</b></p> <p><b>Normal Pump Operation</b> - If the Pinch Delay parameter is less than or equal to 0.0, normal pump reverse (suckback) applies.</p> <p><b>Deferred Pump Reverse Operation</b> - If the Pinch Delay parameter is greater than 0.0, the pump reverse is configured to execute after the Pinch Delay amount of time using the normal pump reverse parameters. After Pinch Delay seconds has passed, the pump reverse begins.</p>
Auger Speed	Speed at which to operate a variable speed auger.
Pre Snap-off Delay	Time to delay after dispense but before beginning snap-off.
Post Delay	Post operation delay.
Snap Off Velocity	Snap-off velocity.
Snap Off Acceleration	Snap-off acceleration.
Micro Valve Acceleration	Micro-Dot valve acceleration.
Mixer Velocity	Speed at which to operate the mixer valve.
Scale Factor	Scales a feature up or down by a particular percent. Applies especially to shapes; a shape can be executed as a different size than it is defined.

#### SELECTABLE PANEL - ARRAY & TRACK

Element	Description
Rotation	Angle through which the array is to be rotated, independent of Object Rotation. The entire array is rotated as a unit about the point (X, Y).  <b>NOTE:</b> Object Rotation, rather than Rotation, should be used to rotate a single item because Object Rotation rotates individual elements of the array, not the array itself.
X Count Y Count	default = 1 for a non-array  Number of array elements in the X and Y directions before rotation of the array.
X Space Y Space	default = 0  Specifies the spacing between array elements in the X and Y directions before rotation of the array. To jog to desired space in the XY direction, you can click TEACH SPACE.
TEACH SPACE	Calculates offsets for X Space and Y Space. Appears only when valid coordinates are used in the X and Y fields of the Standard Values panel.
Needle Track	default = N  Indicates whether to backtrack over last fill line.
Mixer Valve	Velocity of mixer valve.
X Y	Location where backtracking is to occur relative to the board reference point.
Start Z	Distance above the board where backtracking is to take place; a negative value indicates drilling into a drill pad.
End Z	Distance above Start Z (the Z location where backtracking takes place) for the operation to end. This value is non-zero to create pillars or to dispense along an angle to the plane of the board.
Velocity	Speed at which the gantry moves from Start Z to End Z.

**SELECTABLE PANEL - OPERATE**

Max Repeat	Number of times the system attempts to pick up the component at the current Z location.
Retries	Number of times to retry a failed operation.
Skip Lines	Number of program lines to skip forward (+) or backward (-).
Message	Message number (-1 and greater) associated with this operation.
Flag Counter Number Flag/Counter Value	Bit number (0-31) and value (0-1) to change or test bit flags. Used to test the status of various conditions within a program/shape and, based on the test results, direct the control software to either continue or skip program detail lines.
Head Pressure	Operating pressure for this head.
Minimum Z Value Maximum Z Value	Minimum and maximum Z coordinate values allowed (mm).
Operation Time	Operating time for this operation.
Blow Off Time	Blow-off time to release a part.
Pattern	Name of a pattern, up to 24 characters long. This field is used when an OPERATE line requires a vision pattern.

**SELECTABLE PANEL - VISION**

Camera Select	Camera number to be used in this operation.
Gain	Camera gain (0-255). Use -1 to disable.
Offset	Camera offset (0-255). Use -1 to disable.

Element	Description
Zoom	Value (0.0 to 1.0) of focal length for an automatic focus camera for changes within the program.
Focus	Value (0.0 to 1.0) for focusing an automatic focus camera for changes within the program.
f-stop	Value (0.0 to 1.0) for f-stop on an automatic focus camera for changes within the program.
Light on Dark	A <b>Y</b> indicates use of a light dot on a dark background for dot inspection on the board. An <b>N</b> indicates use of a dark dot on a light background.
Light Level	Level of lighting for changes within the program.
Light Color	Light color for changes within the program.

**SELECTABLE PANEL - BLOBS**

Blob Count	Number of blobs to be found by the vision system (0-50).
Low Gray	Gray level pixel values (0-255) for low limit.
High Gray	Gray level pixel values (0-255) for high limit.
Blob Ratio	Minimum to maximum length ratio for blobs.
Min Area	Minimum area (pixels) of blobs for blob search.
Max Area	Maximum area (pixels) of blobs for blob search.
Window Height Window Width	Used to determine the size of a search window for dot inspection. Establishing a narrow area only slightly larger than the dot to be found is suggested. Refer to <a href="#">Dot Inspection</a> (pg 106).
Dot Volume	Dispensed dot volume.
Target Size	Desired blob (dot) size. Refer to <a href="#">Dot Inspection</a> (pg 106).
Target Range	Desired tolerance value. Refer to <a href="#">Dot Inspection</a> (pg 106).

**SELECTABLE PANEL - SERVICE**

Program Code	Internal use. Code to identify the program. The value is inherited from the @PRORAM or @SHAPE record.
Program Flag	Internal use. Indicator used internally to select items.
Sequence Number	Internal use. Code to sequence the detail records. Records are re-sequenced automatically as they are encountered.
PS Type	Internal use.
Alternate PS Type	Internal use.
MoPar Index	Internal use.
Snap Mopar	Internal use.
ST Code	Internal use.
Ident	Internal use.
Needle Inside Diameter	Internal use.
Head Type	Internal use.

**SELECTABLE PANEL - FUNCTIONS**

Only functional when the dispenser is configured for Wedge configuration. Refer to custom Wedge project documentation.