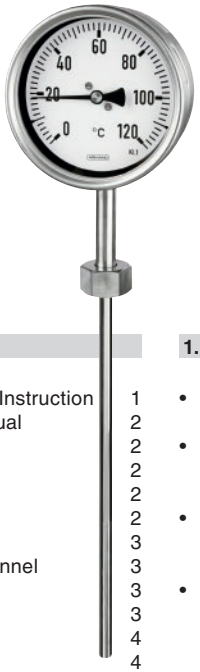


Contents

1. Information on This Operating Instruction

- This operating instruction is an integral product part of the gas-actuated thermometers described.
- It must be freely accessible in close vicinity to the product during the entire period of storage and application.
- The operating instruction contains important information on the safe and adequate use of gas-actuated thermometers.
- All persons, which mount, apply or control the thermometer, have to thoroughly read, understand and implement the manual.

If you have any problems or questions, please contact your supplier or contact us directly at:

ARMANO Messtechnik GmbH
Location Beierfeld
Am Gewerbepark 9 • 08344 Grünhain-Beierfeld
Tel.: +49 3774 58 – 0 • Fax: +49 3774 58 – 545
mail@armano-beierfeld.com

Location Wesel
Manometerstraße 5 • 46487 Wesel-Ginderich
Tel.: +49 2803 9130 – 0 • Fax: +49 2803 1035
mail@armano-wesel.com

1.1 Pictographs Used in This Manual

In this manual, pictographs are used as hazard warnings.

Particular information, instructions and restrictions designed for the prevention of personal or substantial property damage:

WARNING! Is used to warn you against an imminent danger that may result in personal injury or death.

IMPORTANT! Is used to warn you against a possibly hazardous situation that may result in personal, property or environmental damage.

CAUTION! Is used to draw your attention to important recommendations to be observed. Disregarding them may result in property damage.

Passages in the text containing **explanations, information or advice** are highlighted with this pictograph.

The following symbol highlights
actions you have to conduct
or
instructions that have to be strictly observed.

1.2 Quality

Gas-actuated thermometers are high-quality measuring instruments. The device family solely contains versions, which meet the demands on best operation and maximum safety. A manufacturing process certified according to DIN EN ISO 9001 guarantees the consistently high level of quality. Of course, it cannot be excluded completely that a product is defective or becomes damaged during the transport. In case of a complaint, this will be processed immediately. A detailed description of the damage helps us to identify the sources of product defects or product damage and to remedy them in the customer's interest (contact and support see page 1).

1.3 Exclusion of Liability

We accept no liability for any damage or malfunction resulting from failure to follow the instructions in this manual, incorrect installation, inappropriate use of the device, construction types that are not suitable for the process, inappropriate operating conditions, unauthorised or unqualified personnel and unauthorised manipulations in and on the device.

2. Safety Instructions

Gas-actuated thermometers are safe products that do not contain any dangerous, health- or environmentally damaging substances. When using gas-actuated thermometers, specific hazards arise whenever the process, in which the temperature is measured, is potentially hazardous.
The design of the port to the process and the selection of the suitable thermometer model decide upon safety and metrologically precise results.
For the design, comprehensive material in terms of data sheets and information on the website is available (⇨ chapter 3 “Device Description”).

2.1 Appropriate Use

IMPORTANT! Thermometers with a construction type that is not suitable for the storage and application conditions, or which are applied outside their limitations, can cause severe accidents or damage!

- Medium, cleaning agent and surrounding atmosphere must not corrode the thermometer materials and sealings exposed to them.
- The degree of protection (DIN EN 60 529) of the thermometer has to be suitable for the operating conditions.
- If vibrations or shocks can occur at the operating site, only appropriate construction types shall be used.
- The thermometer has to be stored or mounted in a way that the permissible storage and ambient temperature on case and capillary line does neither exceed the maximum nor falls below the minimum temperature.
- The minimum and maximum medium temperature has to be within the temperature range.

