



Operating Manual
Series 47K
Gas Detector (SIL 2)



Order No.: 10052472/18

 WARNING!

These instructions must be provided to users before use of the product and retained for ready reference by the user. Read this manual carefully before using or maintaining the device. The device will perform as designed only if it is used and maintained in accordance with the manufacturer's instructions. Otherwise, it could fail to perform as designed, and persons who rely on this device could sustain serious injury or death.

The warranties made by MSA with respect to the product are voided if the product is not installed and used in accordance with the instructions in this manual. Please protect yourself and your employees by following the instructions.

Please read and observe the WARNINGS and CAUTIONS inside. For additional information relative to use or repair, call 1-800-MSA-2222 during regular working hours.

For countries of Russian Federation, Republic of Kazakhstan and Republic of Belarus, the gas detector will be delivered with a passport document that includes valid approval information. On the CD with manual instruction attached to the gas detector the user will find the documents "Type Description" and "Test Method" - appendixes to Pattern Approval Certificate of Measuring instrument, valid in the countries of use.

The Declaration of Conformity can be found under the following link: <https://MSAsafety.com/DoC>.

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1 Safety Regulations

1.1 Correct Use

The MSA Gas Detector Series 47K is designed to continuously monitor the atmosphere for the presence of potentially explosive gas or vapour in air in the range 0 to 100% LEL.

It is designed for use as an integral part of an MSA fixed gas detection system for the protection of industrial plant and workers.

It is imperative that this operating manual be read and observed when using the system. In particular, the safety instructions, as well as the information for the use and operation of the apparatus, must be carefully read and observed. Furthermore, the national regulations applicable in the user's country must be taken into account for a safe use.

DANGER!

This product is supporting life and health. Inappropriate use, maintenance or servicing may affect the function of the device and thereby seriously compromise the user's life.

Before use, the product operability must be verified. The product must not be used if the function test is unsuccessful, it is damaged, a competent servicing/ maintenance has not been made, genuine MSA spare parts have not been used.

Failure to follow this warning will result in serious personal injury or death.

Alternative use, or use outside this specification will be considered as non-compliance. This also applies especially to unauthorised alterations to the apparatus and to commissioning work that has not been carried out by MSA or authorised persons.

1.2 Liability Information

MSA accepts no liability in cases where the product has been used inappropriately or not as intended. The selection and use of the product are the exclusive responsibility of the individual operator.

Product liability claims, warranties also as guarantees made by MSA with respect to the product are voided, if it is not used, serviced or maintained in accordance with the instructions in this manual.

1.3 Application, Advice, and Restrictions

This Manual should be carefully read by those responsible for use and maintenance of the gas detection and monitoring system.

- The series 47K catalytic sensor is suitable for the detection of gases or vapours in air with a concentration below the Lower Explosive Limit [LEL].
- The series 47K catalytic sensor cannot measure concentrations of gases or vapours in inert atmospheres or oxygen deficient atmospheres. The European standard EN 60079-29-2 indicates an Oxygen concentration higher than 10 vol% is necessary for correct operation of catalytic sensors.

WARNING!

The certification does not permit use of the series 47K sensor in oxygen enriched atmospheres.

Failure to follow this warning can result in serious personal injury or death.

- The series 47K catalytic sensors can be poisoned by high levels or long exposure to certain substances present in the atmosphere being monitored. When a catalytic sensor is installed in a place where those substances may be present, to ensure the correct operation and measurement accuracy the sensor should be calibrated more frequently.
- The sensitivity of the series 47K catalytic sensors is reduced by the presence of silanes, silicates, silicones, tetraethyl lead, halogen compounds, sulfurous compounds, organic-phosphorous compounds and compounds

containing: fluorine, chlorine, iodine or bromine, therefore the sensors must be recalibrated after exposure to these substances.

- The series 47K sensor opening [sintered disc] must be protected against water, dust and mechanical damage. During painting operations in the area where the sensor is installed, avoid traces of paint on the sensor opening. The paint must not interfere with the diffusion process.
- Note that the sensor opening [sintered disc] must always face downwards.
- After exposure of gas above the measuring range, the sensor has to be immediately calibrated / adjusted, independent of the calibration interval. In the case of an adjustment the zero point and sensitivity of the sensor has to be rechecked again after 24 hours.

WARNING!

Exposure to polar solvents may reduce the catalytic combustible gas sensors response to hydrogen and hydrocarbons resulting in erroneously low readings for hydrogen and hydrocarbons. Calibration of the sensors with a surrogate gas will not detect the reduction in response.

Customers using the catalytic combustible gas sensors to detect hydrogen and hydrocarbons in an environment that may contain polar solvents must:

- Calibrate their sensors with the target gas. Do not use a surrogate gas for calibration.
- After exposure to polar solvents, the sensor must be recalibrated using the target gas, independent of the calibration interval, and a gas/ function check shall be performed 24 hours after calibration to verify sensor response and accuracy.

Failure to follow these warnings can result in serious personal injury or death.

The only method of verifying the correct operation of the sensor is to carry out a span check using a known concentration of calibration gas in air.



For response curves contact your national MSA office.

2 Description

2.1 General

The MSA Gas Detector Series 47K is designed to continuously monitor the atmosphere for the presence of potentially explosive gas or vapour in air in the range 0 to 100% LEL.

It is designed for use as an integral part of an MSA fixed gas detection system for the protection of industrial plant and workers.

- Typical areas where the MSA Series 47K Gas Detector can be used include:
- The chemical and petrochemical industry
- The paint and solvent-processing industry
- The gas-processing industry
- The steel-processing industry
- Municipal areas
- The Production, Warehousing, Distribution, Shipping and processing of gases and vapours

The MSA Series 47K Gas Detector consists of the Series 47K catalytic sensor and the junction box that contains the terminal board.

There are two versions of the junction box available:

- Flameproof [Ex d] with $\frac{3}{4}$ " NPT cable gland thread
- Increased safety [Ex e] with metric M25 cable gland thread

The following Sensor Versions are available:

- Series 47K-PRP: Poison Resistant Pellistor [100% LEL]
- Series 47K-HT-PRP: High Temperature Poison Resistant Pellistor [100 % UEG] in conjunction with the Wall mounted bracket and a separate Junction Box ATEX 100 °C

All versions are available in Stainless Steel 316.

Five accessories are available to allow easy calibration and to adapt the gas detector to various applications:

- Calibration cap
- Flow through adapter
- Duct mount flange
- Weather protection cap with remote calibration capability
- Wall mounted bracket, Sensor S47K-HT-PRP

2.2 Principle of Operation

The MSA 47K series of sensors operate on the principle of catalytic combustion. The sensing element consists of a pair of filaments ["pellistors"] connected to a pair of precision resistors to form a Wheatstone bridge.

One of the filaments, the detector, is coated with a catalyst, whilst the other, the compensator is used as a reference to achieve the best stability.

The gas or vapour diffuses through a porous Stainless Steel sintered disc, which acts as a flashback arrestor. When gas comes into contact with the surface of the detector filament, it is oxidised. The heat generated by the reaction increases the temperature of the detector, which results in a change of the detector electrical resistance, and hence an unbalance of the Wheatstone bridge. The result is an output signal directly proportional to the concentration of the flammable gas or vapour. The signal is processed by an MSA controller designed to display the gas concentration, actuate alarms and provide a suitable output signal to activate subordinated external measurement data acquisition systems.

2.3 Technical Specification

The Series 47K combustible gas sensors are designed to meet the rigorous requirements of ATEX Directive 2014/34/EU for fixed gas detection installations.

Sensor	
Power consumption	1 Watt, typically
Linear dynamic range	PRP & HT-PRP-Sensor: 0–100% LEL
Response time	t50 ≤10 sec for propane + methane*** t90 ≤20 sec for propane + methane *** For other gases or vapours the response time may be longer.
Typical sensitivity	PRP- sensor methane: 12 mV/vol%; propane: 16 mV/vol%; HT-PRP- sensor methane: 12 mV/vol%; propane: 16 mV/vol%;
Operating configuration	Wheatstone Bridge circuit
Operating mode	Constant current Sensor current 310 mA for 47K-PRP, 300mA for 47K-HT-PRP Vmax 10 V
Operating life time	3 Years, in clean air, typically
Storage life time	5 Years, in MSA container, typically
Storage temperature range	-20 °C to +40 °C**
Operating temperature range	PRP- sensor -25 °C to +55 °C Extended range *) -40 °C to +55 °C HT-PRP sensor *) -40 °C to +160 °C
Operating humidity range	5% to 95% RH non-condensing
Operating pressure range	800–1100 hPa
Ingress Protection	IP 6X Sensor ***** IP 6X Junction Box
Air velocity	Air velocity 0–6 m/s**** [with duct mount flange: 0.5–20 m/s]
Poison resistance	PRP sensor and HT-PRP sensor: 10 ppm HMDS for 40 min. [max. signal loss 5% of reading]
Dimension	Ø 36 x 56 mm
Weight	< 230 g
Material	St. St. 316
Accessory thread	M36 x 1.5 mm
Sensor to junction box	¾" NPT or M25 x 1.5 mm

2 Description

*) Extended range: The sensor extended temperature range is greater than the maximum specified in EN 60079-29-1. It is therefore strongly recommended that if used above +55 °C or below -25 °C the sensor is calibrated at the operating temperature.

**) The storage temperature range is also valid for spare parts and accessories.

***) The response time was tested with an calibration Cap and 1 l/m test gas flow.

****) Tested according to EN 60079-29-1 higher values will maybe results in higher deviations of the gas reading.

*****) IP rating implies not that the Sensor can detect gas under this environmental condition, for details see 3.3.

3 Installation

3.1 Installation-Step by Step

1. Unpack and inspect the device or its components.
2. Check the suitability of the installation site and the cabling requirements.
3. Install the sensors and connect the wiring to the MSA control unit.
4. The installation of the sensor must be performed according to standard EN 60079-14 or according to applicable national standards.

WARNING!

Follow the installation instructions for hazardous areas!

Failure to follow this warning can result in serious personal injury or death.

