Tradinco Instruments®

Calibration methods

TRADINCO INSTRUMENTS OFFERS THE BEST SOLUTION FOR TEST, MEASUREMENT, AND CALIBRATION CHALLENGES IN THE INDUSTRY.

✓ CALIBRATION SPECIALISTS ✓ CUSTOMER-ORIENTED ✓ LONG-TERM COOPERATION

Introduction

The calibration methods applied in the Tradinco Calibration Laboratory (TCL) are proprietary methods. During the development of these methods, generally accepted technical guidelines and references were used, such as international, regional, or national standards, publications from recognized technical organizations, relevant scientific literature, and manufacturer documentation.

The proprietary calibration methods of TCL have been validated and are applied only when demonstrably suitable for the intended use. Each method is described based on the functionality of the instrument to be calibrated, the associated measurement quantities, ranges, and required accuracies. Customer-specific methods are not performed — Tradinco applies its own validated methods. If a customer requests a specific method, the customer will be informed accordingly. Upon request, calibrations can be performed at specific measurement points. If Tradinco considers these measurement points unsuitable, the customer will also be informed. The types of calibrations are classified according to the Harmonised Classification Scheme code (HCS code), as listed in our scope K050 published by the Dutch Accreditation Council (RvA).

All calibrations at Tradinco follow the process steps outlined below:

- Preparation in our specialized workshop. Each instrument to be calibrated must be in good condition;
- Acclimatization for 4 hours, or 12 hours for pressure balances (deadweight testers);
- Setup and preparation of the calibration;
- Measurement of the instrument as received (“As found calibration”) and digital recording using our calibration software;
- Adjustment, if applicable (see chapter 4), followed by remeasurement (“As left calibration”);
- Labeling of the instrument with a calibration label;
- Verification of the completed work and release of the instrument.

Specific additions apply for each measurement quantity. If no specific measurement points are specified by the customer in the request, the measurement points defined in our calibration method will be applied. The number of measurement points is distributed as evenly as possible across the entire measurement range to ensure that the results provide a representative reflection of the instrument’s performance.

Quantity	Calibration type	Performed under accreditation? (RvA-K050)	Accuracy	Number of measurement points	Standard/method	Test accuracy ratio (TAR value)
Pressure	Analog pressure gauge	yes	all class specifications	11 (6 up and 5 down)	TCL-PV-01	4:1
		no	≥ 0,2%	5 (3 up and 2 down)		4:1
			< 0,2%	11 (6 up and 5 down)		4:1
Pressure	Digital display units	yes	≥ 0.05%	11 (6 up and 5 down)		2:1
			< 0.05%	21 (11 up and 10 down)		2:1
		no	≥ 0,2%	5 (3 up and 2 down)		2:1
			< 0,2%	11 (6 up and 5 down)		2:1
Pressure	Transmitter P -> I	yes	all class specifications	9 (5 up and 4 down): 4/8/12/16/20mA		2:1
		no				4:1
Pressure	Barometric reference cell	yes	all class specifications	11 (6 up and 5 down)		2:1
		no				2:1
Pressure	Deadweight tester cross float	yes	all class specifications	minimum 8 per piston	TCL-PV-02	1:1
Electrical signals	Digital multimeters	yes	all class specifications	minimum 3 (depending on the linearity determination)	TCL-DC/LF-01	4:1
		no				4:1
Temperature	Dry block ovens	yes	all class specifications	9 (5 up and 4 down)	TCL-TE-01	4:1
		no		min. 5 ascending only		
Temperature	Semi-electric temperature simulation	yes	all class specifications	min. 3 (depending on linearity/measuring range)	TCL-TE-02	4:1
		no				

Tradinco Instruments | Radonstraat 250 | 2718 TB | Zoetermeer | The Netherlands
+31 792033130 | sales@tradinco.com | www.tradinco.com

Content

1. Pressure & vacuum
   - Method TCL-PV-01
     Analogue pressure gauges and digital pressure gauges
   - Method TCL-PV-02
     Pressure balances (deadweight testers)

2. Electrical quantities
   - Method TCL-DC/LF-01
     Digital multimeters
   - Method TCL-DC/LF-02
     Electrical safety tests (NEN 3140)

3. Temperature
   - Method TCL-TE-01
     Dry-block calibrators (dry block ovens)
   - Method TCL-TE-02
     Semi-electrical temperature simulators

4. Adjustment of measuring equipment

5. Expire dates, intervals and conformity

1. Pressure & vacuum

For the measurement quantity pressure, a distinction is made between analog and digital pressure measuring instruments with an elastic sensing element, and pressure balances (deadweight testers). The general guidelines are derived from standardization and include terminology (e.g., VIM, ISO/IEC 80000), guidelines for determining measurement uncertainty (EA-4/02), and requirements for the content of calibration certificates according to ISO/IEC 17025.

