

	 SOCRATE <i>Working for Sustainability</i>	COMMESSA NQR22199	UNITA' -
	FSRU Ravenna e collegamento alla Rete Nazionale Gasdotti	REL-MEC-E-52033	
	NQR22199 – Allacciamento FSRU Ravenna	Rev.	00

Rif. Codice Vendor: C23-00142-G-35

4.2.1.5 REPORT / CERTIFICATI DI CALIBRAZIONE

Pos.	DESCRIZIONE	N° CERTIFICATO	SERIAL NUMBER	PAGINA
4.2.1.5.1	US-M1A	21628c/2023	23251000	
4.2.1.5.2	US-M2B	21629c/2023	23251001	
4.2.1.5.3	US-M2A	21626c/2023	23251002	
4.2.1.5.4	US-M2B	21627c/2023	23251003	
4.2.1.5.5	US-M3A	21624c/2023	23251004	
4.2.1.5.6	US-M3B	21625c/2023	23251005	

	 SOCRATE Working for Sustainability	COMMESSA NQ/R22199	UNITA' -
	FSRU Ravenna e collegamento alla Rete Nazionale Gasdotti NQR22199 – Allacciamento FSRU Ravenna	REL-MEC-E-52033	
		Rev.	00

Rif. Codice Vendor: C23-00142-G-35

4.2.1.5.1 CERTIFICATI DI CALIBRAZIONE - US-M1A

Calibration Certificate

Number 21628c/2023
Date 2023-11-15

Applicant Name: SICK Engineering GmbH, Germany
Order No. DHG/4502457968

Meter under test Description: Ultrasonic meter
Manufacturer: Sick AG
EC number: DE-16-MI002-PTB001
Type: Flowsic600-XT
Serial number: 23251000
Nominal size: 20"
Range of flow rate: 200 ... 14000m³/h
Year of manufacture: 2023
Nominal diameter of meter: 500 mm
Nominal diameter of flange: 500 mm
Nominal flange pressure: ANSI 600

Date of test 2023-11-15

Results The results of the calibration are presented on page 3.

Test procedure According to EC type-examination certificate no. DE-16-MI002-PTB001

Test facility *pigsar* operates the National Standard of the Federal Republic of Germany for the unit of volume for high pressure natural gas under supervision of PTB. *pigsar* disseminates the harmonised values for the unit of volume for high pressure gas flow measurements of the Federal Republic of Germany, France and The Netherlands.
pigsar is accredited according to ISO/IEC 17025.

Traceability The presented results of the calibration are based on the unified Dutch-French-German reference values for the unit of volume for high-pressure gas flow measurements. On June-02-1999, PTB (Physikalisch-Technische Bundesanstalt) and VSL (formerly NMi-VSL, Nederlands Meetinstituut – Van Swinden Laboratorium) and later on May-04-2004 LNE (The Laboratoire national de métrologie et d'essais) have joined the harmonization (unification) procedure and the use of these reference values, see page 2.

Dorsten, 2023-11-15



The presented results of the calibration are based on the harmonized Dutch-French-German reference values for the unit of Volume for High Pressure Natural Gas flow measurements. In Paris, on 2004-May-4, PTB (Physikalisch-Technische Bundesanstalt), VSL (Van Swinden Laboratorium) and LNE (The Laboratoire national de métrologie et d'essais) have agreed on the harmonization and the use of these reference values.



The Physikalisch-Technische Bundesanstalt (PTB) in Braunschweig and Berlin is the national institute for science and technology and the highest technical authority of the Federal Republic of Germany for the field of metrology and certain sectors of safety engineering. The PTB comes under the auspices of the Federal Ministry of Economics. It meets the requirements for calibration and testing laboratories as defined in the EN ISO/IEC 17025.

It is the fundamental task of the PTB to realize and maintain the legal units in compliance with the International System of Units (SI) and to disseminate them, above all within the framework of legal and industrial metrology. The PTB thus is on top of the metrological hierarchy in Germany.

This certificate is consistent with the Calibration and Measurement Capabilities (CMCs) that are included in Appendix C of the Mutual Recognition Arrangement (MRA) drawn up by the International Committee for Weights and Measures (CIPM). Under the MRA, all participating institutes recognize the validity of each other's calibration and measurement certificates for the quantities, ranges and measurement uncertainties specified in Appendix C (for details see <http://www.bipm.org>).



Dutch
Metrology
Institute

VSL is the National Metrology Institute of The Netherlands and is part of the Holland Metrology Group (formerly known as NMi Group). VSL is appointed by the Dutch Government as the national institute for developing and maintaining the national measurement standards.

VSL makes an important contribution towards the reliability, quality and innovation of products and processes, both in business and society at large and provides a direct link to international accepted measurement standards in order to achieve traceability for measurement results of companies, laboratories and organisations.

VSL is accredited by RvA (Raad voor Accreditatie, "Board of Accreditation") to perform calibrations conform ISO17025 and is accredited to perform initial verification services for and on behalf of NMi Certin B.V.



The Laboratoire national de métrologie et d'essais (LNE) is the company designated by the French government as responsible of policy in terms of metrology in replacement of BNM (Bureau National de Métrologie) since January 2005.

The LNE is also designated by the French government as the Legal Metrology Service to perform type approvals and verifications. Thus, it is the fundamental task of the LNE to realize, develop and maintain the national primary standards and to insure the traceability of industries and users to the S.I units by the realization of specific instrumentation and calibration benches.

Certificate Number: 21628c/2023

Date: 2023-11-15

Applicant SICK Engineering GmbH, Germany

Meter under Test

Type	Ultrasonic meter Flowsic600-xT
Manufacturer	Sick AG
Serial number	23251000
Nominal Size	20"
Year of manufacture	2023

Test Conditions

Testing medium	Natural gas	CO ₂	0,8 mole %
Pressure, absolute	60,2 bar	H ₂	0,0 mole %
Gas Temperature	20,6 °C	Calorific value,s	10,28 kWh/m ³
Gas density (p, T)	50,8 kg/m ³	Density,normal	0,8250 kg/m ³
Dyn. viscosity (p, T)	1,30E-05 Pa s	normal conditions (273,15 K; 101,325 kPa)	

Results	Qi / Qmax	Qi (m ³ /h)	Reynolds number	deviation (%)	n	U _{meter} (%)	U _{tot} (%)
(as left)	0,01	194,91	0,54 *10 ⁶	0,01	5	0,29	0,33
	0,05	697,69	1,93 *10 ⁶	0,01	4	0,08	0,16
	0,10	1405,23	3,89 *10 ⁶	-0,02	4	0,07	0,15
	0,25	3502,65	9,64 *10 ⁶	0,01	4	0,05	0,16
	0,40	5615,54	15,53 *10 ⁶	0,01	4	0,04	0,18
	0,70	9786,93	27,08 *10 ⁶	-0,02	4	0,05	0,18
	1,00	13958,49	38,58 *10 ⁶	0,01	4	0,07	0,21

Verification

0,70	9778,83	27,08 *10 ⁶	0,00	3	0,12	0,21
0,40	5643,34	15,65 *10 ⁶	-0,05	3	0,16	0,23

Weighted mean error, with continuous and linear decrease of weighing factor between 0,7 Q_{max} and Q_{max} 0,00 %. (as left)

The deviation is defined as
$$\text{deviation} = \frac{(\text{Indicated Value} - \text{Reference Value})}{(\text{Reference Value})} \cdot 100\%$$

where the reference volume refers to the conditions at the meter under test. The reported values of this deviation are the arithmetic means of *n* single measurements at each flow-rate.

The reported total uncertainty is defined as:
$$U_{tot} = \sqrt{U_{harmonized}^2 + U_{meter}^2}$$

where *U_{harmonized}* is the expanded uncertainty of the harmonized reference value, stated as the standard uncertainty of measurement multiplied by the coverage factor *k*=2, and *U_{meter}* is the expanded standard uncertainty of the meter under test, determined on the base of *n* repeats at each flow-rate, multiplied by the Student-t-Faktor(*n*) / *n*^{0,5} with a probability of 0,95 %.

Remarks Security marks are applied.

The calibration of the meter had been performed in following configuration:

A pipe-spool-set delivered by the customer consisting of in total 3 spools was used.

The spools were named by the customer as P37.

Upstream pipe (5500 mm) –FC–upstream pipe (7000 mm) –meter – downstream pipe (3570 mm)

The temperature had been measured 2000 mm downstream of the meter.

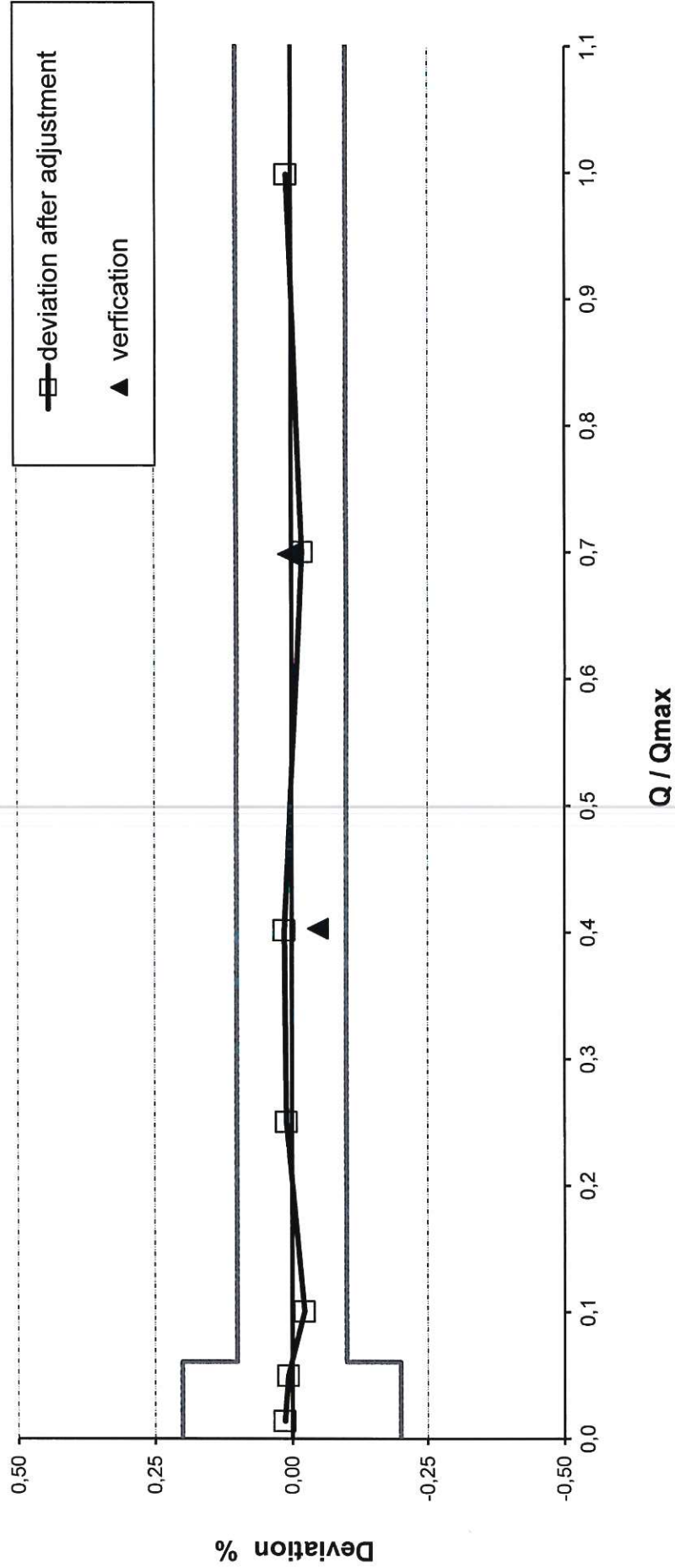
The flow conditioner was provided by the manufacturer/customer.

Tested in Dorsten at pigsar, on 2023-11-15

Schiffmann

Error Curve

Type of meter:	Ultrasonic meter	Customer:	SICK Engineering GmbH, Germany	DN:	500 mm	p (abs):	60	bar	HF 1	257,00	pulses / m ³
Meter no:	23251000	Manufacturer:	Sick AG	Size:	20"	Qmax:	14000	m ³ /h	HF 2	257,00	pulses / m ³
Date:	2023-11-15	Gear 1:	---			Qmin:	200	m ³ /h			pulses / m ³
Inspector:	Schiffmann	Gear 2:	---								pulses / m ³



Certificate Number 21628c/2023
Date 2023-11-15

Stated test results are based on following parameters

- value of 'Temperature fixed' and 'Pressure (fixed)' had been set to the test conditions during calibration -

Geräteidentifikation / meter identification				ModelName	F6A-4RSD20-DC1L-H218				755
Serial_Device	Serial_Meterbody	Serial_Electronics	Firmware_Version						
23251000	23360005	23150003	10600						
Firmware_CRC	MetrologyCRC	Parameter_CRC_Sensor	Parameter_CRC_Adjust						
0x06F9	0xFADE	0x5AAD	0x8132						
Zählerjustage / meter adjustment									
FixedPressure bar(a)	FixedTemperature °C	MinOperatingPressure bar(a)	MaxOperatingPressure bar(a)						
61	15	20,2	76						
LowFlowCutOff [m³/h]	Qmin [m³/h]	Qt [m³/h]	Qmax [m³/h]						
50	200	850	14000						
AdjustMode	FactoryAdjustFwd	1,0000	FactoryAdjustRev	1,0000					
2 - Polynom	AdjustFactorFwd	1,0000	AdjustFactorRev	1,0000					
Polynomial coefficients	AdjustFwd_CC0	-1,119016E-04	AdjustRev_CC0	0,000000E+00					
	AdjustFwd_CC1	1,127056E-02	AdjustRev_CC1	0,000000E+00					
	AdjustFwd_CC2	1,111165E-01	AdjustRev_CC2	0,000000E+00					
	AdjustFwd_CC3	1,518461E-01	AdjustRev_CC3	0,000000E+00					
	AdjustFwd_CC4	-1,022062E-01	AdjustRev_CC4	0,000000E+00					
Reynolds correction									
FlowPTConfig	CC_Linearization0	3,72169E+02	CC_Medium0	1,02000E+00					
external value	CC_Linearization1	-3,13937E+01	CC_Medium1	-3,95210E-03					
	CC_Linearization2	-8,09056E+03	CC_Medium2	2,27730E-05					
	CC_Linearization3	-1,89320E-03	CC_Medium3	-9,80010E-08					
	CC_Linearization4	1,01093E+00							
Frequenzausgang / frequency output									
Impulse_Value	Impulse_Factor [Imp/m³]	Impulse_FactorAirtest [Imp/m³]	Impulse_FrequencyLimit [Hz]						
flow a.c.	257	257	10000						
Messaufnehmergeometrie / transducer geometry									
PipeDiameter [m]	0,45560	Diameter [m]	0,45002						
Path	1-1	1-2	1-3	1-4	2-1	2-2	2-3	2-4	
Length [m]	0,38515	0,57288	0,57285	0,38503	0,38515	0,57289	0,57287	0,38503	
Angle [°]	60,026	60,012	60,007	60,019	59,981	59,987	59,990	59,979	
Ultraschallsensoren / ultrasonic sensors									
Path	1-1	1-2	1-3	1-4	2-1	2-2	2-3	2-4	
A SerialN°	23120018	23120024	23120023	23120027	0	0	0	0	
B SerialN°	23120015	23120017	23120020	23120025	0	0	0	0	
A Length [m]	0,03898	0,03896	0,03897	0,03896	0,00000	0,00000	0,00000	0,00000	
B Length [m]	0,03897	0,03897	0,03897	0,03897	0,00000	0,00000	0,00000	0,00000	
TimeOffset [µs]	17,6295	17,6829	17,7017	17,6492	0,0000	0,0000	0,0000	0,0000	
TimeDiff [ns]	0,620	-2,115	-0,029	0,650	0,000	0,000	0,000	0,000	
ZeroPhase AB	1,23	1,17	1,16	1,19	1,80	1,80	1,80	1,80	
ZerroPhase BA	1,24	1,16	1,17	1,19	1,80	1,80	1,80	1,80	
Messumformer / transducer									
Path	1-1	1-2	1-3	1-4	2-1	2-2	2-3	2-4	
TimeOffset [µs]	0,0774	0,0785	0,0770	0,0775	0,0000	0,0000	0,0000	0,0000	
TimeDiff [ns]	0,311	-1,854	4,346	-4,476	0,000	0,000	0,000	0,000	
DiffractionTime	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	

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			Rev.	00

Rif. Codice Vendor: C23-00142-G-35

4.2.1.5.2 CERTIFICATI DI CALIBRAZIONE - US-M1B

Calibration Certificate

Number 21629c/2023

Date 2023-11-15

Applicant	Name:	SICK Engineering GmbH, Germany
	Order No.	DHG/4502457968
Meter under test	Description:	Ultrasonic meter
	Manufacturer:	Sick AG
	EC number:	DE-16-MI002-PTB001
	Type:	Flowsic600-XT
	Serial number:	23251001
	Nominal size:	20"
	Range of flow rate:	200 ... 14000m³/h
	Year of manufacture:	2023
	Nominal diameter of meter:	500 mm
	Nominal diameter of flange:	500 mm
	Nominal flange pressure:	ANSI 600
Date of test		2023-11-15
Results		The results of the calibration are presented on page 3.
Test procedure		According to EC type-examination certificate no. DE-16-MI002-PTB001
Test facility		<i>pigsar</i> operates the National Standard of the Federal Republic of Germany for the unit of volume for high pressure natural gas under supervision of PTB. <i>pigsar</i> disseminates the harmonised values for the unit of volume for high pressure gas flow measurements of the Federal Republic of Germany, France and The Netherlands. <i>pigsar</i> is accredited according to ISO/IEC 17025.
Traceability		The presented results of the calibration are based on the unified Dutch-French-German reference values for the unit of volume for high-pressure gas flow measurements. On June-02-1999, PTB (Physikalisch-Technische Bundesanstalt) and VSL (formerly NMI-VSL, Nederlands Meetinstituut – Van Swinden Laboratorium) and later on May-04-2004 LNE (The Laboratoire national de métrologie et d'essais) have joined the harmonization (unification) procedure and the use of these reference values, see page 2.

Dorsten, 2023-11-15



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Certificate Number: 21629c/2023
Date: 2023-11-15

Applicant SICK Engineering GmbH, Germany

Meter under Test
Type Ultrasonic meter Flowsic600-xT
Manufacturer Sick AG
Serial number 23251001
Nominal Size 20"
Year of manufacture 2023

Test Conditions
Testing medium Natural gas CO₂ 0,8 mole %
Pressure, absolute 60,2 bar H₂ 0,0 mole %
Gas Temperature 20,6 °C Calorific value,s 10,28 kWh/m³
Gas density (p, T) 50,8 kg/m³ Density,normal 0,8250 kg/m³
Dyn. viscosity (p, T) 1,30E-05 Pa s normal conditions (273,15 K; 101,325 kPa)

Results	Qi / Qmax	Qi (m ³ /h)	Reynolds number	deviation (%)	n	U _{meter} (%)	U _{tot} (%)
(as left)	0,01	194,92	0,54 *10 ⁶	0,04	5	0,23	0,28
	0,05	697,59	1,93 *10 ⁶	0,00	4	0,10	0,17
	0,10	1405,34	3,88 *10 ⁶	0,00	4	0,06	0,15
	0,25	3501,68	9,63 *10 ⁶	0,00	4	0,06	0,17
	0,40	5614,30	15,52 *10 ⁶	0,01	4	0,06	0,19
	0,70	9786,24	27,06 *10 ⁶	-0,01	4	0,03	0,18
	1,00	13956,31	38,56 *10 ⁶	0,01	4	0,04	0,20

Verification	0,70	9775,32	27,09 *10 ⁶	-0,02	3	0,06	0,18
	0,40	5642,29	15,65 *10 ⁶	-0,05	3	0,13	0,22

Weighted mean error, with continuous and linear decrease of weighing factor between 0,7 Q_{max} and Q_{max} 0,00 %. (as left)

The *deviation* is defined as
$$\text{deviation} = \frac{(\text{Indicated Value} - \text{Reference Value})}{(\text{Reference Value})} \cdot 100\%$$

where the reference volume refers to the conditions at the meter under test. The reported values of this deviation are the arithmetic means of *n* single measurements at each flow-rate.

The reported *total uncertainty* is defined as:
$$U_{\text{tot}} = \sqrt{U_{\text{harmonized}}^2 + U_{\text{meter}}^2}$$

where *U_{harmonized}* is the expanded uncertainty of the harmonized reference value, stated as the standard uncertainty of measurement multiplied by the coverage factor *k*=2, and *U_{meter}* is the expanded standard uncertainty of the meter under test, determined on the base of *n* repeats at each flow-rate, multiplied by the Student-t-Faktor(*n*) / *n*^{0,5} with a probability of 0,95 %.

Remarks Security marks are applied.

The calibration of the meter had been performed in following configuration:

A pipe-spool-set delivered by the customer consisting of in total 3 spools was used.

The spools were named by the customer as P37.

Upstream pipe (5500 mm) –FC–upstream pipe (7000 mm) –meter – downstream pipe (3570 mm)

The temperature had been measured 2000 mm downstream of the meter.

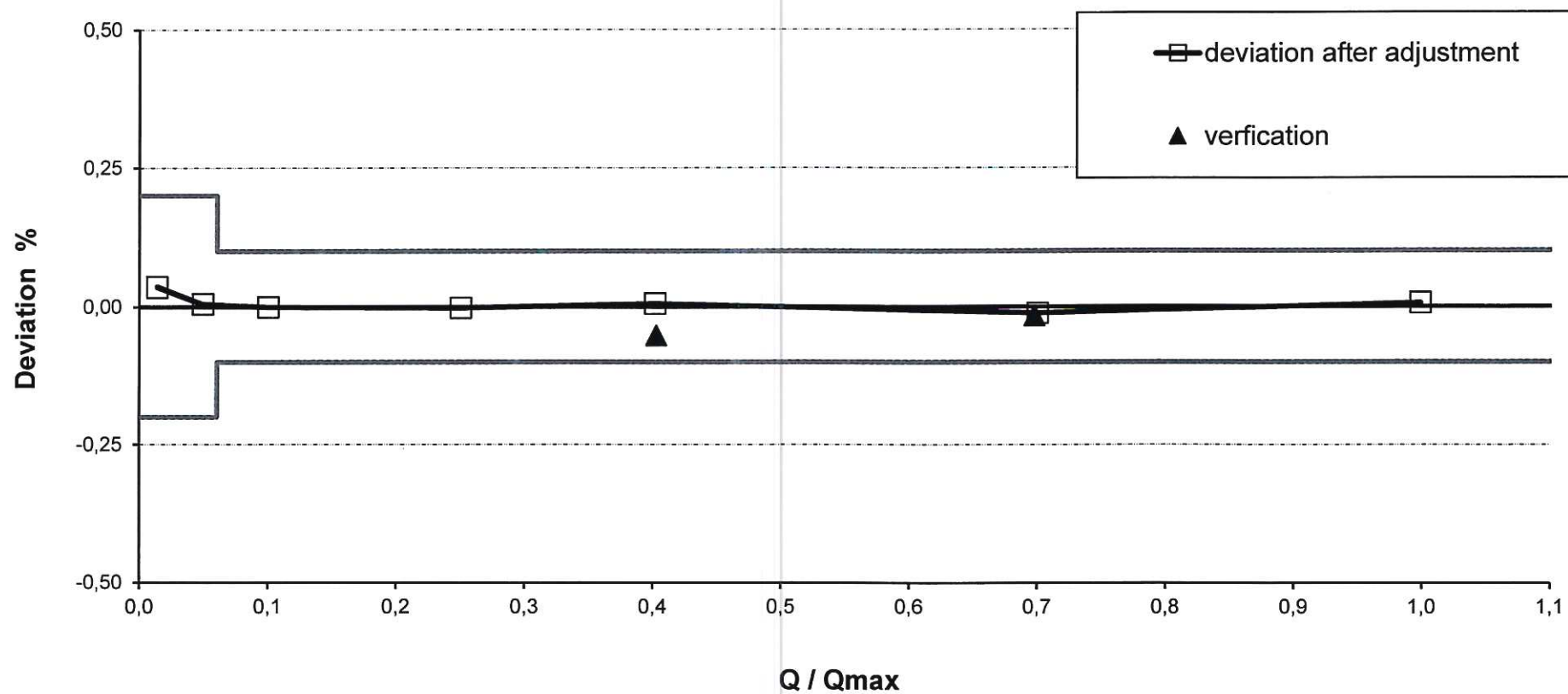
The flow conditioner was provided by the manufacturer/customer.

