

**Technical note T138: CCI step height verification**

CCI – step height standards

# Step height verification and correlation

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*“Internationally traceable artifacts are essential requirements for verification of system performance.”*

Jon Leeman, Head of Taylor Hobson UKAS Laboratory

## Introduction

Step height standards, also known as 3 line standards, are an accurate way of testing an instrument’s capability to measure vertical distance. They are an industry standard and can be used to show correlation between instruments. Accurate height measurements are an integral part of all non-contact measurements and are regularly used to define system capabilities.

## Step height applications

Step height measurements are used to verify the height/depth of grooves and ridges in applications such as electronic circuit boards, etching and coatings

## International traceability

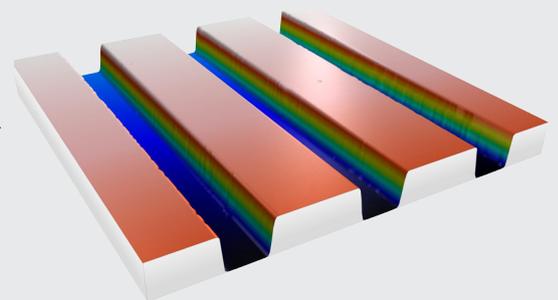
Step height standards can be calibrated using contact measurement techniques at the Taylor Hobson UKAS accredited laboratory, to provide them with internationally recognised traceability. These certified artefacts can then be measured using non-contact measurement techniques on CCI instruments to show both accuracy and correlation to traceable artefacts and contact measurement techniques.

## Software verification function

Talysurf CCI has a built in verification function for showing correlation to calibrated step height standards. The ‘Z Verification’ button is located in the calibration menu and can be used at the end of a calibration routine. Simply enter the calibrated value and follow the setup information.

## Taylor Hobson correlation studies

A UKAS certificate of calibration issued by Taylor Hobson’s accredited laboratory provides international traceability. The UKAS calibration measurements for step height standards are carried out on a Taylor Hobson Form Talysurf PGI 400 instrument. A calibrated step height standard was measured 300 times on a CCI instrument as a part of a correlation study, the results for which are shown in Table 1 below.



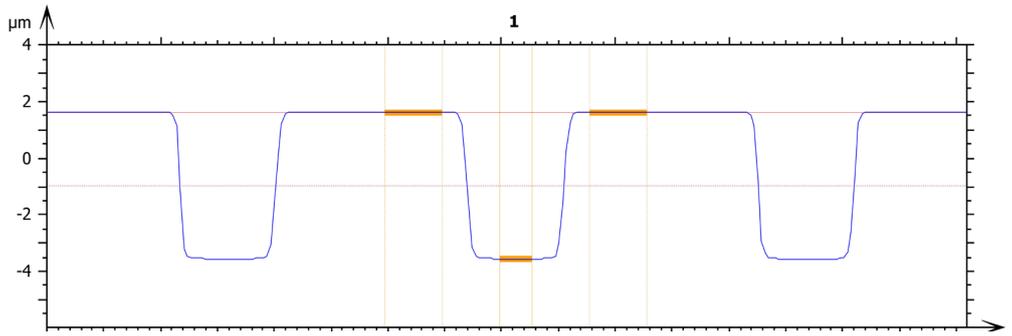
**Table 1: Results of UKAS calibration and CCI correlation study**

Measurement	UKAS Certified	300 CCI measurements – mean	300 CCI measurements – standard deviation
Mean depth	5.176 µm ± 0.029 µm	5.177 µm	0.0006 µm

## 2D step height analysis

The CCI results were analysed using TalyMap software to extract a series of 2D traces across the step, which allows for the data to be analysed in accordance to ISO 5436-1:2000, as per the UKAS calibration measurements. An example of this type of analysis is shown in figure 2.

Fig. 2: Example of 2D step height analysis using ISO 5436-1 method

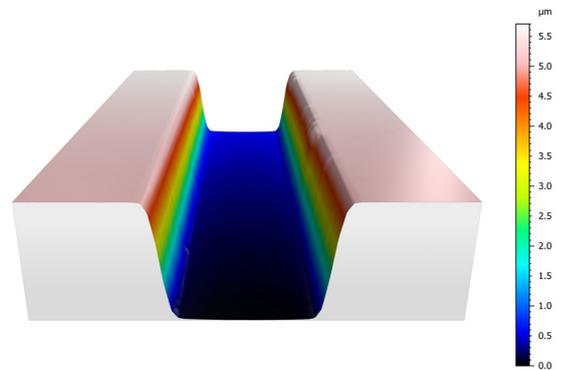
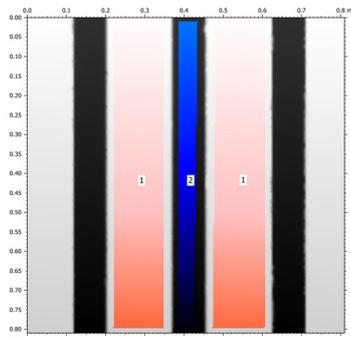


Parameters	Step 1	Unit
Mean depth	5.178	µm

## 3D step height analysis

TalyMap software also facilitates 3D step height analysis for surfaces, which allows for additional features to be measured. Using this type of analysis the angle between the two surfaces can be determined as well as the average, minimum and maximum height differences. Figure 3 shows an example of a step height analysis between two user defined surfaces.

Fig. 3: 3D step height analysis



Differential parameters	Value	Unit
Zmean(2) - Zmean(1)	-5.175	µm
Angle difference	0.011	°

## Conclusion

The study shown, as well as others carried out by Taylor Hobson, show that the CCI series demonstrate exceptional correlation to internationally traceable, step height standards. Their advanced 3D capabilities allow for further analysis of the individual surfaces and their relative alignment. Talysurf CCI software includes a verification function for a quick check for accuracy and correlation to traceable artefacts.



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