1.1 Method TCL-PV-01

For pressure gauges with an elastic measuring element, the main reference standard is DIN EN 837-1:1997, although parts may also be derived from the OIML Recommendation R 53 and the Euramet Calibration Guide No. 17.
For analog manometers, the gauge is not tapped during the measurement for reading. Analog and digital pressure measuring instruments with an elastic measuring element are calibrated using our pressure balances or digital pressure controller by means of a comparative measurement. The zero point of a measurement is taken after the device under test has been set to zero according to the manufacturer's prescribed procedure. Atmospheric pressure is used as the reference for the zero point in relative pressure measurements. The calibration of absolute pressure measuring instruments with an elastic measuring element is carried out using a digital absolute pressure gauge, which may be combined with a pressure balance. The overpressure portion of the total pressure is measured with a pressure balance, while the atmospheric pressure is measured with the absolute pressure gauge. The sum of both values gives the total pressure.
The instrument to be calibrated is measured using a comparative method at increasing and decreasing pressure. The number of measurement points depends on the accuracy specification of the instrument to be calibrated. A minimum of 21 measurement points (11 increasing and 10 decreasing) is used. The number of measurement points is reduced to 11 (6 increasing and 5 decreasing) if the instrument to be calibrated has a factory accuracy greater than or equal to 0.05%. Exceptions to this are barometric reference cells and P/I transmitters. Barometric reference cells generally have a small range and are primarily intended to display the barometric pressure, which is why they are measured at 11 (6 increasing and 5 decreasing) measurement points. P/I transmitters are typically used in industry at 4 mA, 8 mA, 12 mA, 16 mA and 20 mA, and are therefore measured at five increasing and four decreasing points. The electrical output signals are measured with an accredited and calibrated multimeter reference standard.
For non-accredited calibrations, the total number of measurement points is 11 (6 increasing and 5 decreasing), and this may be reduced to 5 (3 increasing and 2 decreasing) if the instrument to be calibrated has a factory accuracy greater than or equal to 0.2%. The determination of corrections is performed in the calibration software, and the recorded values are included on the certificate.

1.2 Method TCL-PV-02

Pressure balances are calibrated according to the "cross-floating" procedure as described in Euramet CG-3. The number of measurement points used when calibrating a pressure balance is at least eight. The measurement points are selected in such a way that all weights of the pressure balance being calibrated are included in the measurement at least once. For pressure balances with two pistons, and therefore two measuring ranges, the number of measurement points per range is also at least eight. The measurement points are distributed as evenly as possible over the entire measuring range. The weights of the deadweight tester must be clearly marked; if this is not the case, a marking will be applied after consultation with the customer.

Tradinco Instruments | Radonstraat 250 | 2718 TB | Zoetermeer | The Netherlands
+31 792033130 | sales@tradinco.com | www.tradinco.com

2. Electrical quantities

2.1 Method TCL-DC/LF-01

Electrical calibrations are performed for the quantities AC and DC voltage, AC and DC current, resistance, and frequency. These quantities apply both to generation and to measurement. The execution of electrical calibrations follows a validated procedure based on the prescribed guidelines of "EURAMET cg-15: Guidelines on the Calibration of Digital Multimeters." Using calibration software, the number of measurement points is selected in such a way that the linearity of the measured range can be determined. A validated protocol is followed in which each step is recorded through a comparative measurement using our accredited and calibrated 8.5-digit electrical multimeter for measurement and the multiproduct calibrator for generation.

2.2 Method TCL-DC/LF-02

Electrical safety tests can be performed at the customer's request. Electrical measuring instruments are designed, constructed, installed, maintained, and identified in such a way that the safe use of electricity is ensured as effectively as possible. To this end, the necessary provisions and protective measures have been implemented. The purpose of our electrical safety tests is to detect defects that could hinder safe operation. Our qualified technicians perform these tests in accordance with the latest NEN 3140+A3 standard, conducting a visual inspection, an inspection through measurement and testing, and a functional test, the results of which are recorded on a certificate.

3. Temperature

In temperature calibrations, a distinction is made between (semi-)electrical temperature calibrations and dry-block temperature calibrations. The results of these calibrations are traceable to the International Temperature Scale of 1990 (ITS-90).

3.1 Method TCL-TE-01

The calibration of the dry-block calibrator is carried out according to an internal method derived from the guidelines in EURAMET cg-13: Guidelines on the Calibration of Temperature Block Calibrators. Prior to calibration, the axial temperature gradient and the stability of the dry-block calibrator are determined. The calibration is performed using a platinum resistance thermometer (PRT), which is inserted to the bottom of the insert.
Measurements are taken at a minimum of five increasing and four decreasing temperature points, evenly distributed across the entire temperature range of the dry-block calibrator. The lowest achievable temperature is used as the first measurement point, and the highest temperature as the final ascending measurement point.

3.2 Method TCL-TE-02

The (semi-)electrical calibrations are performed in accordance with the guidelines of the EURAMET CG-15 guide. These calibrations involve comparative electrical measurements, in which voltage and resistance are simulated using the accredited and calibrated multimeter reference standard. The conversion of these electrical quantities into temperature is carried out using reference tables that are traceable to international IEC standards.

