RJG

eDART® Shuttle Control Option
Applications & Reference

RJG, Inc.

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Help Molders Succeed™

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Shuttle Control Tool

Introduction

The Shuttle Control tool organizes data in shuttle and rotary molding applications. It does not control co-injection or multi-shot injection applications.

The functions of this tool are:

- Accepts inputs from the machine or table for current position*.
- Automatically determines which cavity pressure sensors are active in each position.
- Activates alarms only for those values computed from currently active sensors.
- Saves summary and cycle data only for currently active sensors.
- Diverter delays by N cycles for rotary applications.
- Separate setpoints for separate mold halves.

Fixed vs. Moving Half Functionality

Sensors in the “fixed” half will see pressure on every shot. Sensors in the “moving” half will see pressure only when their mold half is under the fixed half.

Sensors placed in the moving half will provide:

- Separate alarm levels, if desired, for each mold half.
- Single alarm levels for both mold halves using the “High” and “Low” values (for most summary values).
- Separate control setpoints for each mold half or use the Valve Gate Control option.
- A single control setpoint, if desired, using the “High” curve.
- Separate summary curves for each sensor in each half.

Sensors placed in the fixed half will provide:

- A single setpoint for each mold half (cannot be separated).
- A single alarm level for each mold half (cannot be separated).
- A single summary curve that represents the value in both halves with the points on the curve (for example “Peak, End of Cavity”) alternating between halves.

**2 to 4 positions/24 sensor max.*

Installation

Software

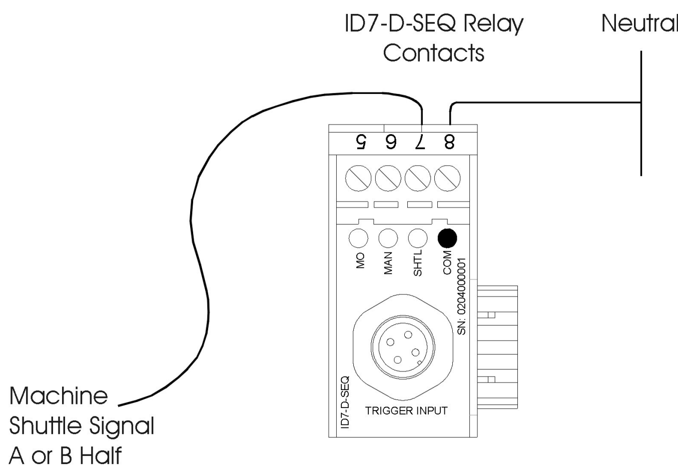
The Shuttle Control tool requires that a single software function be copied onto the *eDART*® (once you have the current release). The steps to do this are described below:

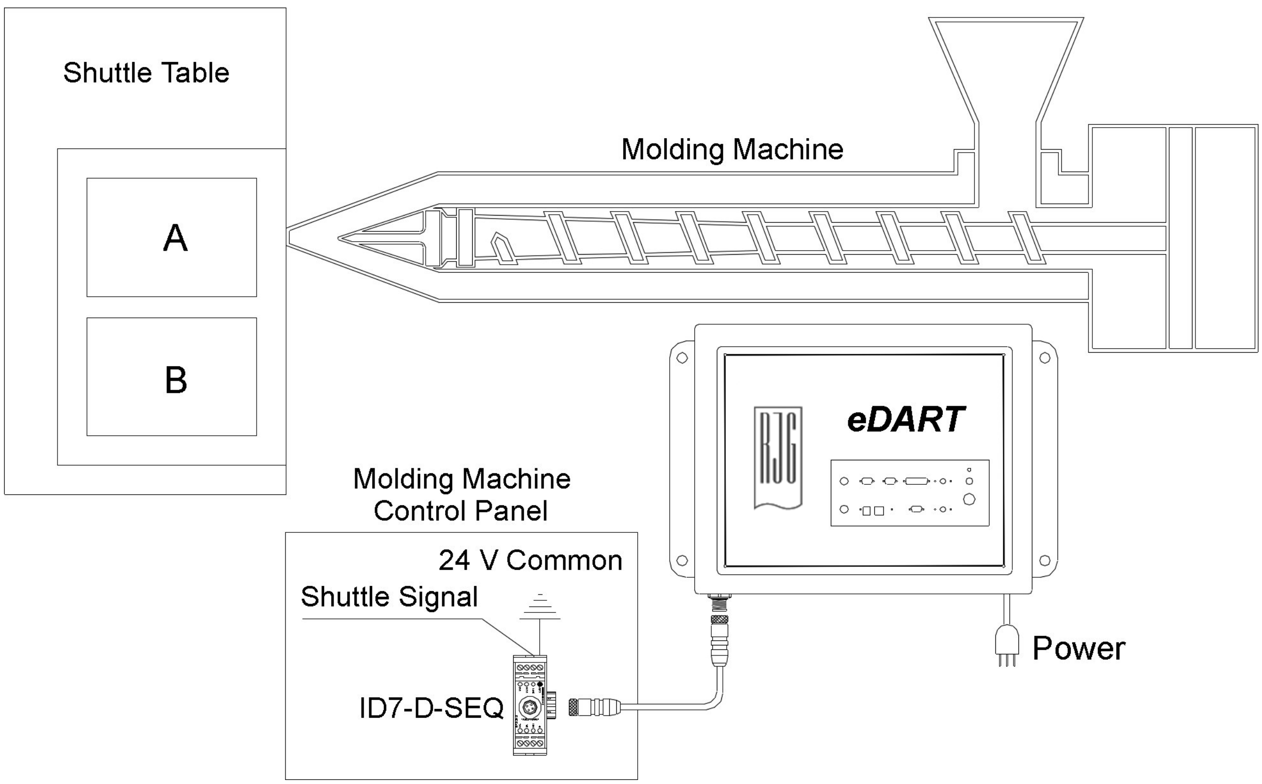
1. Make a connection to the *eDART*® with a Windows based computer.
2. Insert the Shuttle software floppy disk into the D:\ drive.
3. Go to the Start Menu Run command. Type “D:\load_edart <your IP address>” then click *OK*. (Note that there is a space between the word “edart” and the IP address.)
4. Restart the *eDART*®.

