



Operating Manual Microwave Position Measuring System (MPMS) 360 mm / 385 mm / 480 mm / 560 mm V2.0



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Area of responsibility	Production
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Document history

Version	Date	Author	Changes
V1.0	29.02.2024	S. Lüttich	Initial version
V2.0	17.01.2025	S. Lüttich	New IZ drawings and glands on the FPH



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1. Introduction

The purpose of this document is the safe installation, commissioning, and maintenance of the Microwave Position Measuring System (MPMS). This document is valid from the date indicated on the front page (Date of last change) until a new version is released.

Failure to observe the following instructions as well as any improper intervention in the apparatus terminates all liability of the manufacturer. It also terminates the warranty on the apparatus and any accessories.

Observe all instructions in this operating manual as well as operating conditions and allowed data stated in the data sheets and certificates.

The MPMS may only be mounted and dismounted by specifically trained and experienced personnel. The manufacturer has to be contacted with any questions or in case of any ambiguity.

The explanations, information and data in this operating manual are depicted as clearly as possible. The publisher of this operating manual is not liable for any damage caused by improper handling, installation, operation, maintenance, or repair.

There cannot be any guarantee that the same performance will be achieved as described in this operating manual, since the manufacturer has no control over the deployment of the systems. It is the responsibility of each user to assess whether the systems are appropriate under the given operating conditions.

This operating manual is the property of the manufacturer. Creating copies of this operating manual or passing it to third parties is prohibited without written approval by the manufacturer.

2. System Description

The Microwave Position Measuring System (MPMS) determines the position of a piston within a cylinder which is filled with nitrogen on the side of the measurement.

The system consists of two components: an antenna sub-assembly and an Evaluation Box sub-assembly.

The antenna sub-assembly is mounted inside of the nitrogen filled cylinder in a cavity in the end-cap.

The Evaluation Box is installed in a flame proof housing (FPH) which is mounted on the outside of the cylinder end-cap. The FPH consists of an Ex d and an Ex e housing, both robust against hostile environments. These two housings are firmly connected to each other.

A reflector plate is mounted on the piston to increase the accuracy of the measurement and minimize the susceptibility to interference by small quantities of hydraulic fluid.

During operation the Evaluation Box transmits a very low energy high frequency signal to the antenna. The antenna transmits this signal to the reflector plate and the reflector plate reflects the signal back to the antenna. Subsequently the signal is forwarded from the antenna to the evaluation unit and analyzed. Depending on the distance between piston and antenna the value of the signal varies. The evaluation unit calculates an actual distance from the end cap to the piston and thereby the rod of the cylinder. This information is transmitted to the customer interface.



The MPMS requires calibration (See Paragraph 8. Calibration). This is the only way to guarantee the specified performance. A „Certificate of Calibration“ can be issued on request for each successfully calibrated system. Any changes in the hardware of the MPMS require new calibration.

3. Explosion Protection

The MPMS is applicable for operation in areas with gas explosion risk of „Zone 2“ for the antenna sub-assembly and „Zone 1“ for the Evaluation Box sub-assembly conforming to EN-IEC 60079-10-1

You can find all ATEX Certificates on our Homepage:

www.astyx-mps.de

4. Safety Measures

The MPMS is not designed for environments exposed to X-rays or radioactive radiation.

Never power up the sensor outside the grounded cylinder or without proper shielding against electromagnetic radiation (refer to local authorities for applicable regulations).

5. Apparatus

5.1. Antenna Sub-assembly

Cylinder Bore / Astyx MPS mark	360 mm / 7038	385 mm / 7039	480 mm / 7030 Typ A / Typ B	560 mm / 7035
Subject	Microwave sensor MPMS antenna Atex Zone 2 / 7038	Microwave sensor MPMS antenna Atex Zone 2 / 7039	Microwave sensor MPMS antenna Atex Zone 2 / 7030	Microwave sensor MPMS antenna Atex Zone 2 / 7035
Cable length	2 m or 3 m	2,75 m	1,5 m	2 m

Table 1

Manufacturer	ASTYX MPS GmbH, Caroline-Herschel Str. 4, 85521 Ottobrunn, Germany
Basis for standards	Directive 2014/34/EU
Standards	EN 60079-0: Equipment - General requirements EN 60079-7: Equipment protection by increased safety 'e'
Certificate	see Chapter 15 Declaration of Conformity Antenna
Further details refer to chapter 14 Specification in this document.	