Tested in Dorsten at pigsar, on 2023-11-15

Schiffmann

Error Curve

Type of meter:	Ultrasonic meter	Customer:	SICK Engineering GmbH, Germany	DN:	500 mm	p (abs):	60 bar	HF 1	257,00 pulses / m³
Meter no:	23251001	Manufacturer:	Sick AG	Size:	20"	Qmax:	14000 m³/h	HF 2	257,00 pulses / m³
Date:	2023-11-15	Gear 1:	---			Qmin:	200 m³/h		pulses / m³
Inspector:	Schiffmann	Gear 2:	---						pulses / m³



Certificate Number **21629c/2023**
Date **2023-11-15**

Stated test results are based on following parameters

- value of 'Temperature fixed' and 'Pressure (fixed)' had been set to the test conditions during calibration -

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Geräteidentifikation / meter identification		ModelName	F6A-4RSD20-DC1L-H218					
Serial_Device	Serial_Meterbody	Serial_Electronics	Firmware_Version					
23251001	23360005	23150006	10600					
Firmware_CRC	MetrologyCRC	Parameter_CRC_Sensor	Parameter_CRC_Adjust					
0x06F9	0x070B	0xC97F	0xC516					
Zählerjustage / meter adjustment								
FixedPressure bar(a)	FixedTemperature °C	MinOperatingPressure bar(a)	MaxOperatingPressure bar(a)					
61	15	20,2	76					
LowFlowCutOff [m³/h]	Qmin [m³/h]	Qt [m³/h]	Qmax [m³/h]					
50	200	850	14000					
AdjustMode	FactoryAdjustFwd	1,0000	FactoryAdjustRev	1,0000				
2 - Polynom	AdjustFactorFwd	1,0000	AdjustFactorRev	1,0000				
Polynomial coefficients	AdjustFwd_CC0	2,686555E-05	AdjustRev_CC0	0,000000E+00				
	AdjustFwd_CC1	1,298031E-03	AdjustRev_CC1	0,000000E+00				
	AdjustFwd_CC2	2,952045E-01	AdjustRev_CC2	0,000000E+00				
	AdjustFwd_CC3	-7,276385E-02	AdjustRev_CC3	0,000000E+00				
	AdjustFwd_CC4	3,696467E-03	AdjustRev_CC4	0,000000E+00				
Reynolds correction								
FlowPTConfig	CC_Linearization0	3,72169E+02	CC_Medium0	1,02000E+00				
external value	CC_Linearization1	-3,13937E+01	CC_Medium1	-3,95210E-03				
	CC_Linearization2	-8,09056E+03	CC_Medium2	2,27730E-05				
	CC_Linearization3	-1,89320E-03	CC_Medium3	-9,80010E-08				
	CC_Linearization4	1,01093E+00						
Frequenzausgang / frequency output								
Impulse_Value	Impulse_Factor [Imp/m³]	Impulse_FactorAirtest [Imp/m³]	Impulse_FrequencyLimit [Hz]					
flow a.c.	257	257	10000					
Messaufnehmergeometrie / transducer geometry								
PipeDiameter [m]	0,45560	Diameter [m]	0,45002					
Path	1-1	1-2	1-3	1-4	2-1	2-2	2-3	2-4
Length [m]	0,38515	0,57289	0,57287	0,38503	0,38515	0,57289	0,57287	0,38503
Angle [°]	59,981	59,987	59,990	59,979	59,981	59,987	59,990	59,979
Ultraschallsensoren / ultrasonic sensors								
Path	1-1	1-2	1-3	1-4	2-1	2-2	2-3	2-4
A SerialN°	23307858	23307856	23310054	23310019	0	0	0	0
B SerialN°	23307853	23307854	23310040	23310016	0	0	0	0
A Length [m]	0,03896	0,03897	0,03894	0,03894	0,00000	0,00000	0,00000	0,00000
B Length [m]	0,03895	0,03898	0,03898	0,03896	0,00000	0,00000	0,00000	0,00000
TimeOffset [µs]	17,7866	17,7455	17,6454	17,6205	0,0000	0,0000	0,0000	0,0000
TimeDiff [ns]	-0,205	0,578	0,245	0,064	0,000	0,000	0,000	0,000
ZerroPhase AB	1,14	1,17	1,34	1,28	1,80	1,80	1,80	1,80
ZerroPhase BA	1,14	1,18	1,35	1,28	1,80	1,80	1,80	1,80
Messumformer / transducer								
Path	1-1	1-2	1-3	1-4	2-1	2-2	2-3	2-4
TimeOffset [µs]	0,0073	0,0107	0,0844	0,0823	0,0000	0,0000	0,0000	0,0000
TimeDiff [ns]	-3,453	-4,217	-3,491	0,967	0,000	0,000	0,000	0,000
DiffractionTime	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000

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		Rev.	00

Rif. Codice Vendor: C23-00142-G-35

4.2.1.5.3 CERTIFICATI DI CALIBRAZIONE - US-M2A

Calibration Certificate

Number 21626c/2023

Date 2023-11-15

Applicant	Name:	SICK Engineering GmbH, Germany
	Order No.	DHG/4502457968
Meter under test	Description:	Ultrasonic meter
	Manufacturer:	Sick AG
	EC number:	DE-16-MI002-PTB001
	Type:	Flowsic600-XT
	Serial number:	23251002
	Nominal size:	20"
	Range of flow rate:	200 ... 14000m³/h
	Year of manufacture:	2023
	Nominal diameter of meter:	500 mm
	Nominal diameter of flange:	500 mm
	Nominal flange pressure:	ANSI 600
Date of test		2023-11-15
Results		The results of the calibration are presented on page 3.
Test procedure		According to EC type-examination certificate no. DE-16-MI002-PTB001
Test facility		<i>pigsar</i> operates the National Standard of the Federal Republic of Germany for the unit of volume for high pressure natural gas under supervision of PTB. <i>pigsar</i> disseminates the harmonised values for the unit of volume for high pressure gas flow measurements of the Federal Republic of Germany, France and The Netherlands. <i>pigsar</i> is accredited according to ISO/IEC 17025.
Traceability		The presented results of the calibration are based on the unified Dutch-French-German reference values for the unit of volume for high-pressure gas flow measurements. On June-02-1999, PTB (Physikalisch-Technische Bundesanstalt) and VSL (formerly NMI-VSL, Nederlands Meetinstituut – Van Swinden Laboratorium) and later on May-04-2004 LNE (The Laboratoire national de métrologie et d'essais) have joined the harmonization (unification) procedure and the use of these reference values, see page 2.

Dorsten, 2023-11-15



The presented results of the calibration are based on the harmonized Dutch-French-German reference values for the unit of Volume for High Pressure Natural Gas flow measurements. In Paris, on 2004-May-4, PTB (Physikalisch-Technische Bundesanstalt), VSL (Van Swinden Laboratorium) and LNE (The Laboratoire national de métrologie et d'essais) have agreed on the harmonization and the use of these reference values.



The Physikalisch-Technische Bundesanstalt (PTB) in Braunschweig and Berlin is the national institute for science and technology and the highest technical authority of the Federal Republic of Germany for the field of metrology and certain sectors of safety engineering. The PTB comes under the auspices of the Federal Ministry of Economics. It meets the requirements for calibration and testing laboratories as defined in the EN ISO/IEC 17025.

It is the fundamental task of the PTB to realize and maintain the legal units in compliance with the International System of Units (SI) and to disseminate them, above all within the framework of legal and industrial metrology. The PTB thus is on top of the metrological hierarchy in Germany.

This certificate is consistent with the Calibration and Measurement Capabilities (CMCs) that are included in Appendix C of the Mutual Recognition Arrangement (MRA) drawn up by the International Committee for Weights and Measures (CIPM). Under the MRA, all participating institutes recognize the validity of each other's calibration and measurement certificates for the quantities, ranges and measurement uncertainties specified in Appendix C (for details see <http://www.bipm.org>).



Dutch
Metrology
Institute

VSL is the National Metrology Institute of The Netherlands and is part of the Holland Metrology Group (formerly known as NMi Group). VSL is appointed by the Dutch Government as the national institute for developing and maintaining the national measurement standards.

VSL makes an important contribution towards the reliability, quality and innovation of products and processes, both in business and society at large and provides a direct link to international accepted measurement standards in order to achieve traceability for measurement results of companies, laboratories and organisations.

VSL is accredited by RvA (Raad voor Accreditatie, "Board of Accreditation") to perform calibrations conform ISO17025 and is accredited to perform initial verification services for and on behalf of NMi Certin B.V.



The Laboratoire national de métrologie et d'essais (LNE) is the company designated by the French government as responsible of policy in terms of metrology in replacement of BNM (Bureau National de Métrologie) since January 2005.

The LNE is also designated by the French government as the Legal Metrology Service to perform type approvals and verifications. Thus, it is the fundamental task of the LNE to realize, develop and maintain the national primary standards and to insure the traceability of industries and users to the S.I units by the realization of specific instrumentation and calibration benches.

Certificate Number: 21626c/2023

Date: 2023-11-15

Applicant SICK Engineering GmbH, Germany

Meter under Test

Type	Ultrasonic meter Flowsic600-xT
Manufacturer	Sick AG
Serial number	23251002
Nominal Size	20"
Year of manufacture	2023

Test Conditions

Testing medium	Natural gas	CO ₂	0,8 mole %
Pressure, absolute	60,1 bar	H ₂	0,0 mole %
Gas Temperature	20,5 °C	Calorific value,s	10,28 kWh/m ³
Gas density (p, T)	50,7 kg/m ³	Density,normal	0,8250 kg/m ³
Dyn. viscosity (p, T)	1,30E-05 Pa s	normal conditions (273,15 K; 101,325 kPa)	

Results	Qi / Qmax	Qi (m ³ /h)	Reynolds number	deviation (%)	n	U _{meter} (%)	U _{tot} (%)
(as left)	0,01	194,75	0,54 *10 ⁶	0,01	5	0,22	0,27
	0,05	697,06	1,93 *10 ⁶	-0,01	4	0,08	0,16
	0,10	1405,45	3,89 *10 ⁶	0,04	4	0,03	0,14
	0,25	3502,82	9,65 *10 ⁶	-0,06	4	0,07	0,17
	0,40	5621,56	15,56 *10 ⁶	0,05	4	0,05	0,18
	0,70	9815,55	27,14 *10 ⁶	-0,01	4	0,05	0,18
	1,00	14042,46	38,71 *10 ⁶	0,00	4	0,07	0,20

Verification							
	0,70	9801,32	27,10 *10 ⁶	-0,03	3	0,05	0,18
	0,40	5649,52	15,66 *10 ⁶	0,01	3	0,19	0,26

Weighted mean error, with continuous and linear decrease of weighing factor between 0,7 Q_{max} and Q_{max} 0,00 %. (as left)

The *deviation* is defined as
$$\text{deviation} = \frac{(\text{Indicated Value} - \text{Reference Value})}{(\text{Reference Value})} \cdot 100\%$$

where the reference volume refers to the conditions at the meter under test. The reported values of this deviation are the arithmetic means of *n* single measurements at each flow-rate.

The reported *total uncertainty* is defined as:
$$U_{tot} = \sqrt{U_{harmonized}^2 + U_{meter}^2}$$

where *U_{harmonized}* is the expanded uncertainty of the harmonized reference value, stated as the standard uncertainty of measurement multiplied by the coverage factor *k*=2, and *U_{meter}* is the expanded standard uncertainty of the meter under test, determined on the base of *n* repeats at each flow-rate, multiplied by the Student-t-Faktor(*n*) / *n*^{0,5} with a probability of 0,95 %.

Remarks Security marks are applied.

The calibration of the meter had been performed in following configuration:

A pipe-spool-set delivered by the customer consisting of in total 3 spools was used.

The spools were named by the customer as P41.

Upstream pipe (5500 mm) –FC–upstream pipe (7000 mm) –meter – downstream pipe (3570 mm)

The temperature had been measured 2000 mm downstream of the meter.

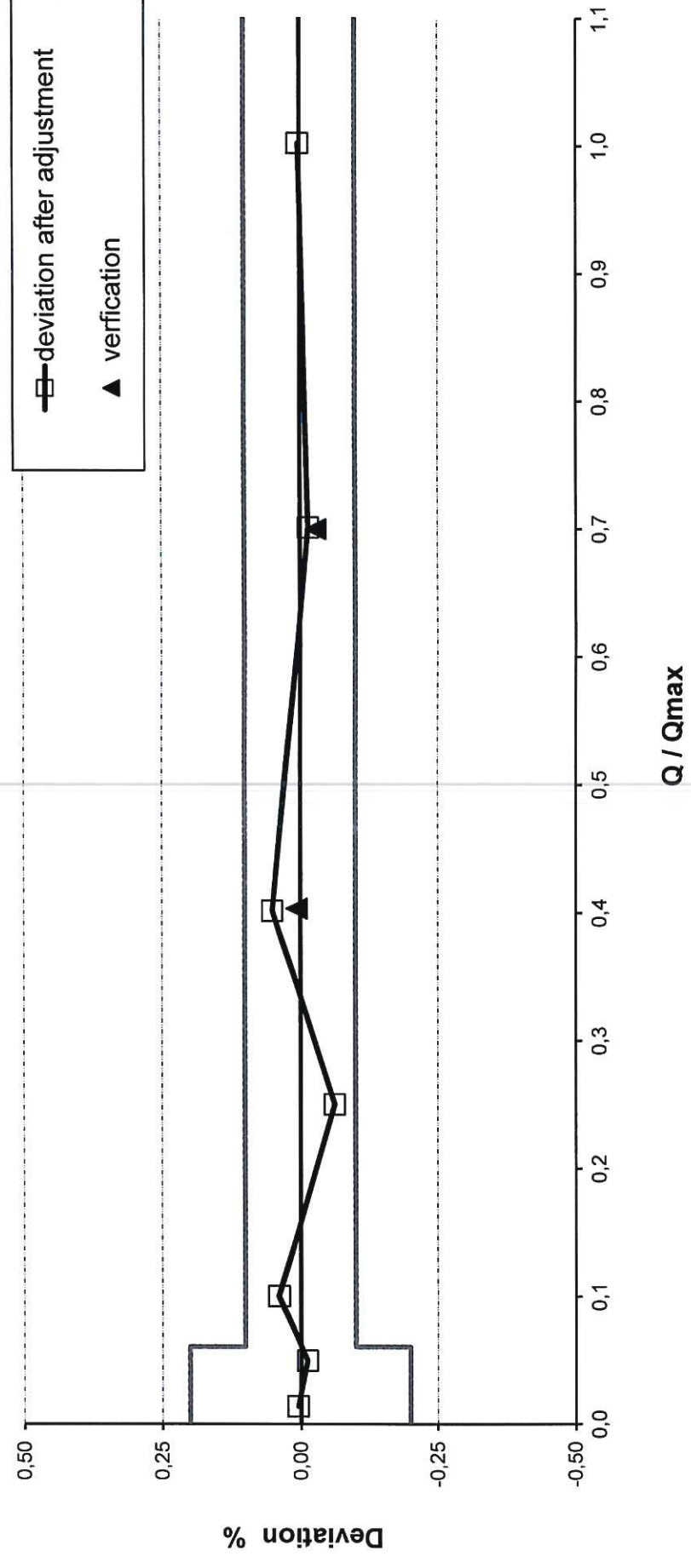
The flow conditioner was provided by the manufacturer/customer.

Tested in Dorsten at pigsar, on 2023-11-15

Schiffmann

Error Curve

Type of meter:	Ultrasonic meter	Customer:	SICK Engineering GmbH, Germany	DN:	500 mm	p (abs):	60	bar	HF 1	257,00	pulses / m ³
Meter no:	23251002	Manufacturer:	Sick AG	Size:	20"	Qmax:	14000	m ³ /h	HF 2	257,00	pulses / m ³
Date:	2023-11-15	Gear 1:	---			Qmin:	200	m ³ /h			pulses / m ³
Inspector:	Schiffmann	Gear 2:	---								pulses / m ³



Certificate Number **21626c/2023**
Date **2023-11-15**

Stated test results are based on following parameters

- value of 'Temperature fixed' and 'Pressure (fixed)' had been set to the test conditions during calibration -

755

Geräteidentifikation / meter identification		ModelName F6A-4RSD20-DC1L-H218						
Serial_Device	Serial_Meterbody	Serial_Electronics	Firmware_Version					
23251002	23360004	23150007	10600					
Firmware_CRC	MetrologyCRC	Parameter_CRC_Sensor	Parameter_CRC_Adjust					
0x06F9	0xE0C2	0xD89E	0xDA6B					
Zählerjustage / meter adjustment								
FixedPressure bar(a)	FixedTemperature °C	MinOperatingPressure bar(a)	MaxOperatingPressure bar(a)					
61	15	20,2	76					
LowFlowCutOff [m³/h]	Qmin [m³/h]	Qt [m³/h]	Qmax [m³/h]					
50	200	850	14000					
AdjustMode	FactoryAdjustFwd	1,0000	FactoryAdjustRev	1,0000				
2 - Polynom	AdjustFactorFwd	1,0000	AdjustFactorRev	1,0000				
Polynomial coefficients	AdjustFwd_CC0	-1,071240E-04	AdjustRev_CC0	0,000000E+00				
	AdjustFwd_CC1	1,685120E-02	AdjustRev_CC1	0,000000E+00				
	AdjustFwd_CC2	-1,121187E-01	AdjustRev_CC2	0,000000E+00				
	AdjustFwd_CC3	4,155270E-01	AdjustRev_CC3	0,000000E+00				
	AdjustFwd_CC4	-3,619787E-01	AdjustRev_CC4	0,000000E+00				
Reynolds correction								
FlowPTConfig	CC_Linearization0	3,72169E+02	CC_Medium0	1,02000E+00				
external value	CC_Linearization1	-3,13937E+01	CC_Medium1	-3,95210E-03				
	CC_Linearization2	-8,09056E+03	CC_Medium2	2,27730E-05				
	CC_Linearization3	-1,89320E-03	CC_Medium3	-9,80010E-08				
	CC_Linearization4	1,01093E+00						
Frequenzausgang / frequency output								
Impulse_Value	Impulse_Factor [Imp/m³]	Impulse_FactorAirtest [Imp/m³]	Impulse_FrequencyLimit [Hz]					
flow a.c.	257	257	10000					
Messaufnehmergeometrie / transducer geometry								
PipeDiameter [m]	0,45560	Diameter [m]	0,44994					
Path	1-1	1-2	1-3	1-4	2-1	2-2	2-3	2-4
Length [m]	0,38519	0,57293	0,57291	0,38508	0,38519	0,57294	0,57291	0,38508
Angle [°]	60,027	60,018	60,016	60,026	59,976	59,980	59,983	59,972
Ultraschallsensoren / ultrasonic sensors								
Path	1-1	1-2	1-3	1-4	2-1	2-2	2-3	2-4
A SerialN°	23307855	23307850	23310018	23310048	0	0	0	0
B SerialN°	23307847	23307848	23307849	23310039	0	0	0	0
A Length [m]	0,03897	0,03897	0,03898	0,03895	0,00000	0,00000	0,00000	0,00000
B Length [m]	0,03898	0,03898	0,03897	0,03895	0,00000	0,00000	0,00000	0,00000
TimeOffset [µs]	17,6200	17,7439	17,6261	17,7536	0,0000	0,0000	0,0000	0,0000
TimeDiff [ns]	0,483	0,234	-0,605	0,540	0,000	0,000	0,000	0,000
ZeroPhase AB	1,22	1,16	1,27	1,17	1,80	1,80	1,80	1,80
ZerroPhase BA	1,22	1,16	1,27	1,17	1,80	1,80	1,80	1,80
Messumformer / transducer								
Path	1-1	1-2	1-3	1-4	2-1	2-2	2-3	2-4
TimeOffset [µs]	0,0047	0,0359	0,0161	0,0296	0,0000	0,0000	0,0000	0,0000
TimeDiff [ns]	1,771	-0,788	1,475	0,708	0,000	0,000	0,000	0,000
DiffractionTime	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000

	 SOCRATE <i>Working for Sustainability</i>		COMMESSA NQ/R22199	UNITA' -
	FSRU Ravenna e collegamento alla Rete Nazionale Gasdotti		REL-MEC-E-52033	
	NQR22199 – Allacciamento FSRU Ravenna		Rev.	00

Rif. Codice Vendor: C23-00142-G-35

4.2.1.5.4 CERTIFICATI DI CALIBRAZIONE - US-M2B

Calibration Certificate

Number 21627c/2023
Date 2023-11-15

Applicant Name: SICK Engineering GmbH, Germany
Order No. DHG/4502457968

Meter under test Description: Ultrasonic meter
Manufacturer: Sick AG
EC number: DE-16-MI002-PTB001
Type: Flowsic600-XT
Serial number: 23251003
Nominal size: 20"
Range of flow rate: 200 ... 14000m³/h
Year of manufacture: 2023
Nominal diameter of meter: 500 mm
Nominal diameter of flange: 500 mm
Nominal flange pressure: ANSI 600

Date of test 2023-11-15

Results The results of the calibration are presented on page 3.

Test procedure According to EC type-examination certificate no. DE-16-MI002-PTB001

Test facility *pigsar* operates the National Standard of the Federal Republic of Germany for the unit of volume for high pressure natural gas under supervision of PTB. *pigsar* disseminates the harmonised values for the unit of volume for high pressure gas flow measurements of the Federal Republic of Germany, France and The Netherlands.
pigsar is accredited according to ISO/IEC 17025.

Traceability The presented results of the calibration are based on the unified Dutch-French-German reference values for the unit of volume for high-pressure gas flow measurements. On June-02-1999, PTB (Physikalisch-Technische Bundesanstalt) and VSL (formerly NMI-VSL, Nederlands Meetinstituut – Van Swinden Laboratorium) and later on May-04-2004 LNE (The Laboratoire national de métrologie et d'essais) have joined the harmonization (unification) procedure and the use of these reference values, see page 2.

Dorsten, 2023-11-15



The presented results of the calibration are based on the harmonized Dutch-French-German reference values for the unit of Volume for High Pressure Natural Gas flow measurements. In Paris, on 2004-May-4, PTB (Physikalisch-Technische Bundesanstalt), VSL (Van Swinden Laboratorium) and LNE (The Laboratoire national de métrologie et d'essais) have agreed on the harmonization and the use of these reference values.



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The LNE is also designated by the French government as the Legal Metrology Service to perform type approvals and verifications. Thus, it is the fundamental task of the LNE to realize, develop and maintain the national primary standards and to insure the traceability of industries and users to the S.I units by the realization of specific instrumentation and calibration benches.

Certificate Number: 21627c/2023
Date: 2023-11-15

Applicant SICK Engineering GmbH, Germany

Meter under Test

Type	Ultrasonic meter Flowsic600-xT
Manufacturer	Sick AG
Serial number	23251003
Nominal Size	20"
Year of manufacture	2023

Test Conditions

Testing medium	Natural gas	CO ₂	0,8 mole %
Pressure, absolute	60,1 bar	H ₂	0,0 mole %
Gas Temperature	20,5 °C	Calorific value,s	10,28 kWh/m ³
Gas density (p, T)	50,7 kg/m ³	Density,normal	0,8250 kg/m ³
Dyn. viscosity (p, T)	1,30E-05 Pa s	normal conditions (273,15 K; 101,325 kPa)	

Results	Qi / Qmax	Qi (m ³ /h)	Reynolds number	deviation (%)	n	U _{meter} (%)	U _{tot} (%)
(as left)	0,01	194,87	0,54 *10 ⁶	0,03	5	0,17	0,23
	0,05	697,42	1,93 *10 ⁶	0,00	4	0,08	0,16
	0,10	1405,38	3,89 *10 ⁶	0,01	4	0,05	0,15
	0,25	3502,43	9,65 *10 ⁶	-0,02	4	0,04	0,16
	0,40	5619,95	15,55 *10 ⁶	0,02	4	0,02	0,18
	0,70	9813,48	27,13 *10 ⁶	-0,01	4	0,06	0,18
	1,00	14037,75	38,68 *10 ⁶	0,01	4	0,03	0,20

Verification	0,70	9803,67	27,10 *10 ⁶	-0,01	3	0,08	0,19
	0,40	5647,37	15,66 *10 ⁶	-0,05	3	0,12	0,21

Weighted mean error, with continuous and linear decrease of weighing factor between 0,7 Q_{max} and Q_{max} 0,00 %. (as left)

The *deviation* is defined as
$$\text{deviation} = \frac{(\text{Indicated Value} - \text{Reference Value})}{(\text{Reference Value})} \cdot 100\%$$

where the reference volume refers to the conditions at the meter under test. The reported values of this deviation are the arithmetic means of *n* single measurements at each flow-rate.

The reported *total uncertainty* is defined as:
$$U_{tot} = \sqrt{U_{harmonized}^2 + U_{meter}^2}$$

 where *U_{harmonized}* is the expanded uncertainty of the harmonized reference value, stated as the standard uncertainty of measurement multiplied by the coverage factor *k*=2, and *U_{meter}* is the expanded standard uncertainty of the meter under test, determined on the base of *n* repeats at each flow-rate, multiplied by the Student-t-Faktor(*n*) / *n*^{0,5} with a probability of 0,95 %.

Remarks Security marks are applied.

The calibration of the meter had been performed in following configuration:

A pipe-spool-set delivered by the customer consisting of in total 3 spools was used.

The spools were named by the customer as P41.

Upstream pipe (5500 mm) –FC–upstream pipe (7000 mm) –meter – downstream pipe (3570 mm)

The temperature had been measured 2000 mm downstream of the meter.

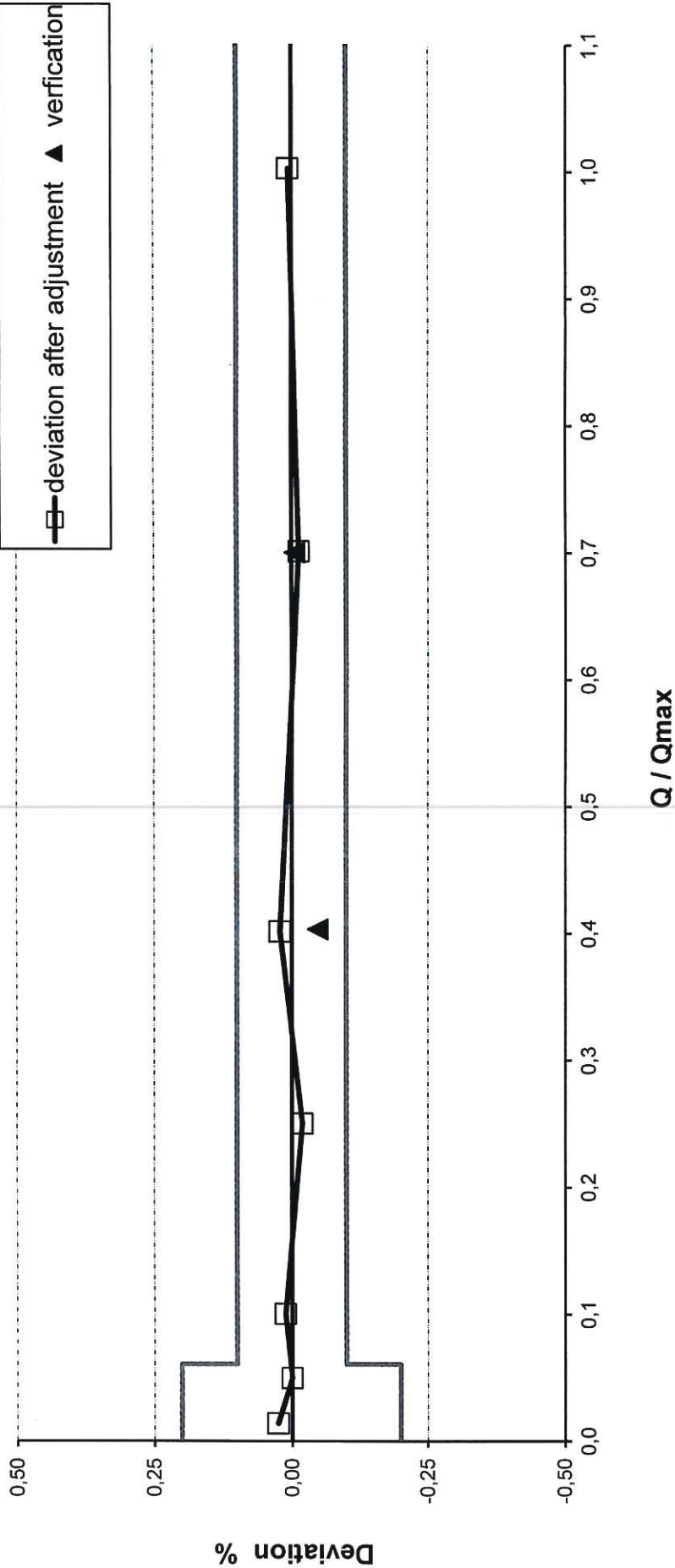
The flow conditioner was provided by the manufacturer/customer.

