Correcting Machining Distortion with Data Compensation

RSD-SUNMAX Series

SUNMAX LASER

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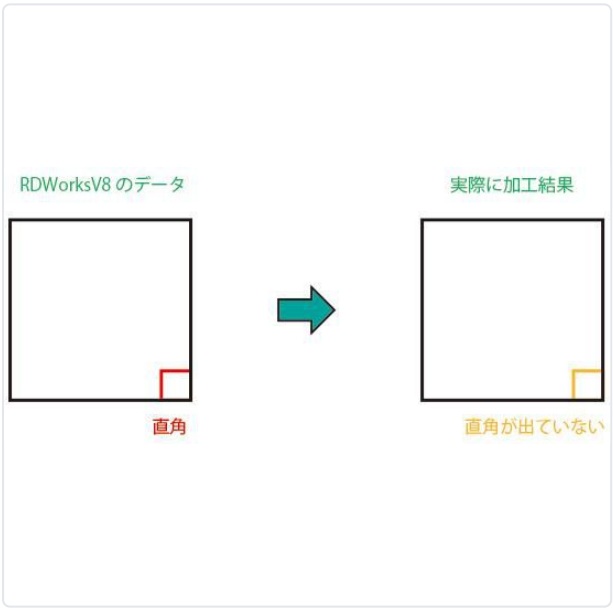
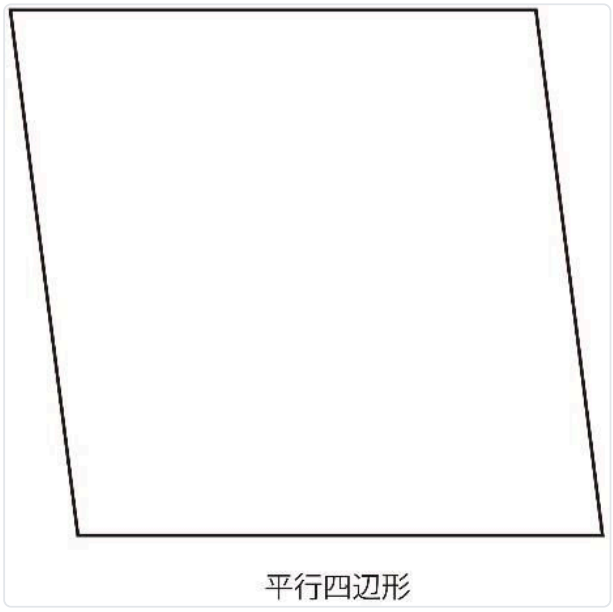
Correcting Machining Distortion with Data Compensation

This technical document explains how to correct machining distortion that occurs on the RSD-SUNMAX series by compensating the data.

What Is Machining Distortion?

Machining distortion refers to the phenomenon in which, for example, you create cutting data for a perfect square in RDWorksV8 and machine it, but the corners do not come out at a true right angle and deviate slightly one way or the other. It is not limited to squares: any data will be subtly distorted.





SUNMAX series machines are assembled to an accuracy within the specified tolerances, and in normal use we do not expect machining distortion to be a problem.

However, when the work requires high precision, such as fine engraving, and the machining distortion must be eliminated completely, this can be achieved by compensating the data.

Cause of Machining Distortion

On the SUNMAX series, machining distortion occurs because the plotter's range of travel is not a perfect square but is instead a slight parallelogram. This applies not only to laser machines but to plotter-type machines in general, and the range of the distortion differs according to the tolerances specified at the parts-assembly stage.

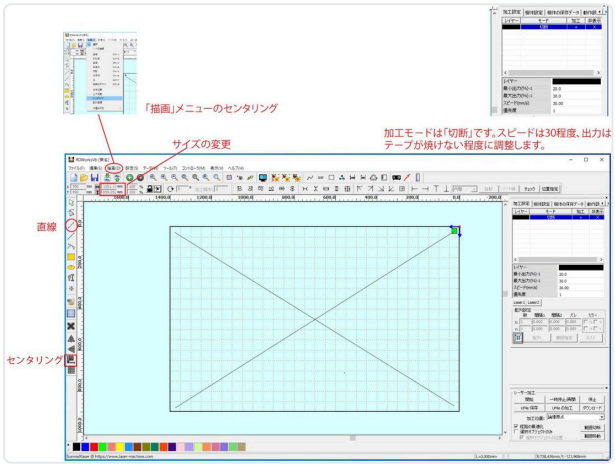
For the SUNMAX series, distortion is measured during manufacturing and in the pre-shipment inspection to confirm that it is within tolerance. However, being within tolerance is not the same as achieving a perfect right angle. A subtle angular deviation that is still within tolerance leads to a right-angle error.

Measuring the Distortion Angle

To compensate for machining distortion, you must take measurements on the actual machine.

