

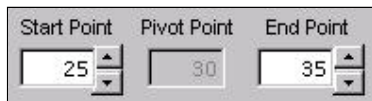
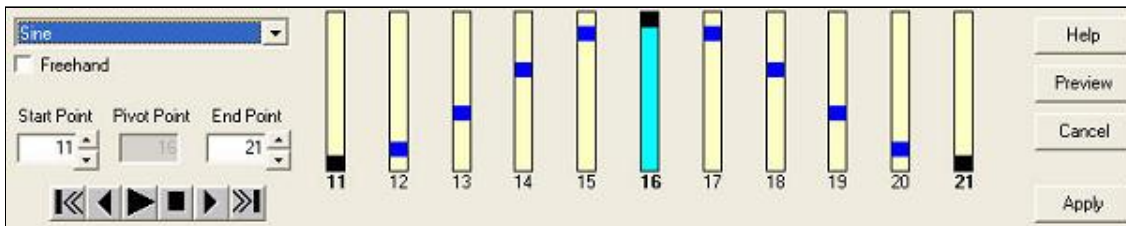
Using the Equalizer

The Equalizer is a very powerful feature that enables the user to modify a group of points in a smooth manner, based on a defined change in one point only. It creates gradual changes in tool [location/orientation](#), and is very useful for bypassing obstacles and applying gradual motion changes.



Before using the equalizer, you are required to make the needed change at the most problematic point, using the [Control Pad](#), **without Updating** it. We call that point, having the **largest change**, the **Pivot** point. After you've made this change, **while still on the Pivot point**, click the **Equalizer** button.

The form will open with some default settings. (the colors on your screen may be somehow different)



The first thing you should do is to indicate the group of points to be affected by the change; Define the **Start Point** and the **End Point**. RobotWorks starts by default with 5 points before and after the pivot point. You may type numbers or click the up-down buttons. The tool will follow your numbers so you can clearly see where to start or end.

The major part of the window is a vertical-scroll-bars diagram of the "equalized" points. The blue sliders and can be dragged up and down to change the setting at each point (the tool will move with your change, so you can immediately see its effect). The **Start**, **Pivot** and **End** are black and cannot be dragged. The light-blue scroll-bar is showing the **current** point, where the tool is. When the window first opens it will be at the Pivot Point.



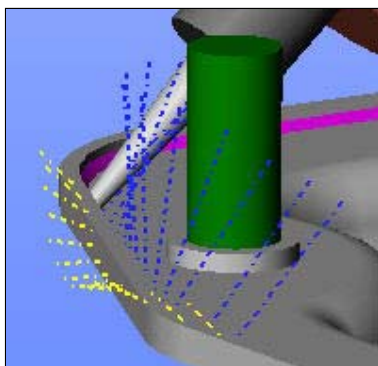
Now, you can choose one of the equalizing **Patterns**.

- **One-time Patterns:** [Manual](#), [Linear](#), [Sine](#), [Square](#);
- **Wave Patterns** which are used when a specific set of changes should be repeated several times: [Triangular Wave](#), [Sine Wave](#), [Square Wave](#);
- **Special Patterns** which are used in special places in the path, to overcome problems. Currently, there is one special pattern: [Corner](#).

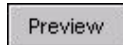
The next topics describe the patterns in details.



You can run the tool along the equalized points using the **Motion Buttons** at the Equalizer window.



You can **Preview** or **Hide** the Point Vectors of the equalized points. Click **Preview** to see all the suggested vectors (the tool will not move) and **Hide** to clear them.



The "equalized" points are held temporarily until you decide if you like the result.

If you don't, just click **Cancel**. The path points will **not** change and the form will close.

If you like the results and wish to modify all the path points within the equalizer range, click the **Apply** button. All the points will update and the form will close.

Note:

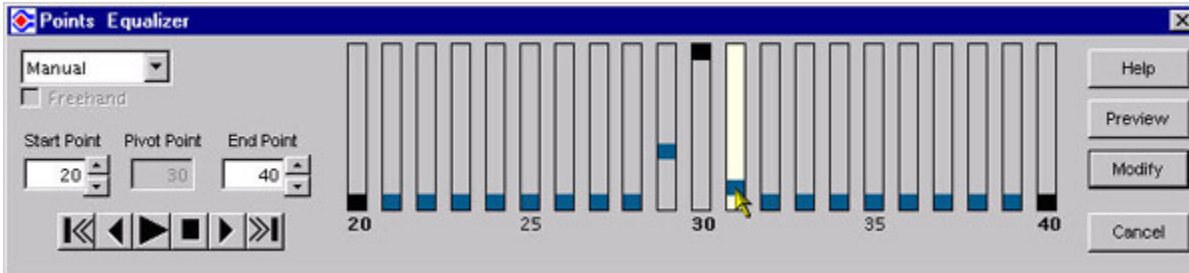
You can't equalize the **first** and **last** point of the path.

