BaSyTec Battery Test Systems	App note Accuracy and Calibration of BaSyTec products	Abteilung: GF Bearbeiter: Groiß Erstellt: 16.02.2024 Aktualisiert:

How to specify accuracy?

Some competitors specify accuracies much better than ours.

When I asked one how they can prove that he told me that they use a transducer with that specification.

Of course **that is not the accuracy you may trust** – that is, the value you measure is within the limits of that accuracy. Because every other element of the measurement chain will also add an error the total error is much bigger that the one of a single element.

Errors in the measurement chain may be caused by:

- Voltage drops
- Temperature effects on resistors
- Temperature effects on Seebeck voltages
- Common mode errors (check the reference potentials)
- Analog digital converter errors
- Reference voltage errors
- Other errors
- Other failures and defects

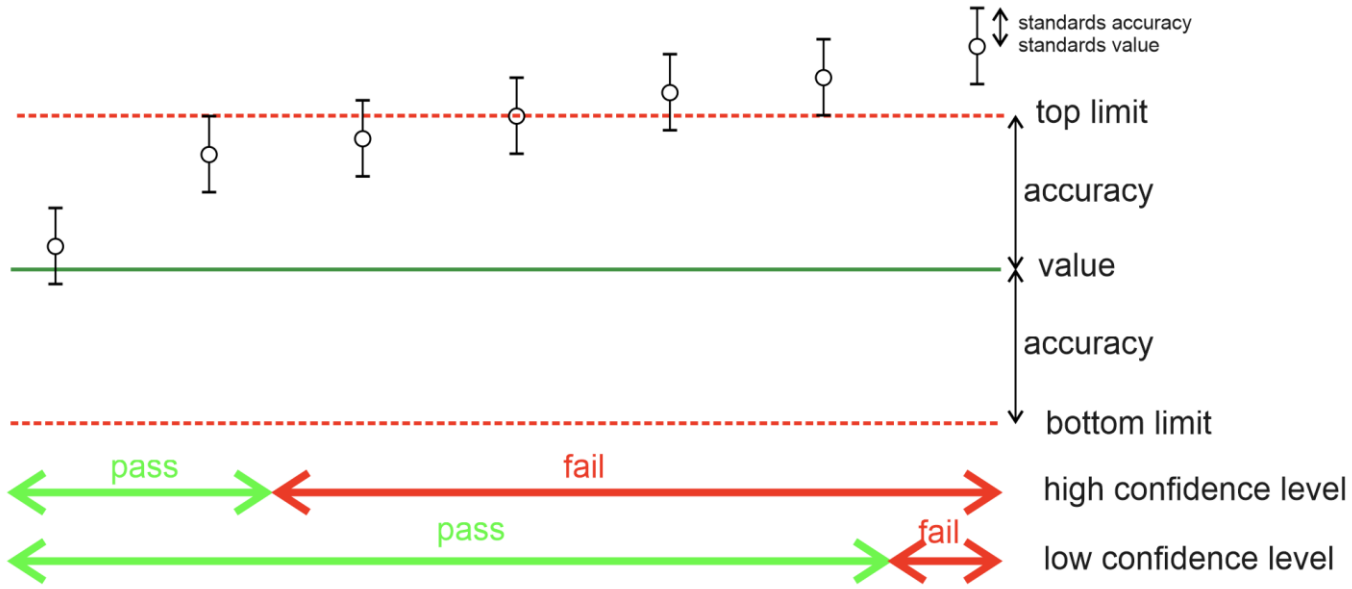
To check the actual error of a DUT (device unter test) (e.g. a voltage input) you have to calibrate it.

Calibration means that you compare the DUT to a standard. So, you require a **standard**.

Unfortunately no standard is perfect, every standard does also have an error which should be within its specified accuracy.

For most certified calibrations (like the german DAkkS) for the error / accuracy of the calibration the expanded uncertainity (= high confidence level) is used. That means that the probability that the actual value is within the limits is 95%. Or, in other words, the probability that **the error is less than the accuracy** is 95%.

Many countries including Germany do have master standards called national standards. In Germany the Physikalisch-Technische Bundesanstalt PTB, the German National Metrology Institute, is responsible from them. All other standards must be derived from them (or others, for example the French or British ones). Of course, the accuracy of a standard decreases (=gets bigger in value) with every derivation. Each of these derivations also is a calibration.