- Process connection and temperature sensor or thermowell have to be resistant to the physical process parameters (e.g. pressure, temperature, flow rate).
- Thermometers have to be free from visible damage or traces of unauthorised manipulation. Damaged or defective instruments need to be checked immediately and replaced if necessary.

2.2 Safe Handling

IMPORTANT! Disregarding work, health and fire protection as well as negligent actions in connection with hazardous or hot substances can cause severe injuries, accidents or damage!

- In all work, the existing local laws, standards and regulations concerning the process, for accident prevention and safety at the workplace must be complied with.
- Labels and information on the thermometer must neither be removed nor covered.
- Mounting and dismounting shall not be carried out during ongoing processes if hazards are imminent due to process conditions, e.g. high pressures and temperatures.
- If the stem is damaged, the nitrogen helium mixture under pressure can be released into the process suddenly. Protective measures have to be taken against the hazards, which might emanate from this.
- Used thermometers can be contaminated by residues of hazardous substances. In this case, actions according to the regulations for the substance itself have to be taken.
- Used thermometers, which are being reused, have to be free of adhering substances to prevent reactions with the medium, which could lead to personal, property and/or environmental damage.

2.3 Deployment of Qualified Personnel

IMPORTANT! Unqualified, untrained personnel can cause severe injuries or damage.

- The installation, commissioning, operation and maintenance of gas-actuated thermometers shall only be conducted by trained personnel, authorised by the operator. In addition to knowledge of measurement and control technology, also necessary expertise on the process on site is required. Existing directives, standards and regulations have to be applied within the scope of the corresponding work. This includes expertise in dealing with hazardous and aggressive media.
- The electrical connection shall be carried out by a fully qualified electrician only.

3. Device Description

3.1 Measuring Principle

Gas-actuated thermometers according to DIN EN 13 190 convert a temperature change at the temperature sensor (stem) into a pressure change, which is transferred to the actual value pointer via measuring spring and movement. The measuring system is filled with an inert gas.

In instruments with limit switches, the actual value pointer actuates, depending on the model, 1–4 contact arms via a mechanism. A contact is made or broken if the adjustable switching temperature has been reached by the actual value pointer.

General technical data and important information, amongst others for the metrologically accurate application, can be found in **model overview 8000 “Mechanical Temperature Measurement”** and in the **technical information sheet T08-000-031** (both accessible on our website).

3.2 Design and Models

Gas-actuated thermometers consist of:

Case ❶:
(with indication elements and measuring spring) with selectable nominal case sizes, connections and mounting elements – depending on the model

Temperature sensor ❷:
with selectable diameters, lengths and process connections – depending on the model

Connection:
between case and temperature sensor:
neck tube ❸, pivot ❹ or capillary line ❺

Dimensional data, nominal case sizes, suitable thermowells and further technical information on thermometer and stem models can be found in the data sheets listed below, accessible on our website.

3.2.1 Rigid Mount to the Stem

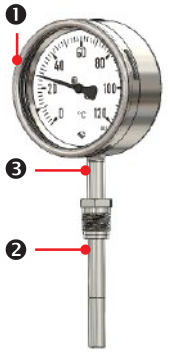


Figure 1: TSCh 100, A4

Basic model	Data sheet
TSCh TSChG TSChOe	8201 8201.9 (models with limit switch contact assembly)
TSChg TSChgG	8202
TAS	8291
TRCh	8293

3.2.2 Every Angle to the Stem

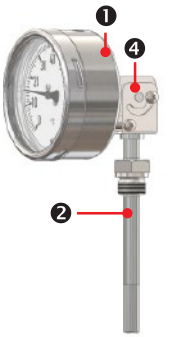


Figure 2: TGelCh 100, A4.1

Basic model	Data sheet
TGelCh TGelChG TGelChOe	8211 8211.9 (models with limit switch contact assembly)
TGelChg TGelChgG	8212

3.2.3 Capillary Line to the Stem

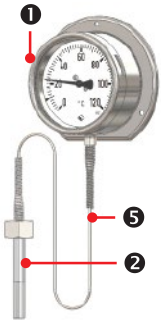


Figure 3: TFCh 100 Rh, A3

Basic model	Data sheet
TFCh TFChG TFChOe	8201 8201.9 (models with limit switch contact assembly)
TFChg TFChgG	8202
TAF	8292
TFQS	8225 8225.9 (models with limit switch contact assembly)

3.2.4 Standard Stem Models

Description, data and suitable thermowells are part of the data sheets for the thermometers (⇨ basic models).

