Correcting Machining Distortion with Data Compensation

RSD-SUNMAX Series

SUNMAX LASER

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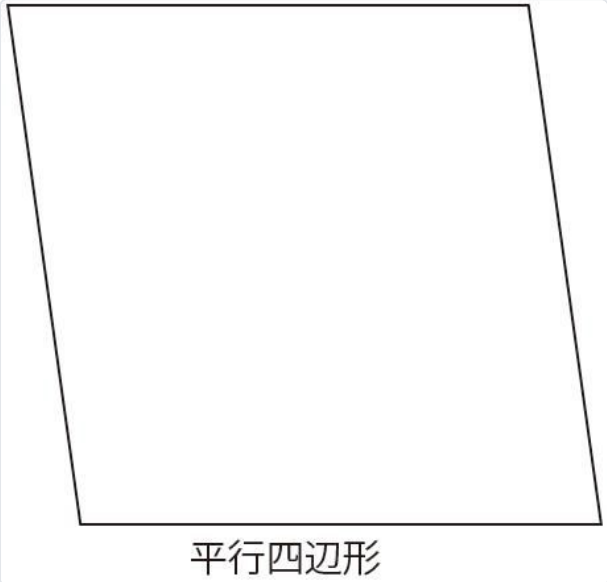
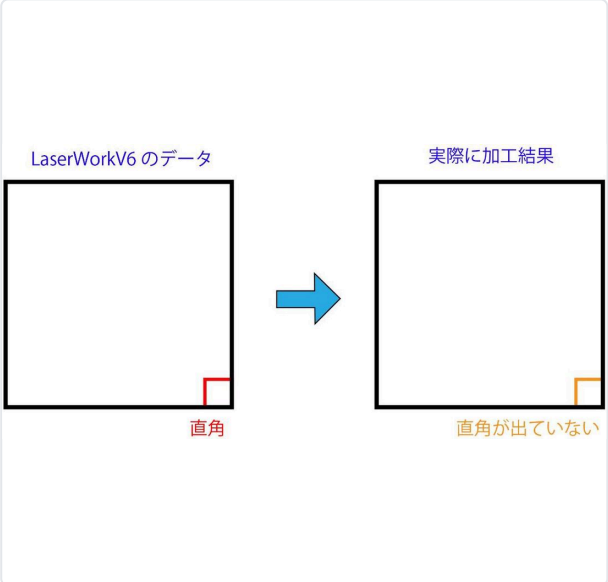
Correcting Machining Distortion with Data Compensation

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 following phenomenon: when you create cutting data for a perfect square in LaserWorkV6, for example, and machine it, the corners do not come out at exactly 90 degrees but deviate slightly. This is not limited to squares — any data will come out slightly distorted.





The SUNMAX series is assembled to an accuracy within the specified tolerances, and in normal use machining distortion should not be a problem.

However, for work that demands high precision, such as fine engraving, where you need to eliminate machining distortion completely, this can be achieved by compensating the data.

Cause of Machining Distortion

On the SUNMAX series, machining distortion occurs because the movable range of the plotter mechanism is not a perfect rectangle but is very slightly parallelogram-shaped. This applies not only to laser machines but to plotter-type machines in general, and the amount of distortion depends on the tolerances specified at the parts assembly stage.

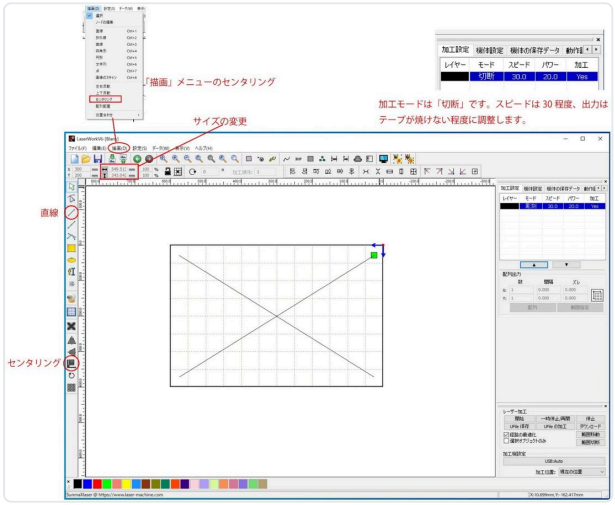
For the SUNMAX series, distortion is measured during manufacturing and in pre-shipment inspection to confirm that it is within tolerance. However, being within tolerance is not the same as achieving perfectly square corners. Slight angular deviations within the tolerance range result in squareness errors.