5.2. Evaluation Box Sub-assembly

Applicable to complete enclosure assembly TNCD Ex d + TNCN Ex e

Astyx MPS mark	IZ 7038 2001 E	IZ 7035 2002 G
Subject	Microwave sensor MPMS Evaluation box sub-assembly Analog interface: 04-20 mA	Microwave sensor MPMS Evaluation box sub-assembly Profibus interface

Table 2

Manufacturer	Bartec Technor AS, 4000 Stavanger, Norway
Type	AST 282815
Basis for standards	Directive 2014/34/EU
Standards	EN 60079-0: Equipment - General requirements EN 60079-11: Equipment protection by intrinsic safety 'i' EN 60079-1: Equipment protection by flameproof enclosures 'd'
Certificate	see Chapter 16 Declaration of Conformity Evaluation Box
Interface	Profibus Interface Analog output Interface

Further details refer to chapter 14 Specification in this document.



6. Commissioning

The commissioning of the sensor antenna and the sensor Evaluation Box is performed by Astyx MPS as the MPMS-manufacturer before delivery.

The commissioning of the cylinder including the sensor antenna is not performed by Astyx MPS.

7. Installation

The respective Ex-regulations have to be observed during installation, maintenance, or repair; particularly EN 60079-14: Electrical installations design, selection and erection.

7.1. Antenna sub-assembly

The O-ring seal surfaces have to be clean and in a technically flawless condition. The antenna sub-assembly is firmly mounted with 4 screws on the inside of the cylinder. The housing of the antenna sub-assembly has to be connected to the cylinder and the Evaluation Box in a permanently conductive manner for the purpose of potential equalization. The cylinder completely encloses the antenna like a housing. The internal chamber of the cylinder on the antenna side is filled with Nitrogen. The operator of the cylinder ensures that at least an appropriate positive pressure exists relative to the environment.

The damage and contamination protection of the coaxial cable must be maintained. A damaged antenna or a damaged cable may not be installed or operated. The coaxial cable installed by the manufacturer may not be modified and may only be connected to the designated Evaluation Box.

7.2. Evaluation Box sub-assembly

The enclosures flame paths (=interface between two parts that prevents the transmission of an explosion inside the housing into an explosion hazardous environment) must be securely protected to avoid damage during transport, handling, installation and maintenance.

Before commissioning of the system the MPMS markings have to be compared to the designated operating conditions to ensure an appropriate operating environment.

The Evaluation Box has to be mounted by 4 steel bolts. During mounting of the housing ensure that support is strong enough to accept the full weight of the housing (approx. 45 Kg).

The Hawke SB474 gland offers a thread to attach an external protective pipe for the antenna and sensor cable.

- DO NOT OPEN LID BEFORE THE ENCLOSURE IS SECURELY FASTENED AND IN PREFERABLY AN UPRIGHT POSITION. THE WEIGHT OF THE LID OF THE FLAMEPROOF ENCLOSURE IS 8 Kg, BE AWARE OF THIS WEIGHT AND ACT ACCORDINGLY WHEN HANDLING THE LID.
- When connecting external cabling, ensure the incoming cables/wires are isolated from all sources of power.
- Perform installation according installation standard for explosion safe equipment EN 60079-14 and/or equivalent local requirements valid on the site of installation.



