

Certificato di Taratura Certificate of Calibration

Data di emissione

Date of issue

Cliente

Customer

Destinatario

Receiver

Si riferisce a:

Referring to:

- oggetto Catena Termometrica - Termoresistenza Pt100
item *Thermometric Chain - Thermoresistance Pt100*
- costruttore
manufacturer
- modello
model
- matricola
serial number
- data di ricevimento - - -
date of receipt of item
- data delle misure
date of measurements
- registro di laboratorio
laboratory reference

Il presente certificato di taratura è emesso in base all'accreditamento n. 00171 Calibration che 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) in conformità ai requisiti della norma UNI CEI EN ISO/IEC 17025. L'accreditamento è rilasciato in accordo ai decreti attuativi della legge n. 273/1991 che ha istituito il Sistema Nazionale di Taratura (SNT).

This certificate of calibration is issued in compliance with the accreditation n. 00171 Calibration attesting 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) in compliance with requirements of ISO/IEC 17025. The accreditation is granted according to decrees connected with Italian law No. 273/1991 which has established the National Calibration System.

I risultati di misura riportati nel presente Certificato sono stati ottenuti applicando le procedure di taratura 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 calibration 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 the 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 un 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 Guide 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.

per la Direzione tecnica
(on behalf of the Approving Officer)

Mauro Berton

CERTIFICATO DI TARATURA LAT 124 Certificato di Taratura
Certificate of Calibration

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.

DHLT-E-07 Rev.8

La catena di riferibilità ha inizio dai campioni di riferimento N. 1744, 0697504

Traceability is through reference standards No.

muniti di certificati validi di taratura rispettivamente N. INRiM 23-0791-01, LAT 046 375951
validated by certificates of calibration No.

CONDIZIONI AMBIENTALI DI TARATURA - ENVIRONMENTAL CONDITIONS :

Temperatura - Temperature : $(23 \pm 2) ^\circ\text{C}$
Umidità relativa - Relative Humidity : $(50 \pm 20) \% \text{R.H.}$

INCERTEZZE - UNCERTAINTIES :

Le migliori incertezze estese di taratura accreditate, espresse al livello di fiducia del 95 %, sono:
The best measurement capability, expressed at a confidence level of about 95 %, is:

0.2 °C	per il punto in azoto liquido - <i>at liquid nitrogen calibration point</i>	-196 °C
0.15 °C	per i punti compresi nell'intervallo - <i>at calibration points in the range</i>	-75 °C / 0 °C
0.02 °C	per il punto in ghiaccio fondente - <i>at melting ice calibration point</i>	0 °C
0.06 °C	per i punti compresi nell'intervallo - <i>at calibration points in the range</i>	0 °C / 100 °C
0.1 °C	per i punti compresi nell'intervallo - <i>at calibration points in the range</i>	100 °C / 250 °C
0.2 °C	per i punti compresi nell'intervallo - <i>at calibration points in the range</i>	250 °C / 540 °C

LA TARATURA VIENE ESEGUITA SECONDO IL SEGUENTE PROCEDIMENTO:

THE CALIBRATION HAS BEEN CARRIED OUT ACCORDING TO THE FOLLOWING PROCEDURES:

- 196 °C in bagno di azoto liquido per confronto con termometro campione a resistenza di platino;
immersione dei termoelementi: 210 mm
*-196 °C in liquid nitrogen bath by comparison with standard platinum resistance thermometer;
immersion depth: 210 mm*
- da -75 °C a 0 °C in bagno termostatico a fluido fluorurato per confronto con termometro campione a resistenza di platino;
immersione dei termoelementi: 200 mm
*from -75 °C to 0 °C in fluorinated fluid bath by comparison with standard platinum resistance thermometer;
immersion depth: 200 mm*
- da 0 °C a 250 °C in bagno termostatico ad olio di siliconi per confronto con termometro campione a resistenza di platino;
immersione dei termoelementi: 200 mm
*from 0 °C to 250 °C in silicone oil bath by comparison with standard platinum resistance thermometer;
immersion depth: 200 mm*
- da 250 °C a 540 °C in bagno termostatico a sali fusi per confronto con termometro campione a resistenza di platino;
immersione dei termoelementi: 250 mm
*from 250 °C to 540 °C in molten salts bath by comparison with standard platinum resistance thermometer;
immersion depth: 250 mm*

Tutte le letture a 0 °C sono realizzate per immersione in una miscela di ghiaccio di acqua deionizzata satura d'aria.
0 °C measurement carried out in an air saturated ice bath. Ice contains deionized water.