5. After installation is complete, perform the start-up procedure as instructed in the relevant MSA controller manual.

3.2 Unpacking

Perform the following steps on receipt of the shipment:

1. Carefully unpack the device or its components, observing all of the instructions printed on or accompanying the packaging.
2. Also inspect the contents of the delivery to determine if any transport damage has occurred and verify that everything listed in the shipping papers has been received.

3.3 General Installation Instructions

- For connection to the power supply system a fault-free ground or fault-free equipotential bonding must be provided.
- An appropriate supply voltage free of feedback to the external source in accordance with the EMC Directives (2014/30/EU) must be used.
- If the devices are supplied from a direct voltage [dc] source, the supply cable must be screened.
- Screened cable is to be used to connect the sensor signal.
- Screened cable must have at least 80% coverage by the screening.
- Sensor cables must be installed physically separate from power supply cables.
- Screened cables must be installed in one piece. If it should prove necessary to extend a cable by way of a terminal box, the terminal box must be screened, and the connections in the box must be kept as short as possible.
- Unscreened cables and cables from which the insulation has been stripped must be as short as possible and must be terminated without loops.
- If additional high-voltage surge protection measures are required an appropriate high-voltage protection filter, approved by MSA, must be installed in the sensor cable.
- Strict adherence to the specifications and regulations applicable to installation, start-up, operation, and maintenance is required.
- Follow the installation instructions for hazardous areas.
- The specified environmental conditions must be adhered to.
- Position the height of the MSA Gas detector Series 47K according to the density of gas or vapour to be measured.
- The proper installation location must be chosen to ensure that the sintered disc of the MSA Gas detector Series 47K is kept dry and dust-free.

3 Installation

- The MSA gas detector S47K-HT-PRP can be installed in an ambient temperature until 160 °C, the Junction Box 100 °C must be installed in an area where the ambient temperature is lower 90 °C.
- To ensure proper function the Gas detector Series 47K must be kept dry and free of any contaminants, e.g. dust particles and water. Regular visual checks are recommended. Any contaminants must be removed by blowing them off with clean, oil-free compressed air or with a dry brush. Ensure that the air entrances are kept free from any coating, e.g. paint, grease or similar.
- The sintered disc must always face downwards ($\pm 15^\circ$).
- The MSA Gas detector Series 47K must never be covered with paint, grease or similar.
- These substances prevent diffusion, of the atmosphere to be monitored, to the sensing elements.

3.4 Recommended Torque and Terminal Sizes

Cable gland size	Connection thread	Pressing screw	Terminal sizes
M25 x 1,5	3,0 Nm	2,0 Nm	7–12/10–17* mm

* To be able to use size M25 x 1,5 for terminal sizes 10–17 mm, remove the small sealing ring.

3.5 Electrical Connection to the Control Unit

3.5.1 Junction Box Terminals

Screw terminals: cross section 0,5–2,5 mm², screw torque 0,55 Nm $\pm$ 0,05 Nm

Spring terminal: cross section 0,5–1,5 mm²

3.5.2 Maximum Cable Length

The maximum cable length depends on the maximum permissible load, the cross section of the conductor and the conductor material.

The maximum permissible load [loop resistance] is 36 ohms for the MSA Control units SUPREMA [for MSA Control unit 9010/9020 refer to the control unit manual].

$$\text{Maximum cable length: } L = \frac{R \times k \times A}{2}$$

L = cable length in metres [loop]

R = maximum permissible load in ohms

A = cross sectional area of conductor in mm²

k = conductivity of copper = at 20 °C [1/Resistivity]

Example: R = 36 ohms, A = 0.75 mm², k = 56 m ohms⁻¹ mm⁻²

$$L = 36 \times 56 \times 0.75 / 2 = 756 \text{ m}$$

Wire Cross Section	Maximum Load [max. cable resistance]	Maximum Length	Remarks
0.75 mm ²	36 Ohm	750 m	Screened cable is required.
1.5 mm ²	36 Ohm	1,500 m	

For detailed information refer to the relevant MSA controller manual.

3.6 Electrical Connections

WARNING!

Installation should only be carried out by suitably qualified personnel.

Failure to follow this warning can result in serious personal injury or death.

- During installation all relevant codes of practice and National wiring regulations should be complied with especially in places where there is a risk of explosion and fire. [Classified areas]
- Refer to the MSA controller instruction manual for the sensor connection details.
- Where an earth connection to the junction box/ sensor is required use the earth terminal provided on the outside of the junction box / Wall mounted bracket.

The sensor connections are shown in Section [10 Wiring Diagrams](#).

4 Start up

WARNING!

Installation should only be carried out by suitably qualified personnel.

Failure to follow this warning can result in serious personal injury or death.

Before applying power ensure that all installation steps have been correctly carried out and the cable connections and controller configuration are correct.

CAUTION!

Ensure that the sensor current is correctly set to 310 mA for the 47K-PRP and 300 mA for the 47K-HT-PRP.

Failure to follow this caution can result in minor or moderate injury.

Allow a warm-up time of at least 30 minutes before calibrating the gas sensor.

Perform an initial calibration following the instructions in Section [5.1 Calibration](#) and the manual for the relevant MSA controller.

5 Maintenance and Service

There are no serviceable or adjustable parts within the sensor assembly and any attempt to dismantle the assembly or access it will invalidate the sensor approvals and manufacturers guarantee.

Maintenance and service may only be performed by authorised and suitably qualified personnel.

CAUTION!

To guarantee the nonambiguity of the series 47K catalytic sensor operation ensure [e.g. by check with hand-held test instruments] each time before turning on the sensors that the atmosphere to be monitored by the sensors is free of combustible gases.

Failure to follow this caution can result in minor or moderate injury.

Maintenance must be performed according to standards EN 60079-17 and EN 60079-29-2 or according to applicable national standards.

5.1 Calibration

According to EN 60079-29-2 the combustible gas detectors must be checked at regular intervals to ensure that it is functioning properly in accordance with the applicable international, national, industry-specific or company regulations.

The sensitivity and zero point of the sensor must be adjusted as necessary [every 6 months at the latest] in accordance with the operating instructions for the type of sensor and controller it is connected to.

In case of high dust or water pollution is expected then the calibration intervals should be shortened.

Sensors that are no longer able to generate the minimum signal must be replaced [see relevant controller manual].

Allow a warm-up time of at least 30 minutes for the sensor to stabilise, before calibration is performed. For calibration a test gas cylinder can be used otherwise the humidity of the test gases shall be in the range specified in [2.3](#).

Calibrating the Gas Detectors 47K-HT-PRP

These gas detectors must be calibrated at their ambient working temperature using the flow through adaptor [please refer to [5.1.3 Calibration with Accessories](#)].

The specified temperature range of the 47K-HT-PRP gas detectors is -40 °C to +160 °C and the bridge operating current is 300 mA.

A gas/ function check shall be performed 24 hours after first calibration at the ambient working temperature to verify sensor response and accuracy.

5.1.1 Zero Calibration

- Apply zero gas to the sensor using the appropriate calibration adapter.
- Wait for approximately 2 minutes or until the sensor reading has stabilised.
- Adjust the controller until the correct reading is obtained.

Gas flow rate : 1.0 l/min

Zero gas : synthetic air or component-free ambient air

5.1.2 Span Calibration



See also Section [5.3](#).

- Apply span calibration gas to the sensor using the appropriate calibration adapter.

- After the reading has stabilised adjust the controller until the correct reading is obtained.
- Remove calibration adapter.

Gas flow rate : 1.0 l/min

Stabilization time : depending on gas type between 2 and 4 min

CAUTION!

Use span gas with a concentration of approximately 50% of the measuring range. In no case should the span gas concentration be less than 25% of the full scale value of the measuring range.

If possible, the span gas [the gas used to calibrate the sensor] and the measurement gas [the gas to be monitored] should be identical. If this is not the case and a reference gas is used, the response factor of the gas used must be known.

Failure to follow these cautions can result in minor or moderate injury.

5.1.3 Calibration with Accessories

Calibration of Gas detectors used with duct mount flange, flow through adapter or weather protection cap should be carried out as described above using the particular gas inlets of the accessories.

Gas flow rate : 1.0 l/min

5.2 Sensor Replacement

CAUTION!

In a hazardous area, ensure all necessary precautions are taken before opening the junction box. Replacement of the sensor or other parts should only be carried out by suitably qualified personnel.

Failure to follow this caution can result in minor or moderate injury.

After checking if it is possible to carry out operation, according to the type of danger in the area where the gas detector is installed, proceed as follows:

1. Disconnect the power supply to the gas detector at the Control unit.
2. Remove the sensor junction box cover.
3. Note the wire colours and numbering of the terminal board and disconnect the sensor wires.
4. Unscrew the sensor from the junction box.
5. Screw the new sensor into the junction box using the correct size of tool across the hexagon flats.
6. Connect the sensor wires to the terminal block and ensure they are connected to the correct terminals.

Refer also to the wiring diagram in Section 10 .

Close the sensor junction box cover and ensure that the gas detector is in compliance with all relevant safety regulations and directives.

5.3 Series 47K-PRP and Series 47K-HT-PRP

For the gases or vapours shown in the tables of Section 5.3.1 and 5.3.2 the response curves have been tested according to EN 60079-29-1. If the LEL of a substance was not listed in EN 60079-20-1, the LEL has been taken from the Chemsafe data base [Dechema, Frankfurt]. Due to legal requirements other locally used LEL values might be mandatory.

It is highly recommended that the gas detector is exposed to clean air when calibrating the zero and a mixture of the target gas in air with a concentration of approximately 50% LEL. Other gases/ vapours on request.

If calibration with the target gas is not possible a reference calibration can be performed with 0,85 vol% Propane C_3H_8 in air and using the relative response data given in the table of Section 5.3.1 and 5.3.2. These values are only valid for new sensors and may vary after aging or poisoning. Unless otherwise stated, they refer to an ambient temperature of 20 °C. If using a reference gas to calibrate the gas detector the displayed values may vary by up to $\pm 20\%$ from the target gas concentration.

Customers using the catalytic combustible gas sensors to detect hydrogen and hydrocarbons in an environment that may contain polar solvents must:

- Calibrate their sensors with the target gas. Do not use a surrogate gas for calibration.
- After exposure to polar solvents, the sensor must be recalibrated using the target gas, independent of the calibration interval, and a gas/ function check shall be performed 24 hours after calibration to verify sensor response and accuracy.

