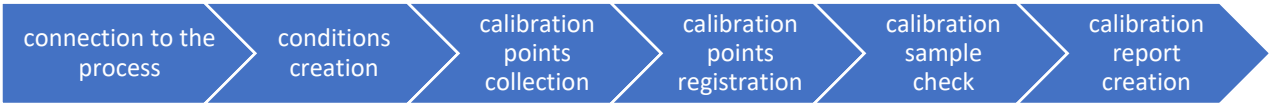
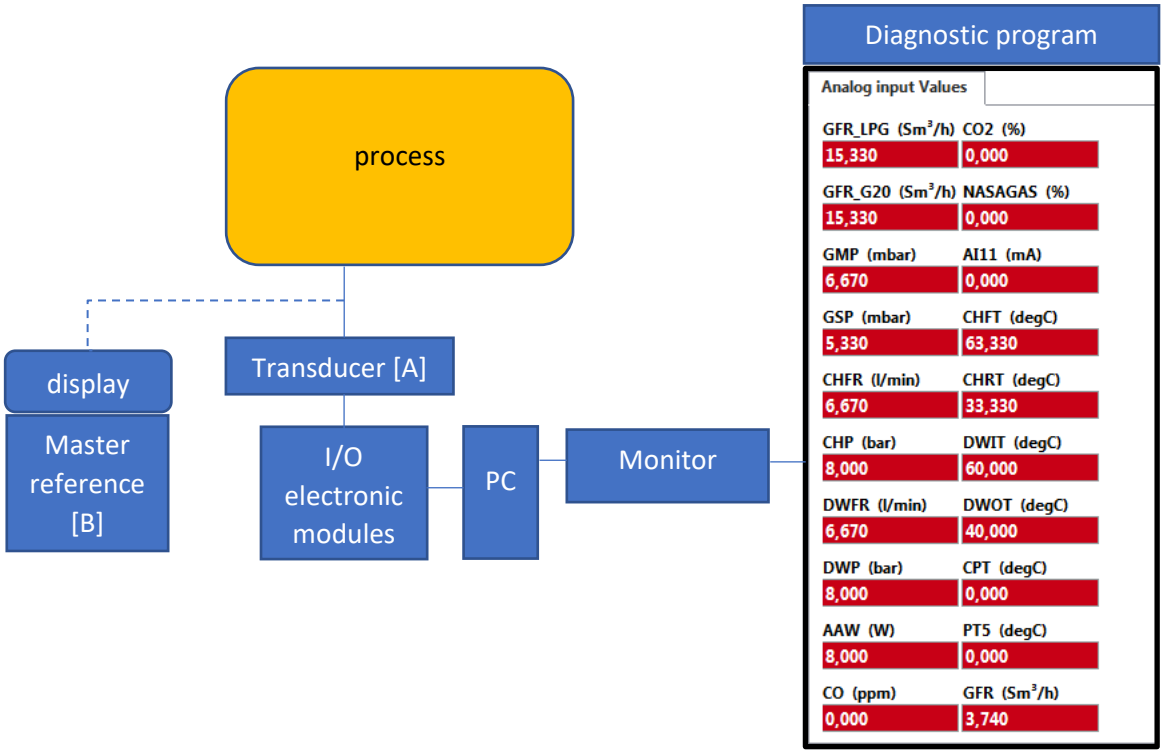
What is the procedure to execute a calibration?

Calibration consists in comparing the measure of a transducer [A], installed in a test bench, against a master reference measuring instrument [B] and to correct the settings of the first so to match with the second.
This is a recommended periodic good practise to ensure the test bench accurate, reliable and trustful measuring process throughout the years.

To do so you should execute the following activities:



1. Connect the master instrument [B] to the process, for instance to the water circuit where the transducer [A] is installed; only temperature probes, like PT100 and TC, need to be removed from the process for the calibration operations and inserted into the master calibration oven together with a master temperature probe. Flue gas analysers are usually calibrated against gas certified bottles.

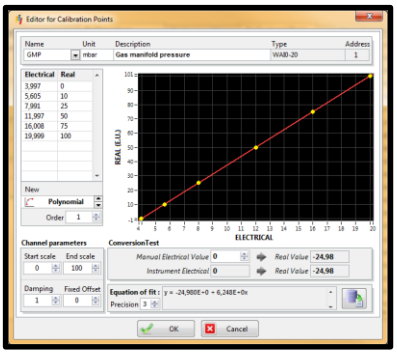


2. Produce the different conditions for the calibration, for instance different flow rates or different pressures, temperatures. Usually calibration covers 4 to 5 points regularly distributed within the measuring range of the transducer [A]. For example, when calibrating a pressure transducer with a full scale of 6 bar, it is adviced to calibrate the two end scale points, in this case 0 bar and 6 bar (better a little less, for instance 5.9 bar, to prevent false indication from transducer [A] possible drifts), and additional two or three intermediate points uniformly distibuted, for example 2 and 4 bar.

3. Once the desired steady state conditions are reached, for example the desired pressure, collect the measures of both master [B] from its display and the transducer [A] from the diagnostic program of the test bench, in the "electric" mode, which displays the output electrical value given by the transducer [A]. Let's make an example of a 0 – 100 mbar pressure transducer with a 4 – 20 mA output signal: produce levels of pressures of 0, 25, 50, 75, 100 mbar (check pressure on the display of master instrument) and for each level of pressure register the associated value displayed on the diagnostic program of the test bench. As a result you'll create a table like the following one:

mbar (from Master reference [B] display)	**mA** (from Diagnostic program of the test bench)
0	3.997
25	7.991
50	11.997
75	16.008
100	19.999

4. Register the values collected at point 3., for each calibrated transducers, into the calibration editor tool, usually Caled, which is included in the software of the test bench. Register the electrical values read by the transducer [A] in the column "Electrical", while in the column "Real" register the associated value read by the master [B]. A different procedure has to be followed in case of volumetric gas counter calibration as "Real" in that case means real gas flowrate measured by the master [B] while the column "Error" means the percentage of error at that flow rate.



5. A sample check is adviced to ensure the overall calibration process has been correctly executed. To do so repeat operations 1. and 2. for a few sample instruments, just for few sample conditions, better at different scales, for instance, again with reference to our 100 mbar pressure transducers, you could make a check at 30 and 60 mbar. Once the desired steady state conditions are reached cross check the reading displayed by the master [B] against the reading of transducer [A], this time in the "Real" mode of the diagnostic program. The two readings should be almost the same.

6. Issue a calibration report to show the measurement consistency and accuracy of the calibrated transducer [A]. Report should include values collected for the master instrument [B] and the correspondent values of the calibrated transducer [A] together with the deviation of this last against the first. Deviation must stay within the calibrated instrument characteristic precision, for instance 0.25%.

7. Once the editing and sample check operations are accomplished the calibration is concluded as transducer [A] has been set to read as master instrument [B] from that moment on until the next calibration.

The in-situ calibration process described here above ensures the entire measuring channel calibration, therefore the chain composed by transducer >> I/O electronic modules >> PC >> monitor, so that no uncertainties are left behind.

However customer can decide to get calibration done by an external metrology laboratory and ship transducers out for calibration; doing so the transducer itself will be returned calibrated, but the rest of the chain will not. In any case, once the calibration report issued by the metrology institute is received, customer must execute operations described at points 4. and 5. here above.