Manual Equalizing

Under the Manual pattern RobotWorks does not apply any change to points, and leaves it for you to set manually the value of change at each point.

All the points are set to **0%** change, except the **Pivot**, which always means **100%** change.

After you select this pattern, move each slider to its desired position.



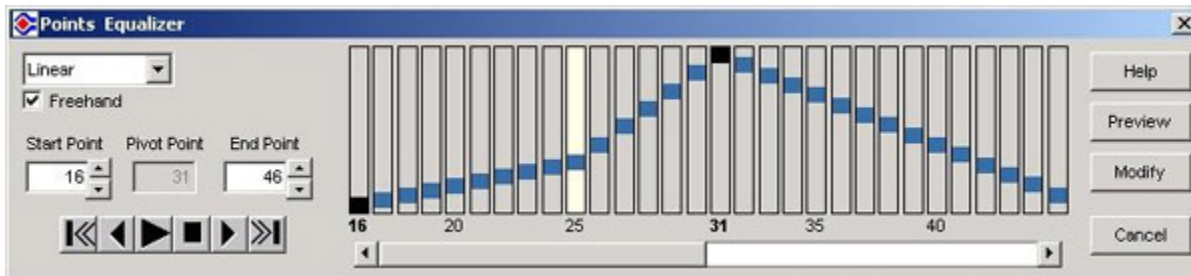
(The colors on your screen may be different)

[More about using the Equalizer](#)

Linear Equalizing

The Linear pattern makes the change in a linear fashion, starting from 0% in a straight line to 100% and then back to 0%. The **amount of change** at each slider depends upon the number of points between the **Start** and **Pivot** on one side, and the **Pivot** and **End** point on the other.

Check the **Freehand** option if you want to make changes to the sliders while preserving the linear 'character' of the pattern. As an example consider the next picture: A linear pattern was chosen and then point 25 was changed in **Freehand** mode, by dragging the slider. All other points in the same range (**Start** Point to **Pivot** Point) also moved, to reflect your 'freehand' desire.



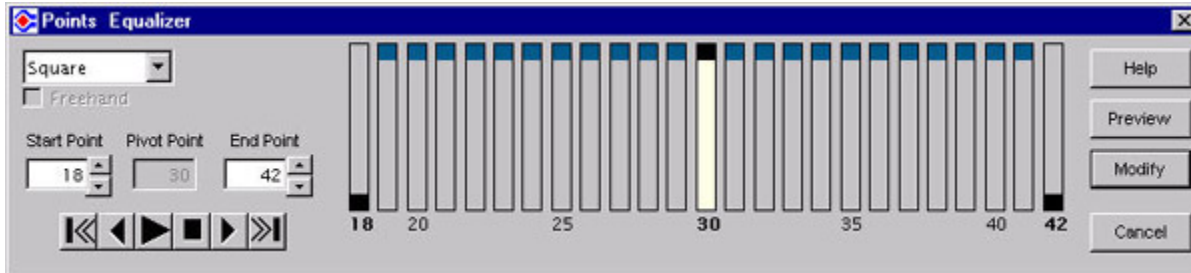
(the colors on your screen may be different)

[More about using the Equalizer](#)

Square Equalizing

The Square pattern is for applying the **exact same** change of the pivot point to **all the points** in the range. The tool location/orientation jump from 0% immediately to 100%, at the beginning of the range, and drop sharply from 100% immediately to 0% at the end, with no intermediate values.

You can change the first and last points manually if you wish to have less sharp effect.



(the colors on your screen may be different)

[More about using the Equalizer](#)


Wave Pattern Equalizing

Wave patterns are used when a specific set of changes should be repeated several times. It is useful for adding 'side motion' to regular motion along a lead, such as zigzag, Sine wave motion like in arc welding, up and down motion like in stitching etc.

Triangular Wave – The triangular wave is a [Linear pattern](#) repeated several times between Start Point and End Point.

Sine Wave – The sine wave is a [Sine pattern](#) repeated several times between Start Point and End Point.

Square Wave – The Square wave is a [Square pattern](#) repeated several times between Start Point and End Point.

