Calibration Protocol

We would like to inform you about the calibration services provided by TPF Control for service orders submitted to us. These services are performed under ISO/IEC 17025:2017 accreditation, in accordance with our published scope of accreditation (K-149) as recognized by the Dutch Accreditation Council (RvA).

When you send an instrument to TPF Control for calibration, the following services will be carried out:

1. **As-Found comparisons**
2. **Service and repair (if applicable)**
3. **As-Left (post-service) comparisons**
4. **Traceable calibration certificates**
5. **Application of the latest scope-related uncertainty values**

What it all means;

1. As-Found and As-Left comparisons

These are comparisons between the measurements from your instrument and our accredited laboratory standards.

- **As-Found**: Conducted upon receipt of the instrument
- **As-Left**: Conducted just prior to return shipment

As an ISO/IEC 17025:2017 accredited laboratory, TPF Control adheres to the ISO Guide to the Expression of Uncertainty in Measurement (GUM). All calibrations are performed by qualified personnel using validated methods under controlled conditions. Results are documented in the certificate as:

- Calibration results; As-Found (pre-service)
- Calibration results after adjustment; As-Left (post-service)

It is important to clarify that calibration is not the same as adjustment. Calibration is the comparison of the value displayed by the Device Under Test (DUT) with the corresponding value from a higher-level standard. Adjustment, if required, is a separate process.

For standard calibration points, methods, manufacturer tolerances, and conformity criteria, please refer to **Annex A**. These may vary depending on the make and model of your device.

Note: If adjustment is *not* required even when the As-Found results fall outside manufacturer tolerances please specify this clearly when placing your service order.

2. Calibration method (Lab and on-site)

The calibration methods employed by TPF Control are validated and accredited by the Dutch Accreditation Council (RvA). By default, flow devices, with the exception of flow calibrators, are calibrated in a serial connection setup using working standards. This approach is intended to protect reference standards from potential contamination but results in slightly higher measurement uncertainty. Upon request, flow devices can be calibrated directly using reference standards for improved accuracy.

Flow calibrators are calibrated using a parallel connection setup with references standards to ensure precise measurement.

Temperature, pressure, and humidity instruments are calibrated using references standards via comparison methods, ensuring traceability and accuracy in line with our accredited procedures.

3. Service and repair

If necessary and applicable, your product will be disassembled to its core components for a thorough inspection. Each part is examined for signs of wear, defects, contamination, or damage, and is cleaned, repaired, or replaced as needed. Where applicable, we also upgrade hardware components that have been improved since your product was last purchased or serviced.

Once reassembled, the product undergoes its calibration after adjustment. Should it fail any part of this test, the unit will be disassembled again, and the maintenance process will continue until it successfully meets all calibration criteria..

4. Recertification warranty

We provide a 90-day warranty on our service, labor, and any parts replaced, effective from the date of the most recent recertification. This warranty applies provided the product has been operated under normal conditions and the failure is directly attributable to the work performed or components installed during that recertification.

Terms and conditions

1. **Delivery time:**
   Delivery time of calibration will be one max 14 days unless stated otherwise in the order acknowledgement.
   The calibration certificate will be shipped together with the instrument(s).

2. **Pricing:**
   Pricing of calibration is through our standard pricelist which is available on request.
   Pricing of non standard items on request.

3. **Due date on certificate or calibration label**
   If an expiration date is indicated on the calibration certificate or label, it should *not* be interpreted as a guarantee of measurement validity for the entire stated period. The calibration results are valid only for the conditions and time at which the calibration was performed.

4. Customer supplied information on certificates

TPF Control is responsible for the calibration results, reported measurement uncertainty, metrological traceability, conformity statements where applicable, and all technical information generated by the laboratory. Certain information included on a calibration certificate may be supplied by the customer. This may include, but is not limited to, instrument identification, tag number, asset number, location, requested calibration points, manufacturer tolerance, calibration interval or requested calibration due date.

