

Zertifikat Id ID du certificat Certificate ID	210209_C06_000	Projekt Id ID de Project Project ID	210109_MSC_01
Kunde Id Client Client	Muster AG Musterstrasse, CH-XXXX Musterort	Kalibrierungs ID ID d' étalonnage Calibration ID	4296278753

**KALIBRIERZERTIFIKAT  
CERTIFICAT D'ÉTALONNAGE  
CALIBRATION CERTIFICATE**

Gegenstand Objet Object	Data Acquisition/Switch Unit
Hersteller Fabricant Manufacturer	Agilent
Typ Type Type	34970A
Serien-Nr. No de serie Serial number	Seriennummer
Bemerkungen Remarque Remarks	none
Datum / Ort der Kalibrierung Date / localité de l'étalonnage Date / lcoation of calibration	25 Jan 2021 / Scheidt MessTechnik, Wetzikon

**Dieses Kalibrierzertifikat dokumentiert die Rückverfolgbarkeit auf nationale Normale zur Darstellung der physikalischen Einheiten (SI).  
Ce certificat d'étalonnage confirme le raccordement aux étalons nationaux qui matérialisent les grandeurs physiques (SI).  
This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).**

Messresultate, Messunsicherheiten mit Vertrauensbereich und Messverfahren sind auf den folgenden Seiten aufgeführt und sind Teil des Zertifikates.  
Les résultats, les incertitudes avec le niveau de confiance et les méthodes de mesure sont donnés aux pages suivantes et font partie du certificat.  
The measurements, the uncertainties with confidence probability and calibration methods are given on the following pages and are part of the certificate

Dieses Kalibrierzertifikat darf ohne die schriftliche Zustimmung des Laboratoriums nicht auszugsweise vervielfältigt werden.  
Ce certificat d'étalonnage ne doit pas être reproduit, sinon en entier, sans l'autorisation écrite du laboratoire.  
This calibration certificate shall not be reproduced except in full, without written approval of the laboratory.

Datenaufbewahrungsdauer: 5 Jahre  
Le délai de conservation de données: 5 ans  
Record retention period: 5 years

Datum / Date/ Date

Leiter der Kalibrierstelle/ Chef du laboratoire d'étalonnage/ Head of the calibration laboratory

**Dr. Michael Scheidt**

**E**  
The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k = 2$ , which for a normal distribution corresponds to a coverage probability of approximately 95%.

**F**  
L'incertitude de mesure élargie donnée est l'incertitude-type sur le résultat de la mesure multipliée par le facteur d'élargissement  $k = 2$  ce qui, pour une distribution gaussienne, correspond à un niveau de confiance d'environ 95%.

**D**  
Die angegebene erweiterte Messunsicherheit ist die Standardunsicherheit der Messung multipliziert mit einem Erweiterungsfaktor  $k = 2$ , was bei einer Normalverteilung einem Vertrauensniveau von etwa 95% entspricht.

**I**  
L'incertezza di misura riportata è la deviazione standard della misura moltiplicata con un fattore di copertura  $k = 2$ , che, per una distribuzione gaussiana, corrisponde ad un fattore di confidenza di circa 95%.

## Instruments used

Instrument	Manufacturer and Model	Serial number	Latest calibration
Calibrator	Fluke 5500E	1924010	04 Feb 2021
Multimeter	Agilent 3458A	MY45048825	08 Jan 2021

## External Traceability Information

SI Unit	Reference standard kind Manufacturer Model ID	Latest link to national standard	Latest surveille
V	Fixed voltage Scheidt MessTechnik Zener Reference V3 131220_ASC_01_4	05-07-2019	08-01-2021
Ohm	Fixed resistor Scheidt MessTechnik Resistorbox 10R 100R 1k 10k 100k Hw V02 161011_MSC_01	12-11-2019	08-01-2021
s	Gps receiver Trimble Thunderbold E 41470268	continuous	continuous
K	Temperature sensor Moser TMT AG TR7c 130475	23-07-2019	23-07-2019

## Laboratory Environment

Temperature: 23°C ±2K

### Test: Visual inspection

#### Measuring principle:

Visual inspection of DUT by the operator.

#### Used procedure:

py3.calibration.procedures.special.visual\_inspection\_m02\_v01.Procedure

#### Traceability:

Result
no visual functional issues

### Test: Zero Offset Verification Ohm 4W Front

#### Measuring principle:

Direct application of a resistance to the DUT.