Wiring for Two Positions

<u>Wiring Option #1</u>

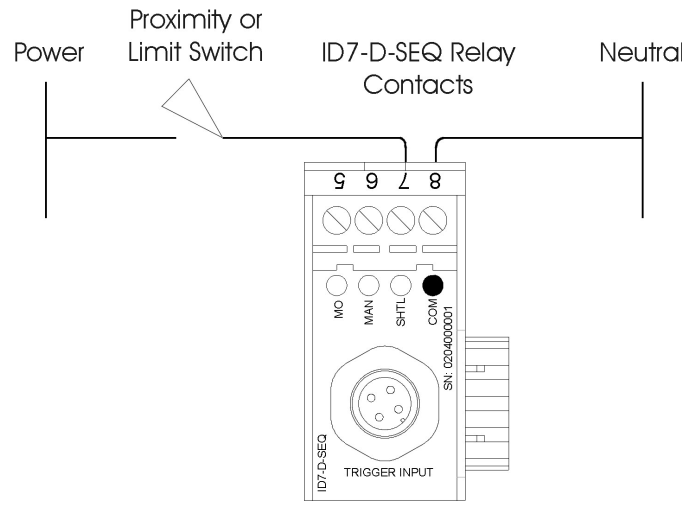
The preferred option is to wire a machine shuttle signal (or signals for more than 2 positions) to the Sequence Module. The signal should be ON at the start of the cycle for the mold in one position and OFF when the cycle starts in the other position.