Reference calibration example for 50% Acetone:

1. Relative response factor for Acetone from table in Section 5.3.2 = 0.94
2. Propane calibration gas concentration being used = 0.89 vol% C_3H_8
3. Propane volume concentration for 100% LEL = 1.7 vol%
4. Propane calibration gas concentration in % LEL

$$= 0.89 \text{ vol\% } C_3H_8 \times \frac{100\% \text{ LEL}}{1.7 \text{ vol\% } C_3H_8} = 52.4\% \text{ LEL}$$

5. Gas detector span setting = 52.4% LEL x 0.94 = **49.3% LEL**

5.3.1 47K-HT-PRP

Relative response factors of tested gases with reference to Propane.

These values are only valid for new sensors and may vary after aging or poisoning. Unless otherwise stated, refer to an ambient temperature of 110 °C. In this case the displayed values may vary by up to $\pm 20\%$ from the target gas concentration.

Sample Gas	100% LEL in vol%	Propane relative response factor	Response time [secs] t_{50} *)	Response time [secs] t_{90} *)
Methane	4.4	0.52	< 11	< 17
Propane	1.7	1.00	< 11	< 17

*) Response times are with a flow through adapter and a gas flow of 1 l/min

5.3.2 47K-PRP

Relative response factors of tested gases with reference to Propane.

These values are only valid for new sensors and may vary after aging or poisoning. Unless otherwise stated, refer to an ambient temperature of 20 °C. The response factors can have a deviation up to 20%. Response times stated in the enclosed table may vary by $\pm 20\%$ depending on the tolerances of individual sensors.

Sample Gas	100% LEL in vol%	Propane relative response factor	Response time [secs] t ₅₀ *)	Response time [secs] t ₉₀ *)
Acetone	2,5	0.94	< 14	< 27
2-Butanone	1,5	1.30	< 16	< 41
Ethanol	3,1	0.97	< 14	< 31
1-Ethoxy-2 propanol [30 °C]	1,3	1.76	< 26	< 82
Ethyl acetate	2,0	1.19	< 16	< 36
FAM-Benzin 65/95 Gasoline 65/95	0,7	2.00	< 14	< 25
Hydrogen	4	0.59	< 9	< 17
Methane	4,4	0.58	< 11	< 18
Propane	1,7	1.00	< 12	< 19
1-Propanol [30 °C]	2,1	1.30	< 17	< 61
2-Propanol	2	1.07	< 15	< 29
Propene	2	0.82	< 12	< 21
Toulene	1,0	1.36	< 21	< 54
n-Nonane [30 °C]	0,7	2.0	< 20	< 46

*) Response times are with a flow through adapter and a gas flow of 1 l/min

Response factor measured by DEKRA Testing and Certification GmbH

Other gases/vapours on request.

6 Accessories

6.1 Calibration Cap



The calibration cap is pushed on to the front of the sensor and is sealed by an “O” ring. The surface area $S < 20 \text{ cm}^2$.

⚠ WARNING!

The calibrating cap must be removed after completing the calibration!

The gas is supplied via either of the gas inlets by means of suitable flexible tube.

Failure to follow these warnings can result in serious personal injury or death.

Gas flow rate : 1.0 l/min $\pm 20\%$

Operating temperature range : -40°C to $+55^\circ\text{C}$

6.2 Weather Protection Cap



The weather protection cap, protecting the sintered disc of the sensor from splash-water, is recommended for outdoor installations. It is available in Stainless Steel 316.

The stainless steel versions are available with hose or pipe connection for remote calibration.

Pipe connection : 1/8" NPT

Gas flow rate : 1.0 l/min $\pm 20\%$

Air velocity : 0 ... 6 m/s

Operating temperature range : -40°C to $+55^\circ\text{C}$

Calibration must only be carried out if wind speed is $< 1.5 \text{ m/s}$.

Using the Weather Protection Cap will extend the response time to:

$t_{90} < 80 \text{ sec}$ for methane / $t_{90} < 130 \text{ sec}$ for propane

The signals will be reduced by up to 20% when using the weather protection cap. This must be taken into consideration during calibration and when adjusting alarm levels. The cap must not be used if the incident flow is bottom up.

6.3 Flow Through Adapter/ Pump Adapter



Figure 1 Flow Through Adapter

The flow through adapter is for use with a pumped sampling system.

Pipe connection	: 1/8" NPT
Gas flow rate	: 1.0 l/min $\pm$ 20%
Operating temperature range	: - 40 °C to +160 °C

Using the Flow Through Adapter will extend the response time, depending on the gas flow rate and the length of the tubes. Only the pressure range from 800 to 1200 hPa is allowed. The gas flow has to be monitored.

6.4 Duct Mount Flange

Gas monitoring in air ducts can be performed by means of this duct mount flange. When installing it the direction of flow inside the duct must be towards the baffle as shown in the photograph.

The sensor can be calibrated via the gas calibration port, provided the duct is free of all gases to which the sensor will respond. If the duct cannot be gas freed, the sensor has must be removed form the duct during calibration.

The calibration port must be sealed again with the locking cap after calibration has been carried out.

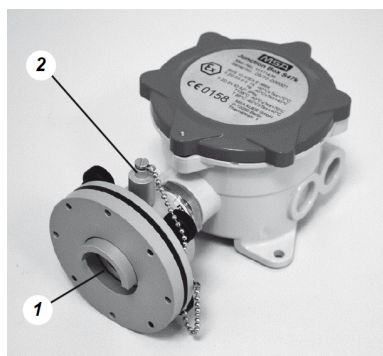


Figure 2 Duct Mount Flange

1. Flow

2. Gas calibration point

In this Picture will be the flow from the bottom up.

You should calibrate with the calibration port only during air velocity < 5 m/s for Series 47K-PRP and 47K-HT-PRP in the air duct.

The response times given in Chapter 2.3 are for an air velocity of 20 m/s.

Doubling of the response time has to be expected for an air velocity of 0.5 m/s.

Gas flow rate : 1.0 l/min $\pm$ 20% [gas calibration]

Air velocity : 0.5 ... 20 m/s

Operating temperature range : - 40 °C to +55 °C

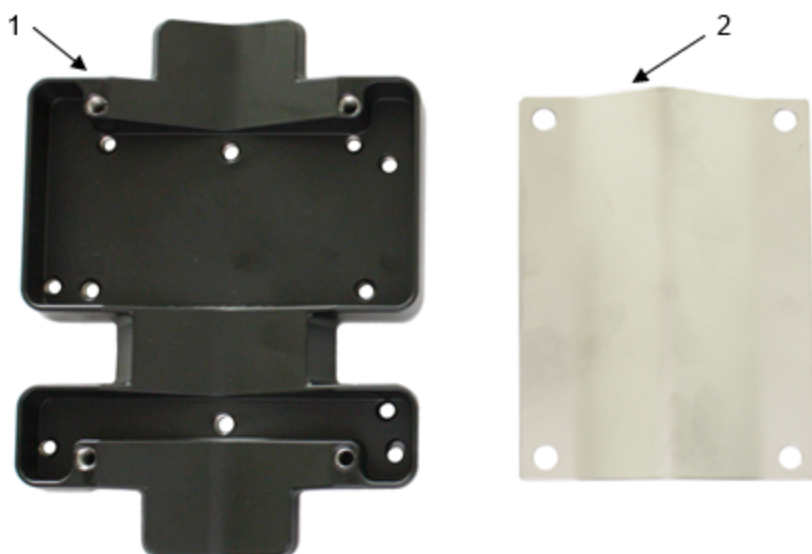
6.5 Pipe Mounting Kit

NOTE: The pipe mounting kit (P/N 10 113032) is not included in the EC-Type Examination Certificates DMT 01 ATEX G 001 X, BVS 03 ATEX G 010 X, DMT 03 ATEX G 003 X, BVS 16 ATEX G 001 X, FTZU 07 ATEX E 0066 X and INERIS 00 ATEX 0028 X

6.5.1 Mounting Kit for Pipes with a Diameter of up to 50 mm

The S 47K-PRP can be mounted vertically by fastening its legs by means of three screws. Additionally, a pipe mount kit allowing the detector to be fixed to pipes or poles is available as an accessory. The kit consists of:

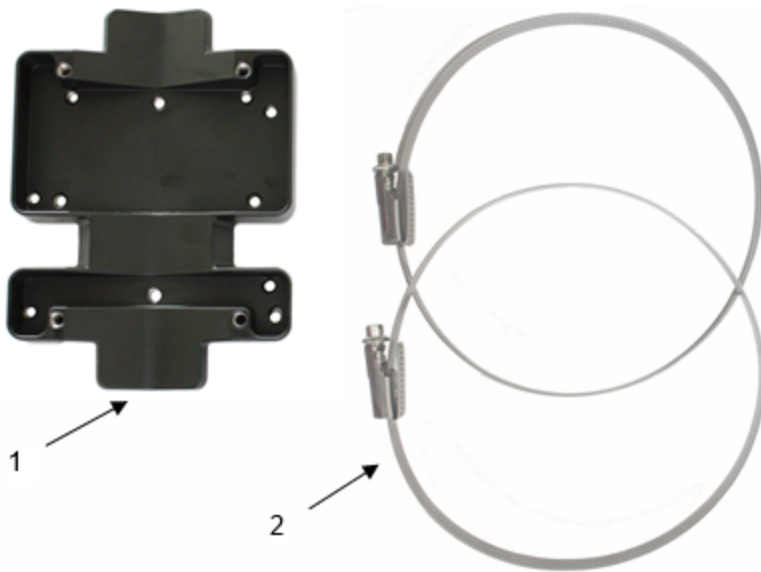
- one universal mounting plate,
- one retaining plate for pipes with a diameter of 20–30 mm,
- one retaining plate for pipes with a diameter of 30–50 mm,
- two tightening straps for pipes with a diameter of 50–150 mm.