Tested in Dorsten at pigsar, on 2023-11-15

Schiffmann

Error Curve

Type of meter:	Ultrasonic meter	Customer:	SICK Engineering GmbH, Germany	DN:	500 mm	p (abs):	60 bar	HF 1	257,00	pulses / m ³
Meter no:	23251003	Manufacturer:	Sick AG	Size:	20"	Qmax:	14000 m ³ /h	HF 2	257,00	pulses / m ³
Date:	2023-11-15	Gear 1:	---			Qmin:	200 m ³ /h			pulses / m ³
Inspector:	Schiffmann	Gear 2:	---							pulses / m ³



Certificate Number **21627c/2023**
Date **2023-11-15**

Stated test results are based on following parameters

- value of 'Temperature fixed' and 'Pressure (fixed)' had been set to the test conditions during calibration -

Geräteidentifikation / meter identification				ModelName	F6A-4RSD20-DC1L-H218				755
Serial_Device	Serial_Meterbody	Serial_Electronics	Firmware_Version						
23251003	23360004	23150008	10600						
Firmware_CRC	MetrologyCRC	Parameter_CRC_Sensor	Parameter_CRC_Adjust						
0x06F9	0xF756	0x075F	0x13F1						
Zählerjustage / meter adjustment									
FixedPressure bar(a)	FixedTemperature °C	MinOperatingPressure bar(a)	MaxOperatingPressure bar(a)						
61	15	20,2	76						
LowFlowCutOff [m³/h]	Qmin [m³/h]	Qt [m³/h]	Qmax [m³/h]						
50	200	850	14000						
AdjustMode	FactoryAdjustFwd	1,0000	FactoryAdjustRev	1,0000					
2 - Polynom	AdjustFactorFwd	1,0000	AdjustFactorRev	1,0000					
Polynomial coefficients	AdjustFwd_CC0	-1,569382E-05	AdjustRev_CC0	0,000000E+00					
	AdjustFwd_CC1	8,152799E-03	AdjustRev_CC1	0,000000E+00					
	AdjustFwd_CC2	4,062798E-02	AdjustRev_CC2	0,000000E+00					
	AdjustFwd_CC3	1,118580E-01	AdjustRev_CC3	0,000000E+00					
	AdjustFwd_CC4	-1,227226E-01	AdjustRev_CC4	0,000000E+00					
Reynolds correction									
FlowPTConfig	CC_Linearization0	3,72169E+02	CC_Medium0	1,02000E+00					
external value	CC_Linearization1	-3,13937E+01	CC_Medium1	-3,95210E-03					
	CC_Linearization2	-8,09056E+03	CC_Medium2	2,27730E-05					
	CC_Linearization3	-1,89320E-03	CC_Medium3	-9,80010E-08					
	CC_Linearization4	1,01093E+00							
Frequenzausgang / frequency output									
Impulse_Value	Impulse_Factor [Imp/m³]	Impulse_FactorAirtest [Imp/m³]	Impulse_FrequencyLimit [Hz]						
flow a.c.	257	257	10000						
Messaufnehmergeometrie / transducer geometry									
PipeDiameter [m]	0,45560	Diameter [m]	0,44994						
Path	1-1	1-2	1-3	1-4	2-1	2-2	2-3	2-4	
Length [m]	0,38519	0,57294	0,57291	0,38508	0,38519	0,57294	0,57291	0,38508	
Angle [°]	59,976	59,980	59,983	59,972	59,976	59,980	59,983	59,972	
Ultraschallsensoren / ultrasonic sensors									
Path	1-1	1-2	1-3	1-4	2-1	2-2	2-3	2-4	
A SerialN°	23310024	23310045	23307846	23310042	0	0	0	0	
B SerialN°	23310017	23120028	23307843	23310036	0	0	0	0	
A Length [m]	0,03897	0,03897	0,03897	0,03898	0,00000	0,00000	0,00000	0,00000	
B Length [m]	0,03899	0,03897	0,03897	0,03900	0,00000	0,00000	0,00000	0,00000	
TimeOffset [µs]	17,6776	17,7329	17,7594	17,6989	0,0000	0,0000	0,0000	0,0000	
TimeDiff [ns]	0,026	-1,099	0,174	0,820	0,000	0,000	0,000	0,000	
ZeroPhase AB	1,29	1,18	1,23	1,25	1,80	1,80	1,80	1,80	
ZerroPhase BA	1,29	1,18	1,23	1,25	1,80	1,80	1,80	1,80	
Messumformer / transducer									
Path	1-1	1-2	1-3	1-4	2-1	2-2	2-3	2-4	
TimeOffset [µs]	0,0840	0,0845	0,0724	0,0799	0,0000	0,0000	0,0000	0,0000	
TimeDiff [ns]	0,220	0,781	-4,302	1,424	0,000	0,000	0,000	0,000	
DiffractionTime	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	

	 SOCRATE Working for Sustainability	COMMESSA NQ/R22199	UNITA' -
	FSRU Ravenna e collegamento alla Rete Nazionale Gasdotti	REL-MEC-E-52033	
	NQR22199 – Allacciamento FSRU Ravenna	Rev.	00

Rif. Codice Vendor: C23-00142-G-35

4.2.1.5.5 CERTIFICATI DI CALIBRAZIONE - US-M3A

Calibration Certificate

Number 21624c/2023
Date 2023-11-16

Applicant Name: SICK Engineering GmbH, Germany
Order No. DHG/4502457968

Meter under test Description: Ultrasonic meter
Manufacturer: Sick AG
EC number: DE-16-MI002-PTB001
Type: Flowsic600-XT
Serial number: 23251004
Nominal size: 20"
Range of flow rate: 200 ... 14000m³/h
Year of manufacture: 2023
Nominal diameter of meter: 500 mm
Nominal diameter of flange: 500 mm
Nominal flange pressure: ANSI 600

Date of test 2023-11-16

Results The results of the calibration are presented on page 3.

Test procedure According to EC type-examination certificate no. DE-16-MI002-PTB001

Test facility *pigsar* operates the National Standard of the Federal Republic of Germany for the unit of volume for high pressure natural gas under supervision of PTB. *pigsar* disseminates the harmonised values for the unit of volume for high pressure gas flow measurements of the Federal Republic of Germany, France and The Netherlands.
pigsar is accredited according to ISO/IEC 17025.

Traceability The presented results of the calibration are based on the unified Dutch-French-German reference values for the unit of volume for high-pressure gas flow measurements. On June-02-1999, PTB (Physikalisch-Technische Bundesanstalt) and VSL (formerly NMI-VSL, Nederlands Meetinstituut – Van Swinden Laboratorium) and later on May-04-2004 LNE (The Laboratoire national de métrologie et d'essais) have joined the harmonization (unification) procedure and the use of these reference values, see page 2.

Dorsten, 2023-11-16



The presented results of the calibration are based on the harmonized Dutch-French-German reference values for the unit of Volume for High Pressure Natural Gas flow measurements. In Paris, on 2004-May-4, PTB (Physikalisch-Technische Bundesanstalt), VSL (Van Swinden Laboratorium) and LNE (The Laboratoire national de métrologie et d'essais) have agreed on the harmonization and the use of these reference values.



The Physikalisch-Technische Bundesanstalt (PTB) in Braunschweig and Berlin is the national institute for science and technology and the highest technical authority of the Federal Republic of Germany for the field of metrology and certain sectors of safety engineering. The PTB comes under the auspices of the Federal Ministry of Economics. It meets the requirements for calibration and testing laboratories as defined in the EN ISO/IEC 17025.

It is the fundamental task of the PTB to realize and maintain the legal units in compliance with the International System of Units (SI) and to disseminate them, above all within the framework of legal and industrial metrology. The PTB thus is on top of the metrological hierarchy in Germany.

This certificate is consistent with the Calibration and Measurement Capabilities (CMCs) that are included in Appendix C of the Mutual Recognition Arrangement (MRA) drawn up by the International Committee for Weights and Measures (CIPM). Under the MRA, all participating institutes recognize the validity of each other's calibration and measurement certificates for the quantities, ranges and measurement uncertainties specified in Appendix C (for details see <http://www.bipm.org>).



Dutch
Metrology
Institute

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VSL makes an important contribution towards the reliability, quality and innovation of products and processes, both in business and society at large and provides a direct link to international accepted measurement standards in order to achieve traceability for measurement results of companies, laboratories and organisations.

VSL is accredited by RvA (Raad voor Accreditatie, "Board of Accreditation") to perform calibrations conform ISO17025 and is accredited to perform initial verification services for and on behalf of NMi Certin B.V.



The Laboratoire national de métrologie et d'essais (LNE) is the company designated by the French government as responsible of policy in terms of metrology in replacement of BNM (Bureau National de Métrologie) since January 2005.

The LNE is also designated by the French government as the Legal Metrology Service to perform type approvals and verifications. Thus, it is the fundamental task of the LNE to realize, develop and maintain the national primary standards and to insure the traceability of industries and users to the S.I units by the realization of specific instrumentation and calibration benches.

Certificate Number: 21624c/2023
Date: 2023-11-16

Applicant SICK Engineering GmbH, Germany

Meter under Test

Type	Ultrasonic meter Flowsic600-xT
Manufacturer	Sick AG
Serial number	23251004
Nominal Size	20"
Year of manufacture	2023

Test Conditions

Testing medium	Natural gas	CO ₂	0,8 mole %
Pressure, absolute	60,4 bar	H ₂	0,0 mole %
Gas Temperature	19,6 °C	Calorific value,s	10,27 kWh/m ³
Gas density (p, T)	51,2 kg/m ³	Density,normal	0,8244 kg/m ³
Dyn. viscosity (p, T)	1,30E-05 Pa s	normal conditions (273,15 K; 101,325 kPa)	

Results	Qi / Qmax	Qi (m ³ /h)	Reynolds number	deviation (%)	n	U _{meter} (%)	U _{tot} (%)
(as left)	0,01	198,33	0,55 *10 ⁶	0,00	5	0,11	0,19
	0,05	703,75	1,97 *10 ⁶	-0,01	4	0,08	0,16
	0,10	1399,37	3,92 *10 ⁶	0,02	4	0,10	0,17
	0,25	3495,95	9,74 *10 ⁶	-0,03	4	0,01	0,16
	0,40	5609,25	15,69 *10 ⁶	0,03	4	0,02	0,18
	0,70	9769,50	27,27 *10 ⁶	-0,01	4	0,06	0,19
	1,00	13963,44	38,87 *10 ⁶	0,00	4	0,05	0,20

Verification	0,70	9811,56	27,42 *10 ⁶	-0,03	3	0,09	0,20
	0,40	5608,30	15,70 *10 ⁶	-0,01	3	0,11	0,21

Weighted mean error, with continuous and linear decrease of weighing factor between 0,7 Q_{max} and Q_{max} 0,00 %. (as left)

The *deviation* is defined as
$$\text{deviation} = \frac{(\text{Indicated Value} - \text{Reference Value})}{(\text{Reference Value})} \cdot 100\%$$

where the reference volume refers to the conditions at the meter under test. The reported values of this deviation are the arithmetic means of *n* single measurements at each flow-rate.

The reported *total uncertainty* is defined as:
$$U_{tot} = \sqrt{U_{harmonized}^2 + U_{meter}^2}$$

 where *U_{harmonized}* is the expanded uncertainty of the harmonized reference value, stated as the standard uncertainty of measurement multiplied by the coverage factor *k*=2, and *U_{meter}* is the expanded standard uncertainty of the meter under test, determined on the base of *n* repeats at each flow-rate, multiplied by the Student-t-Faktor(*n*) / *n*^{0,5} with a probability of 0,95 %.

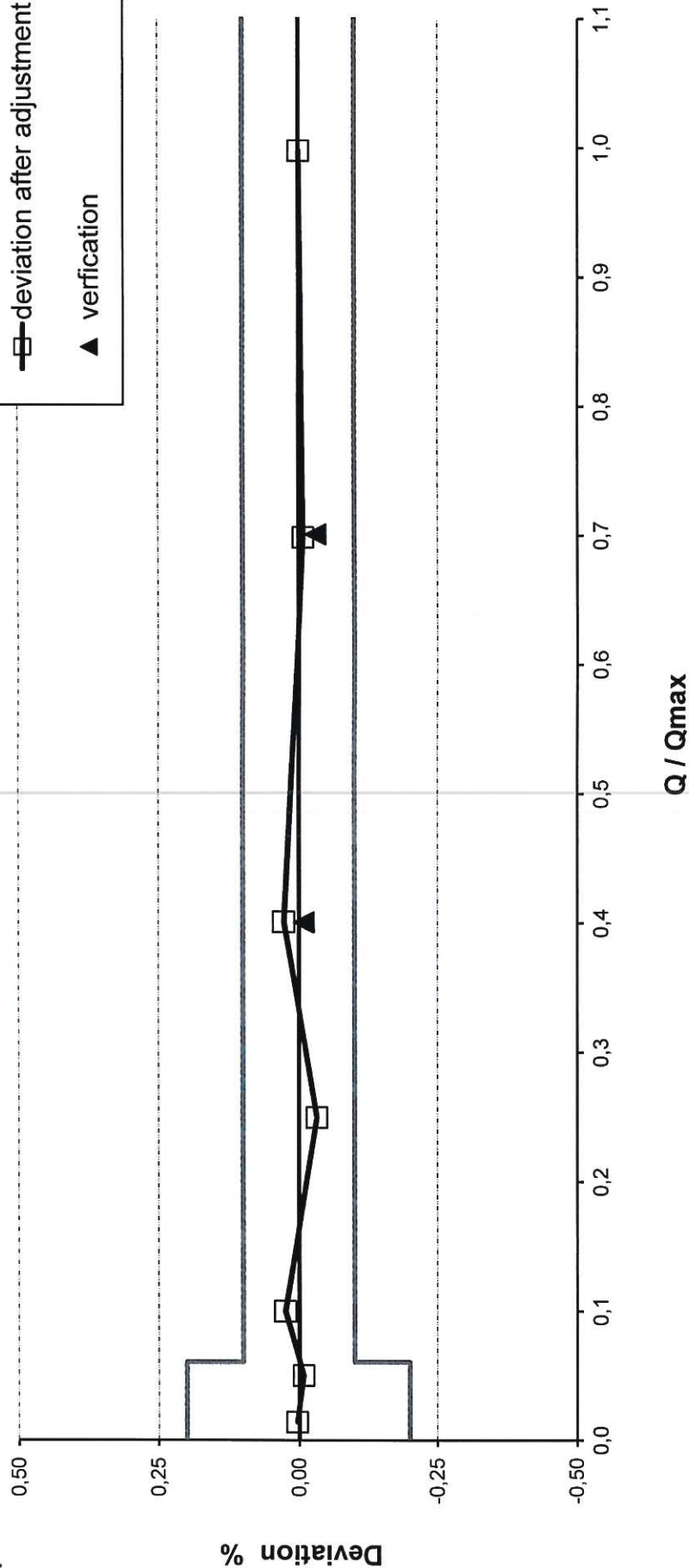
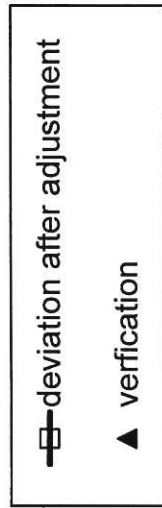
Remarks Security marks are applied.

The calibration of the meter had been performed in following configuration:
 A pipe-spool-set delivered by the customer consisting of in total 3 spools was used.
 The spools were named by the customer as P45.
 Upstream pipe (5500 mm) –FC–upstream pipe (7000 mm) –meter – downstream pipe (3570 mm)
 The temperature had been measured 2000 mm downstream of the meter.
 The flow conditioner was provided by the manufacturer/customer.

Tested in Dorsten at pigsar, on 2023-11-16 Schiffmann

Error Curve

Type of meter:	Ultrasonic meter	Customer:	SICK Engineering GmbH, Germany	DN:	500 mm	p (abs):	60 bar	HF 1	257,00	pulses / m³
Meter no:	23251004	Manufacturer:	Sick AG	Size:	20"	Qmax:	14000 m³/h	HF 2	257,00	pulses / m³
Date:	2023-11-16	Gear 1:	---			Qmin:	200 m³/h			pulses / m³
Inspector:	Schiffmann	Gear 2:	---							pulses / m³



Certificate Number 21624c/2023
Date 2023-11-16

Stated test results are based on following parameters

- value of 'Temperature fixed' and 'Pressure (fixed)' had been set to the test conditions during calibration -

Geräteidentifikation / meter identification		ModelName	F6A-4RSD20-DC1L-H218	755
Serial_Device	Serial_Meterbody	Serial_Electronics	Firmware_Version	
23251004	23360006	23150002	10600	
Firmware_CRC	MetrologyCRC	Parameter_CRC_Sensor	Parameter_CRC_Adjust	
0x06F9	0xE539	0xCF09	0xD6CA	

Zählerjustage / meter adjustment				
FixedPressure bar(a)	FixedTemperature °C	MinOperatingPressure bar(a)	MaxOperatingPressure bar(a)	
61	15	20,2	76	
LowFlowCutOff [m³/h]	Qmin [m³/h]	Qt [m³/h]	Qmax [m³/h]	
50	200	850	14000	
AdjustMode	FactoryAdjustFwd	1,0000	FactoryAdjustRev	1,0000
2 - Polynom	AdjustFactorFwd	1,0000	AdjustFactorRev	1,0000
Polynomial coefficients	AdjustFwd_CC0	-1,039676E-04	AdjustRev_CC0	0,000000E+00
	AdjustFwd_CC1	1,354665E-02	AdjustRev_CC1	0,000000E+00
	AdjustFwd_CC2	-7,627559E-02	AdjustRev_CC2	0,000000E+00
	AdjustFwd_CC3	5,362408E-01	AdjustRev_CC3	0,000000E+00
	AdjustFwd_CC4	-4,145352E-01	AdjustRev_CC4	0,000000E+00

Reynolds correction				
FlowPTConfig	CC_Linearization0	3,72169E+02	CC_Medium0	1,02000E+00
external value	CC_Linearization1	-3,13937E+01	CC_Medium1	-3,95210E-03
	CC_Linearization2	-8,09056E+03	CC_Medium2	2,27730E-05
	CC_Linearization3	-1,89320E-03	CC_Medium3	-9,80010E-08
	CC_Linearization4	1,01093E+00		

Frequenzausgang / frequency output			
Impulse_Value	Impulse_Factor [Imp/m³]	Impulse_FactorAirtest [Imp/m³]	Impulse_FrequencyLimit [Hz]
flow a.c.	257	257	10000

Messaufnehmergeometrie / transducer geometry							
PipeDiameter [m]	0,45560	Diameter [m]	0,44998				
Path	1-1	1-2	1-3	1-4	2-1	2-2	2-3
Length [m]	0,38515	0,57289	0,57286	0,38503	0,38515	0,57290	0,57287
Angle [°]	60,022	60,017	60,013	60,023	59,980	59,984	59,985
							59,973

Ultraschallsensoren / ultrasonic sensors								
Path	1-1	1-2	1-3	1-4	2-1	2-2	2-3	2-4
A SerialN°	23310022	23310026	23310037	23310044	0	0	0	0
B SerialN°	23310020	23310023	23310025	23310027	0	0	0	0
A Length [m]	0,03898	0,03897	0,03896	0,03899	0,00000	0,00000	0,00000	0,00000
B Length [m]	0,03895	0,03899	0,03895	0,03897	0,00000	0,00000	0,00000	0,00000
TimeOffset [µs]	17,6295	17,6674	17,6362	17,6412	0,0000	0,0000	0,0000	0,0000
TimeDiff [ns]	0,427	0,902	0,835	0,942	0,000	0,000	0,000	0,000
ZeroPhase AB	1,30	1,27	1,32	1,30	1,80	1,80	1,80	1,80
ZerroPhase BA	1,30	1,26	1,33	1,30	1,80	1,80	1,80	1,80

Messumformer / transducer								
Path	1-1	1-2	1-3	1-4	2-1	2-2	2-3	2-4
TimeOffset [µs]	0,0181	0,0220	0,0914	0,0893	0,0000	0,0000	0,0000	0,0000
TimeDiff [ns]	0,660	-3,961	-0,532	-1,624	0,000	0,000	0,000	0,000
DiffractionTime	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000

	 SOCRATE Working for Sustainability	COMMESSA NQ/R22199	UNITA' -
	FSRU Ravenna e collegamento alla Rete Nazionale Gasdotti	REL-MEC-E-52033	
	NQR22199 – Allacciamento FSRU Ravenna	Rev.	00

Rif. Codice Vendor: C23-00142-G-35

4.2.1.5.6 CERTIFICATI DI CALIBRAZIONE - US-M3B

Calibration Certificate

Number 21625c/2023
Date 2023-11-16

Applicant Name: SICK Engineering GmbH, Germany
Order No. DHG/4502457968

Meter under test Description: Ultrasonic meter
Manufacturer: Sick AG
EC number: DE-16-MI002-PTB001
Type: Flowsic600-XT
Serial number: 23251005
Nominal size: 20"
Range of flow rate: 200 ... 14000m³/h
Year of manufacture: 2023
Nominal diameter of meter: 500 mm
Nominal diameter of flange: 500 mm
Nominal flange pressure: ANSI 600

Date of test 2023-11-16

Results The results of the calibration are presented on page 3.

Test procedure According to EC type-examination certificate no. DE-16-MI002-PTB001

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Traceability The presented results of the calibration are based on the unified Dutch-French-German reference values for the unit of volume for high-pressure gas flow measurements. On June-02-1999, PTB (Physikalisch-Technische Bundesanstalt) and VSL (formerly NMI-VSL, Nederlands Meetinstituut – Van Swinden Laboratorium) and later on May-04-2004 LNE (The Laboratoire national de métrologie et d'essais) have joined the harmonization (unification) procedure and the use of these reference values, see page 2.

Dorsten, 2023-11-16



The presented results of the calibration are based on the harmonized Dutch-French-German reference values for the unit of Volume for High Pressure Natural Gas flow measurements. In Paris, on 2004-May-4, PTB (Physikalisch-Technische Bundesanstalt), VSL (Van Swinden Laboratorium) and LNE (The Laboratoire national de métrologie et d'essais) have agreed on the harmonization and the use of these reference values.



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Certificate Number: 21625c/2023
Date: 2023-11-16

Applicant SICK Engineering GmbH, Germany

Meter under Test

Type	Ultrasonic meter Flowsic600-xT
Manufacturer	Sick AG
Serial number	23251005
Nominal Size	20"
Year of manufacture	2023

Test Conditions

Testing medium	Natural gas	CO ₂	0,8 mole %
Pressure, absolute	60,5 bar	H ₂	0,0 mole %
Gas Temperature	19,6 °C	Calorific value,s	10,27 kWh/m ³
Gas density (p, T)	51,2 kg/m ³	Density,normal	0,8243 kg/m ³
Dyn. viscosity (p, T)	1,30E-05 Pa s	normal conditions (273,15 K; 101,325 kPa)	

Results	Qi / Qmax	Qi (m ³ /h)	Reynolds number	deviation (%)	n	U _{meter} (%)	U _{tot} (%)
(as left)	0,01	198,26	0,55 *10 ⁶	0,00	5	0,08	0,18
	0,05	703,57	1,97 *10 ⁶	0,00	4	0,03	0,14
	0,10	1399,06	3,92 *10 ⁶	0,02	4	0,07	0,16
	0,25	3497,29	9,73 *10 ⁶	-0,04	4	0,05	0,16
	0,40	5608,87	15,68 *10 ⁶	0,04	4	0,03	0,18
	0,70	9769,07	27,26 *10 ⁶	-0,01	4	0,03	0,18
	1,00	13964,76	38,83 *10 ⁶	0,00	4	0,07	0,21
Verification							
	0,70	9811,84	27,42 *10 ⁶	0,01	3	0,06	0,19
	0,40	5607,90	15,70 *10 ⁶	0,02	3	0,08	0,19

Weighted mean error, with continuous and linear decrease of weighing factor between 0,7 Q_{max} and Q_{max} 0,00 %. (as left)

The *deviation* is defined as
$$\text{deviation} = \frac{(\text{Indicated Value} - \text{Reference Value})}{(\text{Reference Value})} \cdot 100\%$$

where the reference volume refers to the conditions at the meter under test. The reported values of this deviation are the arithmetic means of *n* single measurements at each flow-rate.

The reported *total uncertainty* is defined as:
$$U_{tot} = \sqrt{U_{harmonized}^2 + U_{meter}^2}$$

where *U_{harmonized}* is the expanded uncertainty of the harmonized reference value, stated as the standard uncertainty of measurement multiplied by the coverage factor *k*=2, and *U_{meter}* is the expanded standard uncertainty of the meter under test, determined on the base of *n* repeats at each flow-rate, multiplied by the Student-t-Faktor(*n*) / *n*^{0,5} with a probability of 0,95 %.

Remarks Security marks are applied.

The calibration of the meter had been performed in following configuration:

A pipe-spool-set delivered by the customer consisting of in total 3 spools was used.

The spools were named by the customer as P45.

Upstream pipe (5500 mm) –FC–upstream pipe (7000 mm) –meter – downstream pipe (3570 mm)

The temperature had been measured 2000 mm downstream of the meter.

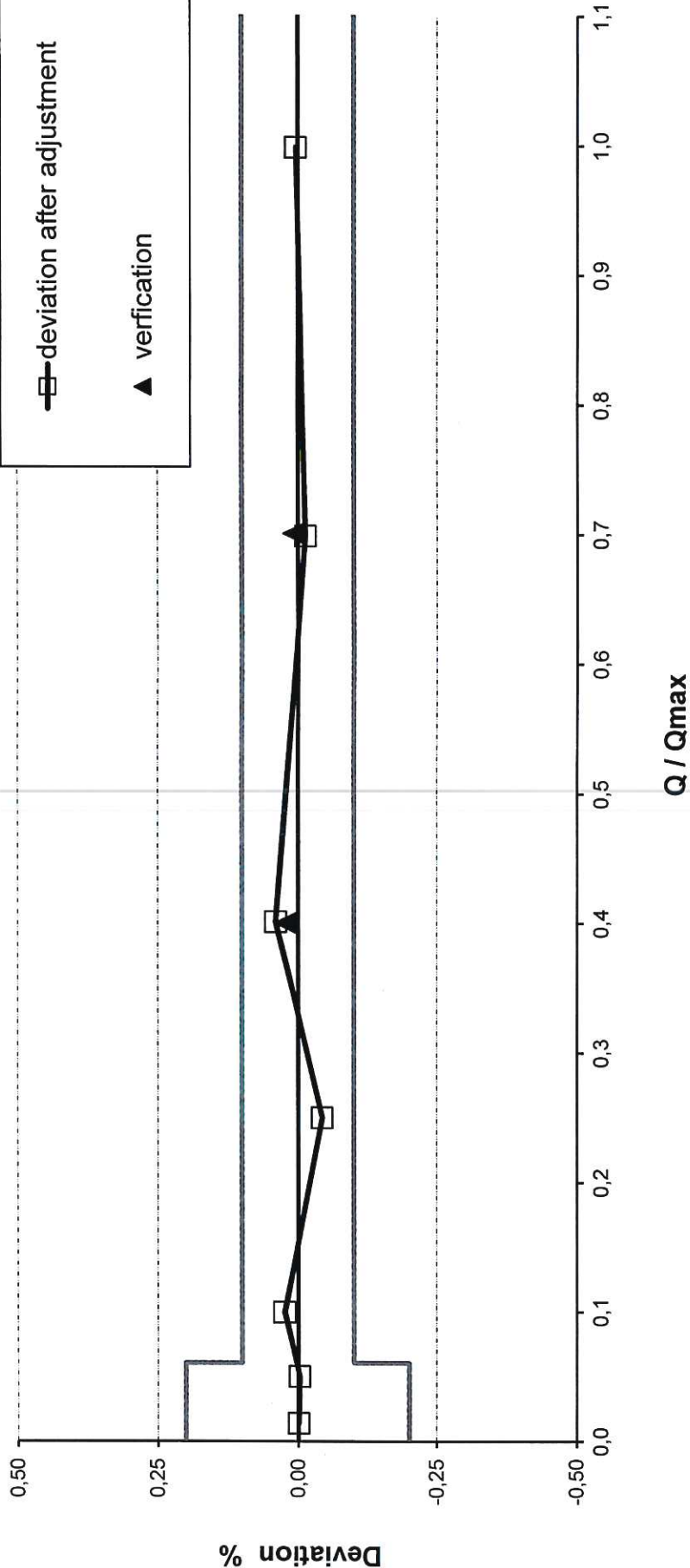
The flow conditioner was provided by the manufacturer/customer.