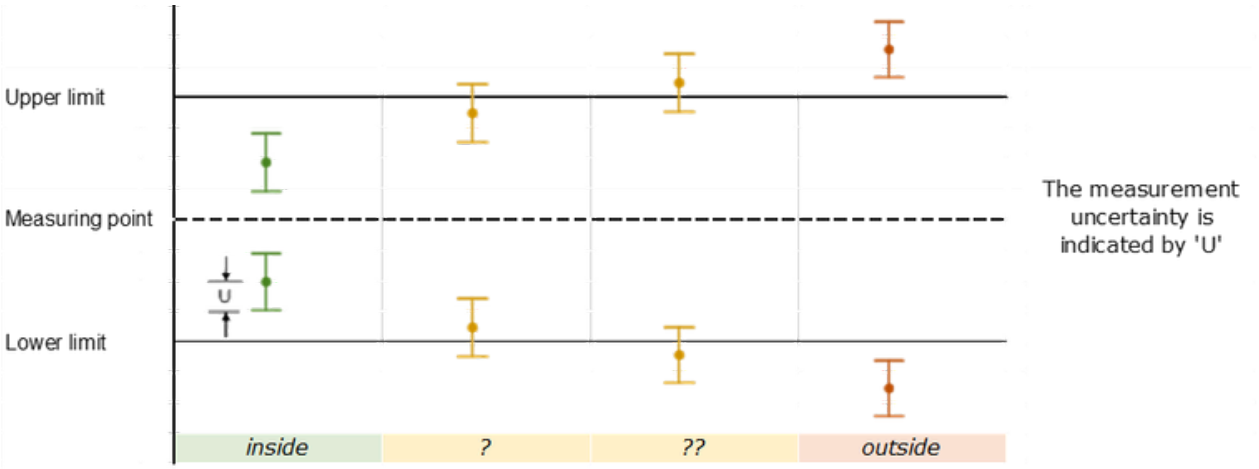
- NEN-EN-IEC 60584-1
- NEN-EN-IEC 60584-3
- NEN-EN-IEC 60751

When simulating resistance elements (RTDs), a two-, three-, or four-wire connection is used, depending on the instrument to be tested and/or the measurement principle. When simulating thermocouples (TCs), the cold junction compensation in the instrument under test is disabled and set by default to 0°C. The connection method for a thermocouple measurement may vary depending on the instrument being tested.
The cold junction compensation is checked separately by simulating a set temperature on the reference generator using a thermocouple cable of the corresponding type.

4. Adjustment of the measuring equipment

Adjustment means that the measuring instrument is readjusted so that it measures as accurately as possible within the specified accuracy limits. Specific instruments, expertise, and often software are required to perform adjustments. At Tradinco, adjustment is often possible (provided it falls within our technical competencies) and is carried out when authorization to do so has been received from the customer.

The measuring instrument is adjusted if, during calibration, it is found to be outside its accuracy specifications. In doing so, either the manufacturer's accuracy specifications of the instrument or the accuracy specifications provided by the customer are applied. The following section outlines when adjustment is performed:



		To adjust
inside	The measuring point including the uncertainty is within specifications	no
?	The measurement point is within specification, but the measurement point including the uncertainty may be outside specifications	yes
??	The measurement point is out of specification, but the measurement point including the uncertainty may be within specifications	yes
outside	The measuring point including the uncertainty is outside specifications	yes

After an adjustment has been performed, a second calibration is always carried out. The customer receives two calibration certificates: one before adjustment (as found) and one after adjustment (as left). The same measurement points are used, except in the case of a dry-block calibrator, where the pre-adjustment measurement includes only the ascending sequence. If, during the initial calibration, it is found that the deviations exceed the specified tolerances, the instrument is adjusted. The determined deviation then applies to all measurements that were previously performed with that instrument. Before proceeding with an adjustment, the customer is informed, unless prior approval has already been given in the order. All measurement data, both before and after adjustment, are recorded and retained.

Tradinco Instruments | Radonstraat 250 | 2718 TB | Zoetermeer | The Netherlands
+31 792033130 | sales@tradinco.com | www.tradinco.com

5. Expiry dates, intervals and conformity

Calibration certificates do not contain any opinions or interpretations regarding the calibration performed. The certificates only include the measured values and the associated measurement uncertainties.

Only at the explicit request of the customer can an expiry date or an annex containing opinions or interpretations related to the calibration be added to the certificate. The responsibility for determining recalibration intervals lies with the customer, unless otherwise agreed.

Tradinco does not issue statements of conformity regarding specifications or standards (such as "approved/rejected" or "within/outside tolerances") based on the performed calibrations. The reported results are presented solely as measured values with their associated measurement uncertainty, without evaluation against predefined specifications.
If a customer explicitly requests a conformity statement, Tradinco will only consider this if the relevant specification or standard, as well as the decision rule to be applied, have been clearly defined, communicated, and agreed upon in writing with the customer, in accordance with ISO/IEC 17025, paragraph 7.1.3.

For the regular activities of the Tradinco Calibration Laboratory (TCL), no conformity statements are issued.