Cycles: 

We describe wave patterns as having several **cycles**. A cycle is a set of orientation changes that goes from 0% change in Start Point to 100% change in Pivot Point and back to 0% change. In a wave pattern there may be more than one cycle, so when the change reaches 0% it increases again until it reaches 100% change, then decreases again, and so on. The Pivot Point, in the case of wave patterns, determines the maximum change (**peak**) of the **first** cycle. There may be several more peaks down the path, as high as the Pivot point. When you select one of the wave patterns you can see that the number of cycles is shown. RobotWorks determines how many cycles can fit in the point range of the equalizer (from Start Point to End Point). If you want more cycles you can extend the point range by increasing End Point or, simply change the cycle count itself (using the arrows next to the cycles display) and the End Point will be adjusted accordingly.

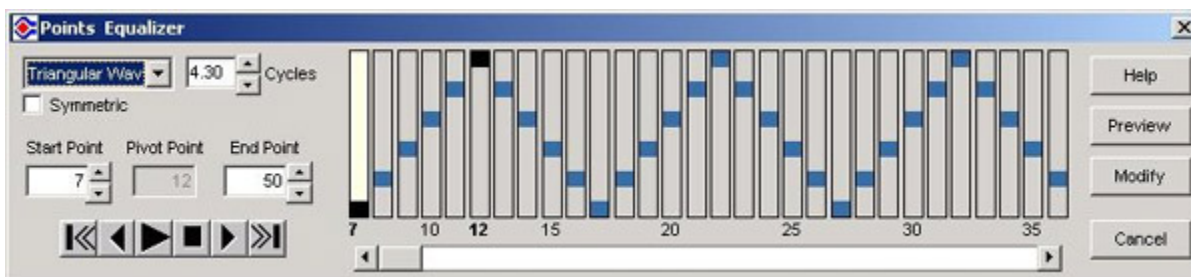
Symmetric Wave: 

So far, we always described patterns that change the orientation from 0% (no change) to 100% (maximum change). 0% represents the original orientation of the tool, while 100% represents the orientation that you applied to the tool at the Pivot Point, using the control pad (see the top of [Using the Equalizer](#)).

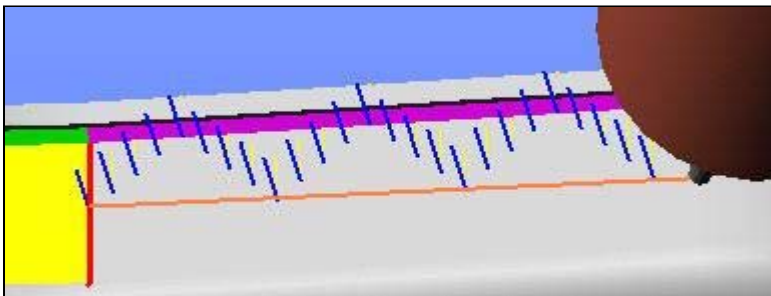
When using wave patterns you have the option of making a real 'back & forth' movement by checking the **Symmetric** option.

Regular equalizer motion is 'one-sided' since the Pivot point represents your maximum change to **one direction**. The change was going 0,100,0. **Symmetrical Wave** doubles the amplitude of the motion, by making the same motion you entered but to both sides, like 0,+100,-100,+100 and so on, then 0 again.

The following pictures show an equalised path on one face, starting from the middle of red edge of the left.



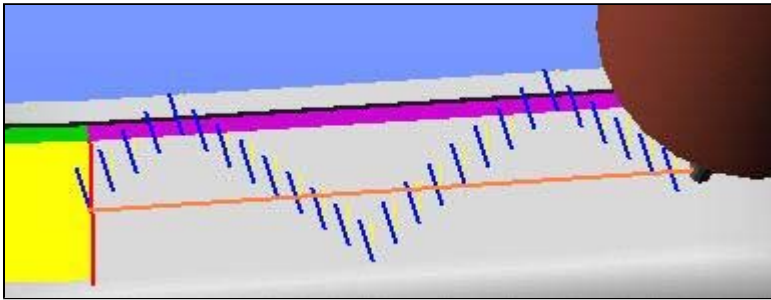
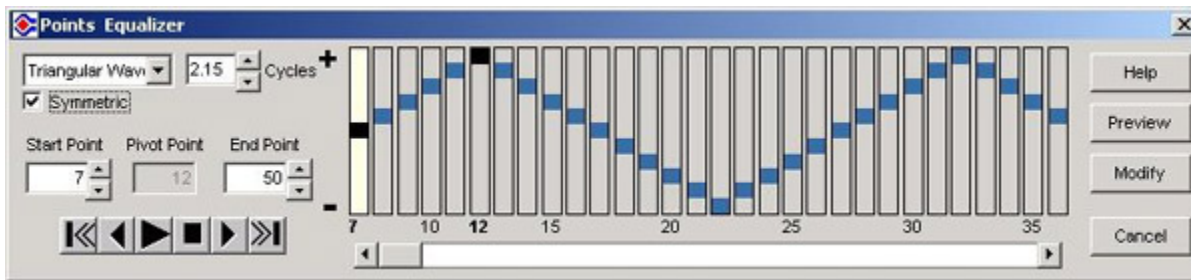
(The colors on your screen may be different)



Normal Triangular Wave

In normal wave the points went up 100% to the top edge of the face, going back down to the middle of the face

(shown as orange line)..