CERTIFICATO DI TARATURA LAT 124 Certificato di Taratura
Certificate of Calibration

RISULTATI DELLA TARATURA - CALIBRATION RESULTS

- Strumento
Instrument
 - Costruttore
Manufacturer
 - Modello
Model
 - Matricola
Serial number
- Catena Termometrica - Termoresistenza Pt100
Thermometric Chain - Thermoresistance Pt100

Indicatore + Sonda su canale A
Indicator + Probe on input A

Punto Point N°	Riferimento Reference t_{ref} /°C	Lettura ¹ Reading ¹ t_{read} input A /°C	Errore ² Error ² $t_{read} - t_{ref}$ /°C	Incertezza ³ Uncertainty ³ U /°C
1	-195.55	-195.54	0.01	0.20
2	-72.74	-72.75	-0.01	0.15
3	-39.97	-39.97	0.00	0.15
4	0.00	0.03	0.03	0.02
5	40.00	40.04	0.04	0.06
6	99.98	100.02	0.04	0.06
7	150.02	150.02	0.00	0.10
8	250.00	249.90	-0.10	0.10
9	450.07	450.20	0.13	0.20

Il separatore decimale usato in questo documento è il punto.

¹ La temperatura indicata è la media delle letture arrotondata alla risoluzione dello strumento in taratura.
¹ The indicated temperature is the average of the readings rounded to the resolution of the instrument under calibration.

² L'errore è la differenza fra la temperatura indicata e la temperatura di riferimento, arrotondata alla risoluzione dello strumento.
² The error is the difference between indicated temperature and reference temperature, rounded to the resolution of the instrument.

³ Le incertezze U dichiarate in questo documento sono espresse come due volte lo scarto tipo (corrispondente, nel caso di distribuzione normale, a un livello di fiducia di circa 95 %, $k = 2$). Esse includono il contributo della risoluzione, della ripetibilità, dell'isteresi e della stabilità a 0 °C del termometro in taratura.
³ The measurement uncertainties have been estimated as extended uncertainty obtained multiplying the standard uncertainty by the coverage factor $k = 2$ corresponding to a confidence level of about 95 %. Resolution, repeatability, hysteresis and stability at 0 °C are included in the uncertainties.

Nota: I risultati valgono per lo strumento nello stato in cui è pervenuto al laboratorio e riconsegnato al committente.
The calibration results are referred to the instrument so as received at our laboratory and delivered to the customer.

Kalibrierschein / Calibration Certificate

gemäß DIN EN ISO/IEC 17025 / according to DIN EN ISO/IEC 17025

erstellt durch das Kalibrierlaboratorium

issued by the calibration laboratory



Deutsche
Akkreditierungsstelle
D-K-21043-01-00

Senseca Germany GmbH
Hans-Sachs-Straße 26
93128 Regenstauf

Mitglied im Deutschen Kalibrierdienst
Member of the Deutschen Kalibrierdienst



Kalibrierzeichen
Calibration mark

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D-K- 21043-01-00
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Gegenstand
Object

**1 Widerstandsthermometer, angeschlossen an
Temperaturanzeigegerät**

**1 Resistance thermometer, connected with temp.
measuring device**

Hersteller
Manufacturer

**Senseca Germany GmbH
Hans-Sachs-Straße 26
93128 Regenstauf**

Typ
Type

**PRO 111
AX 111-D3-AA**

Serien- oder Prüfmittel-Nr.
Serial number

Kunden- oder
Eigentümerdaten
Customer

Auftragsnummer
Order No.

Anzahl der Seiten des Kalibrierscheines
Number of pages of the certificate

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Datum der Kalibrierung
Date of calibration

Dieser Kalibrierschein darf nur vollständig und unverändert weiterverbreitet werden. Auszüge oder Änderungen bedürfen der Genehmigung des ausstellenden Kalibrierlaboratoriums. Kalibrierscheine sind bei Nennung des für die Freigabe Verantwortlichen in Klarschrift auch ohne Unterschrift gültig.

This calibration certificate may not be reproduced other than in full except with the permission of the issuing laboratory. Calibration certificates with the full name of the approval responsible person are valid without signature.