Tested in Dorsten at pigsar, on 2023-11-16

Schiffmann

Error Curve

Type of meter:	Ultrasonic meter	Customer:	SICK Engineering GmbH, Germany	DN:	500 mm	p (abs):	60	bar	HF 1	257,00	pulses / m ³
Meter no:	23251005	Manufacturer:	Sick AG	Size:	20"	Qmax:	14000	m ³ /h	HF 2	257,00	pulses / m ³
Date:	2023-11-16	Gear 1:	---			Qmin:	200	m ³ /h			pulses / m ³
Inspector:	Schiffmann	Gear 2:	---								pulses / m ³



Certificate Number **21625c/2023**
Date **2023-11-16**

Stated test results are based on following parameters

- value of 'Temperature fixed' and 'Pressure (fixed)' had been set to the test conditions during calibration -

755

Geräteidentifikation / meter identification		ModelName		F6A-4RSD20-DC1L-H218				
Serial_Device	Serial_Meterbody	Serial_Electronics		Firmware_Version				
23251005	23360006	23150001		10600				
Firmware_CRC	MetrologyCRC	Parameter_CRC_Sensor		Parameter_CRC_Adjust				
0x06F9	0xDE3D	0xAE42		0xC4B2				
Zählerjustage / meter adjustment								
FixedPressure bar(a)	FixedTemperature °C	MinOperatingPressure bar(a)		MaxOperatingPressure bar(a)				
61	15	20,2		76				
LowFlowCutOff [m³/h]	Qmin [m³/h]	Qt [m³/h]		Qmax [m³/h]				
50	200	850		14000				
AdjustMode	FactoryAdjustFwd	1,0000	FactoryAdjustRev	1,0000				
2 - Polynom	AdjustFactorFwd	1,0000	AdjustFactorRev	1,0000				
Polynomial coefficients	AdjustFwd_CC0	-5,493037E-05	AdjustRev_CC0	0,000000E+00				
	AdjustFwd_CC1	8,715479E-03	AdjustRev_CC1	0,000000E+00				
	AdjustFwd_CC2	8,544107E-02	AdjustRev_CC2	0,000000E+00				
	AdjustFwd_CC3	2,192671E-01	AdjustRev_CC3	0,000000E+00				
	AdjustFwd_CC4	-1,566388E-01	AdjustRev_CC4	0,000000E+00				
Reynolds correction								
FlowPTConfig	CC_Linearization0	3,72169E+02	CC_Medium0	1,02000E+00				
external value	CC_Linearization1	-3,13937E+01	CC_Medium1	-3,95210E-03				
	CC_Linearization2	-8,09056E+03	CC_Medium2	2,27730E-05				
	CC_Linearization3	-1,89320E-03	CC_Medium3	-9,80010E-08				
	CC_Linearization4	1,01093E+00						
Frequenzausgang / frequency output								
Impulse_Value	Impulse_Factor [Imp/m³]	Impulse_FactorAirtest [Imp/m³]		Impulse_FrequencyLimit [Hz]				
flow a.c.	257	257		10000				
Messaufnehmergeometrie / transducer geometry								
PipeDiameter [m]	0,45560		Diameter [m]		0,44998			
Path	1-1	1-2	1-3	1-4	2-1	2-2	2-3	2-4
Length [m]	0,38515	0,57290	0,57287	0,38504	0,38515	0,57290	0,57287	0,38504
Angle [°]	59,980	59,984	59,985	59,973	59,980	59,984	59,985	59,973
Ultraschallsensoren / ultrasonic sensors								
Path	1-1	1-2	1-3	1-4	2-1	2-2	2-3	2-4
A SerialN°	23310031	23310050	23310035	23310046	0	0	0	0
B SerialN°	23310028	23310043	23310032	23310033	0	0	0	0
A Length [m]	0,03896	0,03898	0,03898	0,03898	0,00000	0,00000	0,00000	0,00000
B Length [m]	0,03897	0,03897	0,03897	0,03897	0,00000	0,00000	0,00000	0,00000
TimeOffset [µs]	17,6766	17,6731	17,7709	17,6849	0,0000	0,0000	0,0000	0,0000
TimeDiff [ns]	-0,477	0,929	0,500	-0,793	0,000	0,000	0,000	0,000
ZerroPhase AB	1,24	1,30	1,27	1,27	1,80	1,80	1,80	1,80
ZerroPhase BA	1,24	1,30	1,27	1,27	1,80	1,80	1,80	1,80
Messumformer / transducer								
Path	1-1	1-2	1-3	1-4	2-1	2-2	2-3	2-4
TimeOffset [µs]	0,0257	0,0265	0,0422	0,0946	0,0000	0,0000	0,0000	0,0000
TimeDiff [ns]	-3,063	-2,876	-3,171	-2,800	0,000	0,000	0,000	0,000
DiffractionTime	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000

	 SOCRATE <i>Working for Sustainability</i>	COMMESSA NQ/R22199	UNITA' -
	FSRU Ravenna e collegamento alla Rete Nazionale Gasdotti	REL-MEC-E-52033	
	NQR22199 – Allacciamento FSRU Ravenna	Rev.	00

Rif. Codice Vendor: C23-00142-G-35

4.2.5 FLOW COMUPTER

4.2.5.1 LISTA DEGLI STRUMENTI IN FORNITURA CON SIN E TAG

TAG	DESCRIZIONE	INSTALLAZIONE	TIPO	MARCA	MODELLO	NUMERO DI SERIE
FC-1A	FLOW COMPUTER	Linea 1	FLOW - X	SPIRIT	FLOW - X	23-35-01-088
FC-1B	FLOW COMPUTER	Linea 1	FLOW - X	SPIRIT	FLOW - X	23-35-01-106
FC-2A	FLOW COMPUTER	Linea 2	FLOW - X	SPIRIT	FLOW - X	23-35-01-108
FC-2B	FLOW COMPUTER	Linea 2	FLOW - X	SPIRIT	FLOW - X	23-35-01-098
FC-3A	FLOW COMPUTER	Linea 3	FLOW - X	SPIRIT	FLOW - X	23-35-01-082
FC-3B	FLOW COMPUTER	Linea 3	FLOW - X	SPIRIT	FLOW - X	23-35-01-144

Calibration Certificate

Flow-X series of flow computers



ABB b.v.

Calibration ID **25739**
Date of calibration **25 October 2023**

Achtseweg Zuid 151
5651 GW Eindhoven

Product: **Flow-X/M**

Tel: +31 40 23 69 445

fax: +31 40 23 69 605

Product number: **85-111-005**
Serial number: **23-35-01-088**

Email: nl-spirit-sales@abb.com

Web: www.spiritIT.com

Date: **29 May 2024**

Objectives

Analog Inputs

- Total of 6 analog inputs
- Types of inputs: 4-20mA, 0-20mA, 0-5V, 1-5V
- Accuracy of each input is 0.008 % Full Scale

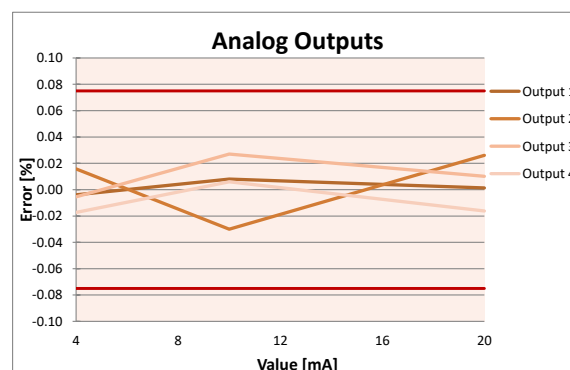
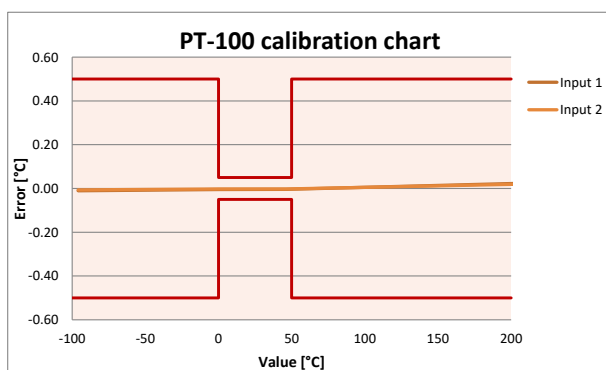
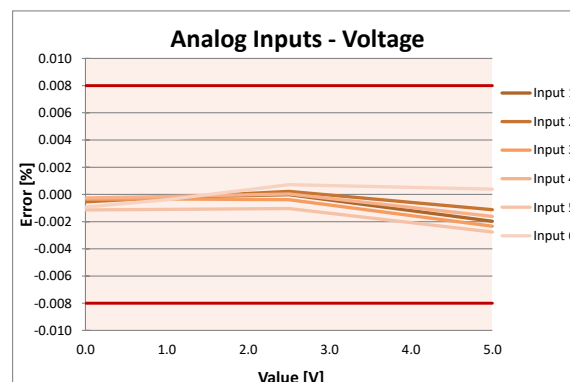
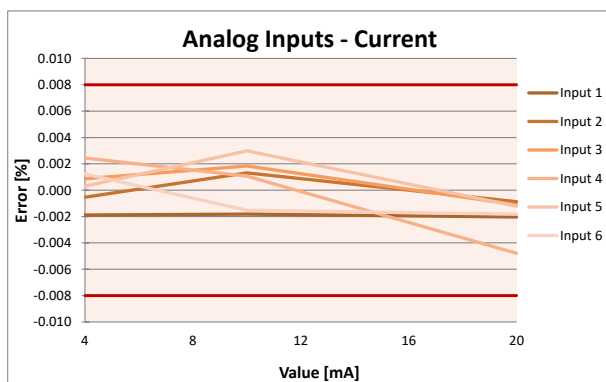
PT-100

- Total of 2 PT-100 inputs
- Resolution 0.02 °C for 100 ohms input.
- For 0 - 50 °C; error of < 0.05 or better
- For -220 - +220 °C; error of < 0.5 or better

Analog Outputs

- Total of 4 analog output
- Accuracy of each output is 0.075 % Full Scale

Calibration Results



This Certificate only applies to the Flow-X flow computer unit identified above.
This Flow-X flow computer was calibrated as per Spirit IT Test Procedure using the comparison technique against the Spirit IT calibration standard.
The calibration has been carried out by AME b.v., Eindhoven.
Detailed calibration data is available on request.

Signature:

Spirit IT
M.J.R. Payens, M.Sc.
Operations manager

Calibration Certificate

Flow-X series of flow computers



Calibration ID

25739

Date of calibration

25 October 2023

ABB b.v.

Product:

Flow-X/M

Product number:

85-111-005

Serial number:

23-35-01-088

Date:

29 May 2024

Achtseweg Zuid 151
5651 GW Eindhoven

Tel: +31 40 23 69 445
fax: +31 40 23 69 605

Email: nl-spiritit-sales@abb.com
Web: www.spiritIT.com

Calibration Results - numerical

Analog inputs - Current

Input 1	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004007340	0.004006964	-0.001884231
	10	0.010024170	0.010023807	-0.001813958
	20	0.020036945	0.020036538	-0.002033341

Input 2	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004007221	0.004007115	-0.000529277
	10	0.010023744	0.010024007	0.001314099
	20	0.020037048	0.020036873	-0.000873736

Input 3	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004007201	0.004007374	0.000867751
	10	0.010023787	0.010024155	0.001836364
	20	0.020036938	0.020036717	-0.001103943

Input 4	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004006759	0.004007247	0.002441752
	10	0.010023648	0.010023861	0.001066570
	20	0.020036998	0.020036040	-0.004787932

Input 5	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004006835	0.004006896	0.000301893
	10	0.010023189	0.010023786	0.002985285
	20	0.020036655	0.020036412	-0.001218447

Input 6	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004006566	0.004006813	0.001233466
	10	0.010023934	0.010023630	-0.001519655
	20	0.020036027	0.020035663	-0.001821495

Analog inputs - Voltage

Input 1	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000567586	0.000549544	-0.000360837
	1	1.000497520	1.000486905	-0.000212287
	2.5	2.500301453	2.500300562	-0.000017826
	5	5.000090115	4.999991377	-0.001974764

Input 2	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000567586	0.000540265	-0.000546430
	1	1.000497520	1.000486096	-0.000228476
	2.5	2.500301453	2.500312578	0.000222499
	5	5.000090115	5.000033892	-0.001124459

Input 3	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000567586	0.000549822	-0.000355286
	1	1.000497520	1.000480790	-0.000334594
	2.5	2.500301453	2.500281863	-0.000391790
	5	5.000090115	4.999973297	-0.002336361

Input 4	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000567586	0.000554375	-0.000264219
	1	1.000497520	1.000489722	-0.000155950
	2.5	2.500301453	2.500303160	0.000034141
	5	5.000090115	5.00009285	-0.001616602

Input 5	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000567586	0.000510837	-0.001134988
	1	1.000497520	1.000442402	-0.001102354
	2.5	2.500301453	2.500249550	-0.001038051
	5	5.000090115	4.999951855	-0.002765205

Input 6	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000567586	0.000521198	-0.000927754
	1	1.000497520	1.000478078	-0.000388827
	2.5	2.500301453	2.500337221	0.000715370
	5	5.000090115	5.000109259	0.000382891

PT-100 Calibration

Input 1	Target	Reference	Measured	Error
	Ohm	°C	°C	°C
	61	-95.92185226	-95.911351910	-0.010500345
	100	0.80113749	0.805817205	-0.004679718
	118	46.13082224	46.134477664	-0.003655428
	182	216.70407803	216.678758206	0.025319821

Input 2	Target	Reference	Measured	Error
	Ohm	°C	°C	°C
	61	-95.910097013	-95.903567202	-0.006529811
	100	-0.005921013	-0.003805754	-0.002115259
	118	46.030284421	46.032596356	-0.002311935
	182	216.742612324	216.721601935	0.021010389

Analog outputs

Input 1	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004000000	0.003999219	-0.003904105
	10	0.010000000	0.010001608	0.008042456
	20	0.020000000	0.020000258	0.001289845

Input 2	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004000000	0.004003141	0.015704634
	10	0.010000000	0.009993997	-0.030012730
	20	0.020000000	0.020005219	0.026096705

Input 3	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004000000	0.003998913	-0.005436540
	10	0.010000000	0.010005410	0.027050379
	20	0.020000000	0.020002028	0.010141135

Input 4	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004000000	0.003996546	-0.017268660
	10	0.010000000	0.010001195	0.005975366
	20	0.020000000	0.019996772	-0.016140940

Calibration Certificate

Flow-X series of flow computers



ABB b.v.

Calibration ID **25756**
Date of calibration **27 October 2023**

Achtseweg Zuid 151
5651 GW Eindhoven

Product: **Flow-X/M**

Tel: +31 40.23 69 445
fax: +31 40 23 69 605

Product number: **85-111-005**
Serial number: **23-35-01-106**

Email: nl-spirit-sales@abb.com
Web: www.spiritIT.com

Date: **29 May 2024**

Objectives

Analog Inputs

- Total of 6 analog inputs
- Types of inputs: 4-20mA, 0-20mA, 0-5V, 1-5V
- Accuracy of each input is 0.008 % Full Scale

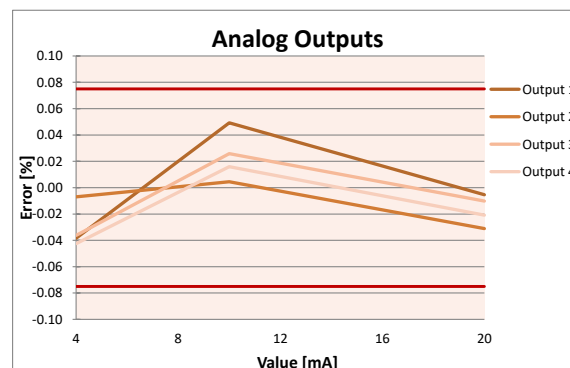
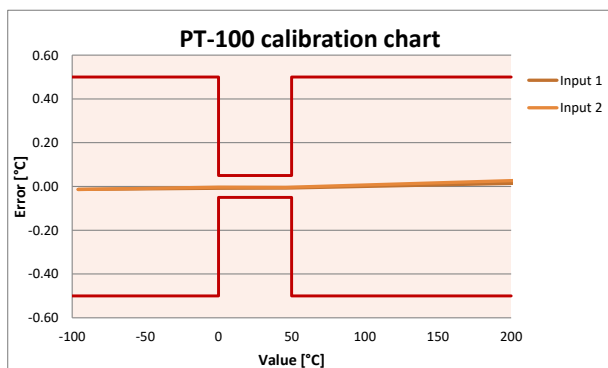
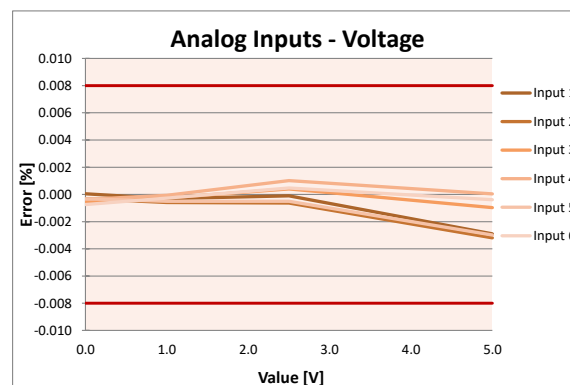
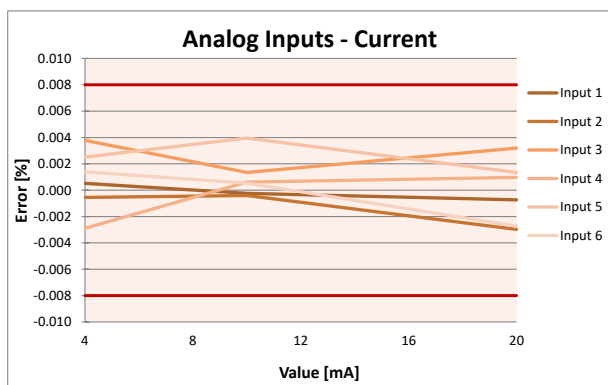
PT-100

- Total of 2 PT-100 inputs
- Resolution 0.02 °C for 100 ohms input.
- For 0 - 50 °C; error of < 0.05 or better
- For -220 - +220 °C; error of < 0.5 or better

Analog Outputs

- Total of 4 analog output
- Accuracy of each output is 0.075 % Full Scale

Calibration Results



This Certificate only applies to the Flow-X flow computer unit identified above.
This Flow-X flow computer was calibrated as per Spirit IT Test Procedure using the comparison technique against the Spirit IT calibration standard.
The calibration has been carried out by AME b.v., Eindhoven.
Detailed calibration data is available on request.

Signature:

Spirit IT
M.J.R. Payens, M.Sc.
Operations manager

Calibration Certificate

Flow-X series of flow computers



Calibration ID

25756

Date of calibration

27 October 2023

ABB b.v.

Product:

Flow-X/M

Product number:

85-111-005

Serial number:

23-35-01-106

Date:

29 May 2024

Achtseweg Zuid 151
5651 GW Eindhoven

Tel: +31 40 23 69 445
fax: +31 40 23 69 605

Email: nl-spiritit-sales@abb.com
Web: www.spiritIT.com

Calibration Results - numerical

Analog inputs - Current

Input 1	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004006609	0.004006713	0.000518185
	10	0.010023601	0.010023554	-0.000236822
	20	0.020036695	0.020036548	-0.000734565

Input 2	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004007048	0.004006937	-0.000553553
	10	0.010023422	0.010023341	-0.000404569
	20	0.020036037	0.020035443	-0.002973681

Input 3	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004006387	0.004007143	0.003779664
	10	0.010023512	0.010023781	0.001347392
	20	0.020035476	0.020036114	0.003191682

Input 4	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004007261	0.004006682	-0.002890887
	10	0.010023286	0.010023409	0.000615228
	20	0.020035805	0.020035999	0.000972522

Input 5	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004006962	0.004007465	0.002517358
	10	0.010023229	0.010024020	0.003955179
	20	0.020036223	0.020036492	0.001344629

Input 6	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004006942	0.004007221	0.001395948
	10	0.010023641	0.010023749	0.000538528
	20	0.020036061	0.020035515	-0.002730652

Analog inputs - Voltage

Input 1	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000559952	0.000562334	0.000047652
	1	1.000503771	1.000488314	-0.000309154
	2.5	2.500313957	2.500308846	-0.000102206
	5	5.000090894	4.999945994	-0.002898005

Input 2	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000559952	0.000544251	-0.000314016
	1	1.000503771	1.000474331	-0.000588818
	2.5	2.500313957	2.500282572	-0.000627699
	5	5.000090894	4.999931196	-0.003193973

Input 3	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000559952	0.000530792	-0.000583195
	1	1.000503771	1.000490519	-0.000265039
	2.5	2.500313957	2.500334182	0.000404507
	5	5.000090894	5.000042315	-0.000971597

Input 4	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000559952	0.000541648	-0.000366066
	1	1.000503771	1.000500751	-0.000060412
	2.5	2.500313957	2.500364791	0.001016691
	5	5.000090894	5.000092848	0.000039071

Input 5	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000559952	0.000543945	-0.000320130
	1	1.000503771	1.000478487	-0.000505688
	2.5	2.500313957	2.500288699	-0.000505148
	5	5.000090894	4.999941638	-0.002985130

Input 6	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000559952	0.000522715	-0.000744735
	1	1.000503771	1.000490086	-0.000273701
	2.5	2.500313957	2.500337533	0.000471529
	5	5.000090894	5.000071187	-0.000394141

PT-100 Calibration

Input 1	Target	Reference	Measured	Error
	Ohm	°C	°C	°C
	61	-95.91930785	-95.905961606	-0.013346239
	100	0.80393544	0.811830244	-0.007894808
	118	46.13305092	46.139988509	-0.006937588
	182	216.69429865	216.677807661	0.016490987

Input 2	Target	Reference	Measured	Error
	Ohm	°C	°C	°C
	61	-95.908789205	-95.894922951	-0.013866254
	100	-0.002154510	0.001096813	-0.003251323
	118	46.032635342	46.036337352	-0.003702010
	182	216.744820081	216.714896205	0.029923876

Analog outputs

Input 1	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004000000	0.003992327	-0.038364907
	10	0.010000000	0.010009846	0.049230462
	20	0.020000000	0.019998940	-0.005297661

Input 2	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004000000	0.003998612	-0.006941036
	10	0.010000000	0.010000899	0.004494787
	20	0.020000000	0.019993790	-0.031052235

Input 3	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004000000	0.003992753	-0.036235456
	10	0.010000000	0.010005168	0.025838021
	20	0.020000000	0.019997978	-0.010111333

Input 4	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004000000	0.003991499	-0.042504897
	10	0.010000000	0.010003190	0.015947821
	20	0.020000000	0.019995839	-0.020802620

Calibration Certificate

Flow-X series of flow computers



ABB b.v.

Calibration ID **25758**
Date of calibration **27 October 2023**

Achtseweg Zuid 151
5651 GW Eindhoven

Product: **Flow-X/M**

Tel: +31 40 23 69 445

fax: +31 40 23 69 605

Product number: **85-111-005**
Serial number: **23-35-01-108**

Email: nl-spirit-sales@abb.com
Web: www.spiritIT.com

Date: **29 May 2024**

Objectives

Analog Inputs

- Total of 6 analog inputs
- Types of inputs: 4-20mA, 0-20mA, 0-5V, 1-5V
- Accuracy of each input is 0.008 % Full Scale

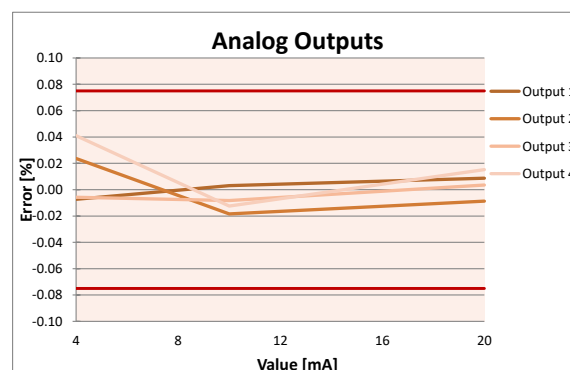
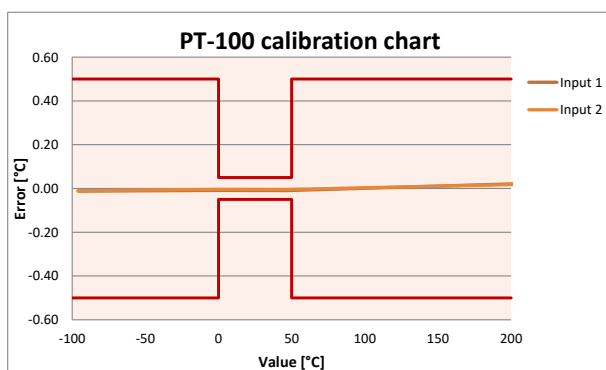
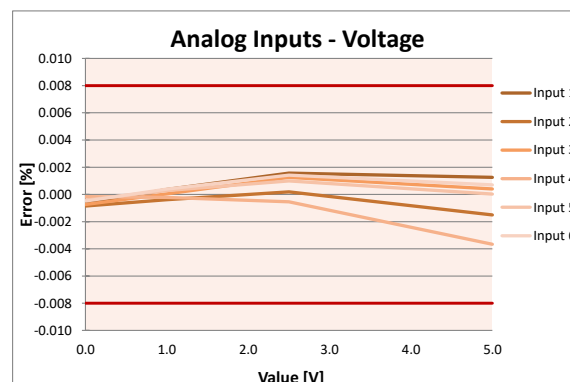
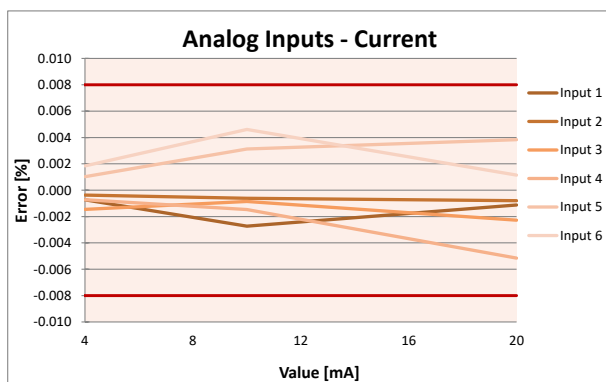
PT-100

- Total of 2 PT-100 inputs
- Resolution 0.02 °C for 100 ohms input.
- For 0 - 50 °C; error of < 0.05 or better
- For -220 - +220 °C; error of < 0.5 or better

Analog Outputs

- Total of 4 analog output
- Accuracy of each output is 0.075 % Full Scale

Calibration Results



This Certificate only applies to the Flow-X flow computer unit identified above.
This Flow-X flow computer was calibrated as per Spirit IT Test Procedure using the comparison technique against the Spirit IT calibration standard.
The calibration has been carried out by AME b.v., Eindhoven.
Detailed calibration data is available on request.

Signature:

Spirit IT
M.J.R. Payens, M.Sc.
Operations manager

Calibration Certificate

Flow-X series of flow computers



Calibration ID

25758

Date of calibration

27 October 2023

ABB b.v.