#### Used procedure:

py3.calibration.procedures.direct.stimulate\_resistance\_m01\_v01.Procedure

#### Traceability:

realized by shorting inputs

Range	Resistance applied	Exp. Unc.	Resistance read	Deviation	Exp. Unc.	Tol. used	Test result
100Ω	0uΩ	350uΩ	-200uΩ	200uΩ	840uΩ	6%	P✓
1kΩ	0uΩ	350uΩ	0uΩ	-0.0mΩ	2.2mΩ	0%	P✓
10kΩ	0uΩ	350uΩ	-1.9mΩ	2mΩ	22mΩ	4%	P✓
100kΩ	0uΩ	350uΩ	-13mΩ	10mΩ	210mΩ	3%	P✓
1MΩ	0uΩ	350uΩ	80mΩ	-0.1Ω	2.1Ω	1%	P✓
10MΩ	0uΩ	350uΩ	0.8Ω	-1Ω	22Ω	1%	P✓
100MΩ	0uΩ	350uΩ	0nΩ	0Ω	210Ω	0%	P✓

**Test: Zero Offset Verification Ohm**

**Measuring principle:**

Direct application of a resistance to the DUT.

**Used procedure:**

py3.calibration.procedures.direct.stimulate\_resistance\_m01\_v01.Procedure

**Traceability:**

realized by shorting inputs

Range	Resistance applied	Exp. Unc.	Resistance read	Deviation	Exp. Unc.	Tol. used	Test result
100Ω	0.5mΩ	1.1mΩ	-9.92mΩ	10.4mΩ	1.2mΩ	0%	P✓
1kΩ	0.5mΩ	1.1mΩ	-9.47mΩ	10.0mΩ	2.4mΩ	0%	P✓
10kΩ	0.5mΩ	1.1mΩ	-8.8mΩ	9mΩ	22mΩ	0%	P✓
100kΩ	0.5mΩ	1.1mΩ	-19mΩ	20mΩ	220mΩ	0%	P✓
1MΩ	0.5mΩ	1.1mΩ	80mΩ	-0.1Ω	2.1Ω	1%	P✓
10MΩ	0.5mΩ	1.1mΩ	-3.8Ω	4Ω	21Ω	4%	P✓
100MΩ	0.5mΩ	1.1mΩ	0nΩ	0Ω	210Ω	0%	P✓

**Test: Zero Offset Verification Volt**

**Measuring principle:**

Direct application of a DC voltage to the DUT.

**Used procedure:**

py3.calibration.procedures.direct.stimulate\_voltage\_dc\_m01\_v01.Procedure

**Traceability:**

realized by shorting inputs

Range	Voltage applied	Exp. Unc.	Voltage read	Deviation	Exp. Unc.	Tol. used	Test result
100mV	0nV	350nV	-30nV	30nV	820nV	1%	P✓
1V	0nV	350nV	120nV	-0.1uV	2.2uV	2%	P✓
10V	0nV	350nV	0.8uV	-1uV	21uV	2%	P✓
100V	0nV	350nV	-10uV	10uV	230uV	1%	P✓
300V	0nV	350nV	-20uV	20uV	630uV	0%	P✓

**Test: Gain Verification Test Voltage DC**

**Measuring principle:**

Direct application of a DC voltage to the DUT. Voltage measured with a reference multimeter.

**Used procedure:**

py3.calibration.procedures.direct.stimulate\_and\_measure\_voltage\_dc\_m01\_v01.Procedure

**Traceability:**

Unit	Kind of Standard / Method	Model	SN / ID	Latest Calibration
V	Direct application of a DC voltage to the DUT. Voltage measured with a reference multimeter.			
└V	Multimeter	3458A	MY45048825	08-01-2021
└└V	Artifact calibration			
└└└V	Fixed voltage	Zener Reference V3	131220_ASC_01_4	08-01-2021

Range	Voltage applied	Exp. Unc.	Voltage read	Deviation	Exp. Unc.	Tol. used	Test result
100mV	99.9996mV	0.0011mV	99.9989mV	0.7uV	1.2uV	12%	P✓
1V	1.000071V	0.000060V	1.000094V	-2.2uV	6.4uV	9%	P✓
10V	10.000072V	0.000052V	10.000060V	12uV	56uV	6%	P✓
10V	-10.000091V	0.000052V	-10.000086V	-4uV	56uV	2%	P✓
100V	100.00249V	0.00087V	100.00095V	1.54mV	0.93mV	59%	P✓
300V	300.0020V	0.0035V	299.9988V	3.1mV	3.6mV	26%	P✓

**Test: Gain Verification Test Voltage AC**

**Measuring principle:**

Direct application of an AC voltage to the DUT. Voltage measured with a reference multimeter.

**Used procedure:**

py3.calibration.procedures.direct.stimulate\_and\_measure\_voltage\_ac\_m01\_v01.Procedure

**Traceability:**

Unit	Kind of Standard / Method	Model	SN / ID	Latest Calibration
V~	Direct application of an AC voltage to the DUT. Voltage measured with a reference multimeter.			
V~	Multimeter	3458A	MY45048825	08-01-2021
	Artifact calibration			
V	Fixed voltage	Zener Reference V3	131220_ASC_01_4	08-01-2021
Ohm	Fixed resistor	Resistorbox 10R 100R 1k 10k 100k Hw V02	161011_MSC_01	08-01-2021