Where customer supplied information is included on the calibration certificate, it shall be identifiable as customer supplied information where relevant. TPF Control does not take responsibility for the correctness, completeness or suitability of information supplied by the customer. If a calibration due date or calibration interval is stated on the certificate or calibration label based on customer supplied information, it shall not be interpreted as a guarantee of measurement validity for the stated period. The calibration results are valid only for the conditions and time at which the calibration was performed. Customer supplied information is used only for identification, reporting, order handling or agreed calibration requirements, unless otherwise defined in the management system or agreed with the customer.

Statement of conformity - Binary decision rule explanation:

On the calibration certificate of MesaLabs dataloggers a statement of conformity is mentioned. It's shown as pass or fail.

We apply a binary decision rule defined as follows;

1. Error (E) (DUT value – Reference value)
2. Tolerance (T) (manufacturer specification)
3. Measurement Uncertainty (MU)
4. Guardband value (GV) depending on the Norm Specification of the logger.
   The GV = Instrument specification – calibration specification.

Decision Rule: E + GV < T; Pass. If E + GV >= T; Fail

Explanation of the above for logger calibrations:

During the calibration process, an out-of-tolerance condition is determined by combining the Error (E) tolerance with a guardband value (GV).

The sum of the Error (E) and the guardband is less than the instrument tolerance specified on the certificate. This results in a Pass.

The sum of the Error (E) and the guardband is greater than the instrument tolerance specified on the certificate. This results in a Fail.

Example:

Temperature calibration of a M3P logger with norm specification Z:

Tolerance (Z) : -20 to +140 °C / ± 0.25 °C
Shipping (Z) : -20 to +140 °C / ± 0.10 °C

-> Results in a GV of 0.15 °C (0.25 °C – 0.1 °C); GV = 0.15 °C

DUT reading : 20.006 °C, Reference reading : 19.994 °C -> Error (DUT-REF) = 0.012 °C

Applying the decision rule : E + GV < T; 0.012 °C + 0.15 °C = 0.162 °C < 0.25 - Pass

For gas flow calibration, the statement of conformity with tolerance or specification is determined using a non-binary decision rule. This statement is based on a 95% coverage probability for the expanded measurement uncertainty and is valid only for the Device Under Test (DUT) at the tested calibration points. Here the Measurement uncertianty (MU) is the guardband value (GV).

1. Error (E) (DUT value – Reference value)
2. Tolerance (T) (manufacturer specification)
3. Measurement Uncertainty (MU)

The statement of conformity with tolerance / specification is reported as:

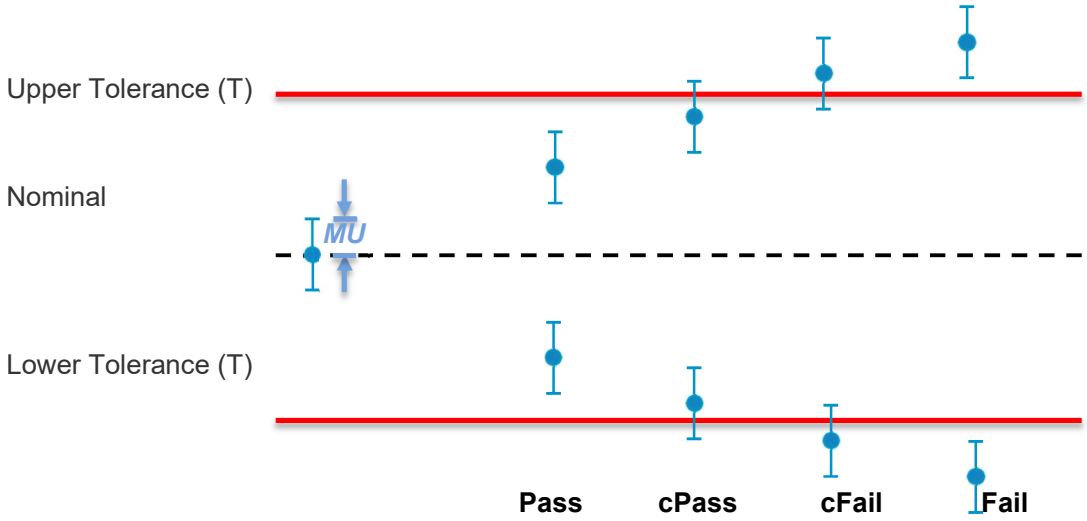
Pass The Error (E) and measurement uncertainty (MU) are below tolerance (T).

cPass The Error (E) is inside the tolerance (T), MU partly outside the tolerance (T)

cFail The Error (E) is outside the tolerance (T), MU partly inside the tolerance (T)

Fail The Error (E) and measurement uncertainty (MU) is outside the (T).