Stem model	Process connection	Stem Ø (mm)
A1	plain, without screw fitting	8 10 12
A3	union nut	
A4	male thread, turnable (against stop)	
A4.1	male thread, rigid	
A5	male thread, clamping ring fitting adjustable at the plain stem	
A6	male thread, turnable / double male adapter	

3.2.5 Standard Stem Models for Diesel Exhaust Thermometers

Description, data and suitable thermowells are part of the data sheets for diesel exhaust thermometers (⇨ basic models TAS, TAF).

Stem model	Process connection	Stem Ø (mm)
A1.5	plain, without screw fitting	10 12 13
A3.5	union nut	
A5.5	male thread, clamping ring fitting adjustable at the plain stem	

3.2.6 Special Stems

The standard range of temperature sensors is supplemented by the special versions listed below.

Stems without bent tube, flexible:
Data sheet: 8299.1

Stem model	Process connection	Stem Ø (mm)
A3.2	union nut	8 10 12
A4.2	male thread, turnable (against stop)	
A4.3	male thread, rigid	

Stems without bent tube with screw fitting adjustable at the capillary line:
Data sheet: 8299.2

Stem model	Process connection	Stem Ø (mm)
A2	union nut	8 10 12
A7	male thread, turnable (against stop)	
A7.1	male thread, clamping ring fitting	

Contact stems:
Data sheet: 8299.4

Stem model	Contact surface
A1.1	plain
A1.2	convex

3.2.7 Special Stems and Thermowells for Food/Bio/Pharmaceutical Industries

Special stems for food/bio/pharmaceutical industries:
Data sheet: 8299.3

Stem model	Process connection	Stem Ø (mm)
A20.1/11/12	Clamp	10 12
A20.3	conical coupling and groove nut	
A20.6	Varivent®	16

Thermowells for food/bio/pharmaceutical industries:
Data sheet: 8.8160

Thermo-well	Process connection	Stem Ø (mm)
SL 1/11/12	Clamp	10 12
SL 20.3	conical coupling and groove nut	
SL 6	Varivent®	16

4. Mounting

☞ Observe the instructions in chapter 2 of this manual. Prior to the installation of a thermometer, ensure that

- the construction type is suitable for the measuring point.
- you do not install the measuring instrument during an ongoing process or you can safely intervene in the process.
- the measuring instrument is not damaged and fully functional.
- the temperature sensor or the thermowell is clean and free from any adhering impurities.

4.1 Mechanical Connection

The mechanical connection of thermometers shall be carried out according to the general technical rules for the selected connection type.

☞ When screwing in the thermometer, do not exert any force on the case. Hold turnable sockets and union nuts at the neck tube while screwing in.

4.1.1 Process Connection in General

- Cylindrical screw fittings: gaskets made of appropriate material (standard: aluminum or copper gaskets)
- Conical screw fittings: (e.g. NPT) sealing in the thread by using appropriate sealants, e.g. PTFE tape
- Sealing materials have to be compatible with the specific process. Necessary approvals and resistances are to be regarded.

4.1.2 Process Connection in the Food/Bio/ Pharmaceutical Industries

Connections in the food/bio/pharmaceutical industries as well as aseptic connections can only be applied in a hygienic design if the port to the process has a hygienic design as well. During mounting, it must be ensured that complete self-draining of the medium is possible. After draining processes, no residues shall remain at the junction.