Measuring the Distortion Angle

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

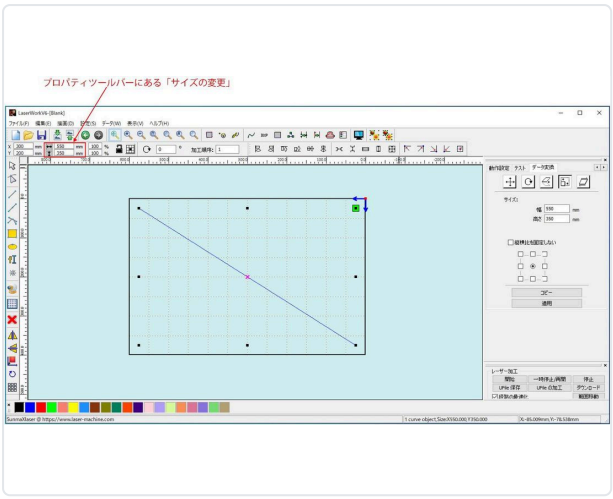
Measurement Procedure

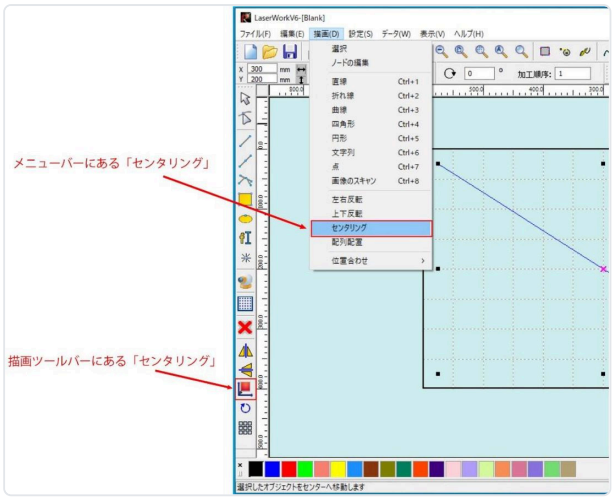
1. Using LaserWorkV6, create cutting data for large diagonal lines that fit within the machining area.



First, click the "Line" button on the LaserWorkV6 toolbar, then drag the mouse on the design screen from the upper left toward the lower right to create a line object.

Next, with the line object you just created still selected, click "Size change" on the properties toolbar and change the size. Set values approximately 50 mm smaller than your machine's working size.





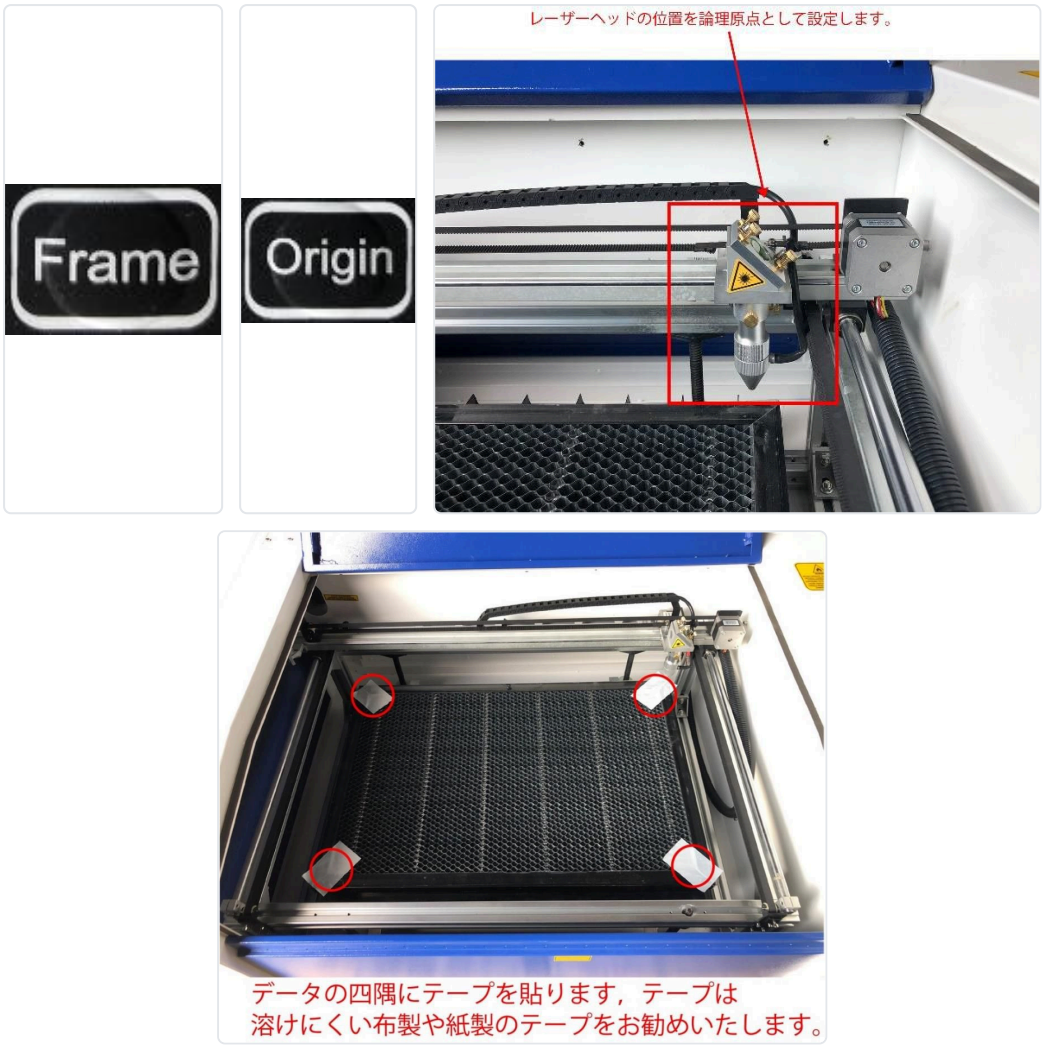
For the 4030: width 350 mm, height 250 mm.
For the 7050: width 650 mm, height 450 mm (approximately).