1. Mounting plate

2. Pipe clamp

6.5.2 Mounting Kit for Pipes with a Diameter from 50 mm up to 150 mm



1. Mounting plate

2. Pipe clamps

6.6 Remote Calibration Adapter (CalGard)



NOTE: Operating the remote calibration adaptor CalGard together with the gas detector model S 47K-PRP is included in the EC-Type Examination Certificates DMT 01 ATEX G 001 X, BVS 03 ATEX G 010 X, DMT 03 ATEX G 003 X, BVS 16 ATEX G001 X, FTZU 07 ATEX E 0066 X and INERIS 00 ATEX 0028 X.

The CalGard stainless steel remote calibration adaptor provides reliable operation of remotely installed gas detectors working under harsh environmental conditions. Additionally, the CalGard allows remote verification ("bump test") or instrument calibration of gases listed in Section 6.6.2 via a hose connection in the presence of wind speeds up to 6 m/s. In normal measurement operation, the ambient air passes through the air vents into the remote calibrator directly to the sensor (diffusion operation). During a bump test or instrument calibration, the test gas is supplied to the sensor via the hose connection at the bottom of the CalGard. An integrated mechanism prevents the dilution and dispersion of test gas otherwise caused by external influences, such as wind. This allows a fast response from the sensor to the applied test gas. To compensate for possible deviations during measurement of flammable gases a calibration factor of 1.05 shall be applied when using the CalGard for remote calibration.

Once calibration is complete, the air inlet reopens to allow the monitoring of ambient air for gas without the need for further user intervention.

6.6.1 Installation

For correct operation, Sensor S47K and CalGard must be used in a vertical position (hose connection pointing downwards $\pm 5^\circ$). The CalGard remote calibrator can be attached to the sensor by screwing on the thread of the detector.

NOTE: The tube connector is adapted for tubes with an inner diameter of 5 mm.

In general the hose should be as short as possible in order to:

- Minimise the gas volume needed to flush the tube
- Reduce external influences (e.g. temperature shift, pressure, etc.)
- Minimize the lead time

Hose material should be adapted to the applied test gas, have no absorptive or adsorptive properties and should be made from inert material such as teflon or polyethylene. When using the CalGard in the hazardous area, a conductive hose must be used.

NOTE: The free end of the test gas tube must be closed if no test gas is applied. This is to prevent gas or air passing through the tube to the sensor, distorting the measurement or in the reverse pressure conditions, the ambient atmosphere escapes from the sensor at the free end of the tube.

NOTE: To ensure proper function the CalGard must be kept dry and free of any contaminants, e.g. dust particles. Regular visual checks are recommended. Any contaminants must be removed by blowing them off with clean, oil-free compressed air or with a dry brush. Ensure that the air entrances are kept free from any coating, e.g. paint, grease or similar.

6.6.2 Operation

Calibration procedure can be carried out as described in chapter 5.1 of this manual.

NOTE: To compensate for possible deviations during measurement of flammable gases a calibration factor of 1.05 shall be applied when using the CalGard for remote calibration.

NOTE: When using the CalGard for a remote calibration, the response time of the system increases depending on the length of the test gas tubes used. If the calibration is done automatically via controller, set the calibration setup with sufficiently long countdown times for zero gas and calibration gas.

Example: When using a 10 metre long tube with an internal diameter of 5 mm and applying a gas flow of 1 litre/min, the test gas takes a minimum of 20 sec to reach the CalGard. For safe flushing of CalGard, an additional 10 seconds has to be added to this calculation.

NOTE: If the CalGard is being used with a control system (i.e. SUPREMA), please ensure the manual for the controller has been read and understood.

NOTE: The pressure in the test gas tube increases with rising test gas flow rates. A flow rate of 1500 ml/min results in a pressure up to 600 hPa. This has to be considered if a flow meter is used which is affected by the media pressure.

Materials:	Stainless steel. 316
Dimensions:	60 x 122 [mm] dia. x height
Weight:	0,6 kg
Working temperature:	-30 °C to +70 °C
Storage temperature:	-30 °C to +70 °C

Maximum wind speed:	up to 6 m/s
Applicable test gases:	H ₂ , CH ₄ , C ₃ H ₈ in air (approval of other gases by MSA on request)
Recommended flow rate:	1.0 l / min
Minimum flow rate:	0,8 l / min
Maximum flow rate:	1.5 l / min
Response times:	CH ₄ $t_{50} \leq 15$ s, $t_{90} \leq 40$ s
	C ₃ H ₈ $t_{50} \leq 20$ s, $t_{90} \leq 55$ s

For Part-No. of CalGard refer to Section [8.5](#) of this manual.

For mechanical installations of CalGard refer to Section [9.7](#) of this manual.

7 Markings, Certificates, and Approvals

7.1 According to the Directive 2014/34/EU [ATEX]

7.1.1 Series 47K PRP, Series 47K-HT-PRP

Manufacturer	MSA Europe GmbH Schlüsselstr. 12, CH - 8645 Rapperswil-Jona				
Product	Remote Sensor SERIES 47 K				
EU-Type Examination Certificate:	Ex Sensor		INERIS	03	ATEX 0208*
	Controller	9010/9020	INERIS	00	ATEX 0028 X*
	Controller	Gasgard XL	FTZU	07	ATEX E 0066 X**
	Controller	Suprema	DMT	03	ATEX G 003 X***
	Controller	9010/9020 SIL	BVS	16	ATEX G 001 X***
Type of protection	EN IEC 60079-0:2018, EN 60079-1 :2014, EN 60079-31 :2014				
Performance	EN 60079-29-1 :2016				
Gas	measuring range : 0–100% LEL				
47K-PRP	Methane, Propane 2-Butanone, Acetone, Ethanol, Ethylacetat, (FAM-) Standard mineral spirit 65/95, 1-Propanol 2-Propanol, Propene, Toluene, Hydrogen, 1-Ethoxy-2-Propanole, n-Nonane				
47K-HT-PRP	Methane , Propane				
Special Condition	Attend to the special conditions for the for safe use at the manual of the controller units.				
Marking	47K-PRP, 47K-HT-PRP				
	II 2G Ex db IIC T3 / T4 / T6 Gb  T3 -40 °C ≤ Ta ≤ +160 °C (HT-PRP) T4 -40 °C ≤ Ta ≤ +90 °C (PRP) T6 -40 °C ≤ Ta ≤ +40 °C (PRP)				
	II 2D Ex tb IIIB T85 °C / T135 °C / T200 °C Db IP6X  T85 °C -40 °C ≤ Ta ≤ +40 °C (PRP) T135 °C -40 °C ≤ Ta ≤ +90 °C (PRP) T200 °C -40 °C ≤ Ta ≤ +160 °C (HT-PRP)				
Quality Assurance Notification	2776 (CML B.V.)				
Year of Manufacture	see label				
Serial Nr.	see label				

* INERIS Institut National de l'Environnement Industriel et des Risques France

** FTZU Physical-Technical Testing Institute s.p. Czech republic

*** DEKRA Testing and Certification GmbH Germany

7.1.2 Junction Box Typ S47K and X Series AL Junction Box

Manufacturer	MSA Europe GmbH Schlüsselstr. 12, CH - 8645 Rapperswil-Jona
Product	Junction Box Typ S47K and X Series AL Junction Box
EU-Type Examination Certificate	BVS 10 ATEX E 066X (DEKRA Testing and Certification GmbH)
Standards	EN IEC 60079-0 :2018, EN 60079-1 :2014, EN 60079-7 :2015+A1:2018, EN 60079-31 :2014
Performance	see MSA Controller together with sensor serie 47K-PRP
Marking	cable gland: NPT ¾" or M25 x 1,25
	II 2G Ex db IIC T4/T6 Gb  II 2G Ex e IIC T4/T6 Gb II 2D Ex tb IIIB T85 °C / T135 °C Db IP6X
Cable gland type HSK-M-Ex-d	T4 -50 °C ≤ Ta ≤ +80 °C T6 -50 °C ≤ Ta ≤ +40 °C T85 °C -50 °C ≤ Ta ≤ +40 °C T135 °C -50 °C ≤ Ta ≤ +80 °C
Cable gland type 8161/5-M25-17	T4 -40 °C ≤ Ta ≤ +70 °C T6 -40 °C ≤ Ta ≤ +40 °C T85 °C -40 °C ≤ Ta ≤ +40 °C T135 °C -40 °C ≤ Ta ≤ +80 °C
Special conditions:	The connection cable has to be appropriate for the +80 °C ambient temperature range. For group III application, the apparatus has to be installed in such a way that process-related electrostatic charges, e.g. caused by media passing by, can be excluded
Quality Assurance Notification	2776 (CML B.V.)
Year of Manufacture	see label
Serial Nr.	see label

7.2 According to IECEx

Manufacturer	MSA Europe GmbH Schlüsselstr. 12, CH - 8645 Rapperswil-Jona
Product	Series AL Junction Box
IECEx-Type Examination Certificate	IECEx BVS 12.0057 X (DEKRA Testing and Certification GmbH)
Standards	IEC 60079-0 :2017, IEC 60079-1 :2014, IEC 60079-7 :2017, IEC 60079-31 :2013
Marking	cable gland: NPT ¾" or M25 x 1,25
	Ex db IIC T4/T6 Gb Ex e IIC T4/T6 Gb Ex tb IIIB T85 °C / T135 °C Db IP6X
Cable gland type HSK-M-Ex-d	T4 -50 °C ≤ Ta ≤ +80 °C T6 -50 °C ≤ Ta ≤ +40 °C T85 °C -50 °C ≤ Ta ≤ +40 °C T135 °C -50 °C ≤ Ta ≤ +80 °C
Cable gland type 8161/5-M25-17	T4 -40 °C ≤ Ta ≤ +70 °C T6 -40 °C ≤ Ta ≤ +40 °C T85 °C -40 °C ≤ Ta ≤ +40 °C T135 °C -40 °C ≤ Ta ≤ +80 °C
Special conditions:	The connection cable has to be appropriate for the +80 °C ambient temperature range. For group III application , the apparatus has to be installed in such a way that process-related electrostatic charges, e.g. caused by media passing by, can be excluded
Quality Assurance Notification	2776 (CML B.V.)
Year of Manufacture	see label
Serial Nr.	see label

7.3 Special Conditions for SIL 2 According to TUV Certificate 968 / EZ 392.03/24

Safety relevant parameters for Sensor Type 47K-PRP at 25 °C_{amb} and for 47K HT PRP at 120 °C_{amb}:

Type	A
Structure	1001
HFT	0
PFD	1,3 x 10 ⁻³
HFT	1

Type	A
PFH	$1,9 \times 10^{-7}$
SFF	75,8%
MTBF	272946 h
λ tot	3664 fit
λ D	1832 fit
λ DU	886 fit
λ DD	946 fit
MTTR	72 h

Special conditions for the safe use according to SIL 2

1. The application advice and limitations specified in this Manual have to be considered. For calibration and maintenance, the regional and national regulations have to be considered.
2. Applications with High Demand mode are only permitted with redundant configuration. The Control Unit has to activate an alarm by a single sensor.
3. A defective sensor must be changed within 72 hours.
4. The safety related specifications for the MSA passive sensors Series 47K are only valid when used in combination with certified MSA Controllers.
5. A minimum ambient Oxygen concentration of 10 vol% is necessary for the correct operation of the combustible sensor.
6. The presence of any catalytic poisons has to be avoided for the combustible sensor.
7. A functional check / calibration has to be done for the complete system (Chapter 5).
8. A visual check has to be done monthly.
9. A system check has to be done every year.
10. Calibration and adjustment are part of the function / calibration check.
11. The target gas specified for the measurement has to be used for the test gas. The concentration of the test gas has to be in the middle of the measuring range.
12. Synthetic air has to be used for the zero gas.
13. An adjustment has to be done under the following conditions:
 - a. deviation of the zero $> \pm 5\%$ LEL
 - b. deviation of the sensitivity $> \pm 20\%$ of the test gas concentration
14. If the calibration is within the tolerances allowed, the calibration interval can be doubled.
15. The maximum calibration interval allowed is 16 weeks.
16. The sensor has to be replaced if its sensitivity during operation is reduced to less than 50% of the initial sensitivity.
17. After exposure to a gas concentration above the measuring range, the sensor has to be immediately calibrated / adjusted, regardless of the preset calibration interval. In the case of an adjustment, the sensitivity of the sensor has to be rechecked again after 24 hours.
18. If the presence of any catalytic poisons which affect the correct sensor operation cannot be avoided, the calibration interval has to be considerably reduced.

8 Ordering Information

8.1 Gas Detector (Sensor+Junction Box)

Description	Thread	Junction Box Type	Part-No.
Detector Series 47K-PRP <i>Screw terminals</i>	M25 x 1.5	Ex e	10114106
Detector Series 47K-PRP <i>Screw terminals</i>	¾" NPT	Ex d	10114107
Detector Series 47K-PRP <i>Spring terminals</i>	M25 x 1.5	Ex e	10114109
Detector Series 47K-PRP <i>Spring terminals</i>	¾" NPT	Ex d	10114110

8.2 Gas Detector, Calibrated with Certified MSA Gas Controllers

Description	Thread	Part-No.
Detector Series 47K-PRP <i>Screw terminals</i>	M25 x 1.5	10123076
Detector Series 47K-PRP <i>Screw terminals</i>	M25 x 1.5	10123095
Detector Series 47K-PRP <i>Screw terminals</i>	¾" NPT	10178833
Detector Series 47K-PRP <i>Screw terminals</i>	¾" NPT	10178834

8.3 Sensor

Description	Material	Thread	Part-No.
Sensor Series 47K-PRP	St.St. 316	M25 x 1.5	10048100
Sensor Series 47K-HT-PRP	St.St. 316	M25 x 1.5	10147537
Sensor Series 47K-PRP	St.St. 316	¾" NPT	10048272
Sensor Series 47K-HT-PRP 10 m	St.St. 316	M25 x 1.5	10185325

8.4 Junction Box

Description	Material	For use with Sensor	Part-No.
Ex e, 2 x M25 x 1.5 <i>Screw terminals</i>	Aluminium	47K-PRP	10114111
Ex e, 2 x M25 x 1.5 <i>Spring terminals</i>	Aluminium	47K-PRP	10114114
Ex d, 2 x ¾" NPT <i>Screw terminals</i>	Aluminium	47K-PRP	10114112
Ex d, 2 x ¾" NPT <i>Spring terminals</i>	Aluminium	47K-PRP	10114115
Junction Box ATEX 100 °C	Aluminium	47K-HT-PRP	10151980

8.5 Accessories

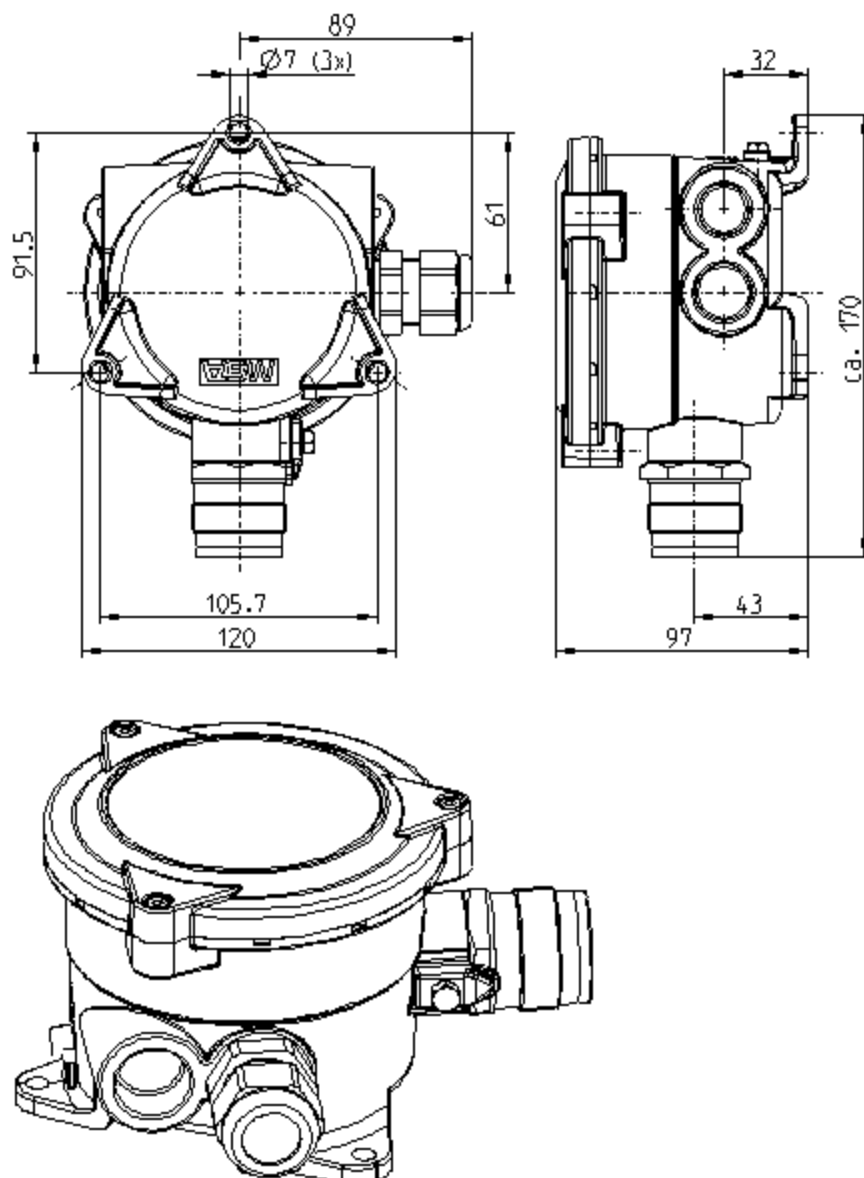
Description	Material	Part-No.
Calibration cap	Plastic	10112789
Weather protection cap/ hose connection	St.St. 316	10051623
Weather protection cap/ 1/8" pipe connection	St.St. 316	10051731
Flow through adapter	St.St. 316	10113031
Duct mount flange	St.St. 316	10112790
Wall mounted bracket	St.St. 316	10048829
S47K adapter plate	St.St. 316	10105760

Description	Material	Part-No.
CalGard	St.St. 316	10150921
Pipe mounting kit	Aluminium	10113032

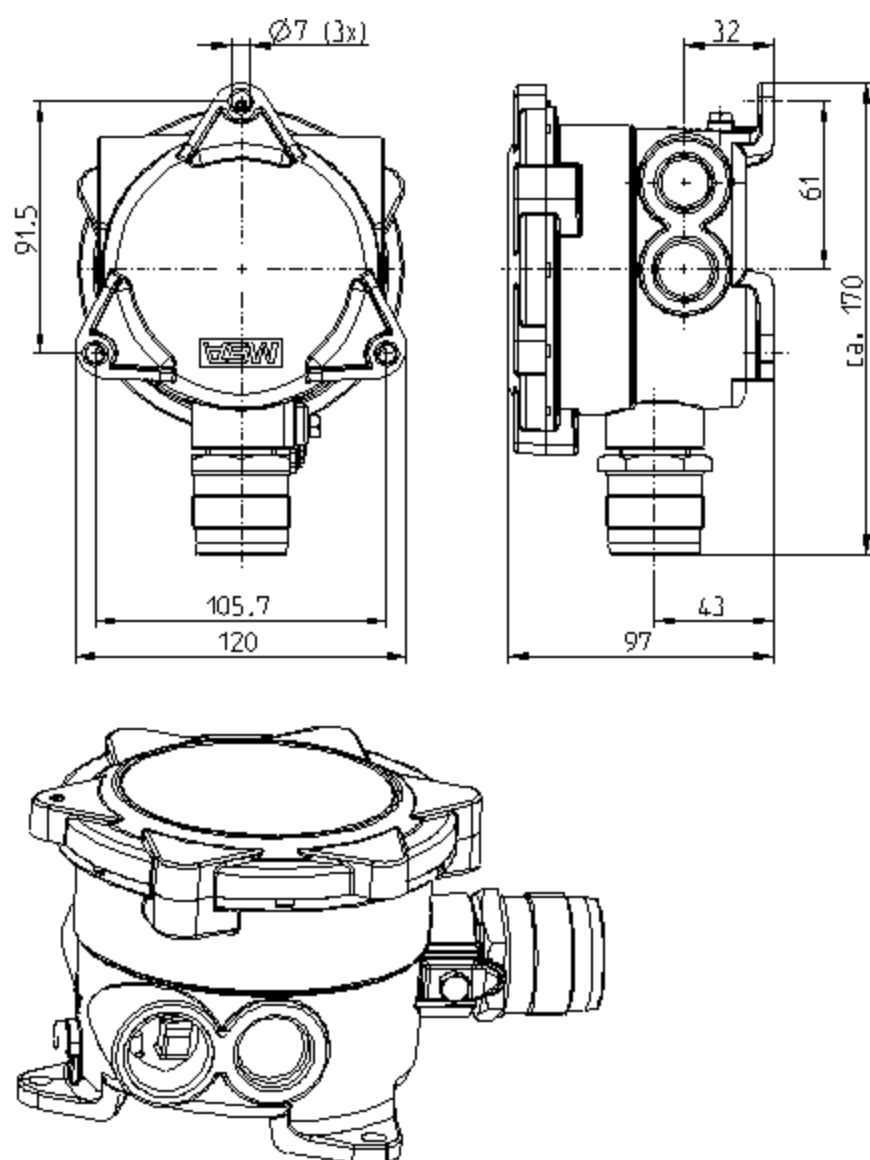
NOTE: The pipe mounting kit (P/N 10 113032) is not included in the EC-Type Examination Certificates DMT 01 ATEX G 001 X (ED 090), BVS 03 ATEX G 010 X (E 292), DMT 03 ATEX G 003 X (SUPREMA), BVS 16 ATEX G 001 X (9010/9020 SIL), FTZU 07 ATEX E 0066 X (GasGard XL), INERIS 00 ATEX 0028 X (9010/9020)