- Dead spaces have to be avoided or kept very small. It must be ensured that cleaning media reach all parts up to the junction with the required operating temperature. Areas that cannot be cleaned, or in which residues remain, are to be precluded.
- Form and materials of sealings and the engineering design of the sealing grooves on the process side have to comply with the approvals and the regulations, standards and directives applying at the installation location. Installation gaps shall tend to zero to avoid bacterial growth in the best possible manner.

☞ EHEDG certifications for temperature sensor and thermowell connections only apply in connection with sealings and junctions on the process side, which are compliant with the following EHEDG guidelines:

Doc. 10: “Hygienic design of closed equipment for the processing of liquid food”
Doc. 37: “Hygienic design and application of sensors”

Particularly note:

- Provided they were installed and commissioned correctly, temperature sensors and thermowells with EHEDG approval do not have to be disassembled for cleaning purposes, i.e. they are CIP-compliant (Cleaning in Place). Cleaning is carried out with the pipe cleaning. In case of tank installations, it must be ensured that the cleaning equipment is aimed towards the connection area and sprays it directly.
- Connections of temperature sensors and thermowells are only certified according to EHEDG if the length of the dead space (L) is shorter than the diameter of the connection (D) minus stem diameter (dF): $L < (D - dF)$! (Doc. 10)
- For clamp connections, the EHEDG certification is only valid in combination with sealings approved for EHEDG. The approval is limited to the tube dimensions (nominal widths), for which suitable sealings are available on the market. (Until the entry into our data sheets, a list with information on available nominal widths is available via the contact addresses on page 1 of this operating instruction.)

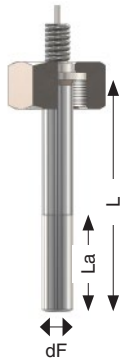
ⓘ Temperature sensor and thermowell connections with EHEDG certification comply with the EHEDG position paper for approved couplings, using special sealings, which are listed as applicable or welded in (available on the EHEDG website www.ehedg.org).

A list of potential suppliers of special sealings is available at the ARMANO Messtechnik GmbH. Only if temperature sensor and thermowell are mounted correctly on the connection port, cleanability as described in the EHEDG approval can be ensured.

4.1.3 Case Position of Installation

- Dial and numbers have to be aligned vertically
- Other positions of installation upon agreement: with indication of the corresponding position symbol (according to DIN EN 13 190) on the dial!

4.1.4 Installation of the Temperature Sensor



The active stem length (La) indicated in the data sheets has to be immersed sufficiently in order to determine the medium temperature exactly. The following relation applies:

immersion depth ≥ La + 2.5 x dF

Measuring errors can occur if the immersion depth is smaller than this value.

- An installation too close to the walls of vessels or in dead spaces of pipes is to be avoided if this is not the actual purpose of the measurement.
- When using thermowells, the thermal resistance between outer stem wall and inner thermowell wall can be reduced by means of a thermal contact agent.

WARNING! Do not fill in the thermal contact agent into hot thermowells. Otherwise, the spurting agent might cause injuries.

4.1.5 Pivot Adjustment

Prior to any adjustment: Loosen the retaining screws of the pivot!
⇨ figure 4

❶ → Bring the pivot into a straight position and tighten the two short retaining screws hand-tight.
→ Align the pivot to the case and tighten the long retaining screws hand-tight.

❷ → To bend the stem, loosen the short retaining screws and set the required angle.
→ Lock the pivot adjustment by tightening the retaining screws.