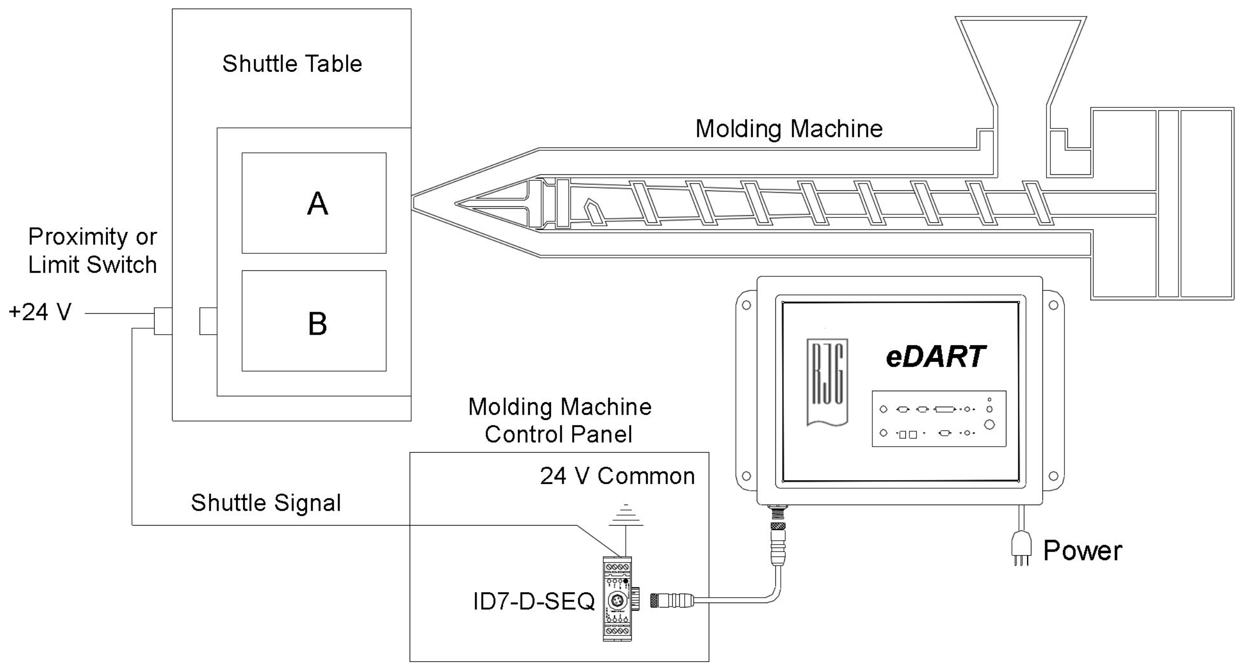




Wiring Option #2

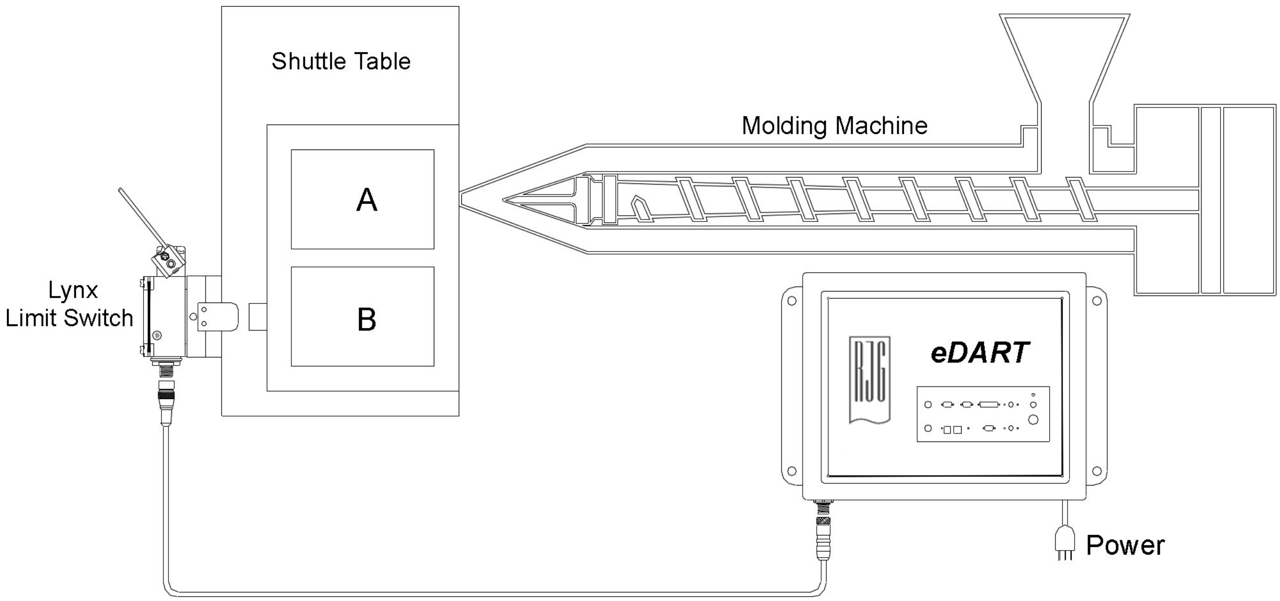
You can also use an off-the-shelf limit or proximity switch in conjunction with the Sequence Module to indicate the shuttle position.