Product:

Flow-X/M

Product number:

85-111-005

Serial number:

23-35-01-108

Date:

29 May 2024

Achtseweg Zuid 151

5651 GW Eindhoven

Tel: +31 40 23 69 445

fax: +31 40 23 69 605

Email: nl-spiritit-sales@abb.com

Web: www.spiritIT.com

Calibration Results - numerical

Analog inputs - Current

Input 1	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004006815	0.004006669	-0.000730899
	10	0.010023930	0.010023385	-0.002728803
	20	0.020036476	0.020036250	-0.001128439

Input 2	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004007031	0.004006957	-0.000372328
	10	0.010023854	0.010023731	-0.000612661
	20	0.020036386	0.020036227	-0.000796296

Input 3	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004006958	0.004006666	-0.001461670
	10	0.010023488	0.010023317	-0.000854241
	20	0.020035934	0.020035479	-0.002277130

Input 4	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004006686	0.004006541	-0.000723881
	10	0.010023262	0.010022967	-0.001475289
	20	0.020036223	0.020035192	-0.005155333

Input 5	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004006433	0.004006638	0.001026140
	10	0.010023020	0.010023646	0.003131697
	20	0.020035841	0.020036608	0.003834468

Input 6	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004006809	0.004007176	0.001837629
	10	0.010022874	0.010023796	0.004610115
	20	0.020035798	0.020036027	0.001143922

Analog inputs - Voltage

Input 1	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000559996	0.000526759	-0.000664734
	1	1.000503139	1.000521076	0.000358742
	2.5	2.500315678	2.500394036	0.001567163
	5	5.000087732	5.000150375	0.001252874

Input 2	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000559996	0.000517382	-0.000852283
	1	1.000503139	1.000483846	-0.000385867
	2.5	2.500315678	2.500325036	0.000187158
	5	5.000087732	5.000012280	-0.001509037

Input 3	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000559996	0.000522906	-0.000741793
	1	1.000503139	1.000505013	0.000037473
	2.5	2.500315678	2.500378296	0.001252370
	5	5.000087732	5.000107616	0.000397694

Input 4	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000559996	0.000551884	-0.000162230
	1	1.000503139	1.000492171	-0.000219364
	2.5	2.500315678	2.500288496	-0.000543632
	5	5.000087732	4.999904491	-0.003664809

Input 5	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000559996	0.000539220	-0.000415506
	1	1.000503139	1.000517353	0.000284273
	2.5	2.500315678	2.500365312	0.000926884
	5	5.000087732	5.000088898	0.000023329

Input 6	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000559996	0.000535635	-0.000487218
	1	1.000503139	1.000522820	0.000393629
	2.5	2.500315678	2.500386590	0.001418254
	5	5.000087732	5.000123004	0.000705448

PT-100 Calibration

Input 1	Target	Reference	Measured	Error
	Ohm	°C	°C	°C
	61	-95.92042079	-95.908344089	-0.012076701
	100	0.80150644	0.810258125	-0.008751689
	118	46.13123250	46.140552140	-0.009319640
	182	216.70428054	216.680185276	0.024095264

Input 2	Target	Reference	Measured	Error
	Ohm	°C	°C	°C
	61	-95.909838445	-95.899589869	-0.010248576
	100	-0.004329854	-0.000461245	-0.003868609
	118	46.032300079	46.037387133	-0.005087054
	182	216.744690486	216.724488853	0.020201634

Analog outputs

Input 1	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004000000	0.003998538	-0.007308722
	10	0.010000000	0.010000615	0.003075004
	20	0.020000000	0.020001744	0.008719565

Input 2	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004000000	0.004004736	0.023680183
	10	0.010000000	0.009996319	-0.018405917
	20	0.020000000	0.019998252	-0.008738042

Input 3	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004000000	0.003998843	-0.005784780
	10	0.010000000	0.009998348	-0.008261801
	20	0.020000000	0.020000706	0.003528595

Input 4	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004000000	0.004008198	0.040989598
	10	0.010000000	0.009997517	-0.012417437
	20	0.020000000	0.020003047	0.015233757

Calibration Certificate

Flow-X series of flow computers



ABB b.v.

Calibration ID **25748**
Date of calibration **27 October 2023**

Achtseweg Zuid 151
5651 GW Eindhoven

Product: **Flow-X/M**

Tel: +31 40 23 69 445
fax: +31 40 23 69 605

Product number: **85-111-005**
Serial number: **23-35-01-098**

Email: nl-spirit-sales@abb.com
Web: www.spiritIT.com

Date: **29 May 2024**

Objectives

Analog Inputs

- Total of 6 analog inputs
- Types of inputs: 4-20mA, 0-20mA, 0-5V, 1-5V
- Accuracy of each input is 0.008 % Full Scale

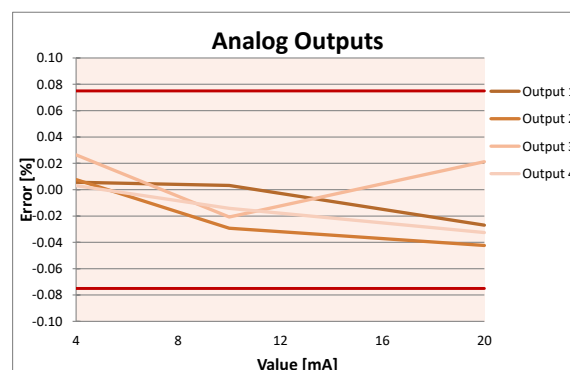
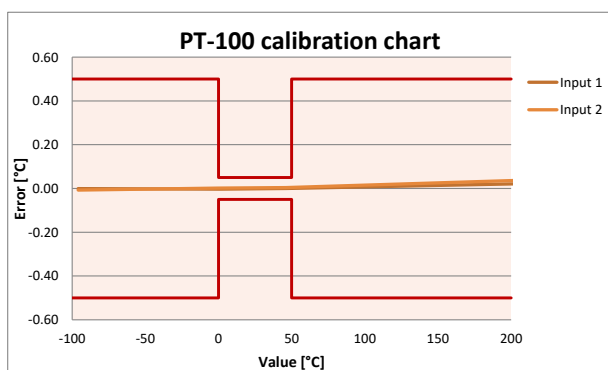
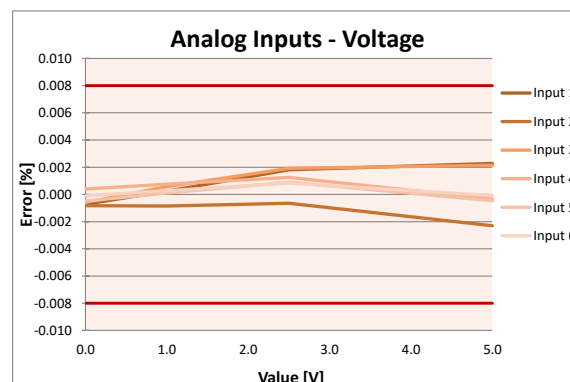
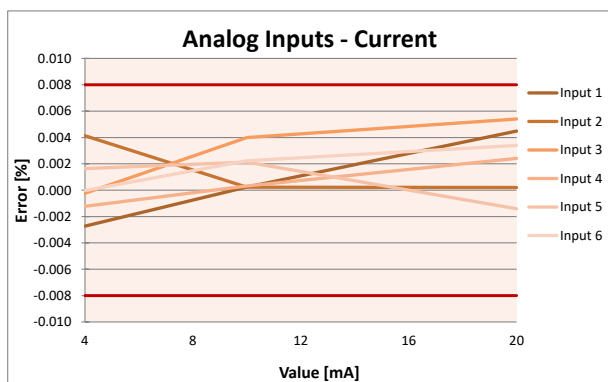
PT-100

- Total of 2 PT-100 inputs
- Resolution 0.02 °C for 100 ohms input.
- For 0 - 50 °C; error of < 0.05 or better
- For -220 - +220 °C; error of < 0.5 or better

Analog Outputs

- Total of 4 analog output
- Accuracy of each output is 0.075 % Full Scale

Calibration Results



This Certificate only applies to the Flow-X flow computer unit identified above.
This Flow-X flow computer was calibrated as per Spirit IT Test Procedure using the comparison technique against the Spirit IT calibration standard.
The calibration has been carried out by AME b.v., Eindhoven.
Detailed calibration data is available on request.

Signature:

Spirit IT
M.J.R. Payens, M.Sc.
Operations manager

Calibration Certificate

Flow-X series of flow computers



Calibration ID

25748

Date of calibration

27 October 2023

ABB b.v.

Product:

Flow-X/M

Product number:

85-111-005

Serial number:

23-35-01-098

Date:

29 May 2024

Achtseweg Zuid 151
5651 GW Eindhoven

Tel: +31 40 23 69 445
fax: +31 40 23 69 605

Email: nl-spiritit-sales@abb.com
Web: www.spiritIT.com

Calibration Results - numerical

Analog inputs - Current

Input 1	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004007018	0.004006472	-0.002728208
	10	0.010023674	0.010023721	0.000234679
	20	0.020036519	0.020037416	0.004485737

Input 2	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004006536	0.004007363	0.004131804
	10	0.010023980	0.010024025	0.000226232
	20	0.020036446	0.020036487	0.000206193

Input 3	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004007540	0.004007493	-0.000233155
	10	0.010023767	0.010024567	0.003995485
	20	0.020036582	0.020037663	0.005403595

Input 4	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004006869	0.004006624	-0.001223265
	10	0.010023571	0.010023635	0.000318071
	20	0.020036184	0.020036666	0.002413323

Input 5	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004006991	0.004007321	0.001649721
	10	0.010023372	0.010023798	0.002129634
	20	0.020036074	0.020035792	-0.001408646

Input 6	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004006991	0.004006987	-0.000024926
	10	0.010023389	0.010023834	0.002228509
	20	0.020035888	0.020036568	0.003398531

Analog inputs - Voltage

Input 1	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000561320	0.000525464	-0.000717114
	1	1.000486884	1.000498760	0.000237508
	2.5	2.500288773	2.500379251	0.001809557
	5	5.000076684	5.000190495	0.002276219

Input 2	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000561320	0.000519826	-0.000829870
	1	1.000486884	1.000444251	-0.000852654
	2.5	2.500288773	2.500256352	-0.000648415
	5	5.000076684	4.999961580	-0.002302088

Input 3	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000561320	0.000531830	-0.000589788
	1	1.000486884	1.000515175	0.000565819
	2.5	2.500288773	2.500384480	0.001914141
	5	5.000076684	5.000184186	0.002150027

Input 4	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000561320	0.000581526	0.000404130
	1	1.000486884	1.000524209	0.000746487
	2.5	2.500288773	2.500351326	0.001251054
	5	5.000076684	5.000060017	-0.000333353

Input 5	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000561320	0.000536580	-0.000494791
	1	1.000486884	1.000491802	0.000098364
	2.5	2.500288773	2.500333919	0.000902919
	5	5.000076684	5.000053250	-0.000468693

Input 6	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000561320	0.000556012	-0.000106147
	1	1.000486884	1.000500298	0.000268267
	2.5	2.500288773	2.500330525	0.000835036
	5	5.000076684	5.000072256	-0.000088577

PT-100 Calibration

Input 1	Target	Reference	Measured	Error
	Ohm	°C	°C	°C
	61	-95.92234315	-95.921808581	-0.000534572
	100	0.79909285	0.802163549	-0.003070703
	118	46.13419479	46.134076530	0.000118259
	182	216.69658343	216.673544543	0.023038890

Input 2	Target	Reference	Measured	Error
	Ohm	°C	°C	°C
	61	-95.910569168	-95.903208382	-0.007360786
	100	-0.004817967	-0.006754058	0.001936091
	118	46.031033947	46.026671225	0.004362722
	182	216.743321216	216.703861667	0.039459550

Analog outputs

Input 1	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004000000	0.004001129	0.005646349
	10	0.010000000	0.010000647	0.003235937
	20	0.020000000	0.019994611	-0.026943091

Input 2	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004000000	0.004001532	0.007661582
	10	0.010000000	0.009994132	-0.029342178
	20	0.020000000	0.019991528	-0.042360430

Input 3	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004000000	0.004005288	0.026440624
	10	0.010000000	0.009995850	-0.020750167
	20	0.020000000	0.020004254	0.021268728

Input 4	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004000000	0.004000612	0.003058911
	10	0.010000000	0.009997168	-0.014160873
	20	0.020000000	0.019993490	-0.032552485

Calibration Certificate

Flow-X series of flow computers



ABB b.v.

Calibration ID **25733**
Date of calibration **26 October 2023**

Achtseweg Zuid 151
5651 GW Eindhoven

Product: **Flow-X/M**

Tel: +31 40.23 69 445

fax: +31 40 23 69 605

Product number: **85-111-005**
Serial number: **23-35-01-082**

Email: nl-spirit-sales@abb.com

Web: www.spiritIT.com

Date: **06 June 2024**

Objectives

Analog Inputs

- Total of 6 analog inputs
- Types of inputs: 4-20mA, 0-20mA, 0-5V, 1-5V
- Accuracy of each input is 0.008 % Full Scale

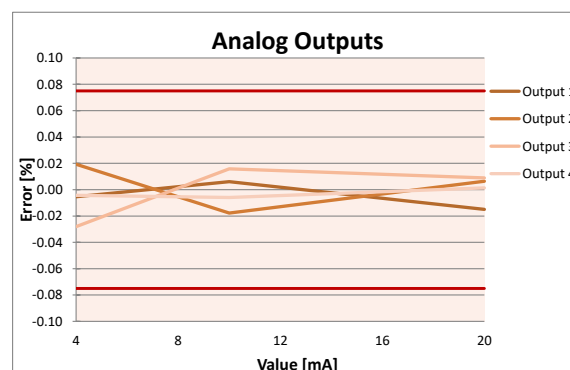
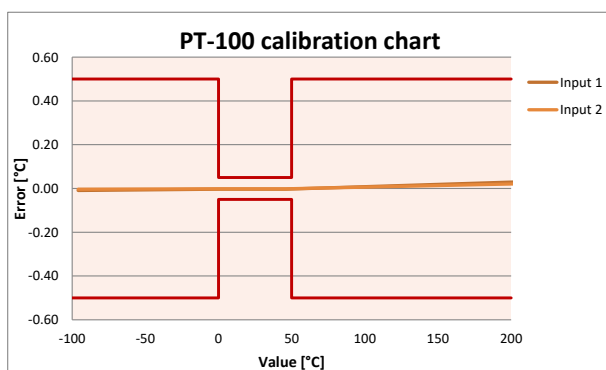
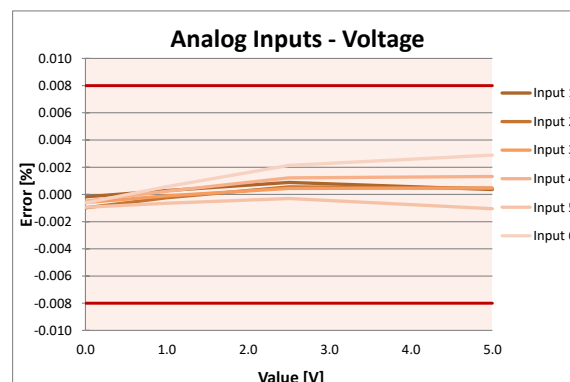
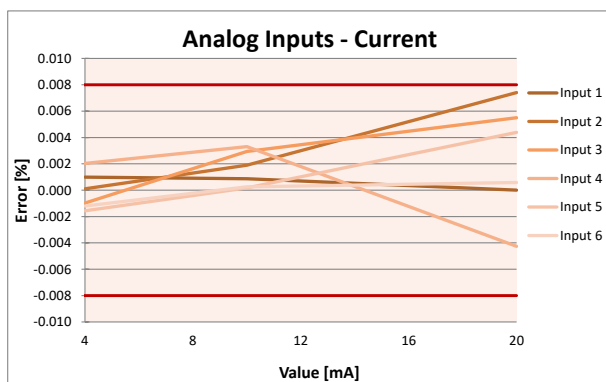
PT-100

- Total of 2 PT-100 inputs
- Resolution 0.02 °C for 100 ohms input.
- For 0 - 50 °C; error of < 0.05 or better
- For -220 - +220 °C; error of < 0.5 or better

Analog Outputs

- Total of 4 analog output
- Accuracy of each output is 0.075 % Full Scale

Calibration Results



This Certificate only applies to the Flow-X flow computer unit identified above.

This Flow-X flow computer was calibrated as per Spirit IT Test Procedure using the comparison technique against the Spirit IT calibration standard.

The calibration has been carried out by AME b.v., Eindhoven.

Detailed calibration data is available on request.

Signature:

Spirit IT
M.J.R. Payens, M.Sc.
Operations manager

Calibration Certificate

Flow-X series of flow computers



Calibration ID

25733

Date of calibration

26 October 2023

ABB b.v.

Product:

Flow-X/M

Product number:

85-111-005

Serial number:

23-35-01-082

Date:

06 June 2024

Achtseweg Zuid 151

5651 GW Eindhoven

Tel: +31 40 23 69 445

fax: +31 40 23 69 605

Email: nl-spiritit-sales@abb.com

Web: www.spiritIT.com

Calibration Results - numerical

Analog inputs - Current

Input 1	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004006902	0.004007100	0.000915774
	10	0.010023545	0.010023720	0.000873770
	20	0.020036230	0.020036231	0.000004016

Input 2	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004007001	0.004007023	0.000105242
	10	0.010023684	0.010024063	0.001895448
	20	0.020035705	0.020037187	0.007408641

Input 3	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004007287	0.004007092	-0.000975154
	10	0.010023342	0.010023931	0.002944271
	20	0.020035702	0.020036802	0.005501290

Input 4	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004006736	0.004007142	0.002032344
	10	0.010023070	0.010023731	0.003306019
	20	0.020036144	0.020035292	-0.004259241

Input 5	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004006775	0.004006463	-0.001563562
	10	0.010023269	0.010023305	0.000177640
	20	0.020036223	0.020037101	0.004387170

Input 6	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004007011	0.004006771	-0.001203779
	10	0.010023847	0.010023897	0.000250733
	20	0.020036017	0.020036134	0.000584674

Analog inputs - Voltage

Input 1	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000563055	0.000554256	-0.000175990
	1	1.000501212	1.000515577	0.000287310
	2.5	2.500318458	2.500362585	0.000882556
	5	5.000096823	5.000115193	0.000367402

Input 2	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000563055	0.000513699	-0.000987136
	1	1.000501212	1.000488828	-0.000247669
	2.5	2.500318458	2.500346190	0.000554649
	5	5.000096823	5.000119746	0.000458465

Input 3	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000563055	0.000533210	-0.000596902
	1	1.000501212	1.000495767	-0.000108896
	2.5	2.500318458	2.500340381	0.000438467
	5	5.000096823	5.000120134	0.000466236

Input 4	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000563055	0.000538496	-0.000491188
	1	1.000501212	1.000513091	0.000237593
	2.5	2.500318458	2.500379595	0.001222755
	5	5.000096823	5.000162735	0.001318258

Input 5	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000563055	0.000515997	-0.000941159
	1	1.000501212	1.000469151	-0.000641221
	2.5	2.500318458	2.500303407	-0.000301011
	5	5.000096823	5.000044208	-0.001052285

Input 6	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000563055	0.000531604	-0.000629037
	1	1.000501212	1.000529611	0.000567993
	2.5	2.500318458	2.500425543	0.002141712
	5	5.000096823	5.000241345	0.002890445

PT-100 Calibration

Input 1	Target	Reference	Measured	Error
	Ohm	°C	°C	°C
	61	-95.92251553	-95.913325164	-0.009190361
	100	0.80197533	0.804925692	-0.002950359
	118	46.13325995	46.136336196	-0.003076249
	182	216.69495486	216.662503029	0.032451836

Input 2	Target	Reference	Measured	Error
	Ohm	°C	°C	°C
	61	-95.909310078	-95.905860278	-0.003449800
	100	-0.006436026	-0.005051244	-0.001384782
	118	46.033282263	46.035128324	-0.001846061
	182	216.740286973	216.717367821	0.022919152

Analog outputs

Input 1	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004000000	0.003998939	-0.005306006
	10	0.010000000	0.010001218	0.006090925
	20	0.020000000	0.019997007	-0.014964344

Input 2	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004000000	0.004003860	0.019300582
	10	0.010000000	0.009996450	-0.017747658
	20	0.020000000	0.020001278	0.006388054

Input 3	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004000000	0.003994387	-0.028067235
	10	0.010000000	0.010003164	0.015818181
	20	0.020000000	0.020001799	0.008993150

Input 4	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004000000	0.003999154	-0.004227758
	10	0.010000000	0.009998814	-0.005928502
	20	0.020000000	0.020000272	0.001359359

Calibration Certificate

Flow-X series of flow computers



ABB b.v.

Calibration ID **25794**
Date of calibration **24 October 2023**

Achtseweg Zuid 151
5651 GW Eindhoven

Product: **Flow-X/M**

Tel: +31 40.23 69 445

fax: +31 40 23 69 605

Product number: **85-111-005**
Serial number: **23-35-01-144**

Email: nl-spirit-sales@abb.com

Web: www.spiritIT.com

Date: **29 May 2024**

Objectives

Analog Inputs

- Total of 6 analog inputs
- Types of inputs: 4-20mA, 0-20mA, 0-5V, 1-5V
- Accuracy of each input is 0.008 % Full Scale

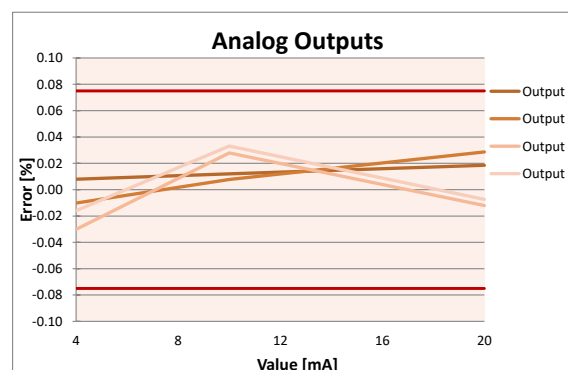
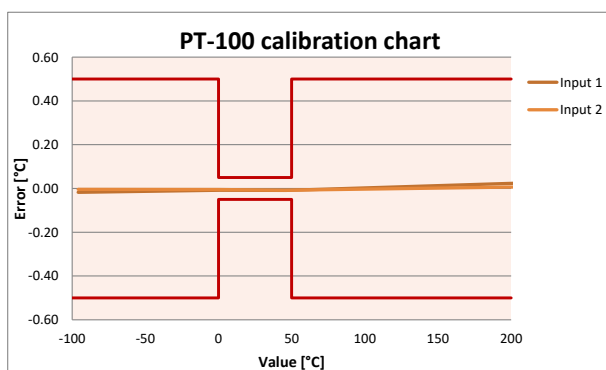
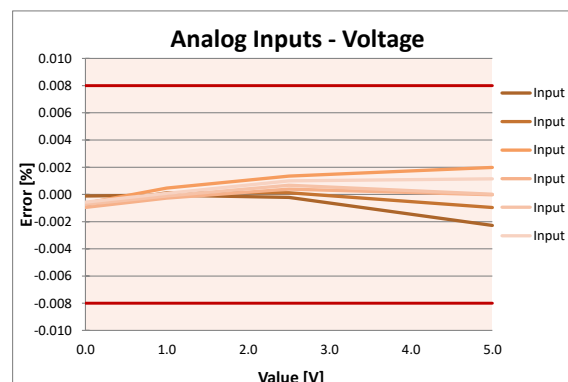
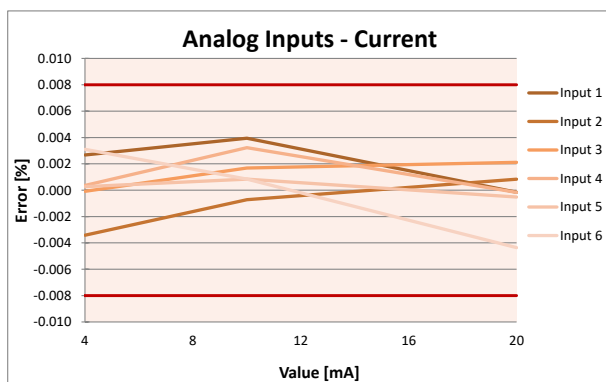
PT-100

- Total of 2 PT-100 inputs
- Resolution 0.02 °C for 100 ohms input.
- For 0 - 50 °C; error of < 0.05 or better
- For -220 - +220 °C; error of < 0.5 or better

Analog Outputs

- Total of 4 analog output
- Accuracy of each output is 0.075 % Full Scale

Calibration Results



This Certificate only applies to the Flow-X flow computer unit identified above.
This Flow-X flow computer was calibrated as per Spirit IT Test Procedure using the comparison technique against the Spirit IT calibration standard.
The calibration has been carried out by AME b.v., Eindhoven.
Detailed calibration data is available on request.

Signature:

Spirit IT
M.J.R. Payens, M.Sc.
Operations manager

Calibration Certificate

Flow-X series of flow computers



Calibration ID

25794

Date of calibration

24 October 2023

ABB b.v.

Product:

Flow-X/M

Product number:

85-111-005

Serial number:

23-35-01-144

Date:

29 May 2024

Achtseweg Zuid 151
5651 GW Eindhoven

Tel: +31 40 23 69 445
fax: +31 40 23 69 605

Email: nl-spiritit-sales@abb.com
Web: www.spiritIT.com

Calibration Results - numerical

Analog inputs - Current

Input 1	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004006639	0.004007175	0.002678574
	10	0.010023033	0.010023822	0.003944120
	20	0.020036476	0.020036445	-0.000155308

Input 2	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004007453	0.004006770	-0.003418439
	10	0.010023625	0.010023480	-0.000720328
	20	0.020035815	0.020035982	0.000834535

Input 3	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004007124	0.004007107	-0.000086678
	10	0.010023708	0.010024044	0.001681858
	20	0.020036247	0.020036670	0.002114885

Input 4	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004006845	0.004006917	0.000356424
	10	0.010023116	0.010023762	0.003226861
	20	0.020036420	0.020036386	-0.000166409

Input 5	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004007085	0.004007138	0.000268247
	10	0.010023890	0.010024058	0.000838096
	20	0.020036838	0.020036734	-0.000519401

Input 6	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004006749	0.004007369	0.003101722
	10	0.010023688	0.010023856	0.000842912
	20	0.020036260	0.020035388	-0.004358896

Analog inputs - Voltage

Input 1	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000566704	0.000560885	-0.000116364
	1	1.000512553	1.000509760	-0.000055867
	2.5	2.500340391	2.500329637	-0.000215063
	5	5.000113357	4.999999292	-0.002281290

Input 2	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000566704	0.000527453	-0.000785005
	1	1.000512553	1.000518360	0.000116140
	2.5	2.500340391	2.500346460	0.000121398
	5	5.000113357	5.000065201	-0.000963107

Input 3	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000566704	0.000534090	-0.000652266
	1	1.000512553	1.000535946	0.000467845
	2.5	2.500340391	2.500407896	0.001350104
	5	5.000113357	5.000212577	0.001984409

Input 4	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000566704	0.000518930	-0.000955474
	1	1.000512553	1.000499039	-0.000270289
	2.5	2.500340391	2.500359921	0.000390615
	5	5.000113357	5.000112258	-0.000021965

Input 5	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000566704	0.000530060	-0.000732875
	1	1.000512553	1.000506449	-0.000122080
	2.5	2.500340391	2.500374098	0.000674144
	5	5.000113357	5.000114294	0.000018751

Input 6	Target	Reference	Measured	Error
	V	V	V	%
	0	0.000566704	0.000538181	-0.000570450
	1	1.000512553	1.000516721	0.000083358
	2.5	2.500340391	2.500390493	0.001002049
	5	5.000113357	5.000170761	0.001148089

PT-100 Calibration

Input 1	Target	Reference	Measured	Error
	Ohm	°C	°C	°C
	61	-95.92178106	-95.904231155	-0.017549900
	100	0.80220979	0.810571429	-0.008361634
	118	46.13121666	46.140015545	-0.008798887
	182	216.69012592	216.663379378	0.026746541

Input 2	Target	Reference	Measured	Error
	Ohm	°C	°C	°C
	61	-95.910295618	-95.905906575	-0.004389043
	100	-0.006478297	-0.001915995	-0.004562303
	118	46.031369211	46.039403049	-0.008033838
	182	216.741348351	216.733338021	0.008010330

Analog outputs

Input 1	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004000000	0.004001591	0.007955731
	10	0.010000000	0.010002404	0.012021066
	20	0.020000000	0.020003707	0.018535259

Input 2	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004000000	0.003997967	-0.010164158
	10	0.010000000	0.010001555	0.007776023
	20	0.020000000	0.020005731	0.028653148

Input 3	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004000000	0.003993975	-0.030124042
	10	0.010000000	0.010005578	0.027887676
	20	0.020000000	0.019997603	-0.011985303

Input 4	Target	Reference	Measured	Error
	mA	A	A	%
	4	0.004000000	0.003996810	-0.015948566
	10	0.010000000	0.010006624	0.033118207
	20	0.020000000	0.019998525	-0.007374884

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Rif. Codice Vendor: C23-00142-G-35

4.2.2 TRASMETTITORI DI PRESSIONE

4.2.2.1 LISTA DEGLI STRUMENTI IN FORNITURA CON SIN E TAG

TAG	INSTALLAZIONE	TIPO	MARCA	MODELLO	NUMERO DI SERIE
PT-1A	Linea 1	Smart	Rosemount	3051S	23CLPE0018822
PT-1B	Linea 1	Smart	Rosmount	3051S	23CLPE0018823
PT-2A	Linea 2	Smart	Rosmount	3051S	23CLPE0018824
PT-2B	Linea 2	Smart	Rosmount	3051S	23CLPE0018825
PT-3A	Linea 3	Smart	Rosmount	3051S	23CLPE0018826
PT-3B	Linea 3	Smart	Rosmount	3051S	23CLPE0018827



Calibration Certificate to 2014/32/EU (MID) - consistent with "type 3.1" ISO 10474:2013 / EN 10204:2004

Customer Information Name: SOCRATE SPA PO: OA23-00335	Manufacturer Information Sales Order: 39391960 Line/Unit: 23 Internal Ref #:
Device Information Device Type: Scalable Transmitter Customer Ref/ID: POS. 40 E 50 Serial #: 23CLPE0018822 Model #: 3051S2TA4A2A11A1AD1B4DOC1E1M5P1Q4Q8A9440	Calibration Information Factory: Emerson Process Management Cluj Station Name: CLUJ_PRESSURE_CALIBRATION_06 Operator ID: 1476027 Calibration Date: Feb 6 2024 9:26PM
Permanent Tag Information PT-1A	Wire-on Tag Information

The product listed above is type-approved under Measuring Instruments Directive (MID) by the notified body NMI-Netherlands with identification "MID Parts certificate TC7457" and is applicable for both liquid and gas applications.