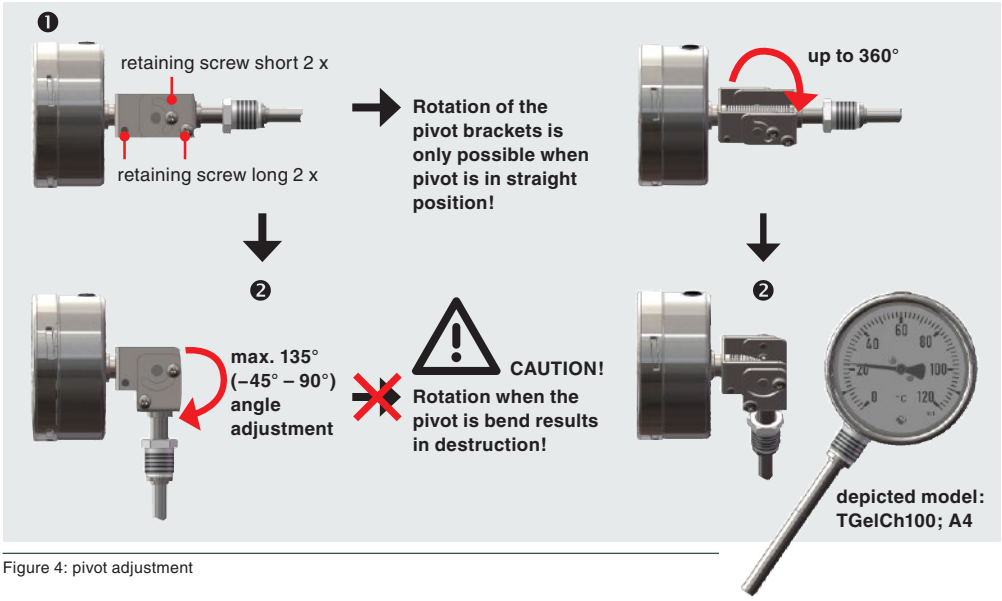


Figure 4: pivot adjustment

4.1.6 Installation of the Capillary Line

- Ensure that no tensile stresses act on the capillary line. Particular attention should be paid on the connection points to the case or the stem!
- The capillary line must not be bent, crimped or interrupted. The permissible minimum bending radius is 20 mm.
- Avoid permanent exposure to vibrations and shocks by installing the capillary line appropriately.
- The capillary line shall be installed with sufficient distance to sources of heat or cold.
- The capillary line has to be insulated in case of considerable temperature influences or temperature deviations.

4.2 Electrical Connection

Detailed information on the electrical connection of gas-actuated thermometers with additional electrical accessories can be found in operating instruction B5: “Electric Limit Switch Contact Assemblies in Pressure and Temperature Measuring Instruments”.

5. Installation in Potentially Explosive Areas

This section solely covers gas-actuated thermometers **without** additional electrical accessory.

The installation of thermometers with additional electrical accessory into explosion hazardous areas is covered separately in operating instruction B5: “Electric Limit Switch Contact Assemblies in Pressure and Temperature Measuring Instruments”.

5.1 General Information

Mechanical temperature measuring instruments do not have any potential ignition sources during its intended operation. Versions made of stainless steel with instrument glass (laminated glass or tempered safety glass) are suitable for the application in areas of category 2 and 3 according to ATEX directive 2014/34/EU.

5.2 Marking for the Explosion Hazardous Area

Thermometers without limit switch contact assembly are marked as follows for the application in explosion hazardous areas:

Example: Thermometer model TSCh 100

ARMANO
ARMANO Messtechnik GmbH
Manometerstraße 5 • 46487 Wesel

Thermometer Model TSCh 100

II 2G Ex h IIC Gb
II 2D Ex h IIIC Db
Temperature range –25/+75 °C

(content obligatory, free layout)

If you have any problems or questions, please contact your supplier or contact us directly.

6. Operation

Safe operation is ensured, when the instrument is properly installed.
For precise readability, the instrument should be installed at eye level.

Ambient temperatures:
Permissible ambient temperatures:

- Standard conditions: –40 / +60 °C (–40 / +140 °F)
  with silicone oil damping in the case or additional electrical accessory: –20 /+ 60 °C (–4 / +140 °F)
- Reference temperature range: +23 °C ±2 °C (+73.4 ±3.6 °F)

Ambient temperatures beyond the reference temperature range affect the temperature indication.

☞ Please regard the information on the ambient temperature influence in model overview 8000 “Mechanical Temperature Measurement” and the technical information sheet T08-000-031.