Measurement Procedure

1. Using RDWorksV8, create cutting data for large diagonal lines that fit within the working area.

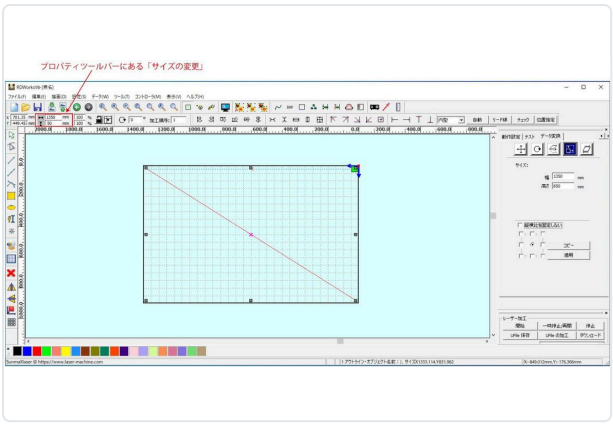


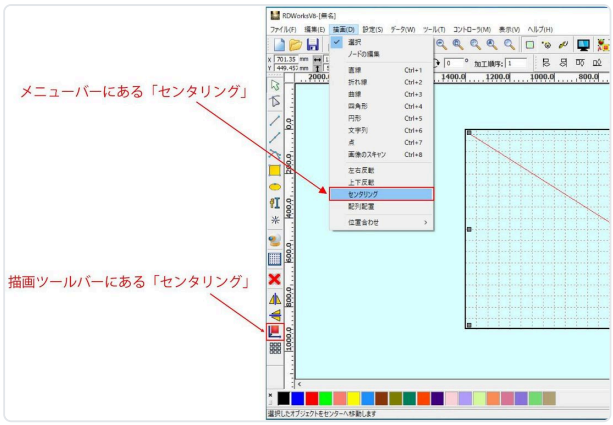
First, click the "Line" button on the RDWorksV8 toolbar and drag the mouse on the design screen from the upper left toward the lower right to create a straight-line object.

Next, with the line object you just created still selected, click "Size" on the property toolbar and change its size. Set a value approximately 50 mm smaller than the size of your machine model.

For the 4030: approximately width 350 mm, height 250 mm.
For the 7050: approximately width 650 mm, height 450 mm.

After changing the size, click "Center" under "Draw" on the menu bar. You now have a diagonal running from the upper left to the lower right.



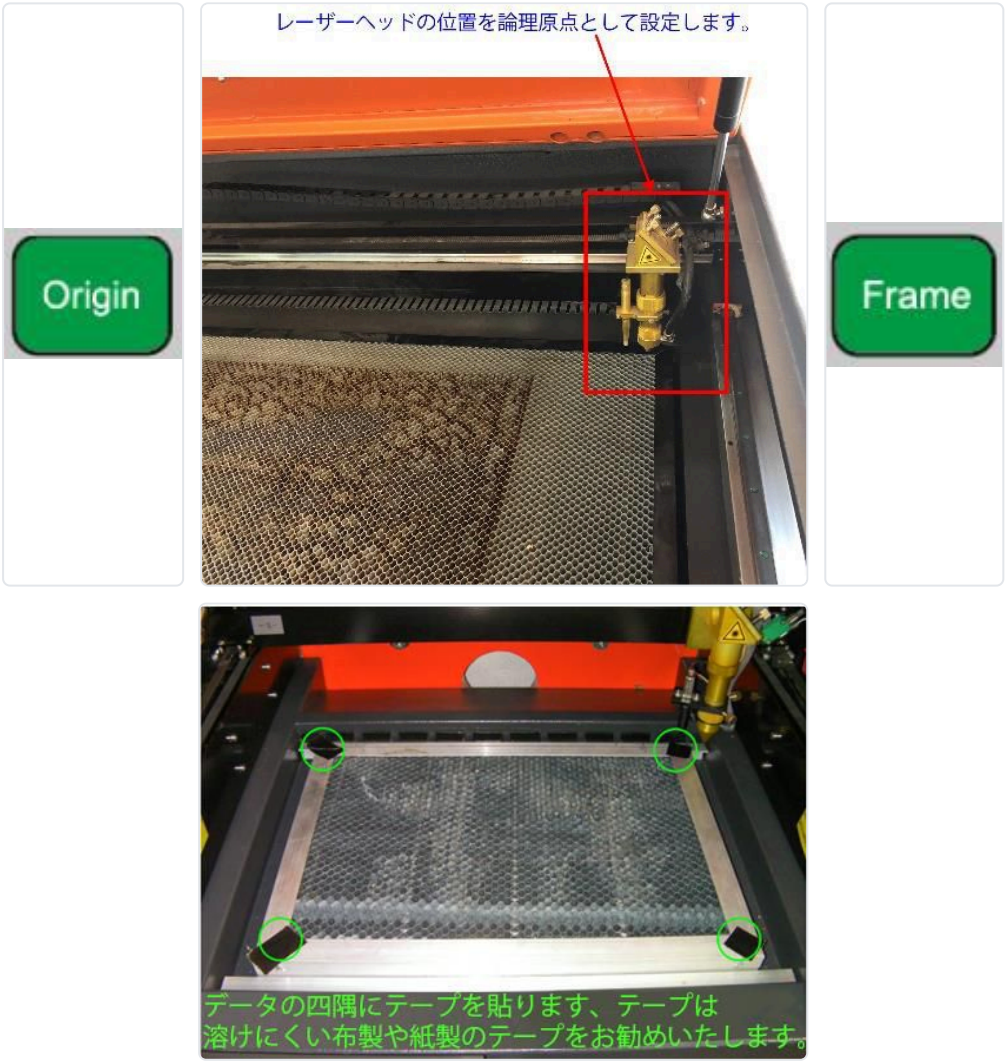


Next, drag the mouse from the upper right toward the lower left to create the other diagonal. Change its size and center it in the same way.