Certification in accordance with applicable articles of MI-002 (gas) and MI-005 (liquid – class 0.3) of the Measuring Instruments Directive (MID) 2014/32/EU – WELMEC 8.8 "General and Administrative Aspects of the Voluntary System of Modular Evaluation of Measuring instruments under the MID", OIML R117-1 Edition 2019(E) "Dynamic measuring systems for liquids other than water" and EN 12405-1/A1 Edition 2021 "Gas meters – Conversion devices – Part 1: Volume conversion".

This calibration is performed in accordance with NMI documents "CPC-7457-P rev 5; 23 August 2011" and "Certificate: QSA-014 EU Quality System Approval" and Rosemount Specification described in "MID-P Calibration".

Equipment Used

Equipment #	Equipment Name	Cal Due Date
CLM-CMMC-103794647-QA	Pressure Controller	4/15/2024 12:00:00 AM
CLM-CMMC-104165771-QA	Multimeter	11/16/2024 12:00:00 AM
CLM-CMMC-104241657-QA	Load Box	9/11/2024 12:00:00 AM

The measuring and test equipment used as reference during this calibration are traceable to National and International standards. The equipment is calibrated by entities accredited to ISO/IEC 17025.

Maximum uncertainty of measurements: 0.0494 % of reference reading

Ambient Conditions

Ambient Temperature	24 ± 2°C
Ambient Pressure	973.90 ± 0.1 mbar

Calibration Data

Analog Output

4-20mA Range: 10 to 80 bar

Custody Transfer Rating: 10 to 80 bar

Reference Pressure (bar)	Analog Output of Device Under Test (mA)	Calculated Pressure of Device Under Test (bar)	Error (%) of Reading	MID Criteria
80.000	19.9989	79.995	-0.006	PASS
66.000	16.8003	66.001	0.002	PASS
52.000	13.6019	52.008	0.016	PASS
38.000	10.4020	38.009	0.023	PASS
24.000	7.2017	24.007	0.031	PASS
10.000	4.0014	10.006	0.060	PASS

Digital Output

Custody Transfer Rating: 10 to 80 bar

Reference Pressure (bar)	Digital Output of Device Under Test (bar)	Error (%) of Reading	MID Criteria
80.000	79.995	-0.006	PASS
66.000	66.001	0.002	PASS
52.000	52.008	0.016	PASS
38.000	38.009	0.023	PASS
24.000	24.007	0.031	PASS
10.000	10.006	0.060	PASS

This is to certify that the listed product meets the applicable Emerson specifications and MID criteria for 0.2% of reference reading for liquid and gas applications.



Mihai Blaga
Measurement Solutions Quality Manager

Calibration Certificate to 2014/32/EU (MID) - consistent with "type 3.1" ISO 10474:2013 / EN 10204:2004

Customer Information Name: SOCRATE SPA PO: OA23-00335	Manufacturer Information Sales Order: 39391960 Line/Unit: 23 Internal Ref #:
Device Information Device Type: Scalable Transmitter Customer Ref/ID: POS. 40 E 50 Serial #: 23CLPE0018823 Model #: 3051S2TA4A2A11A1AD1B4DOC1E1M5P1Q4Q8A9440	Calibration Information Factory: Emerson Process Management Cluj Station Name: CLUJ_PRESURE_CALIBRATION_06 Operator ID: 276963 Calibration Date: Jan 26 2024 9:57AM
Permanent Tag Information PT-1B	Wire-on Tag Information

The product listed above is type-approved under Measuring Instruments Directive (MID) by the notified body NMI-Netherlands with identification "MID Parts certificate TC7457" and is applicable for both liquid and gas applications.

Certification in accordance with applicable articles of MI-002 (gas) and MI-005 (liquid – class 0.3) of the Measuring Instruments Directive (MID) 2014/32/EU – WELMEC 8.8 "General and Administrative Aspects of the Voluntary System of Modular Evaluation of Measuring instruments under the MID", OIML R117-1 Edition 2019(E) "Dynamic measuring systems for liquids other than water" and EN 12405-1/A1 Edition 2021 "Gas meters – Conversion devices – Part 1: Volume conversion".

This calibration is performed in accordance with NMI documents "CPC-7457-P rev 5; 23 August 2011" and "Certificate: QSA-014 EU Quality System Approval" and Rosemount Specification described in "MID-P Calibration".

Equipment Used

Equipment #	Equipment Name	Cal Due Date
CLM-CMMC-103794647-QA	Pressure Controller	4/15/2024 12:00:00 AM
CLM-CMMC-104165771-QA	Multimeter	11/16/2024 12:00:00 AM
CLM-CMMC-104241657-QA	Load Box	9/11/2024 12:00:00 AM

The measuring and test equipment used as reference during this calibration are traceable to National and International standards. The equipment is calibrated by entities accredited to ISO/IEC 17025.

Maximum uncertainty of measurements: 0.0494 % of reference reading

Ambient Conditions

Ambient Temperature	24 ± 2°C
Ambient Pressure	983.10 ± 0.1 mbar

Calibration Data

Analog Output

4-20mA Range: 10 to 80 bar

Custody Transfer Rating: 10 to 80 bar

Reference Pressure (bar)	Analog Output of Device Under Test (mA)	Calculated Pressure of Device Under Test (bar)	Error (%) of Reading	MID Criteria
80.000	20.0000	80.000	0.000	PASS
66.000	16.8006	66.002	0.004	PASS
52.000	13.6011	52.005	0.010	PASS
38.000	10.4013	38.006	0.015	PASS
24.000	7.2020	24.009	0.036	PASS
10.000	4.0019	10.008	0.085	PASS

Digital Output

Custody Transfer Rating: 10 to 80 bar

Reference Pressure (bar)	Digital Output of Device Under Test (bar)	Error (%) of Reading	MID Criteria
80.000	80.000	0.000	PASS
66.000	66.002	0.004	PASS
52.000	52.005	0.010	PASS
38.000	38.006	0.015	PASS
24.000	24.009	0.036	PASS
10.000	10.008	0.085	PASS

This is to certify that the listed product meets the applicable Emerson specifications and MID criteria for 0.2% of reference reading for liquid and gas applications.



Mihai Blaga
Measurement Solutions Quality Manager



Calibration Certificate to 2014/32/EU (MID) - consistent with "type 3.1" ISO 10474:2013 / EN 10204:2004

Customer Information Name: SOCRATE SPA PO: OA23-00335	Manufacturer Information Sales Order: 39391960 Line/Unit: 23 Internal Ref #:
Device Information Device Type: Scalable Transmitter Customer Ref/ID: POS. 40 E 50 Serial #: 23CLPE0018824 Model #: 3051S2TA4A2A11A1AD1B4DOC1E1M5P1Q4Q8A9440	Calibration Information Factory: Emerson Process Management Cluj Station Name: CLUJ_PRESURE_CALIBRATION_06 Operator ID: 276963 Calibration Date: Jan 27 2024 8:22AM
Permanent Tag Information PT-2A	Wire-on Tag Information

The product listed above is type-approved under Measuring Instruments Directive (MID) by the notified body NMI-Netherlands with identification "MID Parts certificate TC7457" and is applicable for both liquid and gas applications.

Certification in accordance with applicable articles of MI-002 (gas) and MI-005 (liquid – class 0.3) of the Measuring Instruments Directive (MID) 2014/32/EU – WELMEC 8.8 "General and Administrative Aspects of the Voluntary System of Modular Evaluation of Measuring instruments under the MID", OIML R117-1 Edition 2019(E) "Dynamic measuring systems for liquids other than water" and EN 12405-1/A1 Edition 2021 "Gas meters – Conversion devices – Part 1: Volume conversion".

This calibration is performed in accordance with NMI documents "CPC-7457-P rev 5; 23 August 2011" and "Certificate: QSA-014 EU Quality System Approval" and Rosemount Specification described in "MID-P Calibration".

Equipment Used

Equipment #	Equipment Name	Cal Due Date
CLM-CMMC-103794647-QA	Pressure Controller	4/15/2024 12:00:00 AM
CLM-CMMC-104165771-QA	Multimeter	11/16/2024 12:00:00 AM
CLM-CMMC-104241657-QA	Load Box	9/11/2024 12:00:00 AM

The measuring and test equipment used as reference during this calibration are traceable to National and International standards. The equipment is calibrated by entities accredited to ISO/IEC 17025.

Maximum uncertainty of measurements: 0.0494 % of reference reading

Ambient Conditions

Ambient Temperature	24 ± 2°C
Ambient Pressure	981.70 ± 0.1 mbar

Calibration Data

Analog Output

4-20mA Range: 10 to 80 bar

Custody Transfer Rating: 10 to 80 bar

Reference Pressure (bar)	Analog Output of Device Under Test (mA)	Calculated Pressure of Device Under Test (bar)	Error (%) of Reading	MID Criteria
80.000	20.0008	80.003	0.004	PASS
66.000	16.8003	66.001	0.002	PASS
52.000	13.6002	52.001	0.002	PASS
38.000	10.4009	38.004	0.010	PASS
24.000	7.2011	24.005	0.020	PASS
10.000	4.0003	10.001	0.015	PASS

Digital Output

Custody Transfer Rating: 10 to 80 bar

Reference Pressure (bar)	Digital Output of Device Under Test (bar)	Error (%) of Reading	MID Criteria
80.000	80.003	0.004	PASS
66.000	66.001	0.002	PASS
52.000	52.001	0.002	PASS
38.000	38.004	0.010	PASS
24.000	24.005	0.020	PASS
10.000	10.001	0.015	PASS

This is to certify that the listed product meets the applicable Emerson specifications and MID criteria for 0.2% of reference reading for liquid and gas applications.



Mihai Blaga
Measurement Solutions Quality Manager



Calibration Certificate to 2014/32/EU (MID) - consistent with "type 3.1" ISO 10474:2013 / EN 10204:2004

Customer Information Name: SOCRATE SPA PO: OA23-00335	Manufacturer Information Sales Order: 39391960 Line/Unit: 23 Internal Ref #:
Device Information Device Type: Scalable Transmitter Customer Ref/ID: POS. 40 E 50 Serial #: 23CLPE0018825 Model #: 3051S2TA4A2A11A1AD1B4DOC1E1M5P1Q4Q8A9440	Calibration Information Factory: Emerson Process Management Cluj Station Name: CLUJ_PRESSURE_CALIBRATION_03 Operator ID: 348057 Calibration Date: Feb 7 2024 7:32AM
Permanent Tag Information PT-2B	Wire-on Tag Information

The product listed above is type-approved under Measuring Instruments Directive (MID) by the notified body NMI-Netherlands with identification "MID Parts certificate TC7457" and is applicable for both liquid and gas applications.

Certification in accordance with applicable articles of MI-002 (gas) and MI-005 (liquid – class 0.3) of the Measuring Instruments Directive (MID) 2014/32/EU – WELMEC 8.8 "General and Administrative Aspects of the Voluntary System of Modular Evaluation of Measuring instruments under the MID", OIML R117-1 Edition 2019(E) "Dynamic measuring systems for liquids other than water" and EN 12405-1/A1 Edition 2021 "Gas meters – Conversion devices – Part 1: Volume conversion".

This calibration is performed in accordance with NMI documents "CPC-7457-P rev 5; 23 August 2011" and "Certificate: QSA-014 EU Quality System Approval" and Rosemount Specification described in "MID-P Calibration".

Equipment Used

Equipment #	Equipment Name	Cal Due Date
CLM-CMMC-104139658-QA	Pressure Controller	4/15/2024 12:00:00 AM
CLM-CMMC-104165770-QA	Multimeter	11/19/2024 12:00:00 AM
CLM-CMMC-104233658-QA	Load Box	9/10/2024 12:00:00 AM

The measuring and test equipment used as reference during this calibration are traceable to National and International standards. The equipment is calibrated by entities accredited to ISO/IEC 17025.

Maximum uncertainty of measurements: 0.0494 % of reference reading

Ambient Conditions

Ambient Temperature	24 ± 2°C
Ambient Pressure	973.30 ± 0.1 mbar

Calibration Data

Analog Output

4-20mA Range: 10 to 80 bar

Custody Transfer Rating: 10 to 80 bar

Reference Pressure (bar)	Analog Output of Device Under Test (mA)	Calculated Pressure of Device Under Test (bar)	Error (%) of Reading	MID Criteria
80.000	20.0003	80.001	0.002	PASS
66.000	16.8005	66.002	0.003	PASS
52.000	13.6004	52.002	0.003	PASS
38.000	10.3999	38.000	-0.001	PASS
24.000	7.2006	24.003	0.011	PASS
10.000	4.0008	10.003	0.034	PASS

Digital Output

Custody Transfer Rating: 10 to 80 bar

Reference Pressure (bar)	Digital Output of Device Under Test (bar)	Error (%) of Reading	MID Criteria
80.000	80.001	0.002	PASS
66.000	66.002	0.003	PASS
52.000	52.002	0.003	PASS
38.000	38.000	-0.001	PASS
24.000	24.003	0.011	PASS
10.000	10.003	0.033	PASS

This is to certify that the listed product meets the applicable Emerson specifications and MID criteria for 0.2% of reference reading for liquid and gas applications.



Mihai Blaga
Measurement Solutions Quality Manager



Calibration Certificate to 2014/32/EU (MID) - consistent with "type 3.1" ISO 10474:2013 / EN 10204:2004

Customer Information Name: SOCRATE SPA PO: OA23-00335	Manufacturer Information Sales Order: 39391960 Line/Unit: 23 Internal Ref #:
Device Information Device Type: Scalable Transmitter Customer Ref/ID: POS. 40 E 50 Serial #: 23CLPE0018826 Model #: 3051S2TA4A2A11A1AD1B4DOC1E1M5P1Q4Q8A9440	Calibration Information Factory: Emerson Process Management Cluj Station Name: CLUJ_PRESURE_CALIBRATION_06 Operator ID: 1418944 Calibration Date: Dec 12 2023 5:32PM
Permanent Tag Information PT-3A	Wire-on Tag Information

The product listed above is type-approved under Measuring Instruments Directive (MID) by the notified body NMI-Netherlands with identification "MID Parts certificate TC7457" and is applicable for both liquid and gas applications.

Certification in accordance with applicable articles of MI-002 (gas) and MI-005 (liquid – class 0.3) of the Measuring Instruments Directive (MID) 2014/32/EU – WELMEC 8.8 "General and Administrative Aspects of the Voluntary System of Modular Evaluation of Measuring instruments under the MID", OIML R117-1 Edition 2019(E) "Dynamic measuring systems for liquids other than water" and EN 12405-1/A1 Edition 2021 "Gas meters – Conversion devices – Part 1: Volume conversion".

This calibration is performed in accordance with NMI documents "CPC-7457-P rev 5; 23 August 2011" and "Certificate: QSA-014 EU Quality System Approval" and Rosemount Specification described in "MID-P Calibration".

Equipment Used

Equipment #	Equipment Name	Cal Due Date
CLM-CMMC-103794647-QA	Pressure Controller	4/15/2024 12:00:00 AM
CLM-CMMC-104165771-QA	Multimeter	11/16/2024 12:00:00 AM
CLM-CMMC-104241657-QA	Load Box	9/11/2024 12:00:00 AM

The measuring and test equipment used as reference during this calibration are traceable to National and International standards. The equipment is calibrated by entities accredited to ISO/IEC 17025.

Maximum uncertainty of measurements: 0.0494 % of reference reading

Ambient Conditions

Ambient Temperature	24 ± 2°C
Ambient Pressure	± 0.1 mbar

Calibration Data

Analog Output

4-20mA Range: 10 to 80 bar

Custody Transfer Rating: 10 to 80 bar

Reference Pressure (bar)	Analog Output of Device Under Test (mA)	Calculated Pressure of Device Under Test (bar)	Error (%) of Reading	MID Criteria
80.000	20.0002	80.001	0.001	PASS
66.000	16.8004	66.002	0.003	PASS
52.000	13.6005	52.002	0.004	PASS
38.000	10.4010	38.004	0.011	PASS
24.000	7.2012	24.005	0.022	PASS
10.000	4.0020	10.009	0.088	PASS

Digital Output

Custody Transfer Rating: 10 to 80 bar

Reference Pressure (bar)	Digital Output of Device Under Test (bar)	Error (%) of Reading	MID Criteria
80.000	80.001	0.001	PASS
66.000	66.002	0.003	PASS
52.000	52.002	0.004	PASS
38.000	38.004	0.011	PASS
24.000	24.005	0.022	PASS
10.000	10.009	0.088	PASS

This is to certify that the listed product meets the applicable Emerson specifications and MID criteria for 0.2% of reference reading for liquid and gas applications.



Mihai Blaga
Measurement Solutions Quality Manager



Calibration Certificate to 2014/32/EU (MID) - consistent with "type 3.1" ISO 10474:2013 / EN 10204:2004

Customer Information Name: SOCRATE SPA PO: OA23-00335	Manufacturer Information Sales Order: 39391960 Line/Unit: 23 Internal Ref #:
Device Information Device Type: Scalable Transmitter Customer Ref/ID: POS. 40 E 50 Serial #: 23CLPE0018827 Model #: 3051S2TA4A2A11A1AD1B4DOC1E1M5P1Q4Q8A9440	Calibration Information Factory: Emerson Process Management Cluj Station Name: CLUJ_PRESSURE_CALIBRATION_03 Operator ID: 1418944 Calibration Date: Feb 20 2024 3:26PM
Permanent Tag Information PT-3B	Wire-on Tag Information

The product listed above is type-approved under Measuring Instruments Directive (MID) by the notified body NMI-Netherlands with identification "MID Parts certificate TC7457" and is applicable for both liquid and gas applications.

Certification in accordance with applicable articles of MI-002 (gas) and MI-005 (liquid – class 0.3) of the Measuring Instruments Directive (MID) 2014/32/EU – WELMEC 8.8 "General and Administrative Aspects of the Voluntary System of Modular Evaluation of Measuring instruments under the MID", OIML R117-1 Edition 2019(E) "Dynamic measuring systems for liquids other than water" and EN 12405-1/A1 Edition 2021 "Gas meters – Conversion devices – Part 1: Volume conversion".

This calibration is performed in accordance with NMI documents "CPC-7457-P rev 5; 23 August 2011" and "Certificate: QSA-014 EU Quality System Approval" and Rosemount Specification described in "MID-P Calibration".

Equipment Used

Equipment #	Equipment Name	Cal Due Date
CLM-CMMC-104139658-QA	Pressure Controller	4/15/2024 12:00:00 AM
CLM-CMMC-104165770-QA	Multimeter	11/19/2024 12:00:00 AM
CLM-CMMC-104233658-QA	Load Box	9/10/2024 12:00:00 AM

The measuring and test equipment used as reference during this calibration are traceable to National and International standards. The equipment is calibrated by entities accredited to ISO/IEC 17025.

Maximum uncertainty of measurements: 0.0494 % of reference reading

Ambient Conditions

Ambient Temperature	24 ± 2°C
Ambient Pressure	984.40 ± 0.1 mbar

Calibration Data

Analog Output

4-20mA Range: 10 to 80 bar

Custody Transfer Rating: 10 to 80 bar

Reference Pressure (bar)	Analog Output of Device Under Test (mA)	Calculated Pressure of Device Under Test (bar)	Error (%) of Reading	MID Criteria
80.000	20.0000	80.000	0.000	PASS
66.000	16.8002	66.001	0.001	PASS
52.000	13.6006	52.003	0.005	PASS
38.000	10.4015	38.007	0.018	PASS
24.000	7.2030	24.013	0.055	PASS
10.000	4.0041	10.018	0.180	PASS

Digital Output

Custody Transfer Rating: 10 to 80 bar

Reference Pressure (bar)	Digital Output of Device Under Test (bar)	Error (%) of Reading	MID Criteria
80.000	80.000	0.000	PASS
66.000	66.001	0.001	PASS
52.000	52.003	0.005	PASS
38.000	38.007	0.018	PASS
24.000	24.013	0.055	PASS
10.000	10.018	0.180	PASS

This is to certify that the listed product meets the applicable Emerson specifications and MID criteria for 0.2% of reference reading for liquid and gas applications.



Mihai Blaga
Measurement Solutions Quality Manager

	 SOCRATE <i>Working for Sustainability</i>	COMMESSA NQR22199	UNITA' -
		REL-MEC-E-52033	
		Rev.	00

Rif. Codice Vendor: C23-00142-G-35

4.2.3 TRASMETTITORI DI TEMPERATURA

4.2.3.1 LISTA DEGLI STRUMENTI IN FORNITURA CON SIN E TAG

TAG	INSTALLAZIONE	TIPO	MARCA	MODELLO	NUMERO DI SERIE
TT-1A TE-1A	Linea 1	SMART Temperature sensor RTD PT100	Rosemount	3144P 214C	23CLTC0005331 23CLTP0010840
TT-1B TE-1B	Linea 1	SMART Temperature sensor RTD PT100	Rosmount	3144P 214C	23CLTC0005332 23CLTP0010841
TT-2A TE-2A	Linea 2	SMART Temperature sensor RTD PT100	Rosmount	3144P 214C	23CLTC0005333 23CLTP0010842
TT-2B TE-2B	Linea 2	SMART Temperature sensor RTD PT100	Rosmount	3144P 214C	23CLTC0005334 23CLTP0010843
TT-3A TE-3A	Linea 3	SMART Temperature sensor RTD PT100	Rosmount	3144P 214C	23CLTC0005335 23CLTP0010844
TT-3B TE-3B	Linea 3	SMART Temperature sensor RTD PT100	Rosmount	3144P 214C	23CLTC0005336 23CLTP0010845

	 SOCRATE Working for Sustainability	COMMESSA NQ/R22199	UNITA' -
	FSRU Ravenna e collegamento alla Rete Nazionale Gasdotti	REL-MEC-E-52033	
	NQR22199 – Allacciamento FSRU Ravenna	Rev.	00

Rif. Codice Vendor: C23-00142-G-35

4.2.3.3.1 CERTIFICATI DI CALIBRAZIONE TE/TT-1A

CERTIFICATO DI TARATURA LAT 051 CTRM24P010CA0
Certificate of Calibration No.

- data di emissione
date of issue 2024/07/11
- cliente
customer SOCRATE SPA
VIA PAPA GIOVANNI XXIII 5
20090 RODANO (MI)
- destinatario
addressee SOCRATE SPA
VIA PAPA GIOVANNI XXIII 5
20090 RODANO (MI)

Il presente certificato di taratura è emesso in base all'accreditamento LAT N° 051 rilasciato in accordo ai decreti attuativi della legge n. 273/1991 che ha istituito il Sistema Nazionale di Taratura (SNT). ACCREDIA attesta le capacità di misura e di taratura, le competenze metrologiche del Centro e la riferibilità delle tarature eseguite ai campioni nazionali e internazionali delle unità di misura del Sistema Internazionale delle Unità (SI). Questo certificato non può essere riprodotto in modo parziale, salvo espressa autorizzazione scritta da parte del Centro.

Si riferisce a
referring to

- oggetto
item Catena termometrica
- costruttore
manufacturer ROSE MOUNT
- modello
model 3144P
- matricola
serial number 23CLTC0005331(TT-1A)
- data ricev. Oggetto
date of receipt of item 2024/07/02
- data delle misure
date of measurements 2024/07/11
- registro di laboratorio
laboratory reference Temperature_2024

This certificate of calibration is issued in compliance with the accreditation LAT N° 051 granted according to decrees connected with Italian law No. 273/1991 which has established the National Calibration System. ACCREDIA attests the calibration and measurement capability, the metrological competence of the Centre and the traceability of calibration results to the national and international standards of the International System of Units (SI). This certificate may not be partially reproduced, except with the prior written permission of the issuing Centre.

I risultati di misura riportati nel presente Certificato sono stati ottenuti applicando le procedure citate alla pagina seguente, dove sono specificati anche i campioni o gli strumenti che garantiscono la catena di riferibilità del Centro e i rispettivi certificati di taratura in corso di validità. Essi si riferiscono esclusivamente all'oggetto in taratura e sono validi nel momento e nelle condizioni di taratura, salvo diversamente specificato.

The measurement results reported in this Certificate were obtained following the procedures given in the following page, where the reference standards or instruments are indicated which guarantee the traceability chain of the laboratory, and the related calibration certificates in their course of validity are indicated as well. They relate only to the calibrated item and they are valid for the time and conditions of calibration, unless otherwise specified.

Le incertezze di misura dichiarate in questo documento sono state determinate conformemente alla Guida ISO/IEC 98 e al documento EA-4/02. Solitamente sono espresse come incertezza estesa ottenuta moltiplicando l'incertezza tipo per il fattore di copertura k corrispondente ad livello di fiducia di circa il 95%. Normalmente tale fattore k vale 2.

The measurement uncertainties stated in this document have been determined according to the ISO/IEC 98 and to EA-4/02. Usually, they have been estimated as expanded uncertainty obtained multiplying the standard uncertainty by the coverage factor k corresponding to a confidence level of about 95%. Normally, this factor k is 2.

Direzione Tecnica
(Approving Officer)
Fenotti F.

CERTIFICATO DI TARATURA LAT 051 CTRM24P010CA0 Certificate of Calibration No.

I risultati di misura riportati nel presente Certificato sono stati ottenuti applicando le procedure N.
The measurement results reported in this Certificate were obtained following procedures No.

MG/SIT/104 Rev.07 Taratura di catene termometriche, indicatori e trasmettitori di temperatura

La catena di riferibilità ha inizio dai campioni di riferimento n°
Traceability is through reference standards No.

4401 Termoresistenza Pt 25.5 campione
2823A16947 Multimetro numerale

Muniti di certificati validi di taratura rispettivamente n°
Validated by certificates of calibration No.