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

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

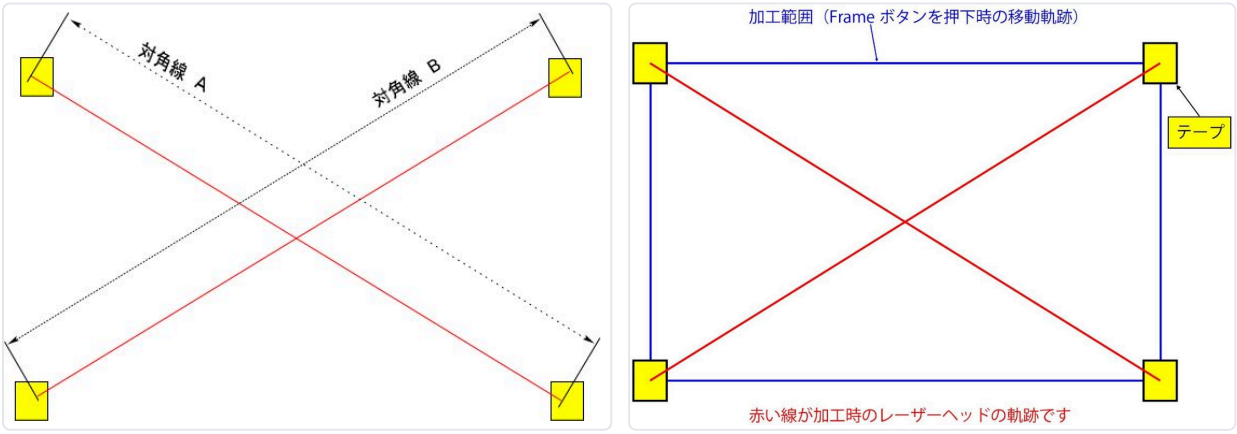
2. Once the data is ready, download it to the machine and perform the cutting operation.

First, press the "Frame" button on the machine's control panel to check the machining area. Attach tape at the four corners of the machining area, positioned so that the start and end points of the laser strokes fall on the tape.



After confirming the machining area, move the laser head to the machining start point and press the "Origin" button on the control panel to set the laser head position as the logical origin. By setting the logical origin, machining is performed at the position that corresponds to the data origin.

Run the job, then measure the diagonal lengths between the marks the laser has left on the tape.



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 are, to good accuracy, the same value, no compensation for machining distortion is necessary.

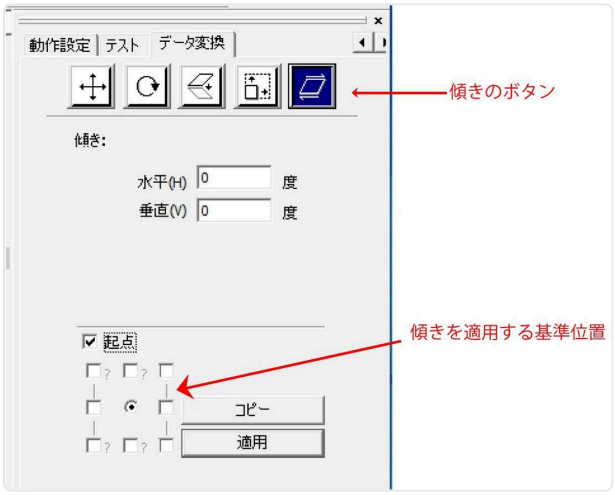
If there is a difference between A and B, calculate the skew angle with the following formula:

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

- B: length of the diagonal
- x: X size of the object when the data was created in LaserWorkV6
- y: Y size of the object when the data was created in LaserWorkV6

4. Use LaserWorkV6's parallelogram (skew) transformation function to compensate the data for machining distortion.

Click the skew button at the top of the "Data transformation" screen. Set the reference position at which the skew is applied to the selected object.



Convert the COS θ value obtained from the calculation into an angle. This is the skew angle. Enter the skew angle as the horizontal skew. Apply the set skew angle, and the corners will now come out square.

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: if the angle is 90.278, the value is 0.278.
If the angle is 89.468, the value is −0.532.