9 Dimensions

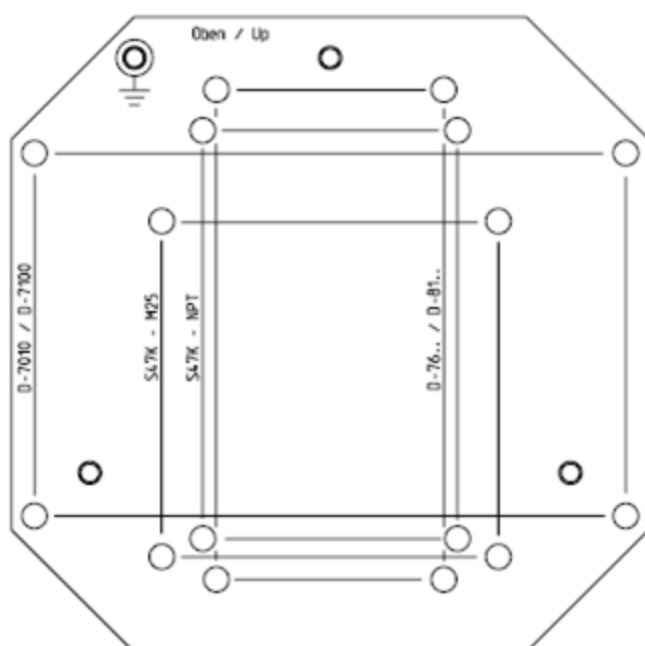
9.1 Gas Detector (EX e Junction Box)



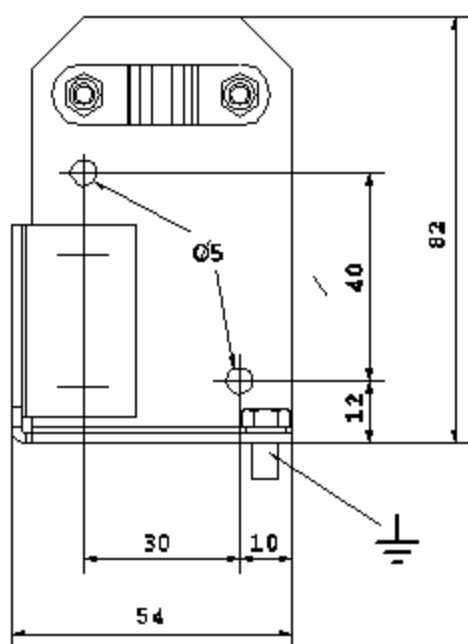
9.2 Gas Detector (Ex d Junction Box)