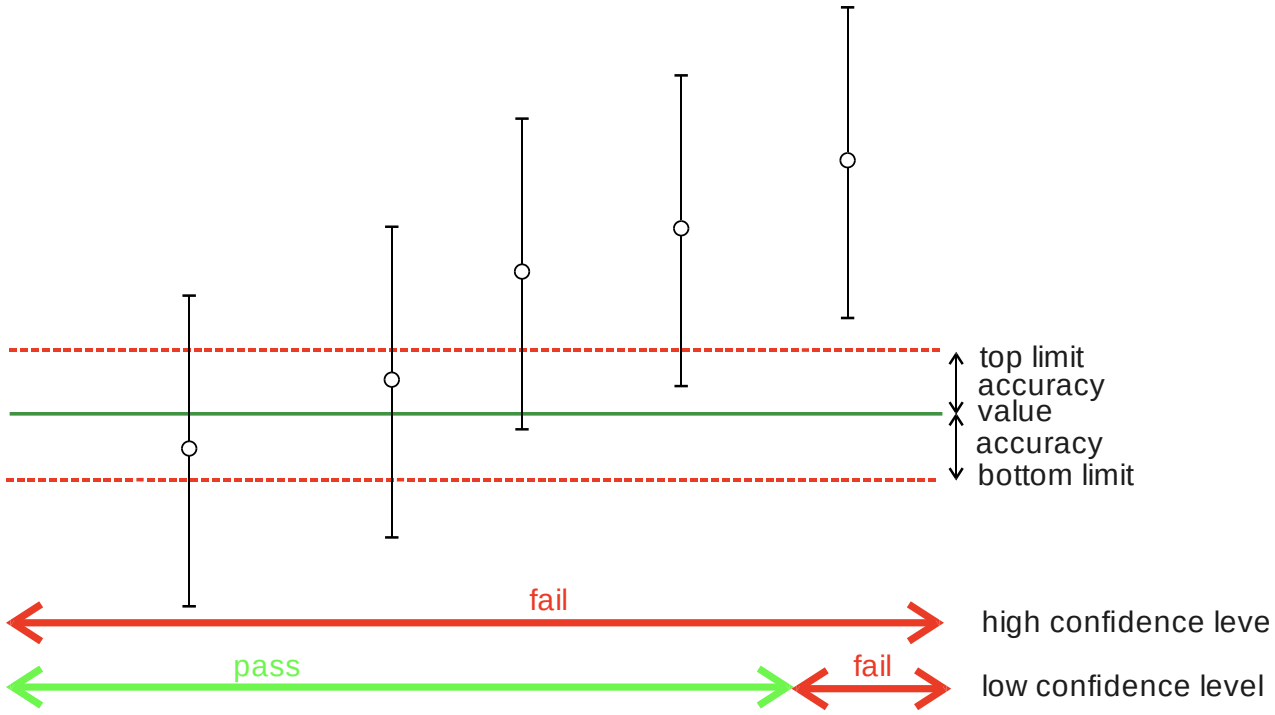
BaSyTec standards and most BaSyTec measurements are calibrated at high confidence level. That means that the prove decision of the conformity assessment is in the way that the error of the DUT is within its accuracy at 95% probability. So, if the DUT has passed the calibration there is only 5% probability that its error is beyond its accuracy.

For that, the actual error of the DUT needs to be less than the accuracy minus the accuracy of the standard. So, actually, the worse the accuracy of the standard the better the actual error of the DUT has to be. And if the accuracy of the standard is worse than that of the DUT it is impossible to pass the calibration.

Therefore, the low confidence level has been created. It won't tell you for sure that the DUT is within ist accuracy, it's just 50% sure or even less. Or, in other words, „it's possible".

The ISO/IEC 17025:2018 standard covers both, the low and the high confidence level. So, altough a calibration follows ISO/IEC 17025:2018 it may only use the low confidence level.

Imagine the accuracy of the standard is extremely poor:



So, for low confidence level, if only the accuracy of the **standard is declared bad** enough the calibration **will always pass**!!!

BaSyTec does only calibrate Pt100 2 wire inputs with low confidence level. That's because the error caused by the cable resistance is to large. As that error adds both to the standards and the DUTs error and that error can't be avoided the calibration won't work otherwise. Since 2004 all our Pt100 inputs are 4 wire ones, so that problem is only for hardware more than 20 years old today.

We did spend a big effort to get our current measurement standards at < 100ppm accuracy. Keep in mind that that is not only the error of the shunt or transducer but the total error of the complete chain. At constant temperature (we do allow +/-5°C today) < 50ppm could be possible but that is not practical.

So, if anybody does offer 0.1% current accuracy or less that's not possible in the way we do define accuracy, which is at high confidence level, calibrated according to ISO/IEC 17025 traceable to national standards and at +/-5°C.