

CALIBRATION CERTIFICATE # 21034

Calibration date : 2023-07-17

Certificate issued : 2023-07-17

Company name
Company address
City, Province, Canada**Calibration of**
Mass flow meter Micro Motion CMF050 S/N : ABCD4**QUALITY PROGRAM CONFORMANCE**

All calibrations are performed in accordance with Polycontrols Laboratory Quality Assurance Manual and conformed to ISO/IEC 17025: 2017, ISO 9001 – 2015 and/or other quality requirements defined in customers purchase descriptions. The results are strictly valid for the device under test or calibration. If applicable, the decision rule is described in the certificate.

TRACEABILITY

The traceability of mass flow is maintained through the fundamental units of mass (Kg) and time (sec) by gravimetric comparison. Mass and time are traceable to either the National Research Council Canada (NRC), the National Institute of Standards and Technology (NIST) or a calibration laboratory accredited and conformed to ISO/IEC 17025.

The Calibration Laboratory Assessment Service (CLAS) of the National Research Council of Canada (NRC) has assessed and certified specific calibration capabilities of this laboratory and traceability to the International System of Units (SI) or to standards acceptable to the CLAS program. This certificate of calibration is issued in accordance with the conditions of certification granted by CLAS and the conditions of accreditation granted by the Standards Council of Canada (SCC). Neither CLAS nor SCC guarantee the accuracy of individual calibrations by accredited laboratories.

CALIBRATION OF MEASURING AND TEST EQUIPMENT

For calibration measurement capability, please refer to the Canadian Calibration Network web page at the National Research Council of Canada. This laboratory is accredited by the Standards Council of Canada as part of the Calibration Laboratory Assessment Service (CLAS) program and is listed at nrc.canada.ca.

This document forms part of the Certificate of Accreditation issued by the Standards Council of Canada (SCC). The original version is available in the Directory of Accredited Laboratories on the SCC website at www.scc.ca.

CONDITION SUMMARY OF THE DEVICE UNDER TEST

Initial conditions	In good condition
Work done	Calibration of the instrument
Results	Initial readings in tolerance-conditional Final readings in tolerance
Remarks	

Olivier Duchesne Bamber
Metrologist

Laboratory Manager

Calibration certificate # 21034

Serial Number:	ABCD4	Test stand:	6
Indicator S/N:	123456	Procedure:	POS-CAL-102
Indicator Model:	2400S	Calibration Date:	2023-07-17
Instrument ID:		Decision rule:	Method #3

Standard equipment used for initial calibration

Description	Model	Serial #	Traceability	Due date
Gravimetric calibrator	6KG	GC-01	C2200211	2024-03-23
Gravimetric calibrator	12KG	GC-02	C2200212	2024-03-23
Gravimetric calibrator	42KG	GC-03	C2200213	2024-03-23
Frequency Counter	53220A	MY50000912	WO-00378128	2024-02-06

Initial specifications of the device under test

Calibration conditions

Fluid	Water	Fluid	Water
Operation temperature	20 °C	Ambient temperature	21.5 °C
Operation pressure		Ambient pressure	1011 mbar
Process fluid density	1000 kg/m ³ @ 4 °C	Calibration fluid density	1000 kg/m ³ @ 4 °C
Process fluid viscosity	1.004 cSt @ 20 °C	Calibration fluid viscosity	1.004 cSt @ 20 °C
Sensor Capacity	7500 PPH	Orientation	Horizontal
Span	0-5000 PPH		
Output Signal	0-10000 Hz		
Supply	24 VDC		
Accuracy	±0.1 %O.R. OR ±0.36 PPH		