Symmetric Triangular Wave

In Symmetric wave the points started in the middle of the red edge, went up to the top edge, then on the way down crossed the middle (shown as orange line) all the way to the bottom edge. The amplitude of the change was doubled and the motion symmetrical to the middle line, although you only indicated the maximum change to one side.

[More about using the Equalizer](#)

Corner Equalizing

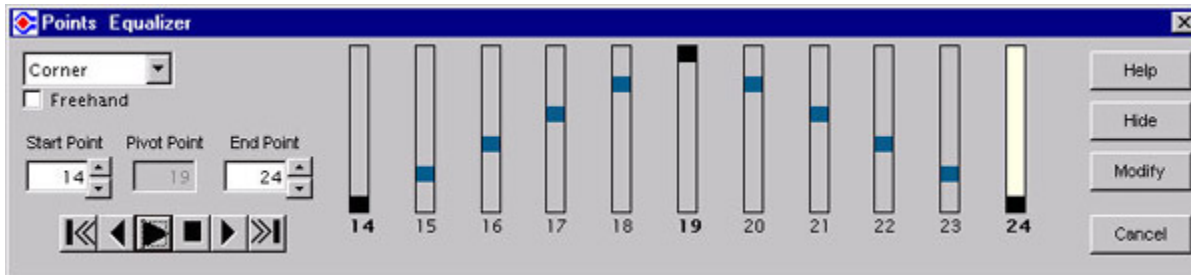
The **Corner** pattern of the equalizer is a special pattern, designed to help you create smooth robot movements when passing through sharp corners in the path. The Pivot point is the corner point itself.

Move the tool to the corner point (the one **before** the sharp jump), open the **Control Pad** and rotate the tool to the orientation at which you want it to be **when it is at the corner** (probably about half the corner angle).

Now open the Equalizer window and choose the **Corner** pattern.

The pattern that you see is similar to a Linear pattern, going from 0% to 100% and back to 0% in straight lines. However, in the corner pattern, the tool will smoothly go from its orientation in **Start Point**, to the orientation of the **corner itself (as you have set using the control pad)**, and from there, to the orientation of **End Point**.

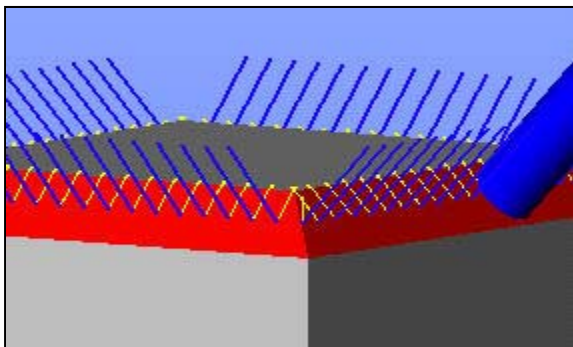
All you need to do is set how many points **before** the corner you want the change to start, and where would you like it to **end** after the corner.



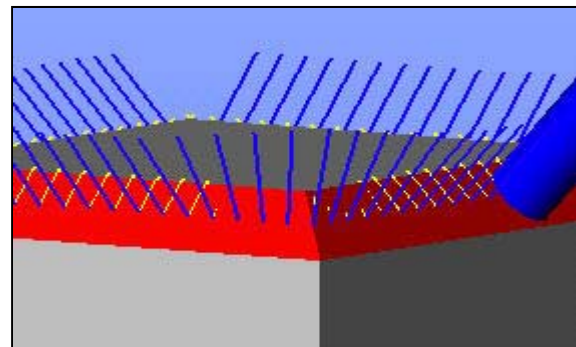
(the colors on your screen may be different)

Notes:

- Make sure you move the tool to the corner point and adjusting its orientation **before** opening the Equalizer. (Zoom if you need to)
- Disregard the original orientation that was calculated by RobotWorks for the corner point. The end result of your control pad maneuver should be the exact orientation that **you want the tool to have** when it's in the corner.
- If the leads before / after the corner do not have enough points for this function, use the utility [Corner Fix](#) instead. It was designed to handle a corner change even without neighbor points.



Non-Equalized Corner, sharp jump



Equalized Corner, 5 points before and 5 after

[More about using the Equalizer](#)