Indication adjustment:
It is possible to adjust the pointer of gas-actuated thermometers. After removing the screw plug or the filling plug at the case, an adjusting screw can be accessed at the movement, which can be adjusted with a screwdriver.

☞ Do never make any indication adjustments on your own if you cannot carry out a comparative measurement. You are not eligible for a free correction in case of an incorrectly performed indication adjustment.

ⓘ Comparative measurement:
The indication is compared to a calibrated standard on at least 3 evenly distributed points of the measuring range. In the standard case, the values are measured at the lower range value, medium range value and upper range value.
The temperature at the temperature sensor both of the thermometer to be checked and of the standard must be identical at the time of measurement.
All measuring values have to be determined at identical reference temperature.

7. Maintenance/Cleaning, Storage and Transport

⚠ **CAUTION! Material damage and loss of warranty!**
Any modifications or interventions in the device, made by the customer, might damage important parts or components. Such intervention leads to the loss of any warranty and manufacturer’s responsibility!
→ Never modify the device or perform any repairs yourself.

Maintenance:
Gas-actuated thermometers are maintenance-free. They do not contain any elements that can be replaced or repaired by the user. A regular functional check is recommended. The accuracy verification can be carried out according to the description in chapter 6 or as service by the manufacturer.
Please contact the supplier or the manufacturer for inspections and repairs.

Cleaning:
The non-installed components of the thermometer can be cleaned with a cloth or a soft bristled brush and appropriate cleaning agents.

Process connections with Varivent connection are designed for CIP cleaning. The measuring range and the optionally agreed excess temperature resistance of the thermometer must be higher than the maximum process cleaning temperature.

⚠ **CAUTION!** Cleaning agents, which damage the outer materials of thermometers (sealings, windows, etc.), or which are applied with too high pressure, can be the reason for the ingress of substances that impair or destroy the material and the function.

☞ Please pay attention to the degree of protection of your thermometer when cleaning!

Storage and transport:

CAUTION! Improper transport and inappropriate storage can destroy the device and cause considerable property damage.
Please inspect the transport packaging and the delivered items immediately upon their receipt to determine their integrity, completeness and conformity with the delivery documents. Any deficiencies are to be reported immediately.

Storage:

- Permissible storage temperature: –40 / +70 °C (–40 / +158 °F)
  with damping fluid: –20 / +70 °C (–4 / +158 °F)
- If possible, store the instrument in its original packaging.
- If possible, remove the packaging not until installation of the device.
- Store the instruments in a dry place, not exposed to direct sunlight or UV light.
- The storage temperature of the instruments should not fall below or exceed the permissible temperature limitations, specified in the data sheets.

Transport:

- Please use a suitable packaging for the transport (if possible, the original packaging) with adequate padding material.
- Do not throw the instruments even when packed.
- Protect the packed instruments from moisture.
- Provide relevant transportation instructions on the packaging.

The packaging can be disposed of as waste paper. For further transport or returns, the instrument must be sufficiently protected against damage.

Please note the information provided on the thermometer.

☞ Protect the thermometers from vibrations and shocks! These might falsify the indication even if no external damage is visible!

☞ Thermometers and thermowells with health- and environmentally damaging contaminations have to be packed securely and have to be labelled prior to storage and transport.

8. Dismounting and Disposal

WARNING! Risk of injury!
Never remove the device from a system in operation.
Make sure that the system is switched off professionally.

Dismounting:
Observe the instructions in chapter 2 of this manual. Prior to the deinstallation of a thermometer or thermowell, ensure that

- the process is shut down and unpressurised.
- the temperatures are neither too high nor too low.
- the electrical energy supply is switched off or is in a hazard-free state.

Protect yourself from adhering or leaking hazardous substances and states, e.g. harmful gases or radiation.

Disposal:

NO DOMESTIC WASTE!
Gas-actuated thermometers comprise various materials. They shall not be disposed of together with domestic waste.

Thermometers with additional electrical accessories must be disposed of separately as electrical and electronic waste in compliance with the directives 2011/65/EU (RoHS) and 2012/19/EU (WEEE).