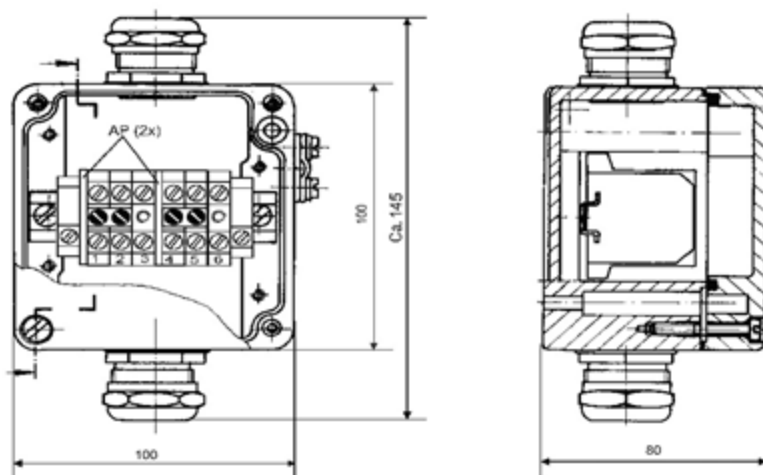
9.3 S47K Adapter Plate Junction Box



9.4 Wall Mounted Bracket Sensor 47K-HT-PRP

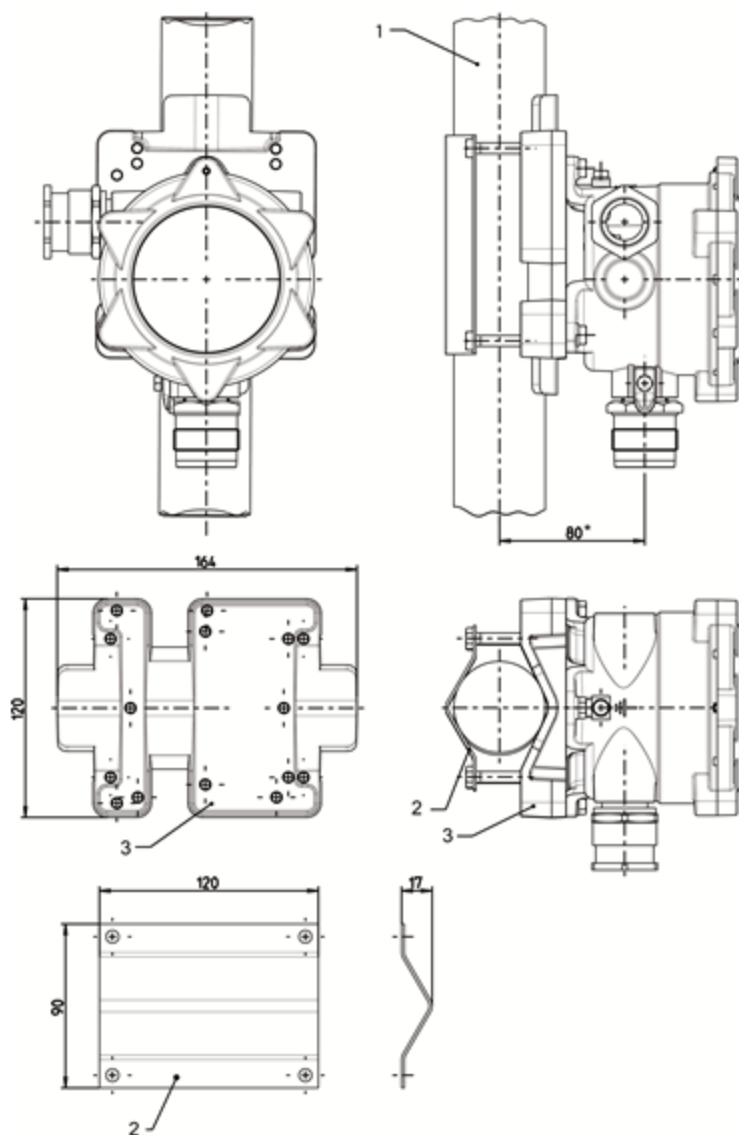


9.5 Junction Box ATEX 100 °C; Sensor 47K-HT-PRP



9.6 Pipe Mounting Kit

9.6.1 Mounting Kit for Pipes with a Diameter of up to 50 mm



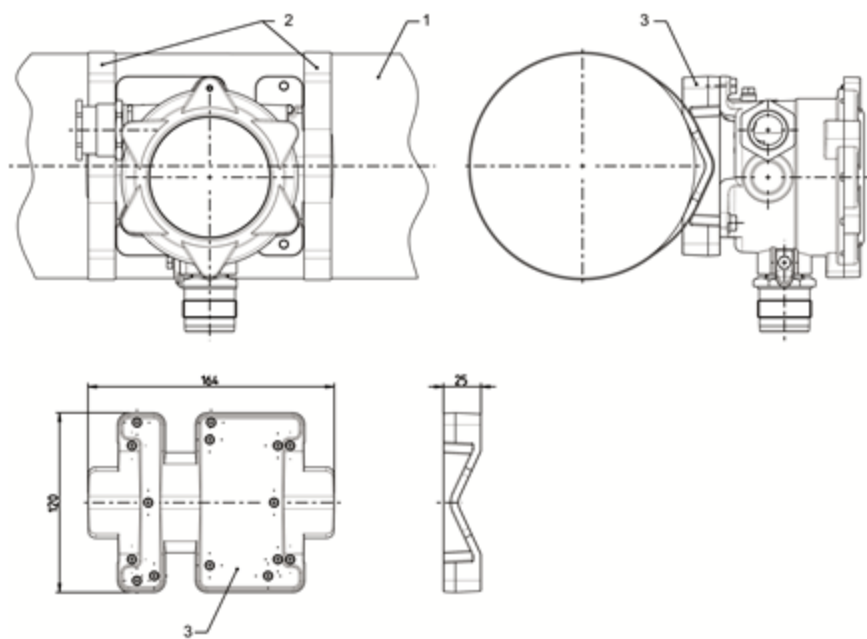
1. Pipe

2. Pipe clamp

3. Mounting plate

* Depending on pipe diameter

9.6.2 Mounting Kit for Pipes with a Diameter from 50mm to 150mm

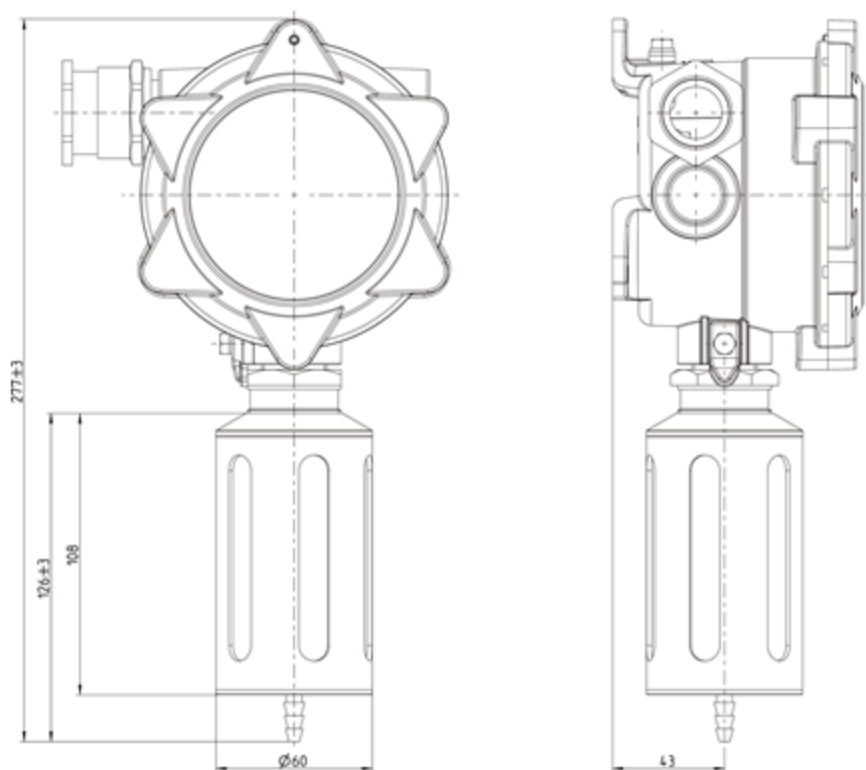


1. Pipe

2. Pipe clamp

3. Mounting plate

9.7 Remote Calibration Adapter



10 Wiring Diagrams

10.1 MSA Control Unit SUPREMA

⚠ WARNING!

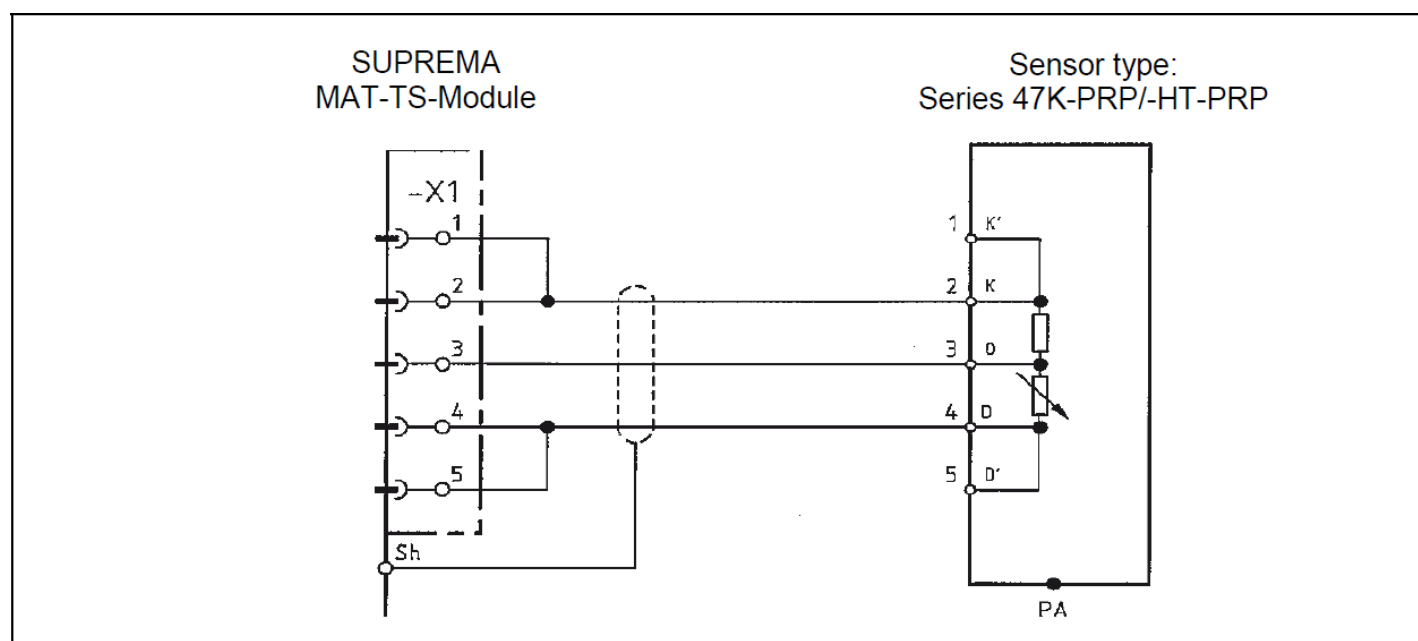
The fault signals required in EN 60079-29-1 for loss of continuity or short circuit of one or more wires to the remote sensor are not provided with a 3 wire connection. A 5 wire connection is therefore recommended.

Failure to follow this warning can result in serious personal injury or death.

When using a 3-wire connection the maximum wire length is reduced. Refer to the appropriate controller operation manual for details of the minimum conductor size and wire length that can be used.

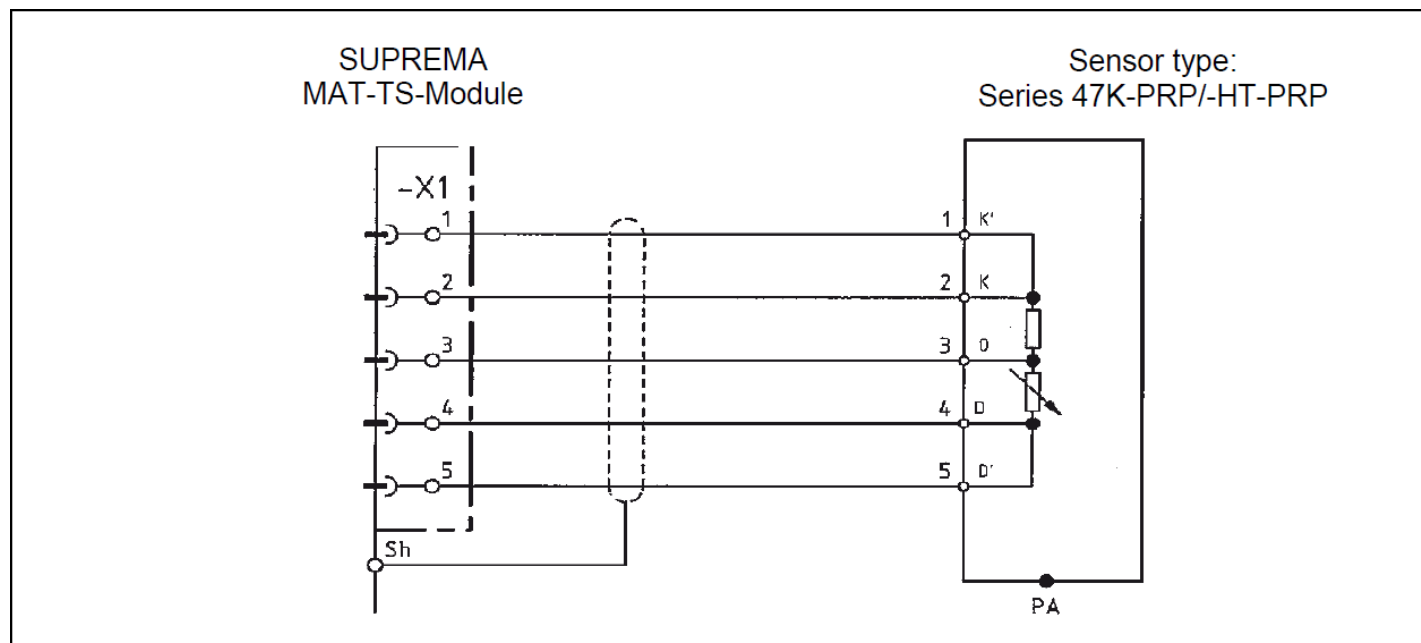
10.1.1 Series 47K-PRP/ -HT-PRP [3-wire]

[47K-HT-PRP see chapter [10.4](#)]



10.1.2 Series 47K-PRP/ -HT-PRP [5 wire]

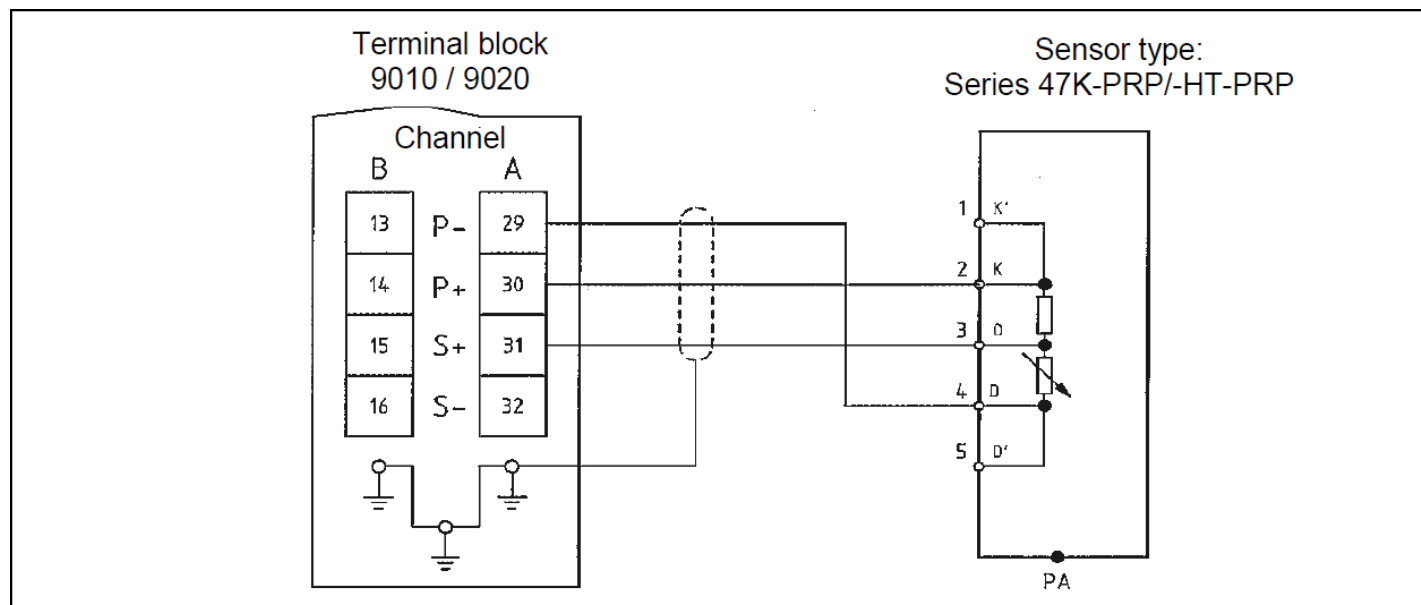
Information regarding the 5-wire wiring of the -HT-PRP can be found in chapter [10.4](#) .