Datum der Ausstellung
Date of issue

Freigabe des Kalibrierscheins durch
Leiter des Kalibrierlaboratoriums
*Approval of the certificate of calibration by
Head of the calibration laboratory*

Bearbeiter
Person in charge

Alexandra König-Gerbersdorf

Kalibriergegenstand
Calibration item

1 Platin Widerstandsthermometer (Pt100), Ø 3 mm, Länge 150 mm, angeschlossen an Temperaturanzeigergerät

1 Platin resistance thermometer (Pt100), Ø 3 mm, length 150 mm, connected with one temp. measuring device

Typ <i>Type</i>	PRO 111	AX 111-D3-AA
Seriennummer <i>Serial number</i>	---	---
Messbereich <i>Measuring range</i>	-200.0 ... +850.0 °C	-50 ... +250.0 °C
Genauigkeit <i>Accuracy</i>	±0,05 °C oder ±0,06% vom Messwert ± 1 Digit	±1/3* (0,3+0,005 * t) °C (0 ... 150 °C)
Spezifikationen <i>Specifications</i>	Pt100 Präzisionsthermometer <i>Pt100 Precision Thermometer</i>	Pt100, 4-Leiter <i>Pt100, 4-Wire</i>

Kalibrierverfahren
Calibration procedure

Die Kalibrierung erfolgt nach der Richtlinie des Deutschen Kalibrierdienstes (DKD-R 5-1:11/2023) für die Kalibrierung von technischen Widerstandsthermometern nach der Vergleichsmethode.

Calibration was carried out to the Guidelines of Deutscher Kalibrierdienst / German Calibration Service
(DKD-R 5-1:11/2023) for the calibration of technical resistance thermometers according to the comparison method.
Messbedingungen
Measurement conditions

Der Temperaturfühler des Kalibriergegenstands und das Referenzthermometer waren während der Kalibrierung direkt in Flüssigkeitsbad eingetaucht. Die Eintauchtiefe betrug 100 mm.

Die Kalibrierung erfolgte bei steigender Temperatur. Falls die Messungen nicht durchgehend bei steigender Temperatur durchgeführt werden, so ist der stärkste Einfluss der Hysterese in der Mitte des Temperaturbereichs zu erwarten. Dies kann bis zu ± 0,06 °C im kalibrierten Messbereich und bis zu ± 0,6 °C im gesamten Messbereich betragen.

The temperature probe and the reference thermometer were immersed in a liquid bath during the calibration. The immersion depth was 100 mm.
The calibration was done with increasing temperature. If the measurements are not carried out with increasing temperatures, then the strongest influence of hysteresis is to be expected in the middle of the temperature range. This can be up to ± 0.06 °C in the calibrated measuring range and up to ± 0.6 °C in the total measuring range.
Umgebungsbedingungen
Environmental conditions
Temperatur
Temperature

(22 ± 2) °C

Ort der Kalibrierung
Place of calibration

Senseca Germany GmbH, Regenstau Kalibrierlabor

Senseca Germany GmbH, Regenstau calibration laboratory

Rückführbarkeit auf Normale
Traceability of Standards

Gerätebezeichnung <i>Device name</i>	Hersteller <i>Manufacturer</i>	Seriennummer <i>Serial number</i>	Messbereich <i>Measuring range</i>	Kalibrierzeichen <i>Calibration mark</i>

Messergebnisse Eingangswerte
Test Results - as found

Bezugswert <i>Reference value</i>	Anzeige <i>Indication</i>	Korrekturwerte <i>Correction values</i>	
°C	°C	OFFS	SCAL
---	---	---	---
---	---		

Der Kalibriergegenstand wurde nicht justiert.

The calibration item has not been adjusted.

Korrekturwerte sind die Einstellungen im Prüfling während der Wertaufnahme.

Correction values are settings of the calibration item during the recording of the value.

Altes Kalibrierzeichen / ---

Previous calibration mark

Messergebnisse Ausgangswerte
Measuring Results - as-left

Bezugswert <i>Reference value</i>	Anzeige <i>Indication</i>	Abweichung <i>Deviation</i>	Messunsicherheit <i>Measurement uncertainty</i>	Korrekturwerte <i>Correction values</i>	
°C	°C	°C	°C	OFFS	SCAL
0,004	0,00	0,00	0,035	0,08	-0,16
29,990	29,98	-0,01	0,038		

Die in diesem Kalibrierschein angegebenen Ergebnisse beziehen sich nur auf den kalibrierten Gegenstand.

The results in this calibration certificate refer only to the calibrated object.