N/A Not Evaluated: Test Uncertainty Ratio is not sufficient (MU > T) to evaluate compliance with tolerances.



A statement is made on the calibration certificate referring to this calibration protocol document.

Annex A

1. Manufacturer tolerance, see datasheet of model on website of manufacturer .

2. Default calibration points and calibration method for:

Gas flow devices		
	Calibration points by default	**Calibration method**
Model	**Gas flow**	
VA meters	6 points to scale values	Serial / parallel
All other gas flow devices	As found: 50%, 100% of full scale flow and indication of 0%	Serial
	As left: 5%, 10%, 25%, 50%, 75%, 100% of full scale flow and indication of 0%	

MesaLabs DryCal Gas Flow calibrators

Flow units are specified as ccm (cubic centimeters per minute) and sccm (standard cubic centimeters per minute).

The term sccm refers to the standardized flow at 21.1°C and 101,325 Pa (standard atmospheric pressure).

Ambient conditions refer to the laboratory temperature and pressure at the time of calibration.

Gas flow calibration is performed using a parallel gas flow setup, while the calibration of pressure and temperature is carried out by comparison of the Device Under Test (DUT) with a reference standard.

For detailed calibration points, please refer to the next page.

MesaLabs - DryCal flow calibrators			
	Calibration points by default		
Model	**Gas flow**	**Pressure [mBar]**	**Temperature [°C]**
DC-2 base		Ambient	Ambient
DC-LC-1	30-100-300 ccm	-	-
DC-MC-1	10-2000-5000 ccm	-	-
DC-HC-1	500-5000-30000 ccm	-	-
DCL-L	30-100-500 ccm	-	-
DCL-ML	50-1000-2000 ccm	-	-
DCL-M	100-2000-7000 ccm	-	-
DCL-MH	200-5000-20000 ccm	-	-
DCL-H	500-5000-30000 ccm	-	-
Defender 510-L	30-100-500 ccm	-	-
Defender 510-M	100-1000-5000 ccm	-	-
Defender 510-H	300-5000-30000 ccm	-	-
Defender 520-L	30-100-500 ccm	Ambient	Ambient
Defender 520-M	100-1000-5000 ccm	Ambient	Ambient
Defender 520-H	300-5000-30000 ccm	Ambient	Ambient
Defender 530-L	30-100-500 ccm	Ambient	Ambient
Defender 530-M	100-1000-5000 ccm	Ambient	Ambient
Defender 530-H	300-5000-30000 ccm	Ambient	Ambient
Definer 220-L	30-100-500 sccm	Ambient	Ambient
Definer 220-M	100-1000-5000 sccm	Ambient	Ambient
Definer 220-H	300-5000-30000 sccm	Ambient	Ambient
Defender 530+ L	30-100-500 sccm	Ambient	Ambient
Defender 530+ M	100-1000-5000 sccm	Ambient	Ambient
Defender 530+ H	300-5000-30000 sccm	Ambient	Ambient
DryCal-500-10	15-90-500 sccm	800-825-850-875-900-925-950-975-1000-1025-1050	16,5-22,5-28,5
DryCal-500-24	50-500-5000 sccm	800-825-850-875-900-925-950-975-1000-1025-1050	16,5-22,5-28,5
DryCal-500-44	500-5000-50000 sccm	800-825-850-875-900-925-950-975-1000-1025-1050	16,5-22,5-28,5
DryCal-800 DCB		800-825-850-875-900-925-950-975-1000-1025-1050	
DryCal-800-3	6-20-40 sccm	0-5-10-20	16,5-22,5-28,5
DryCal-800-10	15-90-500 sccm	0-5-10-20	16,5-22,5-28,5
DryCal-800-24	50-500-5000 sccm	0-5-10-20	16,5-22,5-28,5
DryCal-800-44	500-5000-50000 sccm	0-5-10-20	16,5-22,5-28,5
DryCal-800-75	5000-50000-100000 sccm	0-5-10-20	16,5-22,5-28,5