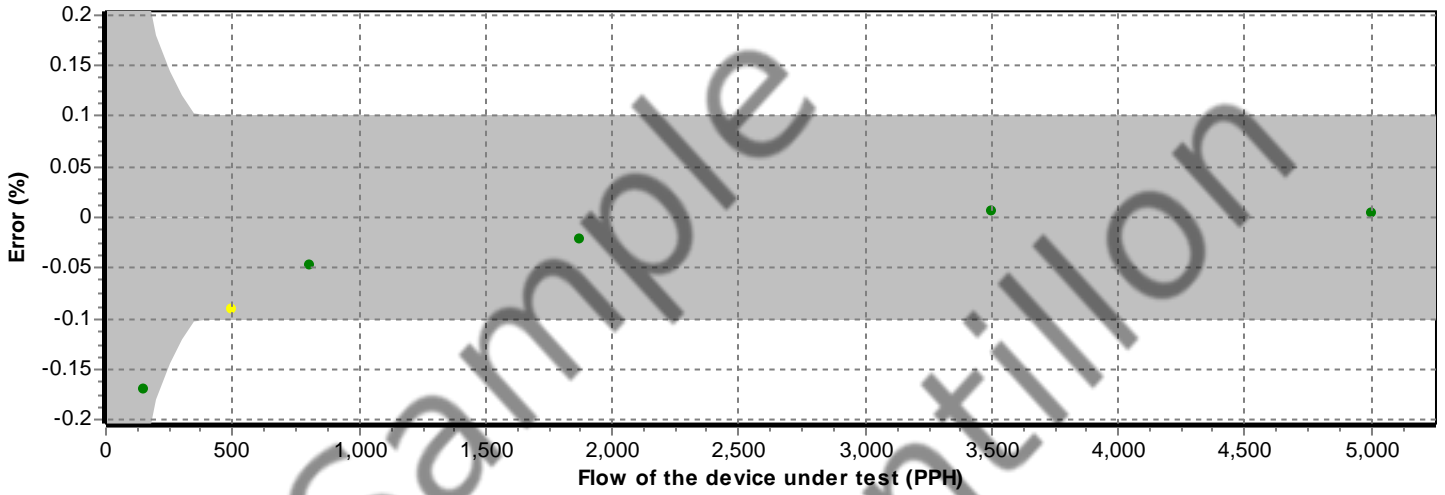
Initial readings

Device under test		Measured values		Calculated reference	Calculated error	Acceptable error	Uncertainty	TUR
Hz	PPH	Temperature °C	Reference Kg/min					
302.303	151.152	22.10	1.144636	151.409415	-0.257	0.360	0.030285	>4
998.268	499.134	22.10	3.776811	499.586545	-0.453	0.500	0.099924	>4
1609.778	804.889	22.09	6.087727	805.268386	-0.379	0.805	0.161065	>4
3748.318	1874.159	22.10	14.171581	1874.579160	-0.420	1.875	0.374941	>4
7006.463	3503.232	22.10	26.482613	3503.049831	0.182	3.503	0.700657	>4
10010.915	5005.458	22.08	37.839136	5005.260582	0.197	5.005	1.001119	>4

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Initial results



See the appendix for the guideline of decision rule

Calibration certificate # 21034

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Indicator Model:	2400S	Calibration Date:	2023-07-17
Instrument ID:		Decision rule:	Method #3

Standard equipment used for final calibration

Description	Model	Serial #	Traceability	Due date
Gravimetric calibrator	6KG	GC-01	C2200211	2024-03-23
Gravimetric calibrator	12KG	GC-02	C2200212	2024-03-23
Gravimetric calibrator	42KG	GC-03	C2200213	2024-03-23
Frequency Counter	53220A	MY50000912	WO-00378128	2024-02-06

Final specifications of the device under test

Calibration conditions

Fluid	Water	Fluid	Water
Operation temperature	20 °C	Ambient temperature	21.5 °C
Operation pressure		Ambient pressure	1011 mbar
Process fluid density	1000 kg/m ³ @ 4 °C	Calibration fluid density	1000 kg/m ³ @ 4 °C
Process fluid viscosity	1.004 cSt @ 20 °C	Calibration fluid viscosity	1.004 cSt @ 20 °C
Sensor Capacity	7500 PPH	Orientation	Horizontal
Span	0-5000 PPH		
Output Signal	0-10000 Hz		
Supply			
Accuracy	±0.1 %O.R. OR ±0.36 PPH		