Messunsicherheit*Measurement uncertainty*

Angegeben ist die erweiterte Messunsicherheit, die sich aus der Standardmessunsicherheit durch Multiplikation mit dem Erweiterungsfaktor $k=2$ ergibt. Sie wurde gemäß EA-4/02 M:2022 ermittelt. Der Wert der Messgröße liegt mit einer Wahrscheinlichkeit von etwa 95% im zugeordneten Werteintervall.

The uncertainty stated is the expanded uncertainty obtained by multiplying the standard uncertainty by the coverage factor $k=2$. It was determined according to EA-4/02 M:2022. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

Bemerkungen*Remarks*

Der Isolationswiderstand beträgt bei Raumtemperatur 20 G Ω und bei 30 °C 2,0 G Ω , ist in der Messunsicherheit berücksichtigt.

Insulation resistance at room temperature is 20 G Ω and 2.0 G Ω at 30 °C. It is taken into account in the measurement uncertainty.

Die Eigenerwärmung ist mit einem Pauschalfaktor berücksichtigt, der nicht experimentell bestimmt wurde.

Self-heating effect is taken into account in the measurement uncertainty using a fixed factor that was not determined experimentally.

Die Kalibrierung wurde innerhalb unseres flexiblen Geltungsbereichs durchgeführt.

The calibration has been performed within the boundaries of our flexible scope.

Meinungen und Interpretationen*Reporting opinions and interpretations*

Weitere Hinweise*Additional information*

Die DAKS ist Unterzeichner der multilateralen Übereinkommen der European co-operation for Accreditation (EA) und der International Laboratory Accreditation Cooperation (ILAC) zur gegenseitigen Anerkennung der Kalibrierscheine. Die weiteren Unterzeichner innerhalb und außerhalb Europas sind den Internetseiten von EA (www.european-accreditation.org) und ILAC (www.ilac.org) zu entnehmen.

The DAKS is signatory to the multilateral agreements of the European co-operation for Accreditation (EA) and of the International Laboratory Accreditation Cooperation (ILAC) for the mutual recognition of calibration certificates. The other signatories in and outside Europe can be seen on the websites of EA (www.european-accreditation.org) and ILAC (www.ilac.org).

Im Zweifelsfall gilt der deutsche Originaltext.

In case of doubt only the German original text is valid and has to be used.

Ende des Kalibrierscheines.

End of calibration certificate.

Werkskalibrierschein

Proprietary Calibration Certificate (Calibration report)



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Kalibrierzeichen / Calibration Mark



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Kalibriergegenstand / Calibration item

PRO 111
AX111-D3-AA150

Seriennummer / Serial number

Hersteller / Manufacturer

Senseca Germany GmbH
Hans-Sachs-Straße 26
93128 Regenstauf

Auftraggeber / Customer

Auftragsnummer / Order number

Datum der Kalibrierung / Date of calibration

Anzahl der Seiten / Number of pages

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Dieser Werkskalibrierschein darf nur vollständig und unverändert weiterverbreitet werden.

Auszüge oder Änderungen bedürfen der Genehmigung des ausstellenden Kalibrierlaboratoriums.

Werkskalibrierscheine ohne Unterschrift haben keine Gültigkeit.

This calibration certificate may not be reproduced other than in full except with the permission of the issuing laboratory.
Calibration certificates without signature are not valid.

Dieser Werkskalibrierschein dokumentiert die Rückführung auf nationale Normale zur Darstellung der Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI).

Am Kalibriergegenstand (KG) ist eine Klebmarke angebracht, die mit der Kalibriernummer dieses Werkskalibrierscheines sowie dem Kalibriermonat und Jahr versehen wurde.

Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.

This calibration certificate documents the traceability to national standards, which realize the units of measurements according to the International Systems of units (SI). The calibration label fixed to the calibration item contains number, month and year of the calibration. The client is responsible for an appropriate calibration interval.

Datum
Date

Leiter des Kalibrierlabors
Head of calibration laboratory

Sachbearbeiter
Person responsible

Alexandra König-Gerbersdorf



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Kalibrierzeichen / Calibration Mark



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Kalibriergegenstand / Calibration item / KG

Messgerät <i>Instrument</i>	Seriennummer <i>Serial number</i>	Linearisierung <i>Linearisation</i>	Geräteanzeige <i>Display</i>
PRO 111 Pt100 Hochpräzisionsthermometer <i>Pt100 High precision thermometer</i>		Kennlinie nach DIN EN 60751 <i>Characteristic according to DIN EN 60751</i>	---

Messfühler <i>Measuring probe</i>	Seriennummer <i>Serial number</i>	Messbereich Messfühler <i>Measuring range sensor</i>	Spezifikationen <i>Specifications</i>
AX111-D3-AA-150 Eintauchfühler <i>Immersion probe</i>		-50 ... +250°C Gültigkeitsbereich DIN Kl. AA <i>Area of validity</i> 0 ... 150°C	Pt100, 4-Leiter, Ø 3 mm, Fühlerlänge 150 mm <i>Pt100, 4-Wire, Ø 3 mm, Probe length 150 mm</i>

Anzeige und Thermometer können nur in der angegebenen Kombination die Kalibrierergebnisse wiedergeben.
The calibration results can only be reproduced, in the specified combination of the indicator and thermometer.