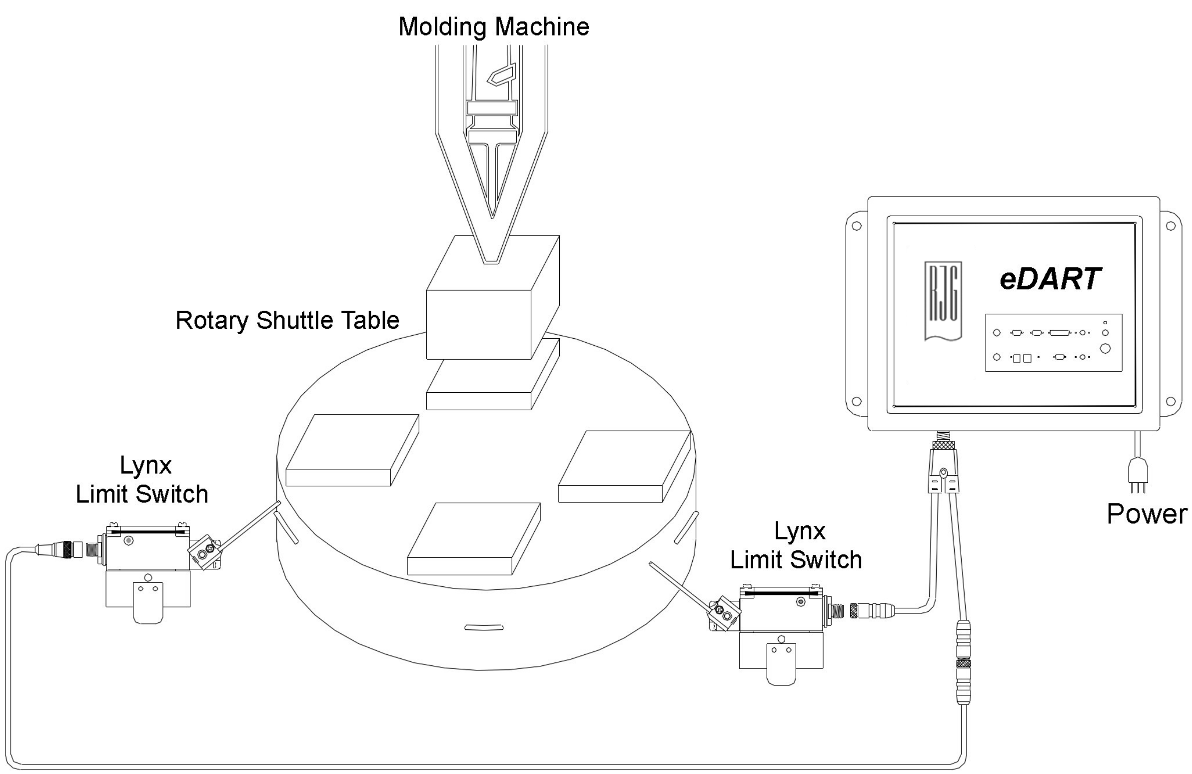
Wiring Option #3

A Lynx Limit Switch can be used as sort of a last resort option to indicate the shuttle position. Simply mount the limit switch and wire it to the *eDART*®.



Wiring for Three or More Positions

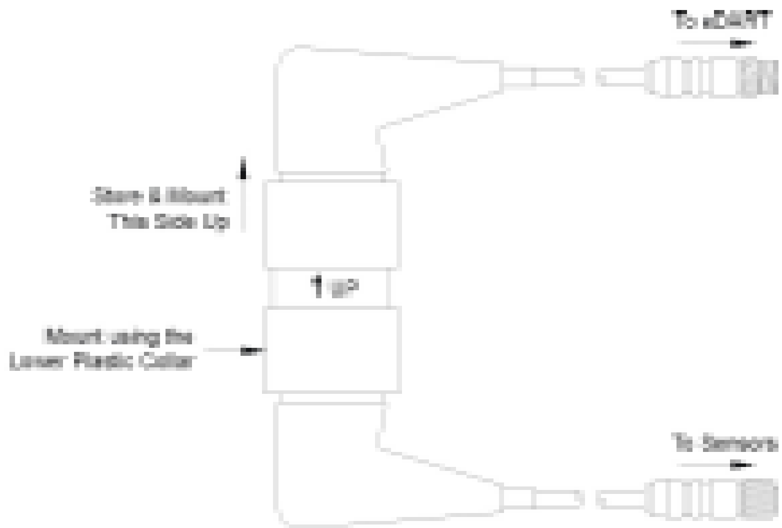
On a rotary table with three or more positions, attach cams to the rotary table for each position. Then mount one limit switch on the machine for each two positions. In the example below (4 position), you would use two limit switches.



Using a Slip Ring

RJG's slip ring can be used to house sensor cabling in applications where a 360° table is used.