☞ Please regard local prevailing national and international laws and regulations!

9. Declaration of Conformity

EU-Konformitätserklärung
nach DIN EN ISO/IEC 17 050-1

EU Declaration of Conformity
according to DIN EN ISO / IEC 17 050-1

Für die nachfolgend bezeichneten Erzeugnisse

MANOMETER
Typen RCh…, RSCh…, RChg…, RQ…, RF…, Pm…, PCh…, PSCh…, PsP…, D(i)RCh…, DiRZCh…, DiKPCh…, KPB…, KPCh…

THERMOMETER
Typen TBi…, TSChg…, TGelChg…, TFChg…, TA…, TSCh…, TGelCh…, TF…, TRCh…

ohne Grenzsignalgebern

wird hiermit erklärt, dass sie den wesentlichen Schutzanforderungen entsprechen, die in der nachfolgend bezeichneten Richtlinie festgelegt sind:

RICHTLINIE 2014/34/EU DES EUROPÄISCHEN PARLAMENTS UND DES RATES vom 26. Februar 2014
für Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen – kurz:

ATEX-Richtlinie

Zur Beurteilung der Erzeugnisse hinsichtlich der Richtlinie wurden folgende Normen herangezogen:

We hereby declare for the following named goods

PRESSURE GAUGES
Models RCh…, RSCh…, RChg…, RQ…, RF…, Pm…, PCh…, PSCh…, PsP…, D(i)RCh…, DiRZCh…, DiKPCh…, KPB…, KPCh…

THERMOMETERS
Models TBi…, TSChg…, TGelChg…, TFChg…, TA…, TSCh…, TGelCh…, TF…, TRCh…

without Limit Switch Contact Assemblies

that they meet the essential protective requirements, which have been fixed in the following directives:

DIRECTIVE 2014/34/EU OF THE EUROPEAN PARLIAMENT AND THE COUNCIL from February 26, 2014
relating to equipment and protective systems intended for use in potentially explosive atmospheres – short:

ATEX Directive

The following standards have been used to assess the goods regarding the directive:

DIN EN 80079-36:2016-12
DIN EN 1127-1:2019-10
DIN EN 80079-37:2016-12

Kennzeichnung:

II 2G Ex h IIC Gb
II 2D Ex h IIIC Db

Temperaturbereich: –25 °C* / +75 °C

* optional bis –60 °C, je nach Gerätetyp und Anforderung

Marking:

II 2G Ex h IIC Gb
II 2D Ex h IIIC Db

Temperature range: –25 °C / +75 °C*

** optionally up to –60 °C, depending on model and requirement*

Diese Erklärung wird verantwortlich für den Hersteller:
This declaration is issued under the sole responsibility of the manufacturer:

ARMANO Messtechnik GmbH
abgegeben durch / *by*
Grünhain-Beierfeld, 2019-12-18

Bernd Vetter
Geschäftsführender Gesellschafter / *Managing Director*

ARMANO Messtechnik GmbH
Standort Beierfeld
Am Gewerbepark 9
08344 Grünhain-Beierfeld
Tel.: +49 3774 58 – 0
Fax: +49 3774 58 – 545
mail@armano-beierfeld.com

Standort Wesel
Manometerstraße 5
46487 Wesel-Ginderich
Tel.: +49 2803 9130 – 0
Fax: +49 2803 1035
mail@armano-wesel.com

www.armano-messtechnik.de

104 EU-Konformitätserklärung ATEX RM PM D K T ohne GSG Ausg. 12/19

ARMANO Messtechnik GmbH

Location Beierfeld
Am Gewerbepark 9
08344 Grünhain-Beierfeld
Tel.: +49 3774 58 – 0
Fax: +49 3774 58 – 545
mail@armano-beierfeld.com

Location Wesel
Manometerstraße 5
46487 Wesel-Ginderich
Tel.: +49 2803 9130 – 0
Fax: +49 2803 1035
mail@armano-wesel.com