Range	Frequency applied	Voltage applied	Exp. Unc.	Voltage read	Deviation	Exp. Unc.	Tol. used	Test result
100mV	1kHz	99.9978mV	0.0098mV	99.9856mV	12.2uV	10.0uV	17%	P✓
100mV	50kHz	99.980mV	0.033mV	99.967mV	14uV	33uV	9%	P✓
1V	1kHz	1.000030V	0.000093V	999.947mV	83uV	93uV	12%	P✓
1V	50kHz	999.95mV	0.33mV	999.75mV	190uV	330uV	13%	P✓
10V	1kHz	10.00001V	0.00095V	9.99909V	920uV	990uV	13%	P✓
10V	50kHz	9.9994V	0.0033V	9.9999V	-0.4mV	3.3mV	3%	P✓
10V	10Hz	10.0006V	0.0012V	9.9995V	1.1mV	1.2mV	16%	P✓
100V	50kHz	29.998V	0.013V	29.972V	26mV	13mV	33%	P✓
100V	1kHz	100.012V	0.023V	99.994V	18mV	23mV	26%	P✓
100V	20kHz	100.024V	0.023V	100.007V	17mV	23mV	25%	P✓
300V	50kHz	29.998V	0.013V	29.841V	157mV	13mV	48%	P✓
300V	1kHz	300.00V	0.15V	299.92V	80mV	150mV	29%	P✓
300V	20kHz	300.01V	0.21V	300.00V	20mV	210mV	6%	P✓

**Test: Gain Verification Test Resistance 4W**

**Measuring principle:**

Direct application of a fixed resistance to the DUT. Resistance was measured with a reference multimeter in advance.

**Used procedure:**

py3.calibration.procedures.direct.measure\_and\_apply\_resistance\_m01\_v02.Procedure

**Traceability:**

Unit	Kind of Standard / Method	Model	SN / ID	Latest Calibration
Ohm	Direct application of a fixed resistance to the DUT. Resistance was measured with a reference multimeter in advance.			
Ohm	Multimeter	3458A	MY45048825	08-01-2021
	Artifact calibration			
Ohm	Fixed resistor	Resistorbox 10R 100R 1k 10k 100k Hw V02	161011_MSC_01	08-01-2021

Range	Resistance applied	Exp. Unc.	Resistance read	Deviation	Exp. Unc.	Tol. used	Test result
100Ω	99.9984Ω	0.0031Ω	99.9983Ω	0.1mΩ	3.1mΩ	0%	P✓
1kΩ	999.992Ω	0.024Ω	1.000008kΩ	-16mΩ	24mΩ	18%	P✓
10kΩ	9.99999kΩ	0.00024kΩ	10.00019kΩ	-210mΩ	240mΩ	23%	P✓
100kΩ	99.9993kΩ	0.0024kΩ	100.0005kΩ	-1.2Ω	2.4Ω	14%	P✓
1MΩ	1.000036MΩ	0.000027MΩ	1.000044MΩ	-8Ω	27Ω	8%	P✓
10MΩ	10.00055MΩ	0.00067MΩ	9.99915MΩ	1.40kΩ	0.70kΩ	67%	P✓
100MΩ	99.990MΩ	0.057MΩ	99.846MΩ	144kΩ	58kΩ	18%	P✓

**Test: Gain Verification Test Frequency**

**Measuring principle:**

Direct application of a sine wave with specified frequency to the DUT.

**Used procedure:**

py3.calibration.procedures.direct.stimulate\_frequency\_m01\_v01.Procedure

**Traceability:**

Unit	Kind of Standard / Method	Model	SN / ID	Latest Calibration
S S S S S	Direct application of a sine wave with specified frequency to the DUT.			
	Calibrator	5500E	1924010	08-01-2021
	Measures the frequency of a periodic signal over many cycles using a counter			
	Frequency_counter	53230A	MY50001670	continuous
	Lock to 10MHz reference signal			
Gps_receiver	Thunderbold E	41470268	continuous	
Lock to GPS signal				

Voltage applied	Frequency applied	Exp. Unc.	Frequency read	Deviation	Exp. Unc.	Tol. used	Test result
10mV	100.0000Hz	0.0036Hz	100.000972Hz	-1mHz	22mHz	1%	P✓
1V	100.0000kHz	0.0026kHz	100.00018kHz	-0.2Hz	2.6Hz	2%	P✓

**Measurements accomplished by:**

Michael Scheidt

**Measurements beyond current accreditation are marked with (\*)**

**Specification used:**

Agilent 34970A Service Guide Edition 5 May 2012

**Abbreviations:**

**Exp. Unc.:** Expanded uncertainty

**P :** Passed. Specification is met for this test.

**P<sup>C</sup>:** It is not possible to state compliance using a 95 % coverage probability for the expanded uncertainty although the measurement result is below the limit. (see ILAC G8:03/2009)

**F<sup>C</sup>:** It is not possible to state non compliance using a 95 % coverage probability for the expanded uncertainty although the measurement result is above the limit. (see ILAC G8:03/2009)

**F :** Failed. Specification is not met for this test.