10.2 MSA Control Unit 9010/ 9020 Series

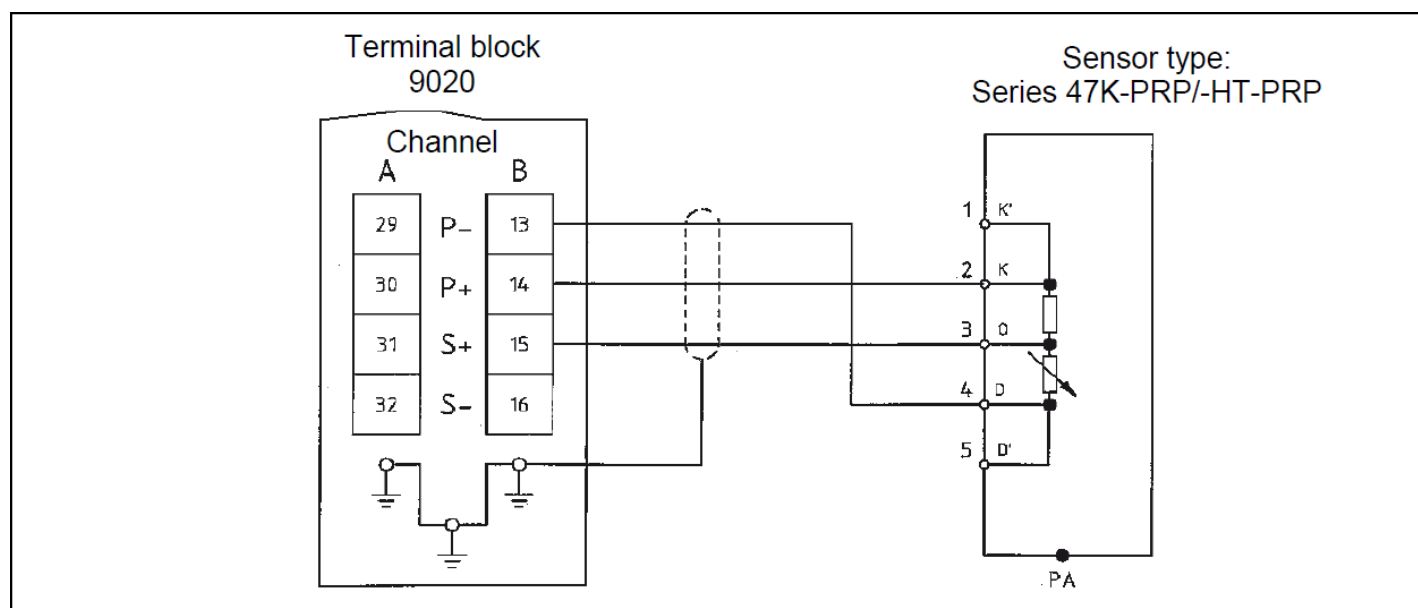
10.2.1 Series 47K-PRP/ -HT-PRP [3-wire] Channel A

[47K-HT-PRP see chapter [10.4](#)]



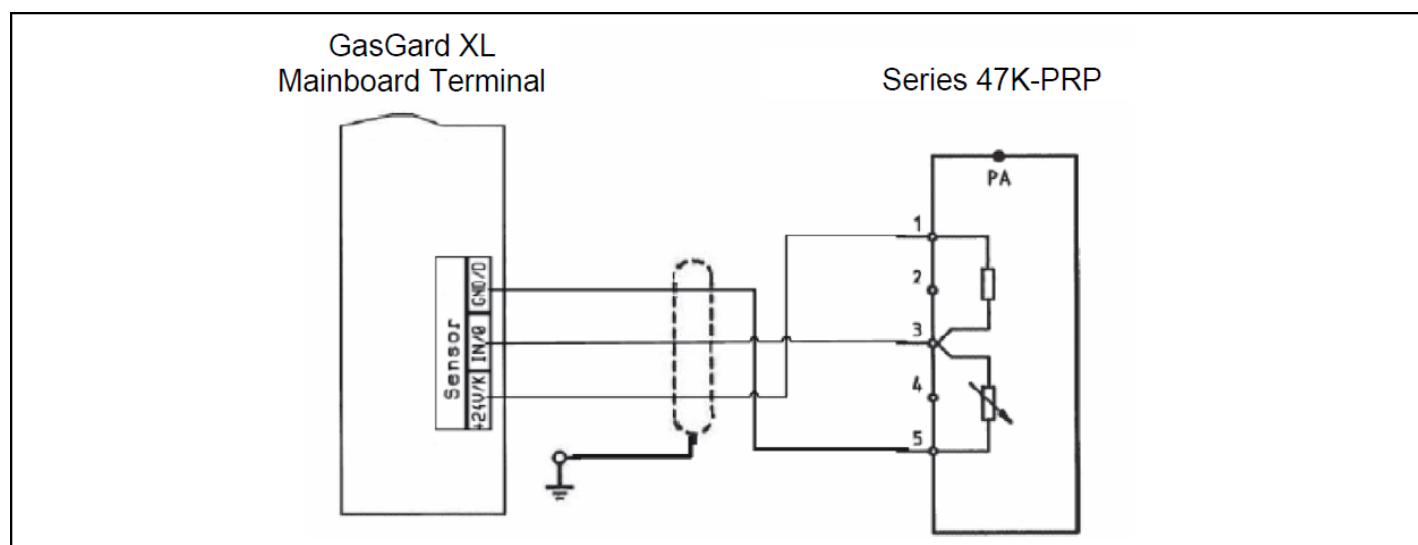
10.2.2 Series 47K-PRP/ -HT-PRP [3-wire] Channel B

[for 47K-HT-PRP see chapter 10.4]

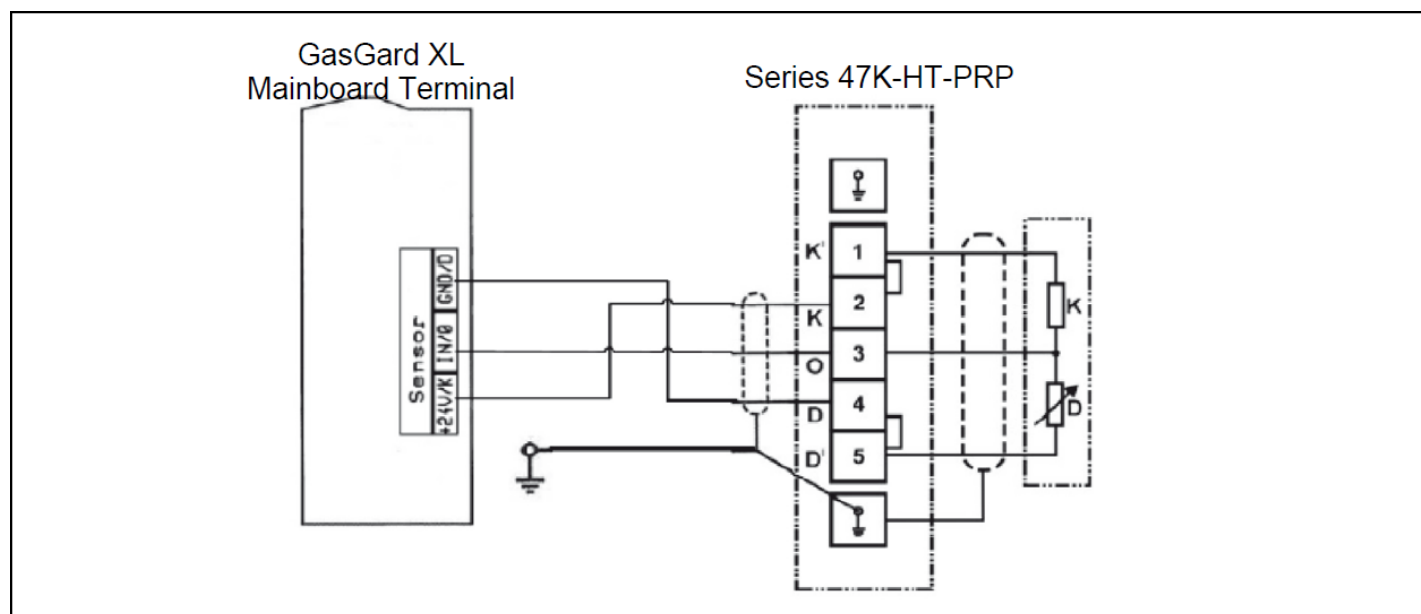


10.3 MSA Control Unit Gasgard XL

10.3.1 Series 47K-PRP [3-wire]



10.3.2 Series 47K-HT-PRP



10.4 Wiring Diagram Sensor 47K-HT-PRP with Junction Box ATEX 100 °C