1012-KL-25041-23 emesso da C.M.I.
LAT 051 CMUL24P009A70 emesso da Trescal

Norme di riferimento

Reference standards:

CEI EN 60751:2009	"Termometri industriali a resistenza di platino e sensori di temperatura in platino"
CEI EN 60584-1:2014	"Termocoppie-Tabelle di riferimento"
UNI 6893:1979	"Termometri, di vetro, con riempimento di liquido. Modalità di controllo e verifica."
UNI EN 12470-1:2009	"Termometri clinici - Parte 1: Termometri a dilatazione di liquido metallico in vetro con dispositivo di massimo"
UNI EN 13190:2003	"Termometri a quadrante"

Condizioni ambientali e di misura

Environmental and measuring conditions

Temperatura : (23 ± 1) °C
Temperature

Umidità relativa : (50 ± 20) %UR
Relative humidity

Metodo di taratura

Calibration method

La taratura delle catene termometriche avviene per confronto con campioni di lavoro del centro. A seconda della temperatura di verifica si utilizza un diverso mezzo di confronto:

Calibration of temperature chains is done by comparison with working standards from the center. Depending on the verification temperature, a different means of comparison is used:

- | | |
|---------------------|---|
| • -196 °C | : in vaso dewar per l'ebollizione dell'azoto / <i>in dewar jar for nitrogen boiling point.</i> |
| • -80 °C ÷ 10 °C | : in bagno di alcool etilico denaturato assoluto / <i>in a bath of absolute denatured ethyl alcohol</i> |
| • 0 °C | : in bagno di ghiaccio fondente saturo d'aria / <i>in an air-saturated melting ice bath</i> |
| • 10 °C ÷ 80 °C | : in bagno di acqua distillata / <i>in a distilled water bath</i> |
| • 80 °C ÷ 250 °C | : in bagno di olio di siliconi / <i>in a silicon oil bath</i> |
| • 250 °C ÷ 550 °C | : in bagno di sali fusi / <i>in a bath of molten salts</i> |
| • 550 °C ÷ 1100 °C | : in forno orizzontale con cilindro in inconel / <i>in horizontal oven with inconel cylinder</i> |
| • 1100 °C ÷ 1500 °C | : in forno orizzontale con cilindro di allumina / <i>in horizontal oven with alumina cylinder</i> |

Per tarature di primo livello viene utilizzato, nel range di applicazione, il seguente forno in sostituzione dei precedentemente elencati:
For first-level calibrations, the following oven is used in the application range in place of the previously listed ones:

- | | |
|--------------------|--|
| • 550 °C ÷ 1500 °C | : in forno orizzontale con cilindro ceramico / <i>in horizontal oven with ceramic cylinder</i> |
|--------------------|--|

Luogo della taratura

Calibration site

La taratura è stata eseguita presso il Laboratorio Permanente del LAT 051 sito in:
Calibrations are performed at the LAT 051 Laboratory located in:

Via dei Metalli, 1 - 25039 Travagliato (BS), Italy

CERTIFICATO DI TARATURA LAT 051 CTRM24P010CA0
Certificate of Calibration No.

Dati generali

General informations

Campo di misura / Range : (-30 ÷ 70) °C
Matricola sensore / Sensor serial number : 23CLTC0005331 (TT-1A)
Unità di formato / Minimum division : 0.0001/0.001 °C
Tipo sensore / Sensor type : Pt100 Ω
Profondità di immersione / Immersion depth : 250 mm

Dati sperimentali

Experimental results

	Temperatura di riferimento Reference temperature t_{rif} °C	Temperatura letta sullo strumento in prova UUT temperature t_{mis} °C	Risoluzione Resolution - °C	Errore Error $t_{\text{mis}} - t_{\text{rif}}$ °C	Incertezza estesa di taratura Expanded calibration uncertainty U °C
1	-30.03	-29.990	0.001	0.04	0.05
2	0.00	-0.0357	0.0001	-0.04	0.05
3	20.15	20.099	0.001	-0.05	0.05
4	50.07	50.013	0.001	-0.06	0.05
5	70.04	69.984	0.001	-0.06	0.06

Note

Notes

- Taratura eseguita sui punti richiesti dal cliente.

L'operatore
(Calibration technician)
Peli G.



Calibration Certificate to 2014/32/EU (MID) - consistent with "type 3.1" ISO 10474:2013 / EN 10204:2004

Customer Information Name: SOCRATE SPA PO: OA23-00335	Manufacturer Information Sales Order: 39391960 Line/Unit: 22 Internal Ref #:
Device Information Trx Model #: 3144PD1A1E1DA1B4M5C1C2D4 Trx Serial #: 0005331 Sensor Model #: 214CRWSMA1S4M0295SLE1AR1C1UAE080MD2G1TB Sensor Serial #: 0010840	Calibration Information Cert #: Factory: Emerson Process Management Cluj Station Name: CLUJ_TEMP_SENSOR_CALIBRATION_0 Operator ID: 1395219 Calibration Date: Oct 5 2023 4:57PM
Permanent Tag Information TE-1A	Wire-on Tag Information

The product listed above is type approved under Measuring Instruments Directive (MID) by the notified body NMI-Netherlands with identification "MID Parts certificate TC7458".

This is to certify that the measurement system consisting of the listed product meets the applicable Emerson specifications and the criteria, following MID directive.

The calibration was performed in an ISO 17025 accredited laboratory and the deviation plus the uncertainty of the measurement of the units passed the criteria mentioned below.

MID Acceptance Criteria [°C] analog output	MID Acceptance Criteria [°C] digital output
0.24	0.30

Temperature in accordance to DIN EN 60751 (ITS90) [°C]	Resistance R(T90) [Ω]
0.0236	100.0177
-49.7638	80.3693
49.8175	119.3728
99.8533	138.5084
Callendar Van Dusen constants	Value
alpha	0.00385522
delta	1.627710
beta	-0.212734
R0	100.0085

I hereby certify the above calibration and CVD values.

A handwritten signature in blue ink, appearing to read 'M. Blaga'.

Mihai Blaga
Measurement Solutions Quality Manager

	 SOCRATE Working for Sustainability	COMMESSA NQ/R22199	UNITA' -
	FSRU Ravenna e collegamento alla Rete Nazionale Gasdotti	REL-MEC-E-52033	
	NQR22199 – Allacciamento FSRU Ravenna	Rev.	00

Rif. Codice Vendor: C23-00142-G-35

4.2.3.3.2 CERTIFICATI DI CALIBRAZIONE TE/TT-1B

CERTIFICATO DI TARATURA LAT 051 CTRM24P010CC0
Certificate of Calibration No.

- data di emissione
date of issue 2024/07/11
- cliente
customer SOCRATE SPA
VIA PAPA GIOVANNI XXIII 5
20090 RODANO (MI)
- destinatario
addressee SOCRATE SPA
VIA PAPA GIOVANNI XXIII 5
20090 RODANO (MI)

Il presente certificato di taratura è emesso in base all'accreditamento LAT N° 051 rilasciato in accordo ai decreti attuativi della legge n. 273/1991 che ha istituito il Sistema Nazionale di Taratura (SNT). ACCREDIA attesta le capacità di misura e di taratura, le competenze metrologiche del Centro e la riferibilità delle tarature eseguite ai campioni nazionali e internazionali delle unità di misura del Sistema Internazionale delle Unità (SI). Questo certificato non può essere riprodotto in modo parziale, salvo espressa autorizzazione scritta da parte del Centro.

Si riferisce a
referring to

- oggetto
item Catena termometrica
- costruttore
manufacturer ROSE MOUNT
- modello
model 3144P
- matricola
serial number 23CLTC0005332(TT-1B)
- data ricev. Oggetto
date of receipt of item 2024/07/02
- data delle misure
date of measurements 2024/07/11
- registro di laboratorio
laboratory reference Temperature_2024

This certificate of calibration is issued in compliance with the accreditation LAT N° 051 granted according to decrees connected with Italian law No. 273/1991 which has established the National Calibration System. ACCREDIA attests the calibration and measurement capability, the metrological competence of the Centre and the traceability of calibration results to the national and international standards of the International System of Units (SI). This certificate may not be partially reproduced, except with the prior written permission of the issuing Centre.

I risultati di misura riportati nel presente Certificato sono stati ottenuti applicando le procedure citate alla pagina seguente, dove sono specificati anche i campioni o gli strumenti che garantiscono la catena di riferibilità del Centro e i rispettivi certificati di taratura in corso di validità. Essi si riferiscono esclusivamente all'oggetto in taratura e sono validi nel momento e nelle condizioni di taratura, salvo diversamente specificato.

The measurement results reported in this Certificate were obtained following the procedures given in the following page, where the reference standards or instruments are indicated which guarantee the traceability chain of the laboratory, and the related calibration certificates in their course of validity are indicated as well. They relate only to the calibrated item and they are valid for the time and conditions of calibration, unless otherwise specified.

Le incertezze di misura dichiarate in questo documento sono state determinate conformemente alla Guida ISO/IEC 98 e al documento EA-4/02. Solitamente sono espresse come incertezza estesa ottenuta moltiplicando l'incertezza tipo per il fattore di copertura k corrispondente ad livello di fiducia di circa il 95%. Normalmente tale fattore k vale 2.

The measurement uncertainties stated in this document have been determined according to the ISO/IEC 98 and to EA-4/02. Usually, they have been estimated as expanded uncertainty obtained multiplying the standard uncertainty by the coverage factor k corresponding to a confidence level of about 95%. Normally, this factor k is 2.

Direzione Tecnica
(Approving Officer)
Fenotti F.

CERTIFICATO DI TARATURA LAT 051 CTRM24P010CC0 Certificate of Calibration No.

I risultati di misura riportati nel presente Certificato sono stati ottenuti applicando le procedure N.
The measurement results reported in this Certificate were obtained following procedures No.

MG/SIT/104 Rev.07 Taratura di catene termometriche, indicatori e trasmettitori di temperatura

La catena di riferibilità ha inizio dai campioni di riferimento n°
Traceability is through reference standards No.

4401 Termoresistenza Pt 25.5 campione
2823A16947 Multimetro numerale

Muniti di certificati validi di taratura rispettivamente n°
Validated by certificates of calibration No.

1012-KL-25041-23 emesso da C.M.I.
LAT 051 CMUL24P009A70 emesso da Trescal

Norme di riferimento

Reference standards:

CEI EN 60751:2009	"Termometri industriali a resistenza di platino e sensori di temperatura in platino"
CEI EN 60584-1:2014	"Termocoppie-Tabella di riferimento"
UNI 6893:1979	"Termometri, di vetro, con riempimento di liquido. Modalità di controllo e verifica."
UNI EN 12470-1:2009	"Termometri clinici - Parte 1: Termometri a dilatazione di liquido metallico in vetro con dispositivo di massimo"
UNI EN 13190:2003	"Termometri a quadrante"

Condizioni ambientali e di misura

Environmental and measuring conditions

Temperatura : (23 ± 1) °C
Temperature

Umidità relativa : (50 ± 20) %UR
Relative humidity

Metodo di taratura

Calibration method

La taratura delle catene termometriche avviene per confronto con campioni di lavoro del centro. A seconda della temperatura di verifica si utilizza un diverso mezzo di confronto:

Calibration of temperature chains is done by comparison with working standards from the center. Depending on the verification temperature, a different means of comparison is used:

- | | |
|---------------------|---|
| • -196 °C | : in vaso dewar per l'ebollizione dell'azoto / <i>in dewar jar for nitrogen boiling point.</i> |
| • -80 °C ÷ 10 °C | : in bagno di alcool etilico denaturato assoluto / <i>in a bath of absolute denatured ethyl alcohol</i> |
| • 0 °C | : in bagno di ghiaccio fondente saturo d'aria / <i>in an air-saturated melting ice bath</i> |
| • 10 °C ÷ 80 °C | : in bagno di acqua distillata / <i>in a distilled water bath</i> |
| • 80 °C ÷ 250 °C | : in bagno di olio di siliconi / <i>in a silicon oil bath</i> |
| • 250 °C ÷ 550 °C | : in bagno di sali fusi / <i>in a bath of molten salts</i> |
| • 550 °C ÷ 1100 °C | : in forno orizzontale con cilindro in inconel / <i>in horizontal oven with inconel cylinder</i> |
| • 1100 °C ÷ 1500 °C | : in forno orizzontale con cilindro di allumina / <i>in horizontal oven with alumina cylinder</i> |

Per tarature di primo livello viene utilizzato, nel range di applicazione, il seguente forno in sostituzione dei precedentemente elencati:
For first-level calibrations, the following oven is used in the application range in place of the previously listed ones:

- | | |
|--------------------|--|
| • 550 °C ÷ 1500 °C | : in forno orizzontale con cilindro ceramico / <i>in horizontal oven with ceramic cylinder</i> |
|--------------------|--|

Luogo della taratura

Calibration site

La taratura è stata eseguita presso il Laboratorio Permanente del LAT 051 sito in:
Calibrations are performed at the LAT 051 Laboratory located in:

Via dei Metalli, 1 - 25039 Travagliato (BS), Italy

CERTIFICATO DI TARATURA LAT 051 CTRM24P010CC0
Certificate of Calibration No.

Dati generali

General informations

Campo di misura / Range : (-30 ÷ 70) °C
Matricola sensore / Sensor serial number : 23CLTC0005331 (TT-1B)
Unità di formato / Minimum division : 0.0001/0.001 °C
Tipo sensore / Sensor type : Pt100 Ω
Profondità di immersione / Immersion depth : 250 mm

Dati sperimentali

Experimental results

	Temperatura di riferimento Reference temperature t_{rif} °C	Temperatura letta sullo strumento in prova UUT temperature t_{mis} °C	Risoluzione Resolution - °C	Errore Error $t_{\text{mis}} - t_{\text{rif}}$ °C	Incertezza estesa di taratura Expanded calibration uncertainty U °C
1	-30.02	-29.982	0.001	0.04	0.06
2	0.00	-0.0672	0.0001	-0.07	0.05
3	20.14	20.068	0.001	-0.07	0.06
4	50.08	49.997	0.001	-0.08	0.05
5	70.04	69.963	0.001	-0.08	0.06

Note

Notes

- Taratura eseguita sui punti richiesti dal cliente.

L'operatore
(Calibration technician)
Peli G.



Calibration Certificate to 2014/32/EU (MID) - consistent with "type 3.1" ISO 10474:2013 / EN 10204:2004

Customer Information Name: SOCRATE SPA PO: OA23-00335	Manufacturer Information Sales Order: 39391960 Line/Unit: 22 Internal Ref #:
Device Information Trx Model #: 3144PD1A1E1DA1B4M5C1C2D4 Trx Serial #: 0005332 Sensor Model #: 214CRWSMA1S4M0295SLE1AR1C1UAE080MD2G1TB Sensor Serial #: 0010841	Calibration Information Cert #: Factory: Emerson Process Management Cluj Station Name: CLUJ_TEMP_SENSOR_CALIBRATION_0 Operator ID: 1395219 Calibration Date: Oct 5 2023 4:56PM
Permanent Tag Information TE-1B	Wire-on Tag Information

The product listed above is type approved under Measuring Instruments Directive (MID) by the notified body NMI-Netherlands with identification "MID Parts certificate TC7458".

This is to certify that the measurement system consisting of the listed product meets the applicable Emerson specifications and the criteria, following MID directive.

The calibration was performed in an ISO 17025 accredited laboratory and the deviation plus the uncertainty of the measurement of the units passed the criteria mentioned below.

MID Acceptance Criteria [°C] analog output	MID Acceptance Criteria [°C] digital output
0.24	0.30

Temperature in accordance to DIN EN 60751 (ITS90) [°C]	Resistance R(T90) [Ω]
0.0224	99.9962
-49.8560	80.3415
49.8167	119.3300
99.8574	138.4295
Callendar Van Dusen constants	Value
alpha	0.00385009
delta	1.715876
beta	-0.562336
R0	99.9874

I hereby certify the above calibration and CVD values.

A handwritten signature in blue ink, appearing to read 'M. Blaga'.

Mihai Blaga
Measurement Solutions Quality Manager

	 SOCRATE Working for Sustainability	COMMESSA NQ/R22199	UNITA' -
	FSRU Ravenna e collegamento alla Rete Nazionale Gasdotti	REL-MEC-E-52033	
	NQR22199 – Allacciamento FSRU Ravenna	Rev.	00

Rif. Codice Vendor: C23-00142-G-35

4.2.3.3.3 CERTIFICATI DI CALIBRAZIONE TE/TT-2A

CERTIFICATO DI TARATURA LAT 051 CTRM24P010D20
Certificate of Calibration No.

- data di emissione
date of issue 2024/07/11
- cliente
customer SOCRATE SPA
VIA PAPA GIOVANNI XXIII 5
20090 RODANO (MI)
- destinatario
addressee SOCRATE SPA
VIA PAPA GIOVANNI XXIII 5
20090 RODANO (MI)

Il presente certificato di taratura è emesso in base all'accreditamento LAT N° 051 rilasciato in accordo ai decreti attuativi della legge n. 273/1991 che ha istituito il Sistema Nazionale di Taratura (SNT). ACCREDIA attesta le capacità di misura e di taratura, le competenze metrologiche del Centro e la riferibilità delle tarature eseguite ai campioni nazionali e internazionali delle unità di misura del Sistema Internazionale delle Unità (SI). Questo certificato non può essere riprodotto in modo parziale, salvo espressa autorizzazione scritta da parte del Centro.

Si riferisce a
referring to

- oggetto
item Catena termometrica
- costruttore
manufacturer ROSE MOUNT
- modello
model 3144P
- matricola
serial number 23CLTC0005333(TT-2A)
- data ricev. Oggetto
date of receipt of item 2024/07/02
- data delle misure
date of measurements 2024/07/11
- registro di laboratorio
laboratory reference Temperature_2024

This certificate of calibration is issued in compliance with the accreditation LAT N° 051 granted according to decrees connected with Italian law No. 273/1991 which has established the National Calibration System. ACCREDIA attests the calibration and measurement capability, the metrological competence of the Centre and the traceability of calibration results to the national and international standards of the International System of Units (SI). This certificate may not be partially reproduced, except with the prior written permission of the issuing Centre.

I risultati di misura riportati nel presente Certificato sono stati ottenuti applicando le procedure citate alla pagina seguente, dove sono specificati anche i campioni o gli strumenti che garantiscono la catena di riferibilità del Centro e i rispettivi certificati di taratura in corso di validità. Essi si riferiscono esclusivamente all'oggetto in taratura e sono validi nel momento e nelle condizioni di taratura, salvo diversamente specificato.

The measurement results reported in this Certificate were obtained following the procedures given in the following page, where the reference standards or instruments are indicated which guarantee the traceability chain of the laboratory, and the related calibration certificates in their course of validity are indicated as well. They relate only to the calibrated item and they are valid for the time and conditions of calibration, unless otherwise specified.

Le incertezze di misura dichiarate in questo documento sono state determinate conformemente alla Guida ISO/IEC 98 e al documento EA-4/02. Solitamente sono espresse come incertezza estesa ottenuta moltiplicando l'incertezza tipo per il fattore di copertura k corrispondente ad livello di fiducia di circa il 95%. Normalmente tale fattore k vale 2.

The measurement uncertainties stated in this document have been determined according to the ISO/IEC 98 and to EA-4/02. Usually, they have been estimated as expanded uncertainty obtained multiplying the standard uncertainty by the coverage factor k corresponding to a confidence level of about 95%. Normally, this factor k is 2.

Direzione Tecnica
(Approving Officer)
Fenotti F.

CERTIFICATO DI TARATURA LAT 051 CTRM24P010D20 Certificate of Calibration No.

I risultati di misura riportati nel presente Certificato sono stati ottenuti applicando le procedure N.
The measurement results reported in this Certificate were obtained following procedures No.

MG/SIT/104 Rev.07 Taratura di catene termometriche, indicatori e trasmettitori di temperatura

La catena di riferibilità ha inizio dai campioni di riferimento n°
Traceability is through reference standards No.

4401 Termoresistenza Pt 25.5 campione
2823A16947 Multimetro numerale

Muniti di certificati validi di taratura rispettivamente n°
Validated by certificates of calibration No.

1012-KL-25041-23 emesso da C.M.I.
LAT 051 CMUL24P009A70 emesso da Trescal

Norme di riferimento

Reference standards:

CEI EN 60751:2009	"Termometri industriali a resistenza di platino e sensori di temperatura in platino"
CEI EN 60584-1:2014	"Termocoppie-Tabella di riferimento"
UNI 6893:1979	"Termometri, di vetro, con riempimento di liquido. Modalità di controllo e verifica."
UNI EN 12470-1:2009	"Termometri clinici - Parte 1: Termometri a dilatazione di liquido metallico in vetro con dispositivo di massimo"
UNI EN 13190:2003	"Termometri a quadrante"

Condizioni ambientali e di misura

Environmental and measuring conditions

Temperatura : (23 ± 1) °C
Temperature

Umidità relativa : (50 ± 20) %UR
Relative humidity

Metodo di taratura

Calibration method

La taratura delle catene termometriche avviene per confronto con campioni di lavoro del centro. A seconda della temperatura di verifica si utilizza un diverso mezzo di confronto:

Calibration of temperature chains is done by comparison with working standards from the center. Depending on the verification temperature, a different means of comparison is used:

- | | |
|---------------------|---|
| • -196 °C | : in vaso dewar per l'ebollizione dell'azoto / <i>in dewar jar for nitrogen boiling point.</i> |
| • -80 °C ÷ 10 °C | : in bagno di alcool etilico denaturato assoluto / <i>in a bath of absolute denatured ethyl alcohol</i> |
| • 0 °C | : in bagno di ghiaccio fondente saturo d'aria / <i>in an air-saturated melting ice bath</i> |
| • 10 °C ÷ 80 °C | : in bagno di acqua distillata / <i>in a distilled water bath</i> |
| • 80 °C ÷ 250 °C | : in bagno di olio di siliconi / <i>in a silicon oil bath</i> |
| • 250 °C ÷ 550 °C | : in bagno di sali fusi / <i>in a bath of molten salts</i> |
| • 550 °C ÷ 1100 °C | : in forno orizzontale con cilindro in inconel / <i>in horizontal oven with inconel cylinder</i> |
| • 1100 °C ÷ 1500 °C | : in forno orizzontale con cilindro di allumina / <i>in horizontal oven with alumina cylinder</i> |

Per tarature di primo livello viene utilizzato, nel range di applicazione, il seguente forno in sostituzione dei precedentemente elencati:
For first-level calibrations, the following oven is used in the application range in place of the previously listed ones:

- | | |
|--------------------|--|
| • 550 °C ÷ 1500 °C | : in forno orizzontale con cilindro ceramico / <i>in horizontal oven with ceramic cylinder</i> |
|--------------------|--|

Luogo della taratura

Calibration site

La taratura è stata eseguita presso il Laboratorio Permanente del LAT 051 sito in:
Calibrations are performed at the LAT 051 Laboratory located in:

Via dei Metalli, 1 - 25039 Travagliato (BS), Italy

CERTIFICATO DI TARATURA LAT 051 CTRM24P010D20
Certificate of Calibration No.

Dati generali

General informations

Campo di misura / Range : (-30 ÷ 70) °C
Matricola sensore / Sensor serial number : 23CLTC0005331 (TT-2A)
Unità di formato / Minimum division : 0.0001/0.001 °C
Tipo sensore / Sensor type : Pt100 Ω
Profondità di immersione / Immersion depth : 250 mm

Dati sperimentali

Experimental results

	Temperatura di riferimento Reference temperature t_{rif} °C	Temperatura letta sullo strumento in prova UUT temperature t_{mis} °C	Risoluzione Resolution - °C	Errore Error $t_{\text{mis}} - t_{\text{rif}}$ °C	Incertezza estesa di taratura Expanded calibration uncertainty U °C
1	-30.02	-29.984	0.001	0.04	0.06
2	0.00	-0.0323	0.0001	-0.03	0.06
3	20.13	20.047	0.001	-0.08	0.06
4	50.06	49.960	0.001	-0.10	0.07
5	70.03	69.953	0.001	-0.08	0.06

Note

Notes

- Taratura eseguita sui punti richiesti dal cliente.

L'operatore
(Calibration technician)
Peli G.



Calibration Certificate to 2014/32/EU (MID) - consistent with "type 3.1" ISO 10474:2013 / EN 10204:2004

Customer Information Name: SOCRATE SPA PO: OA23-00335	Manufacturer Information Sales Order: 39391960 Line/Unit: 22 Internal Ref #:
Device Information Trx Model #: 3144PD1A1E1DA1B4M5C1C2D4 Trx Serial #: 0005333 Sensor Model #: 214CRWSMA1S4M0295SLE1AR1C1UAE080MD2G1TB Sensor Serial #: 0010842	Calibration Information Cert #: Factory: Emerson Process Management Cluj Station Name: CLUJ_TEMP_SENSOR_CALIBRATION_0 Operator ID: 1395219 Calibration Date: Oct 5 2023 4:52PM
Permanent Tag Information TE-2A	Wire-on Tag Information

The product listed above is type approved under Measuring Instruments Directive (MID) by the notified body NMI-Netherlands with identification "MID Parts certificate TC7458".

This is to certify that the measurement system consisting of the listed product meets the applicable Emerson specifications and the criteria, following MID directive.

The calibration was performed in an ISO 17025 accredited laboratory and the deviation plus the uncertainty of the measurement of the units passed the criteria mentioned below.

MID Acceptance Criteria [°C] analog output	MID Acceptance Criteria [°C] digital output
0.24	0.30

Temperature in accordance to DIN EN 60751 (ITS90) [°C]	Resistance R(T90) [Ω]
0.0247	100.0463
-49.7665	80.3910
49.8319	119.4181
99.8532	138.5429
Callendar Van Dusen constants	Value
alpha	0.00385477
delta	1.714888
beta	-0.535102
R0	100.0367

I hereby certify the above calibration and CVD values.

A handwritten signature in blue ink, appearing to read 'M. Blaga'.

Mihai Blaga
Measurement Solutions Quality Manager

	 SOCRATE Working for Sustainability	COMMESSA NQ/R22199	UNITA' -
	FSRU Ravenna e collegamento alla Rete Nazionale Gasdotti	REL-MEC-E-52033	
	NQR22199 – Allacciamento FSRU Ravenna	Rev.	00

Rif. Codice Vendor: C23-00142-G-35

4.2.3.3.4 CERTIFICATI DI CALIBRAZIONE TE/TT-2B

CERTIFICATO DI TARATURA LAT 051 CTRM24P010D10
Certificate of Calibration No.

- data di emissione
date of issue 2024/07/11
- cliente
customer SOCRATE SPA
VIA PAPA GIOVANNI XXIII 5
20090 RODANO (MI)
- destinatario
addressee SOCRATE SPA
VIA PAPA GIOVANNI XXIII 5
20090 RODANO (MI)

Il presente certificato di taratura è emesso in base all'accreditamento LAT N° 051 rilasciato in accordo ai decreti attuativi della legge n. 273/1991 che ha istituito il Sistema Nazionale di Taratura (SNT). ACCREDIA attesta le capacità di misura e di taratura, le competenze metrologiche del Centro e la riferibilità delle tarature eseguite ai campioni nazionali e internazionali delle unità di misura del Sistema Internazionale delle Unità (SI). Questo certificato non può essere riprodotto in modo parziale, salvo espressa autorizzazione scritta da parte del Centro.

Si riferisce a
referring to

- oggetto
item Catena termometrica
- costruttore
manufacturer ROSE MOUNT
- modello
model 3144P
- matricola
serial number 23CLTC0005334(TT-2B)
- data ricev. Oggetto
date of receipt of item 2024/07/02
- data delle misure
date of measurements 2024/07/11
- registro di laboratorio
laboratory reference Temperature_2024

This certificate of calibration is issued in compliance with the accreditation LAT N° 051 granted according to decrees connected with Italian law No. 273/1991 which has established the National Calibration System. ACCREDIA attests the calibration and measurement capability, the metrological competence of the Centre and the traceability of calibration results to the national and international standards of the International System of Units (SI). This certificate may not be partially reproduced, except with the prior written permission of the issuing Centre.