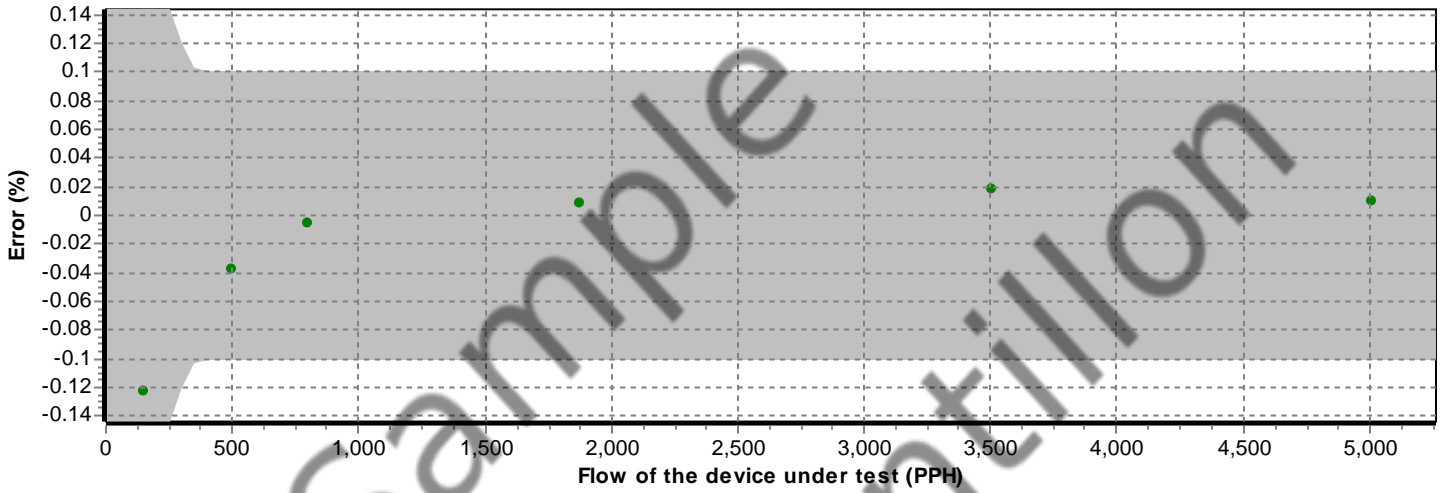
Final readings

Device under test		Measured values		Calculated reference	Calculated error	Acceptable error	Uncertainty	TUR
Hz	PPH	Temperature °C	Reference Kg/min					
299.212	149.606	22.09	1.132383	149.788621	-0.183	0.360	0.029961	>4
1000.490	500.245	22.11	3.783229	500.435501	-0.191	0.500	0.100094	>4
1603.325	801.663	21.98	6.060849	801.713036	-0.050	0.802	0.160354	>4
3748.845	1874.422	22.05	14.169262	1874.272408	0.150	1.874	0.374880	>4
7017.559	3508.780	22.04	26.521178	3508.151107	0.629	3.508	0.701677	>4
10026.947	5013.474	22.08	37.897694	5013.006479	0.468	5.013	1.002668	>4