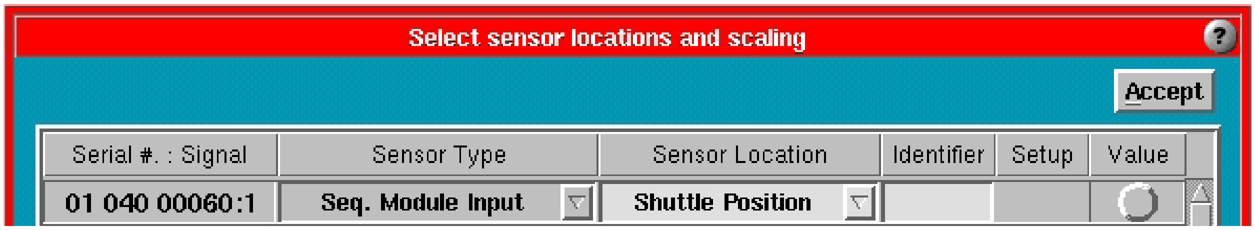
Call RJG Customer Support at (231) 947-3111 ext 170 for further details.



Operation

A. Start-up

When you start a job in the *eDART*® software, you will select, for the appropriate Sequence Module input, the location "Shuttle Position". You will also be able to select "Shuttle Position" for a Lynx limit switch input (See page 4).



For multiple shuttle positions, you will simply number them using the "Identifier" column.

This is all that is required to "install" the option. You should verify that the signals go on and off at the right time using the Sequence Lights tool or the Raw Data Viewer.

B. Test the Input

Watch the light at the end of each row in the Sensor Locations tool to see when the light goes on and off. The light should come on when the table is in one position and off when the table is in the other position.

Once you have selected "Shuttle Position" in the Sensor Locations tool and clicked the *Accept* button, the *eDART*® will automatically start the Shuttle Control tool. The software then begins trying to determine which sensor is operating in which half. Initially the sensors are "not assigned" which means that they are active and will record data regardless of the shuttle position. After a few shots, the software will assign the sensor to a shuttle position. This then controls summary data viewing, alarms, data storage, etc.

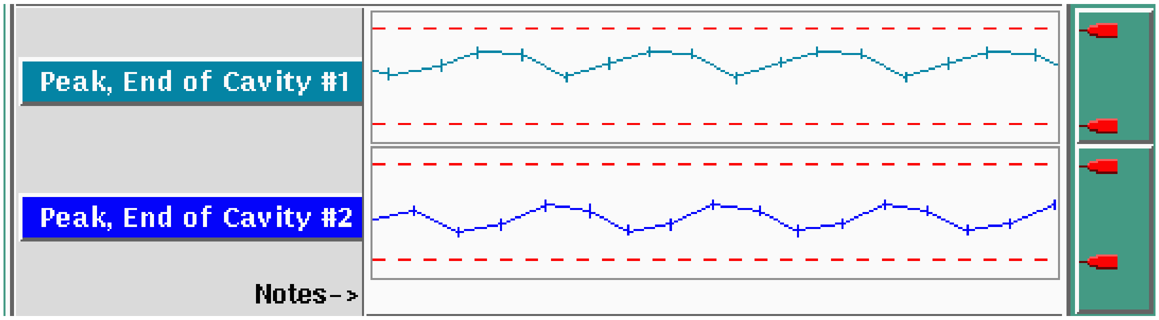
Once the software assigns a sensor to a shuttle position, that sensor and its associated summary data (e.g. peak) are only considered "active" if the shuttle position at the start of the cycle matches the sensor's assigned shuttle position. Sensors that are not assigned are always active.

CAUTION: *If the pressure caused by ejecting the part in the inactive half is higher than the setpoint that the shuttle function uses to detect active sensors, it may assign a sensor as active in both halves. In these cases you will need to use the Shuttle Control tool to lock the sensor assignment in the position you want it to remain.*

