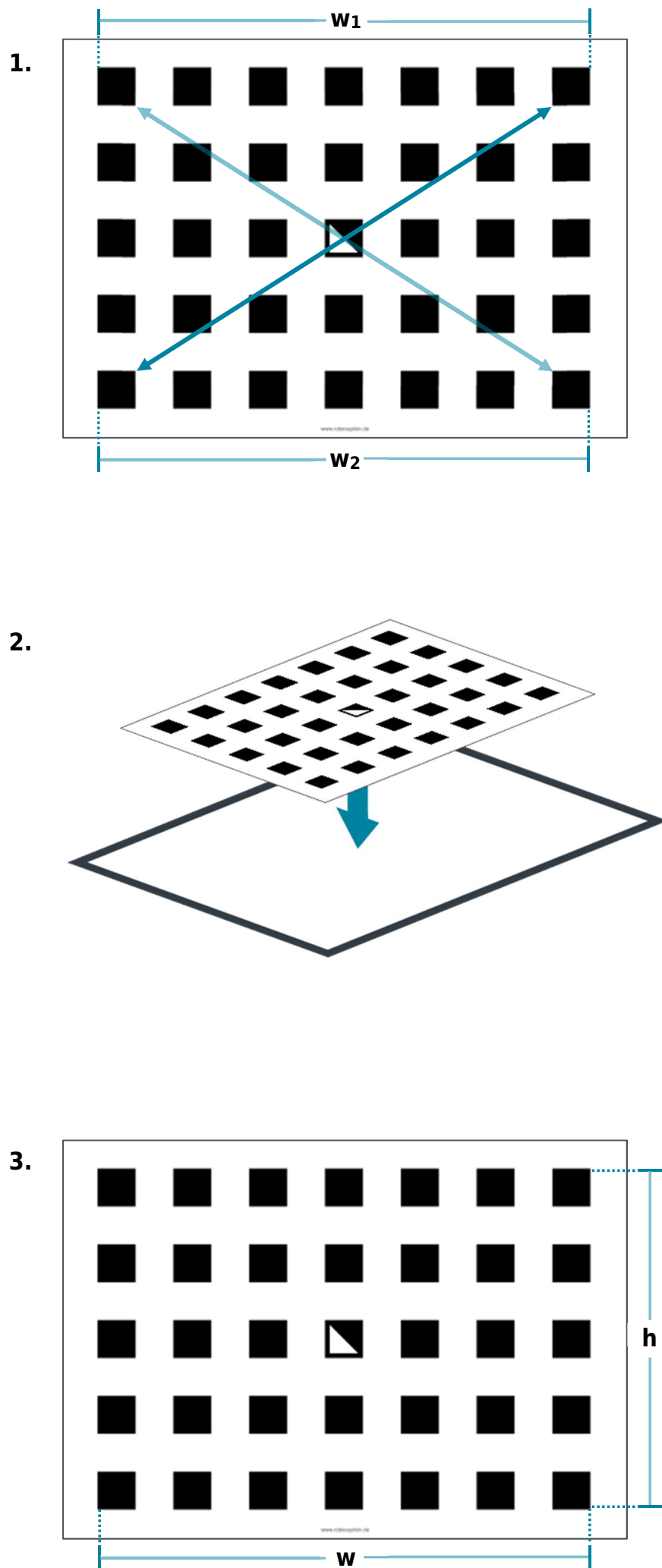


Creation of a Calibration Grid



Calibration is necessary for using cameras as measuring devices. Roboception sensors are always factory pre-calibrated, but there are situations where calibration is still necessary, e.g. to determine the transformation between a sensor and a robot by hand-eye calibration. Calibration works by taking images of a precisely known structure, i.e. a calibration grid, and measuring its appearance in the images. The following steps explain the creation of such a calibration grid:

1. Print out the calibration grid on the next page, if possible in A3. Printing in A4 is acceptable for hand-eye calibration. Highest accuracy can be achieved by plotting the grid. Special care has to be taken when using laser printers as they can deform the printable area in the direction of movement. Typically, that leads to trapezoidal or parallelogram-shaped deformations. To verify if the printout suffers from a parallelogram-shaped deformation, the diagonals of the grid can be measured and compared. To verify if the printout is deformed to a trapezoid, the length of the grid w_1 and w_2 can be measured on both sides. The grid is acceptable if the difference is below 0.5 mm, in both cases. The grid must **not** be used if the difference is higher!
2. It is also important to stick the grid onto a **very** flat surface. The easiest way to do this is by using a picture frame in the size of the printed grid. The grid must **not** be put behind the glass as reflections on the glass may distract grid detection. Instead, the grid should be glued onto the glass using an even, thin layer of glue, e.g. with adhesive spray. Thus, the glass is not used to protect the grid, but just to ensure that it is flat. Make sure that there are **no** bumps in the paper! Even a bump of just one millimeter already degrades calibration accuracy.
3. The last step is to measure the width and height of the grid as shown in picture 3. It should be measured as accurately as possible, i.e. sub-millimeter. These values are necessary for the calibration program.

It is important to strictly follow all steps as described above. Otherwise, calibration verification will show a higher error as quality will be degraded.