MesaLabs - DryCal flow calibrators			
	Calibration points by default		
Model	**Gas flow**	**Pressure [mBar]**	**Temperature [°C]**
FlexCal - L	15-90-500 sccm	800-825-850-875-900-925-950-975-1000-1025-1050	16,5-22,5-28,5
FlexCal - M	50-500-5000 sccm	800-825-850-875-900-925-950-975-1000-1025-1050	16,5-22,5-28,5
FlexCal - H	500-5000-50000 sccm	800-825-850-875-900-925-950-975-1000-1025-1050	16,5-22,5-28,5
DryCal 1020	20-50-100-250-375-500 sccm	800-825-850-875-900-925-950-975-1000-1025-1050	16,5-22,5-28,5
DryCal 1500	50-150-375-750-1125-1500 sccm	800-825-850-875-900-925-950-975-1000-1025-1050	16,5-22,5-28,5

Mesalabs BGI gas flow calibrators.

The gas flow calibration is performed in a serial gas flow setup. The pressure and temperature calibration method is by comparison of the DUT to a reference standard.

MesaLabs - BGI gas flow calibrators			
Model	**Calibration points by default**		
	Gas flow	**Pressure [mBar]**	**Temperature [°C]**
Challanger 30	6-15-30 lpm		
Challanger 6	2-4-6 lpm		
DeltaCal 19.5	2-5-10-15-19 lpm	900-930-960-990-1020-1050	5-15-25-35
DeltaCal 20	2.5-5-10-15-20 lpm	900-930-960-990-1020-1050	5-15-25-35
DeltaCal 60	12-20-30-40-50 lpm	900-930-960-990-1020-1050	5-15-25-35
TretaCal 30	6-15-29 lpm		
TetraCal 6	1.2-3-5.5 lpm		
TetraCal 1.2	0.25-0.6-1 lpm		
TetraCal Ultra 6	2-4-6 lpm		
TetraCal Ultra 20	7-12-19.5 lpm		
TetraCal Ultra 60	21-40-58 lpm		
HiVolCal	400-600-900-1100-1500 lpm	900-930-960-990-1020-1050	5-15-25-35
HVC2	400-600-900-1100-1500 lpm	900-930-960-990-1020-1050	5-15-25-35

MesaLabs DataTrace loggers

The temperature, pressure and humidity calibration methods are by comparison of the DUT to a reference standard.

Conformity statement (Pass/Fail) is mentioned on all DataTrace calibration certificates. Unless otherwise agreed upon with the customer when placing the order, a conformity statement (pass/fail) will be mentioned on the certificate.

MesaLabs - DataTrace loggers			
Model	**Calibration points by default**		
	Temperature [°C]	**Pressure [psi]**	**Humiduty [%]**
M3T	-20,-10,0,10,20,30,40,50,60,70,		
	80,90,100,110,120,130,140		
M4T	-40,-20,0,20,40,60,80,100,120,140		
M4T with -80	-80,-40,-20,0,20,40,60,80,100,120,140		
M4T ET	-20,0,20,40,60,80,100,120,140,160,180,		
	200,220,240,260,280,300,320,340,380,		
	400		
M3P	10,20,30,40,50,60,70,80,90,100,110,	1,10,20,40,60,75 @ 25 °C	
	120,130,140	20,50 @ 120 °C	
		20,50 @ 135 °C	
M4P	-20,-10,0,10,20,30,40,50,60,	1,10,20,40,60,75 @ 25 °C	
	70,80,90,100,110,120,130,140	20,50 @ 120 °C	
		20,50 @ 135 °C	
M3H	0,10,20,30,40,50,60,70,80,85		0,20,25,30,40,50,60,70,80,90,95 @ 25 °C
			25,30,40,60,80,90,95 @ 55 °C
M4H	0,10,20,30,40,50,60,70,80,85		0,20,25,30,40,50,60,70,80,90,95 @ 25 °C
			25,30,40,60,80,90,95 @ 55 °C