Werksnormal / Reference standard / WN

Gerätebezeichnung <i>Device name</i>	Hersteller <i>Manufacturer</i>	Seriennummer <i>Serial number</i>	Messbereich <i>Measuring range</i>	Kalibrierzeichen <i>Calibration mark</i>

Die Rückführung auf nationale Normale ist somit gegeben.
Traceability to recognized national standards is given.

Kalibrierverfahren / Calibration methods

Vergleichsmessung des Kalibriergegenstandes mit dem Werksnormal in einem gerührten Wasser, Silikonöl und Glykol-Wasser Flüssigkeitsbad für die Temperaturen von -20 °C, 0 °C und 70 °C.

Comparison of the calibration item with the reference standard in a well mixed liquid bath with water, silicone oil and glycol-water for the test temperatures -20 °C, 0 °C and 70 °C.

Eintauchtiefe / Immersion depth / 100 mm

Die Kalibrierung erfolgte in Anlehnung an die Richtlinie des Deutschen Kalibrierdienstes (DKD-R 5-1:11/2023)

The calibration has been done according to the Guidelines of Deutscher Kalibrierdienst / German Calibration Service (DKD-R 5-1:11/2023)

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Kalibrierzeichen / Calibration Mark



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Umgebungsbedingungen / Environmental conditions

Temperatur Temperature	Luftdruck Atmospheric pressure	Luftfeuchte Air humidity
22°C ± 2°C	980mbar ± 5mbar	47%RH ± 5%RH

Prüfergebnisse vor Justage / Results before adjustment

PRO 111 + AX111-D3-AA-150			
Werksnorm / WN Reference standard	Kalibriergegenstand / KG Calibration item	Korrekturwerte Correction values	
°C	°C	OFFS	SCAL
---	---	---	---
---	---	---	---

Der Kalibriergegenstand wurde nicht nachgestellt. The calibration item has not been adjusted.

Altes Kalibrierzeichen / Previous calibration mark / ---

Prüfergebnisse nach Justage / Results after adjustment

PRO 111 + AX111-D3-AA-150					
Werksnorm / WN Reference standard	Kalibriergegenstand / KG Calibration item		Mess- unsicherheit Uncertainty of measurement	Korrekturwerte Correction values	
Temperatur Temperature	Anzeige Display	Abweichung Deviation		OFFS	SCAL
°C	°C	°C	°C	-0,02	-0,11
-19,980	-20,02	-0,04	0,08		
0,002	0,00	0,00	0,08		
69,988	69,99	0,00	0,08		

Angegeben ist die erweiterte Messunsicherheit, die sich aus der Standardmessunsicherheit durch Multiplikation mit dem Erweiterungsfaktor $k=2$ (Normalverteilung) ergibt. Sie wurde in Anlehnung an die Richtlinie EA-4/02 M:2022 ermittelt. Der Wert der Messgröße liegt mit einer Wahrscheinlichkeit von 95% im zugeordneten Werteintervall. The uncertainty stated is the expanded uncertainty obtained by multiplying the standard uncertainty by the coverage factor $k=2$ (normal distribution). It has been determined in accordance with EA-4/02 M:2022. The value of the measurand lies within the assigned range of values with a probability of 95%.

(*): Traceability to recognized national standards with accredited calibration are accepted in the following countries: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom. Argentina, Australia, Brazil, Canada, Chile, People's Republic of China, Costa Rica, Cuba, Ecuador, Egypt, Guatemala, Hong Kong China, India, Indonesia, Israel, Japan, Kazakhstan, Republic of Korea, Malaysia, Mexico, New Zealand, Pakistan, Papua New Guinea, Philippines, Russian Federation, Singapore, South Africa, Sri Lanka, Chinese Taipei, Thailand, Tunisia, United Arab Emirates, United States of America, Uruguay and Vietnam.