2. Once the data is ready, download it to the machine and perform the cutting operation.

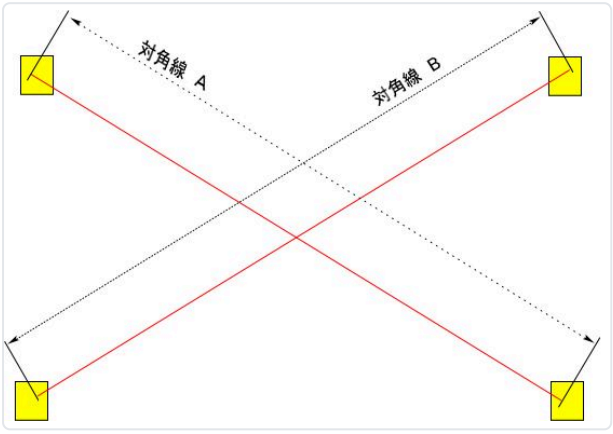
First, press the "Frame" button on the machine's control panel to check the working area.

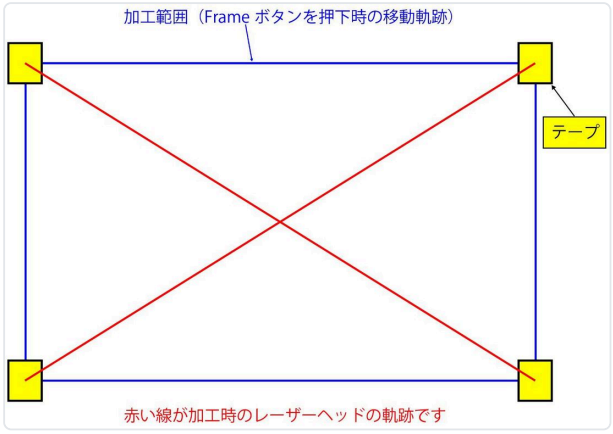
Apply tape at the four corners of the working area. Position the tape so that the start point and end point of the laser exposure fall on it.



After checking the working area, move the laser head to the machining start point and press the "Origin" button on the machine's control panel to set the laser head position as the logical origin. Setting the logical origin makes the machining take place at the position that matches the data origin.

Perform the actual machining, then measure the diagonal lengths of the marks left on the tape where the laser was fired.





Let A be the diagonal from upper left to lower right, and B the diagonal from upper right to lower left.

3. Calculate the angle.

Measure the lengths of A and B accurately. If the shape is a parallelogram, the lengths of A and B will always differ.

If A and B measure precisely the same value, no compensation for machining distortion is necessary.

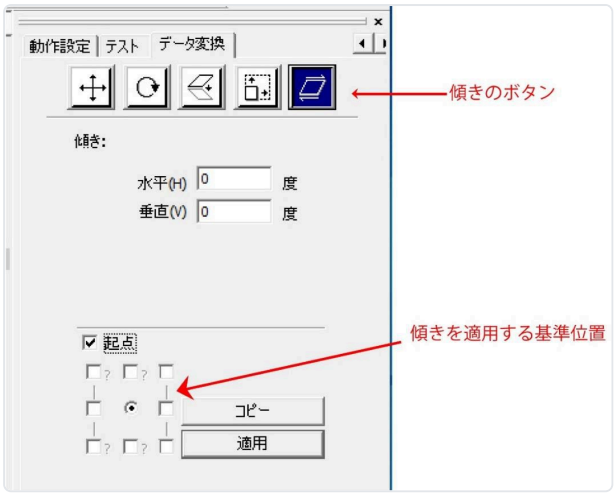
If there is a difference between the values of A and B, obtain the tilt angle with the calculation below.

$\cos\theta = (x^2 + y^2 - B^2) \div 2xy$

B	Length of the diagonal
x	The X size of the object when the data was created in RDWorks V8
y	The Y size of the object when the data was created in RDWorks V8

4. Use RDWorksV8's parallelogram-deformation function to compensate the data for machining distortion.

Click the tilt button at the top of the "Transform" screen. Set the reference position at which the tilt will be applied to the selected object.



Convert the COS θ value obtained from the calculation into an angle. This is the tilt angle. Set this tilt angle as the horizontal tilt. Apply the tilt you have set, and true right angles will be produced.

Note: If you do not have a scientific calculator, you can do the calculation in Excel. If the COS θ value is in cell A1, the Excel formula is =DEGREES(ACOS(A1)).

The angle should be a value close to 90 degrees.

Subtract 90 from this angle. The result is the compensation value.

Example: angle of 90.278	0.278
Example: angle of 89.468	−0.532