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Final results



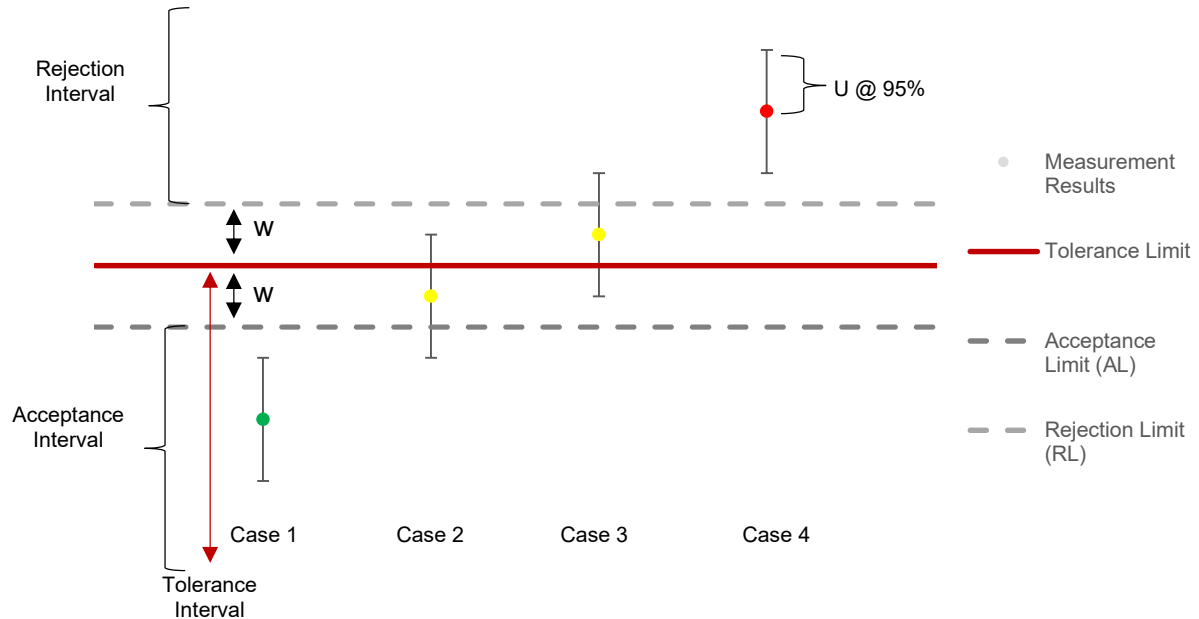
See the appendix for the guideline of decision rule

Appendix for the decision rule

Method #3 Non-binary Statement with Guard Band, uncertainty directly taken into account

This decision rule uses a guard band to define the acceptance and rejection interval. The acceptance limit is defined by the following mathematical formula $AL = TL - w$ and the rejection limit $RL = TL + w$, where $w = rU$. The multiple r that is multiplied by the expanded measurement uncertainty U can be defined following ILAC G8: 2019 table 1 section 5.2. The expanded measurement uncertainty U has a 95% coverage probability ($k = 2$). Non-binary statement with guard band exists when the result is limited to four choices: pass, conditional pass, conditional fail, and fail.

Statements of conformity are reported as:



Graphical representation of a Non-Binary Statement with a Guard Band

Case 1 – Below acceptance limit AL

Status: In tolerance

- The result is inside the acceptance interval. However, assuming a normal distribution, the risk that the result is outside the tolerance limit could be up to 2.5%. Uncertainty is directly taken into account. *Green*.

Case 2 – Below tolerance limit TL, greater than acceptance limit AL

Status: In tolerance-Conditional

- The result is outside the acceptance interval but below tolerance limit. However, the observed value is inside the guard band $w = TL - AL$ and the status is conditional on the customer's risk assessment. Uncertainty is directly taken into account. *Yellow*.

Case 3 – Greater than tolerance limit, below rejection limit RL

Status: Out of tolerance-Conditional

- The result is greater than tolerance limit but outside the rejection interval. However, the observed value is inside the guard band $w = RL - TL$ and the status is conditional on the customer's risk assessment. Uncertainty is directly taken into account. *Yellow*.

Case 4 – Greater than rejection limit RL

Status: Out of tolerance

- The result is inside the rejection interval. Uncertainty is directly taken into account. *Red*.