C. Summary Data (a.k.a. *Cycle Values*)

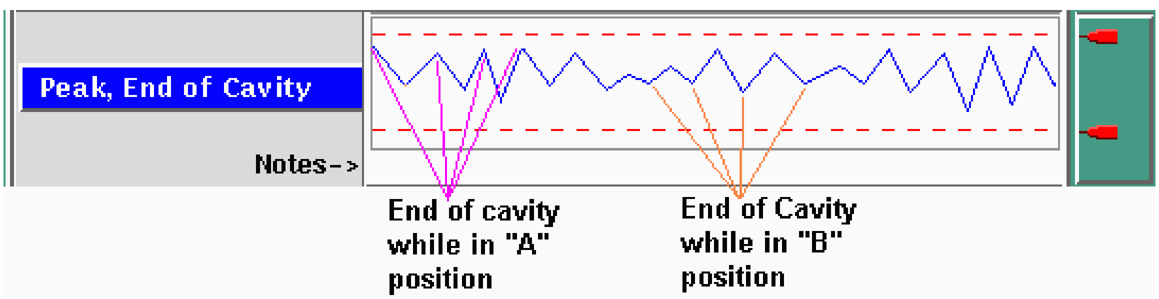
Moving Half Sensors

The Summary Graph will only plot data points for a sensor if it is active. Thus only one of the two sensors in the graph below is active on each shot. The data points for each mold half then alternate. The summary graph will not actually plot the vertical hash marks. We include them here to show you where the data points for each curve lie.

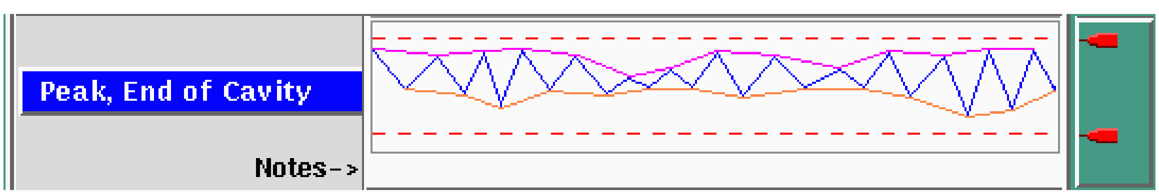


Fixed Half Sensors

A fixed half sensor (or one which is never assigned) will plot a data point on every shot. If the mold shuttles from shot to shot and the data is different between the two halves, you can get a situation where every other shot will alternate.



In the example graph below, the lower line shows the data trend shape for one mold half and the upper line for the other half. The summary graph will not actually plot those lines but it gives you an idea of which points belong to each half.

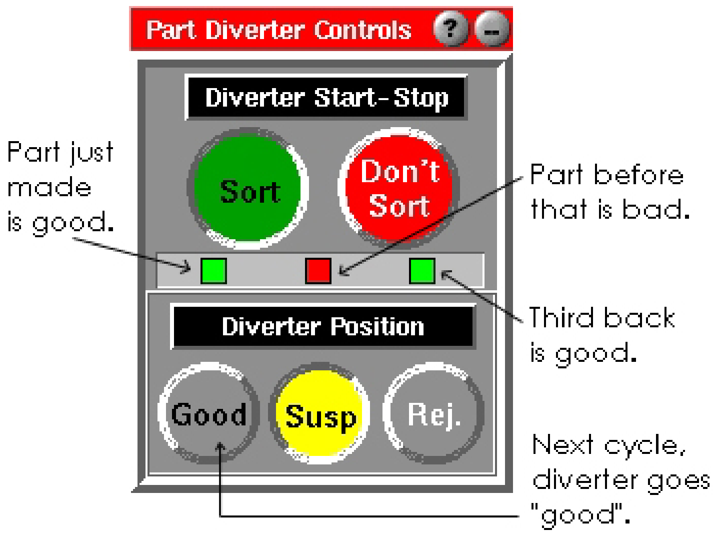


D. Alarm Settings

The Alarm Settings tool runs the same as without the shuttle option with the exception that each value used for alarm will "know" the shuttle position to which the source sensor is assigned. If the shuttle is not in that position, the alarm will be assumed "good" for that value on that cycle. If the shuttle position matches the alarm sensor's position (or the sensor has not been assigned to a shuttle position), the alarm will operate normally (every shot).

E. Diverter Control

To accommodate delayed part sorting, especially in rotary tables, the Part Diverter Controls tool has a feature called "Diverter Delay" (in its settings menu). When turned off, the diverter operates normally. If you have a rotary table in which it takes one or more cycles for a bad part to get off of the table and into the diverter, you can then enable the delay to sort of "hold" the good/reject status of a part for N cycles until the part is actually removed from the press and sent to the part diverter. Typically you will use this feature when a post-molding operation (such as trimmming) is done on the table while in the inactive position. The diverter control shows the status of each part in the queue by color, moving along for N cycles until the Nth alarm back actually operates the diverter.