I risultati di misura riportati nel presente Certificato sono stati ottenuti applicando le procedure citate alla pagina seguente, dove sono specificati anche i campioni o gli strumenti che garantiscono la catena di riferibilità del Centro e i rispettivi certificati di taratura in corso di validità. Essi si riferiscono esclusivamente all'oggetto in taratura e sono validi nel momento e nelle condizioni di taratura, salvo diversamente specificato.

The measurement results reported in this Certificate were obtained following the procedures given in the following page, where the reference standards or instruments are indicated which guarantee the traceability chain of the laboratory, and the related calibration certificates in their course of validity are indicated as well. They relate only to the calibrated item and they are valid for the time and conditions of calibration, unless otherwise specified.

Le incertezze di misura dichiarate in questo documento sono state determinate conformemente alla Guida ISO/IEC 98 e al documento EA-4/02. Solitamente sono espresse come incertezza estesa ottenuta moltiplicando l'incertezza tipo per il fattore di copertura k corrispondente ad livello di fiducia di circa il 95%. Normalmente tale fattore k vale 2.

The measurement uncertainties stated in this document have been determined according to the ISO/IEC 98 and to EA-4/02. Usually, they have been estimated as expanded uncertainty obtained multiplying the standard uncertainty by the coverage factor k corresponding to a confidence level of about 95%. Normally, this factor k is 2.

Direzione Tecnica
(Approving Officer)
Fenotti F.

CERTIFICATO DI TARATURA LAT 051 CTRM24P010D10 Certificate of Calibration No.

I risultati di misura riportati nel presente Certificato sono stati ottenuti applicando le procedure N.
The measurement results reported in this Certificate were obtained following procedures No.

MG/SIT/104 Rev.07 Taratura di catene termometriche, indicatori e trasmettitori di temperatura

La catena di riferibilità ha inizio dai campioni di riferimento n°
Traceability is through reference standards No.

4401 Termoresistenza Pt 25.5 campione
2823A16947 Multimetro numerale

Muniti di certificati validi di taratura rispettivamente n°
Validated by certificates of calibration No.

1012-KL-25041-23 emesso da C.M.I.
LAT 051 CMUL24P009A70 emesso da Trescal

Norme di riferimento

Reference standards:

CEI EN 60751:2009	"Termometri industriali a resistenza di platino e sensori di temperatura in platino"
CEI EN 60584-1:2014	"Termocoppie-Tabelle di riferimento"
UNI 6893:1979	"Termometri, di vetro, con riempimento di liquido. Modalità di controllo e verifica."
UNI EN 12470-1:2009	"Termometri clinici - Parte 1: Termometri a dilatazione di liquido metallico in vetro con dispositivo di massimo"
UNI EN 13190:2003	"Termometri a quadrante"

Condizioni ambientali e di misura

Environmental and measuring conditions

Temperatura : (23 ± 1) °C
Temperature

Umidità relativa : (50 ± 20) %UR
Relative humidity

Metodo di taratura

Calibration method

La taratura delle catene termometriche avviene per confronto con campioni di lavoro del centro. A seconda della temperatura di verifica si utilizza un diverso mezzo di confronto:

Calibration of temperature chains is done by comparison with working standards from the center. Depending on the verification temperature, a different means of comparison is used:

- 196 °C : in vaso dewar per l'ebollizione dell'azoto / *in dewar jar for nitrogen boiling point.*
- 80 °C ÷ 10 °C : in bagno di alcool etilico denaturato assoluto / *in a bath of absolute denatured ethyl alcohol*
- 0 °C : in bagno di ghiaccio fondente saturo d'aria / *in an air-saturated melting ice bath*
- 10 °C ÷ 80 °C : in bagno di acqua distillata / *in a distilled water bath*
- 80 °C ÷ 250 °C : in bagno di olio di siliconi / *in a silicon oil bath*
- 250 °C ÷ 550 °C : in bagno di sali fusi / *in a bath of molten salts*
- 550 °C ÷ 1100 °C : in forno orizzontale con cilindro in inconel / *in horizontal oven with inconel cylinder*
- 1100 °C ÷ 1500 °C : in forno orizzontale con cilindro di allumina / *in horizontal oven with alumina cylinder*

Per tarature di primo livello viene utilizzato, nel range di applicazione, il seguente forno in sostituzione dei precedentemente elencati:
For first-level calibrations, the following oven is used in the application range in place of the previously listed ones:

- 550 °C ÷ 1500 °C : in forno orizzontale con cilindro ceramico / *in horizontal oven with ceramic cylinder*

Luogo della taratura

Calibration site

La taratura è stata eseguita presso il Laboratorio Permanente del LAT 051 sito in:
Calibrations are performed at the LAT 051 Laboratory located in:

Via dei Metalli, 1 - 25039 Travagliato (BS), Italy

CERTIFICATO DI TARATURA LAT 051 CTRM24P010D10
Certificate of Calibration No.

Dati generali

General informations

Campo di misura / Range : (-30 ÷ 70) °C
Matricola sensore / Sensor serial number : 23CLTC0005331 (TT-2B)
Unità di formato / Minimum division : 0.001 °C
Tipo sensore / Sensor type : Pt100 Ω
Profondità di immersione / Immersion depth : 250 mm

Dati sperimentali

Experimental results

	Temperatura di riferimento Reference temperature t_{rif} °C	Temperatura letta sullo strumento in prova UUT temperature t_{mis} °C	Risoluzione Resolution - °C	Errore Error $t_{\text{mis}} - t_{\text{rif}}$ °C	Incertezza estesa di taratura Expanded calibration uncertainty U °C
1	-30.02	-29.986	0.001	0.03	0.05
2	0.00	-0.029	0.001	-0.03	0.05
3	20.13	20.088	0.001	-0.04	0.05
4	50.06	50.007	0.001	-0.05	0.05
5	70.03	69.974	0.001	-0.06	0.05

Note

Notes

- Taratura eseguita sui punti richiesti dal cliente.

L'operatore
(Calibration technician)
Peli G.



Calibration Certificate to 2014/32/EU (MID) - consistent with "type 3.1" ISO 10474:2013 / EN 10204:2004

Customer Information Name: SOCRATE SPA PO: OA23-00335	Manufacturer Information Sales Order: 39391960 Line/Unit: 22 Internal Ref #:
Device Information Trx Model #: 3144PD1A1E1DA1B4M5C1C2D4 Trx Serial #: 0005334 Sensor Model #: 214CRWSMA1S4M0295SLE1AR1C1UAE080MD2G1TB Sensor Serial #: 0010843	Calibration Information Cert #: Factory: Emerson Process Management Cluj Station Name: CLUJ_TEMP_SENSOR_CALIBRATION_0 Operator ID: 1395219 Calibration Date: Oct 5 2023 3:41PM
Permanent Tag Information TE-2B	Wire-on Tag Information

The product listed above is type approved under Measuring Instruments Directive (MID) by the notified body NMI-Netherlands with identification "MID Parts certificate TC7458".

This is to certify that the measurement system consisting of the listed product meets the applicable Emerson specifications and the criteria, following MID directive.

The calibration was performed in an ISO 17025 accredited laboratory and the deviation plus the uncertainty of the measurement of the units passed the criteria mentioned below.

MID Acceptance Criteria [°C] analog output	MID Acceptance Criteria [°C] digital output
0.24	0.30

Temperature in accordance to DIN EN 60751 (ITS90) [°C]	Resistance R(T90) [Ω]
0.0234	100.0309
-49.7640	80.3888
49.8078	119.3860
99.7647	138.4854
Callendar Van Dusen constants	Value
alpha	0.00385444
delta	1.679791
beta	-0.493516
R0	100.0218

I hereby certify the above calibration and CVD values.

A handwritten signature in blue ink, appearing to read 'M. Blaga'.

Mihai Blaga
Measurement Solutions Quality Manager

	 SOCRATE Working for Sustainability	COMMESSA NQ/R22199	UNITA' -
	FSRU Ravenna e collegamento alla Rete Nazionale Gasdotti	REL-MEC-E-52033	
	NQR22199 – Allacciamento FSRU Ravenna	Rev.	00

Rif. Codice Vendor: C23-00142-G-35

4.2.3.3.5 CERTIFICATI DI CALIBRAZIONE TE/TT-3A

CERTIFICATO DI TARATURA LAT 051 CTRM24P010D40
Certificate of Calibration No.

- data di emissione
date of issue 2024/07/11
- cliente
customer SOCRATE SPA
VIA PAPA GIOVANNI XXIII 5
20090 RODANO (MI)
- destinatario
addressee SOCRATE SPA
VIA PAPA GIOVANNI XXIII 5
20090 RODANO (MI)

Il presente certificato di taratura è emesso in base all'accreditamento LAT N° 051 rilasciato in accordo ai decreti attuativi della legge n. 273/1991 che ha istituito il Sistema Nazionale di Taratura (SNT). ACCREDIA attesta le capacità di misura e di taratura, le competenze metrologiche del Centro e la riferibilità delle tarature eseguite ai campioni nazionali e internazionali delle unità di misura del Sistema Internazionale delle Unità (SI). Questo certificato non può essere riprodotto in modo parziale, salvo espressa autorizzazione scritta da parte del Centro.

Si riferisce a
referring to

- oggetto
item Catena termometrica
- costruttore
manufacturer ROSE MOUNT
- modello
model 3144P
- matricola
serial number 23CLTC0005335(TT-3A)
- data ricev. Oggetto
date of receipt of item 2024/07/02
- data delle misure
date of measurements 2024/07/11
- registro di laboratorio
laboratory reference Temperature_2024

This certificate of calibration is issued in compliance with the accreditation LAT N° 051 granted according to decrees connected with Italian law No. 273/1991 which has established the National Calibration System. ACCREDIA attests the calibration and measurement capability, the metrological competence of the Centre and the traceability of calibration results to the national and international standards of the International System of Units (SI). This certificate may not be partially reproduced, except with the prior written permission of the issuing Centre.

I risultati di misura riportati nel presente Certificato sono stati ottenuti applicando le procedure citate alla pagina seguente, dove sono specificati anche i campioni o gli strumenti che garantiscono la catena di riferibilità del Centro e i rispettivi certificati di taratura in corso di validità. Essi si riferiscono esclusivamente all'oggetto in taratura e sono validi nel momento e nelle condizioni di taratura, salvo diversamente specificato.

The measurement results reported in this Certificate were obtained following the procedures given in the following page, where the reference standards or instruments are indicated which guarantee the traceability chain of the laboratory, and the related calibration certificates in their course of validity are indicated as well. They relate only to the calibrated item and they are valid for the time and conditions of calibration, unless otherwise specified.

Le incertezze di misura dichiarate in questo documento sono state determinate conformemente alla Guida ISO/IEC 98 e al documento EA-4/02. Solitamente sono espresse come incertezza estesa ottenuta moltiplicando l'incertezza tipo per il fattore di copertura k corrispondente ad livello di fiducia di circa il 95%. Normalmente tale fattore k vale 2.

The measurement uncertainties stated in this document have been determined according to the ISO/IEC 98 and to EA-4/02. Usually, they have been estimated as expanded uncertainty obtained multiplying the standard uncertainty by the coverage factor k corresponding to a confidence level of about 95%. Normally, this factor k is 2.

Direzione Tecnica
(Approving Officer)
Fenotti F.

CERTIFICATO DI TARATURA LAT 051 CTRM24P010D40 Certificate of Calibration No.

I risultati di misura riportati nel presente Certificato sono stati ottenuti applicando le procedure N.
The measurement results reported in this Certificate were obtained following procedures No.

MG/SIT/104 Rev.07 Taratura di catene termometriche, indicatori e trasmettitori di temperatura

La catena di riferibilità ha inizio dai campioni di riferimento n°
Traceability is through reference standards No.

4401 Termoresistenza Pt 25.5 campione
2823A16947 Multimetro numerale

Muniti di certificati validi di taratura rispettivamente n°
Validated by certificates of calibration No.

1012-KL-25041-23 emesso da C.M.I.
LAT 051 CMUL24P009A70 emesso da Trescal

Norme di riferimento

Reference standards:

CEI EN 60751:2009	"Termometri industriali a resistenza di platino e sensori di temperatura in platino"
CEI EN 60584-1:2014	"Termocoppie-Tabella di riferimento"
UNI 6893:1979	"Termometri, di vetro, con riempimento di liquido. Modalità di controllo e verifica."
UNI EN 12470-1:2009	"Termometri clinici - Parte 1: Termometri a dilatazione di liquido metallico in vetro con dispositivo di massimo"
UNI EN 13190:2003	"Termometri a quadrante"

Condizioni ambientali e di misura

Environmental and measuring conditions

Temperatura : (23 ± 1) °C
Temperature

Umidità relativa : (50 ± 20) %UR
Relative humidity

Metodo di taratura

Calibration method

La taratura delle catene termometriche avviene per confronto con campioni di lavoro del centro. A seconda della temperatura di verifica si utilizza un diverso mezzo di confronto:

Calibration of temperature chains is done by comparison with working standards from the center. Depending on the verification temperature, a different means of comparison is used:

- | | |
|---------------------|---|
| • -196 °C | : in vaso dewar per l'ebollizione dell'azoto / <i>in dewar jar for nitrogen boiling point.</i> |
| • -80 °C ÷ 10 °C | : in bagno di alcool etilico denaturato assoluto / <i>in a bath of absolute denatured ethyl alcohol</i> |
| • 0 °C | : in bagno di ghiaccio fondente saturo d'aria / <i>in an air-saturated melting ice bath</i> |
| • 10 °C ÷ 80 °C | : in bagno di acqua distillata / <i>in a distilled water bath</i> |
| • 80 °C ÷ 250 °C | : in bagno di olio di siliconi / <i>in a silicon oil bath</i> |
| • 250 °C ÷ 550 °C | : in bagno di sali fusi / <i>in a bath of molten salts</i> |
| • 550 °C ÷ 1100 °C | : in forno orizzontale con cilindro in inconel / <i>in horizontal oven with inconel cylinder</i> |
| • 1100 °C ÷ 1500 °C | : in forno orizzontale con cilindro di allumina / <i>in horizontal oven with alumina cylinder</i> |

Per tarature di primo livello viene utilizzato, nel range di applicazione, il seguente forno in sostituzione dei precedentemente elencati:
For first-level calibrations, the following oven is used in the application range in place of the previously listed ones:

- | | |
|--------------------|--|
| • 550 °C ÷ 1500 °C | : in forno orizzontale con cilindro ceramico / <i>in horizontal oven with ceramic cylinder</i> |
|--------------------|--|

Luogo della taratura

Calibration site

La taratura è stata eseguita presso il Laboratorio Permanente del LAT 051 sito in:
Calibrations are performed at the LAT 051 Laboratory located in:

Via dei Metalli, 1 - 25039 Travagliato (BS), Italy

CERTIFICATO DI TARATURA LAT 051 CTRM24P010D40
Certificate of Calibration No.

Dati generali

General informations

Campo di misura / Range : (-30 ÷ 70) °C
Matricola sensore / Sensor serial number : 23CLTC0005335(TT-3A)
Unità di formato / Minimum division : 0.0001/0.001 °C
Tipo sensore / Sensor type : Pt100 Ω
Profondità di immersione / Immersion depth : 250 mm

Dati sperimentali

Experimental results

	Temperatura di riferimento Reference temperature t_{rif} °C	Temperatura letta sullo strumento in prova UUT temperature t_{mis} °C	Risoluzione Resolution - °C	Errore Error $t_{\text{mis}} - t_{\text{rif}}$ °C	Incertezza estesa di taratura Expanded calibration uncertainty U °C
1	-30.02	-29.981	0.001	0.04	0.05
2	0.00	-0.0676	0.0001	-0.07	0.06
3	20.14	20.068	0.001	-0.07	0.05
4	50.09	49.972	0.001	-0.12	0.06
5	70.02	69.951	0.001	-0.07	0.05

Note

Notes

- Taratura eseguita sui punti richiesti dal cliente.

L'operatore
(Calibration technician)
Peli G.



Calibration Certificate to 2014/32/EU (MID) - consistent with "type 3.1" ISO 10474:2013 / EN 10204:2004

Customer Information Name: SOCRATE SPA PO: OA23-00335	Manufacturer Information Sales Order: 39391960 Line/Unit: 22 Internal Ref #:
Device Information Trx Model #: 3144PD1A1E1DA1B4M5C1C2D4 Trx Serial #: 0005335 Sensor Model #: 214CRWSMA1S4M0295SLE1AR1C1UAE080MD2G1TB Sensor Serial #: 0010844	Calibration Information Cert #: Factory: Emerson Process Management Cluj Station Name: CLUJ_TEMP_SENSOR_CALIBRATION_0 Operator ID: 1395219 Calibration Date: Oct 5 2023 3:40PM
Permanent Tag Information TE-3A	Wire-on Tag Information

The product listed above is type approved under Measuring Instruments Directive (MID) by the notified body NMI-Netherlands with identification "MID Parts certificate TC7458".

This is to certify that the measurement system consisting of the listed product meets the applicable Emerson specifications and the criteria, following MID directive.

The calibration was performed in an ISO 17025 accredited laboratory and the deviation plus the uncertainty of the measurement of the units passed the criteria mentioned below.

MID Acceptance Criteria [°C] analog output	MID Acceptance Criteria [°C] digital output
0.24	0.30

Temperature in accordance to DIN EN 60751 (ITS90) [°C]	Resistance R(T90) [Ω]
0.0221	100.0179
-49.7583	80.3886
49.8169	119.3592
99.8417	138.4687
Callendar Van Dusen constants	Value
alpha	0.00385158
delta	1.669984
beta	-0.355731
R0	100.0093

	 SOCRATE <i>Working for Sustainability</i>	COMMESSA NQ/R22199	UNITA' -
	FSRU Ravenna e collegamento alla Rete Nazionale Gasdotti NQR22199 – Allacciamento FSRU Ravenna	REL-MEC-E-52033	
		Rev.	00

Rif. Codice Vendor: C23-00142-G-35

4.2.3.3.6 CERTIFICATI DI CALIBRAZIONE TE/TT-3B

CERTIFICATO DI TARATURA LAT 051 CTRM24P010D50
Certificate of Calibration No.

- data di emissione
date of issue 2024/07/11
- cliente
customer SOCRATE SPA
VIA PAPA GIOVANNI XXIII 5
20090 RODANO (MI)
- destinatario
addressee SOCRATE SPA
VIA PAPA GIOVANNI XXIII 5
20090 RODANO (MI)

Il presente certificato di taratura è emesso in base all'accreditamento LAT N° 051 rilasciato in accordo ai decreti attuativi della legge n. 273/1991 che ha istituito il Sistema Nazionale di Taratura (SNT). ACCREDIA attesta le capacità di misura e di taratura, le competenze metrologiche del Centro e la riferibilità delle tarature eseguite ai campioni nazionali e internazionali delle unità di misura del Sistema Internazionale delle Unità (SI). Questo certificato non può essere riprodotto in modo parziale, salvo espressa autorizzazione scritta da parte del Centro.

Si riferisce a
referring to

- oggetto
item Catena termometrica
- costruttore
manufacturer ROSE MOUNT
- modello
model 3144P
- matricola
serial number 23CLTC0005336(TT-3B)
- data ricev. Oggetto
date of receipt of item 2024/07/02
- data delle misure
date of measurements 2024/07/11
- registro di laboratorio
laboratory reference Temperature_2024

This certificate of calibration is issued in compliance with the accreditation LAT N° 051 granted according to decrees connected with Italian law No. 273/1991 which has established the National Calibration System. ACCREDIA attests the calibration and measurement capability, the metrological competence of the Centre and the traceability of calibration results to the national and international standards of the International System of Units (SI). This certificate may not be partially reproduced, except with the prior written permission of the issuing Centre.

I risultati di misura riportati nel presente Certificato sono stati ottenuti applicando le procedure citate alla pagina seguente, dove sono specificati anche i campioni o gli strumenti che garantiscono la catena di riferibilità del Centro e i rispettivi certificati di taratura in corso di validità. Essi si riferiscono esclusivamente all'oggetto in taratura e sono validi nel momento e nelle condizioni di taratura, salvo diversamente specificato.

The measurement results reported in this Certificate were obtained following the procedures given in the following page, where the reference standards or instruments are indicated which guarantee the traceability chain of the laboratory, and the related calibration certificates in their course of validity are indicated as well. They relate only to the calibrated item and they are valid for the time and conditions of calibration, unless otherwise specified.

Le incertezze di misura dichiarate in questo documento sono state determinate conformemente alla Guida ISO/IEC 98 e al documento EA-4/02. Solitamente sono espresse come incertezza estesa ottenuta moltiplicando l'incertezza tipo per il fattore di copertura k corrispondente ad livello di fiducia di circa il 95%. Normalmente tale fattore k vale 2.

The measurement uncertainties stated in this document have been determined according to the ISO/IEC 98 and to EA-4/02. Usually, they have been estimated as expanded uncertainty obtained multiplying the standard uncertainty by the coverage factor k corresponding to a confidence level of about 95%. Normally, this factor k is 2.

Direzione Tecnica
(Approving Officer)
Fenotti F.

CERTIFICATO DI TARATURA LAT 051 CTRM24P010D50 Certificate of Calibration No.

I risultati di misura riportati nel presente Certificato sono stati ottenuti applicando le procedure N.
The measurement results reported in this Certificate were obtained following procedures No.

MG/SIT/104 Rev.07 Taratura di catene termometriche, indicatori e trasmettitori di temperatura

La catena di riferibilità ha inizio dai campioni di riferimento n°
Traceability is through reference standards No.

4401 Termoresistenza Pt 25.5 campione
2823A16947 Multimetro numerale

Muniti di certificati validi di taratura rispettivamente n°
Validated by certificates of calibration No.

1012-KL-25041-23 emesso da C.M.I.
LAT 051 CMUL24P009A70 emesso da Trescal

Norme di riferimento

Reference standards:

CEI EN 60751:2009	"Termometri industriali a resistenza di platino e sensori di temperatura in platino"
CEI EN 60584-1:2014	"Termocoppie-Tabella di riferimento"
UNI 6893:1979	"Termometri, di vetro, con riempimento di liquido. Modalità di controllo e verifica."
UNI EN 12470-1:2009	"Termometri clinici - Parte 1: Termometri a dilatazione di liquido metallico in vetro con dispositivo di massimo"
UNI EN 13190:2003	"Termometri a quadrante"

Condizioni ambientali e di misura

Environmental and measuring conditions

Temperatura : (23 ± 1) °C
Temperature

Umidità relativa : (50 ± 20) %UR
Relative humidity

Metodo di taratura

Calibration method

La taratura delle catene termometriche avviene per confronto con campioni di lavoro del centro. A seconda della temperatura di verifica si utilizza un diverso mezzo di confronto:

Calibration of temperature chains is done by comparison with working standards from the center. Depending on the verification temperature, a different means of comparison is used:

- | | |
|---------------------|---|
| • -196 °C | : in vaso dewar per l'ebollizione dell'azoto / <i>in dewar jar for nitrogen boiling point.</i> |
| • -80 °C ÷ 10 °C | : in bagno di alcool etilico denaturato assoluto / <i>in a bath of absolute denatured ethyl alcohol</i> |
| • 0 °C | : in bagno di ghiaccio fondente saturo d'aria / <i>in an air-saturated melting ice bath</i> |
| • 10 °C ÷ 80 °C | : in bagno di acqua distillata / <i>in a distilled water bath</i> |
| • 80 °C ÷ 250 °C | : in bagno di olio di siliconi / <i>in a silicon oil bath</i> |
| • 250 °C ÷ 550 °C | : in bagno di sali fusi / <i>in a bath of molten salts</i> |
| • 550 °C ÷ 1100 °C | : in forno orizzontale con cilindro in inconel / <i>in horizontal oven with inconel cylinder</i> |
| • 1100 °C ÷ 1500 °C | : in forno orizzontale con cilindro di allumina / <i>in horizontal oven with alumina cylinder</i> |

Per tarature di primo livello viene utilizzato, nel range di applicazione, il seguente forno in sostituzione dei precedentemente elencati:
For first-level calibrations, the following oven is used in the application range in place of the previously listed ones:

- | | |
|--------------------|--|
| • 550 °C ÷ 1500 °C | : in forno orizzontale con cilindro ceramico / <i>in horizontal oven with ceramic cylinder</i> |
|--------------------|--|

Luogo della taratura

Calibration site

La taratura è stata eseguita presso il Laboratorio Permanente del LAT 051 sito in:
Calibrations are performed at the LAT 051 Laboratory located in:

Via dei Metalli, 1 - 25039 Travagliato (BS), Italy

CERTIFICATO DI TARATURA LAT 051 CTRM24P010D50
Certificate of Calibration No.

Dati generali

General informations

Campo di misura / Range : (-30 ÷ 70) °C
Matricola sensore / Sensor serial number : 23CLTC0005335(TT-3B)
Unità di formato / Minimum division : 0.0001/0.001 °C
Tipo sensore / Sensor type : Pt100 Ω
Profondità di immersione / Immersion depth : 250 mm

Dati sperimentali

Experimental results

	Temperatura di riferimento Reference temperature t_{rif} °C	Temperatura letta sullo strumento in prova UUT temperature t_{mis} °C	Risoluzione Resolution - °C	Errore Error $t_{\text{mis}} - t_{\text{rif}}$ °C	Incertezza estesa di taratura Expanded calibration uncertainty U °C
1	-30.03	-29.970	0.001	0.06	0.05
2	0.00	-0.0179	0.0001	-0.02	0.05
3	20.12	20.061	0.001	-0.06	0.05
4	50.06	49.992	0.001	-0.07	0.05
5	70.02	69.985	0.001	-0.04	0.05

Note

Notes

- Taratura eseguita sui punti richiesti dal cliente.

L'operatore
(Calibration technician)
Peli G.



Calibration Certificate to 2014/32/EU (MID) - consistent with "type 3.1" ISO 10474:2013 / EN 10204:2004

Customer Information Name: SOCRATE SPA PO: OA23-00335	Manufacturer Information Sales Order: 39391960 Line/Unit: 22 Internal Ref #:
Device Information Trx Model #: 3144PD1A1E1DA1B4M5C1C2D4 Trx Serial #: 0005336 Sensor Model #: 214CRWSMA1S4M0295SLE1AR1C1UAE080MD2G1TB Sensor Serial #: 0010845	Calibration Information Cert #: Factory: Emerson Process Management Cluj Station Name: CLUJ_TEMP_SENSOR_CALIBRATION_0 Operator ID: 1395219 Calibration Date: Oct 5 2023 3:38PM
Permanent Tag Information TE-3B	Wire-on Tag Information

The product listed above is type approved under Measuring Instruments Directive (MID) by the notified body NMI-Netherlands with identification "MID Parts certificate TC7458".

This is to certify that the measurement system consisting of the listed product meets the applicable Emerson specifications and the criteria, following MID directive.

The calibration was performed in an ISO 17025 accredited laboratory and the deviation plus the uncertainty of the measurement of the units passed the criteria mentioned below.

MID Acceptance Criteria [°C] analog output	MID Acceptance Criteria [°C] digital output
0.24	0.30

Temperature in accordance to DIN EN 60751 (ITS90) [°C]	Resistance R(T90) [Ω]
0.0260	100.0253
-49.8034	80.3754
49.8150	119.3699
99.8504	138.4785
Callendar Van Dusen constants	Value
alpha	0.00385142
delta	1.724623
beta	-0.564366
R0	100.0151

I hereby certify the above calibration and CVD values.

A handwritten signature in blue ink, appearing to read 'M. Blaga'.

Mihai Blaga
Measurement Solutions Quality Manager