PRESSURE SOLUTIONS

C304: Automating Temperature Calibration (VK)

In practice, the only way to fully automate temperature calibration is with a dry-block calibrator.

Why Automate:
Heat flow is a lot like current flow. It is determined by the potential (temperature) difference and the resistance (conductivity). This means that when the temperature difference is small, the heat flow is small, and the time to change is long.

In practice, it can be observed that when the dry-block temperature reaches stability, the unit under test is still changing its reading.

Let us consider running a test with a Jofra ATC320A. For example, we are testing an RTD which is used over the range from ambient to 250ºC. We are going to do a 3 point test in one direction, at 50ºC, 150ºC and 250ºC.

Step 1: Ambient to 50°C

Heating Time to 50ºC	1 minute
Stability Time	10 minutes
Total Time for Step 1	11 minutes

Step 2: 50 to 150°C

Heating Time to 150ºC	3 minutes
Stability Time	10 minutes
Total Time for Step 2	13 minutes

Step 3: 150 to 250°C

Heating Time to 150ºC	4 minutes
Stability Time	10 minutes
Total Time for Step 3	14 minutes

Total Time for Sequence: 38 minutes. To that we have to add time to install and connect up the instrument under test, and record the readings. This is the simplest test procedure one can imagine, and it means that a technician is tied up for the best part of an hour, of which most is spent sitting waiting. If a bi-direction run is required, it gets worse:-

Step 4: 250 to 150°C

Cooling Time to 150ºC	10 minute
Stability Time	10 minutes
Total Time for Step 4	20 minutes

Step5: 150 to 50°C

Cooling Time to 50ºC	25 minutes
Stability Time	10 minutes
Total Time for Step 5	35 minutes

Accuracy versus Time:
It is obvious that the more accurate the device, the greater the time required. Greater stability generally requires greater thermal mass, which takes longer to change temperature. In addition, more accurate devices usually need more calibration points.

Calibration Software:
All Jofra temperature calibrators come with an RS232 port and the Jofracal software as part of the package. This package allows automated calibration procedures to be set up for electrical sensors, providing a compatible Jofra signal calibrator is used.

Location of Test:
For most calibrators, automatic calibration can only be done while connected to a PC. This limits calibration location to locations compatible with a PC or laptop.

The ATC type B are unique in that they do not require the presence of a host computer to carry out fully automatic calibrations on electrical sensors. The procedure, once defined, can be downloaded to the ATC-B, which can be taken away to the sensor location for the calibration job(s), then returned to the PC for uploading of results.

Stepping System Test:
There is another type of on-location automated test that most Jofra temperature calibrators can perform. The calibrator can be taken to the sensor location, and the sensor remains connected to the SCADA or DCS system. An automatic step series is programmed into the calibrator and executed automatically, and the results are recorded by the supervisory control system. At the conclusion of the test the sensor is refitted to the plant. This type of test has the advantage that we are comparing the final control reading with the reference reading, and any problems with the loop or system linearisation or scaling are exposed.

Summary:
Any Jofra calibrator can run under the control of a host computer running the Jofracal software supplied with the calibrator.
Electrical sensors, ie RTDs, thermocouples and transmitters, can be read automatically by the Jofra ASC300 signal calibrator, or directly by the ATC-B calibrators,.
Supervisory control systems can be used instead of the Jofracal software, where the calibrator takes the sensor through a predetermined step sequence, and the resulting signal is monitored by the control system.