F. Multi-Cavity Mixer

The multi-cavity mixer automatically creates four sort of "phantom" curves when you have multiple sensors with the same location name. Each of these ends with a specific ID (i.e.: "Post Gate #High", "Post Gate #Avg", "Post Gate #Low" or "Post Gate #Rng"). These curves are made of the values of all of the Post Gate sensors at each point in time. The highest sensor at each instant gets put in the "#High" curve, the lowest in the "#Low" and the average of all of them in the "#Avg". The "#Rng" curve is the *range* meaning the difference at each instant between the highest and lowest sensor of the same name (e.g. Post Gate).

With the shuttle option, the mixer will only include those sensors that are active when the mold half is active. Once a sensor is assigned (by seeing pressure) it gets included in the mixer for these two measurements. Thus you will not have sensors with no pressure (in the inactive half) mixed into the "High", "#Low", "#Avg" and "#Rng" curves.

G. V->P Transfer Control

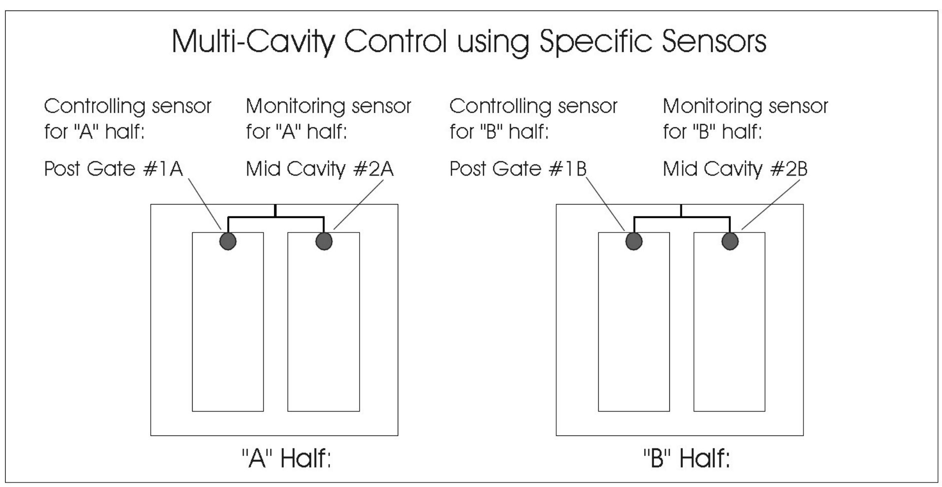
Moving Half Sensors

When each mold half has a control sensor, you will use the "#High" sensor to control cavity pressure transfer. Note that the "#High" sensors are generated at 250 samples per second giving them a 4 mS response time even if the input sensors are running faster than that.

If you have more than one cavity in each mold half and each cavity has a sensor with the same location name (e.g. Post Gate), then selecting "Post Gate #High" for transfer will cause the V->P control to use the first sensor to reach the setpoint pressure. This can be a good thing if you never want any pressure to exceed that setpoint.

CAUTION: *When you use "Post Gate #High" (or any other mixer signal as described above) you must make sure that the sensors get assigned to the proper side using the Shuttle Control (below). If the sensor is assigned to the wrong side, its signal will not be included in the "#High" (or any of the other mixer curves) and the machine will not transfer.*

If you want to control off of a specific sensor in each half, you will need to name the non-controlling sensors something other than the name you gave to the controlling ones (e.g. "Mid Cavity"). Then you need to remember that in the data the Mid Cavity sensors are really the sensors for post gate. The diagram below may help with this:



Setting control to "Post Gate #High" will control off of "Post Gate #1A" when in the "A" position and "Post Gate #1B" in the "B" position.

Fixed Half Sensors

If your control sensor is in the fixed half, it will see pressure in either shuttle position. Thus you have only one sensor and one setpoint which you can use for control in the V to P Transfer tool. That single cavity pressure setpoint level will control the parts made in both halves.

H. Data Storage

The *eDART*® stores all data for both halves in a single "phlat-file". Sensors that are not assigned or have pressure in both positions ("fixed half") will have a data point for each shot (as in the second Summary Graph on page 7).

Summary values from inactive sensors (moving half, once assigned) will be skipped and will not exist in the phlat-file.

Also the Shuttle Control tool will create a summary value called "Timing Signal, Shuttle Position". This is simply a number starting at one that can be plotted on the summary graph in the Analyzer program. Thus you can tell what the shuttle position was at the start of each shot.

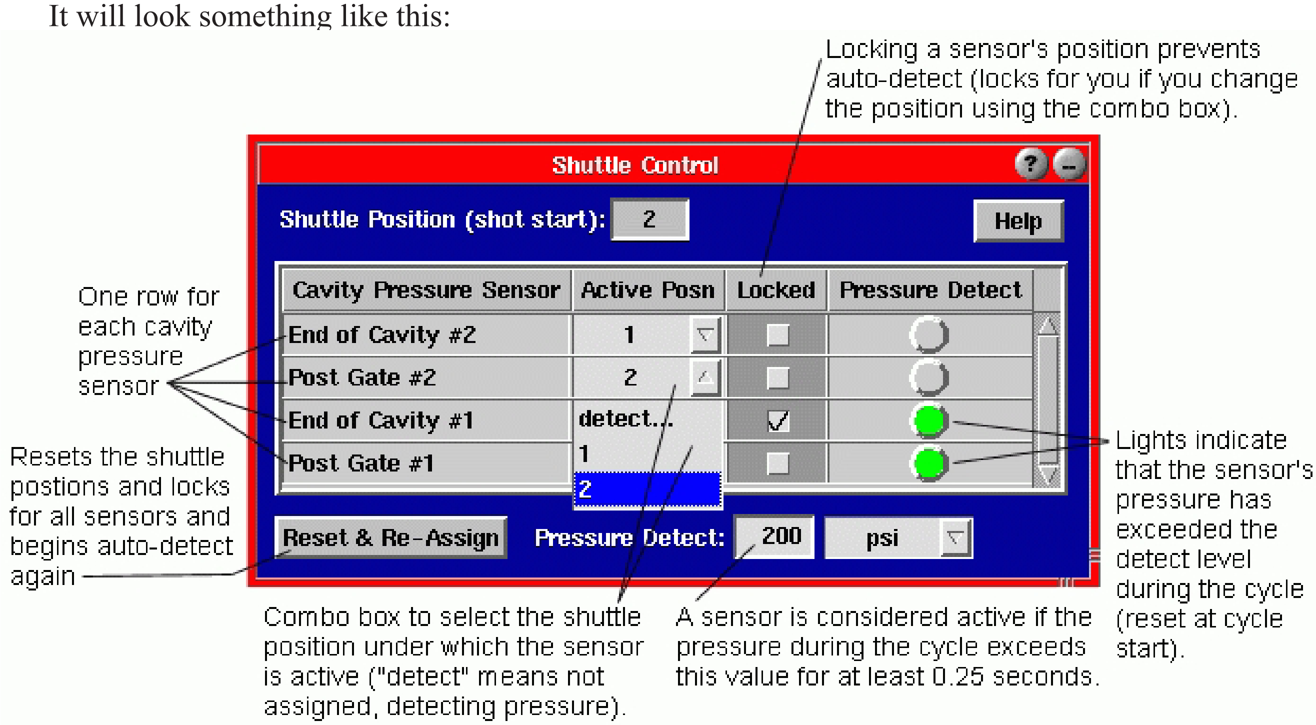
User Controls

As mentioned, the Shuttle Control tool is designed to work without user inputs except for proper choices of the "Shuttle Position" Sequence Module or limit switch inputs and the naming of cavities to prevent control. The rest is taken care of automatically by the software.

However, in the event that the automatic assignment comes up with incorrect settings, the Shuttle Control tool allows you to assign cavities manually to each position. It will also display the position number as the summary value recorded at the start of each cycle.

The Shuttle Control tool can be attached to the mold, machine, or the system menu as desired (using the Architect). It is optional and not required to run if the auto-detect works properly.

It will look something like this:



The Active Position column will show "detect" if pressure has not yet been seen on this sensor and the sensor is not yet assigned. The Shuttle Control tool will be looking for pressure. Also, if the position shows "All" it means that it is active in both positions "1" and "2". The shuttle control will automatically set the value to "All" if it sees pressure over the threshold for longer than 0.25 seconds in both positions.

The Locked column prevents the shuttle control from changing the position. The control automatically turns this switch on after a sensor is found to have the same position for three consecutive parts made in that position. So on a two-position shuttle, if pressure is detected for a sensor while in position "2" for six shots, that sensor will be locked in position "2". This keeps the control from thinking there is pressure when an operator tries to remove stuck plastic or presses an insert on exceptionally hard.

NOTE: *Any changes made on this setup will NOT be saved when the job stops. This prevents accidental forced miss-assignment if cables get moved around (especially with sensor adapters). The pressure detect setpoint is saved as a system and network wide default.*