- **NOTE! It is a must to read the instructions and requirements mentioned in the certificate and in the documentation of the enclosure (wiring diagram etc.), before connecting the housing to a power source and other equipment intended for the housing.**
- **It is the responsibility of the company mounting the housing that the technical data for the housing match the technical data to which the cabinet is connected. Special attention is to be made to all safety and explosion safety aspects.**
- All openings must be closed according to the same protection degree against ignition as applicable to the housing: Use certified Ex d II cable glands or blind plugs to the flameproof compartment and certified Ex e II cable glands or blind plugs to the connection terminal compartment.
- Make sure during installation that there is no damage to the housing or cable. In particular inspect the gasket and cover of the increased safe connection terminal enclosure.
- When un-installing the enclosure, apply the same precautions as those to be observed when installing the enclosure.

8. Calibration

Calibration of the MPMS is required after installation to achieve the best possible performance of the system. Calibration can only be performed by Astyx MPS expert personnel.

The first measurement data of the MPMS are compared to the output of a reference measurement system. Any deviations are used to calculate a cylinder specific correction factor and saved in the Evaluation Box. The process requires one stroke from position zero to full stroke and back to position zero.

Each cylinder with MPMS is calibrated by the manufacturer.

The calibration will be documented in the Certificate of Calibration. Changes of any hardware after calibration require re-calibration. For guidance contact ASTYX MPS.



Calibration of the Microwave Position Measuring System is required after mounting for best performance.

Calibration and use of the CAN bus interface is only allowed Astyx expert personnel.



9. Usage, Mounting, Maintenance, and Dismounting

9.1. Antenna sub-assembly

The antenna sub-assembly is an integral part of the Microwave sensor and cannot be operated without the Evaluation Box.

The antenna sub-assembly consists of a housing (stainless steel); an antenna pin is screwed into the housing using a fastener (PPS GF40). A non-removable coaxial cable is used to feed the signal for distance measurement into the antenna. The cable is connected to the Evaluation Box which is mounted on the outside of the cylinder.

The operational environment for the antenna sub-assembly is inside of a metallic cylinder.

The operator has to ensure that the operating conditions inside the cylinder are of sufficient quality for the antenna sub-assembly.

Should any failures or malfunction occur during operation, the system needs to be shut down immediately and the manufacturer needs to be contacted. To dismount the sensor the 4 screws need to be loosened which connect the antenna to the inside of the cylinder end-cap. It needs to be ensured that the system is cut off from the power supply and that all electrical connections have been disconnected. Disconnecting the electrical connections may only be performed by qualified personnel observing any national regulations.

10. Electrical Connection

The respective Ex-regulations have to be observed. The drawing below describes the electrical connections. System connection may only be performed by qualified personnel observing any national regulations (in Germany VDE 0100).

a) Antenna sub-assembly connection, high frequency signal

- The cylinder built-in antenna transmits and receives RF signals necessary to calculate the distance between the antenna and the cylinder piston.
- The RF signal feeds through a coaxial cable coming from the antenna sub-assembly.
- The antenna cable enters the evaluation box through a Hawke SB474 gland. Therefore, the gland requires a cable opening in its sealing with the correct size for the Antenna cable..

The coaxial cable must be secured using the gland and appropriate torque without damaging the cable.

- The coaxial cable (antenna cable) enters the Ex d compartment through a certified gland. The SMA connector of the coaxial antenna cable has to be connected to the SMA connector of the Electronic Box inside the Evaluation Box according the wiring scheme. Use a torque of 0.8 to 1.1 Nm. **NOTE: The lead through of the coaxial cable (antenna cable) is relevant to the Explosion Safety of the zone 1 Ex d compartment. The coaxial cable must be secured using the gland and appropriate torque without damaging the cable. Coaxial cable and certified gland have to be clean and in good condition.**



- The antenna cable outside the Evaluation Box has to be well protected against damage and contamination.
- The bending radius for the coaxial cable may not go below the minimum of 25 mm.

b1) Power supply and current loop interface cable

- The power supply 24V input and the current loop output signal connect to cable terminals inside the Ex e compartment according to the wiring scheme.
- The combined cable enters the terminal housing by a certified gland.
- Unused wires of the interface cable are connected to PE.

b2) Power supply and profibus signal

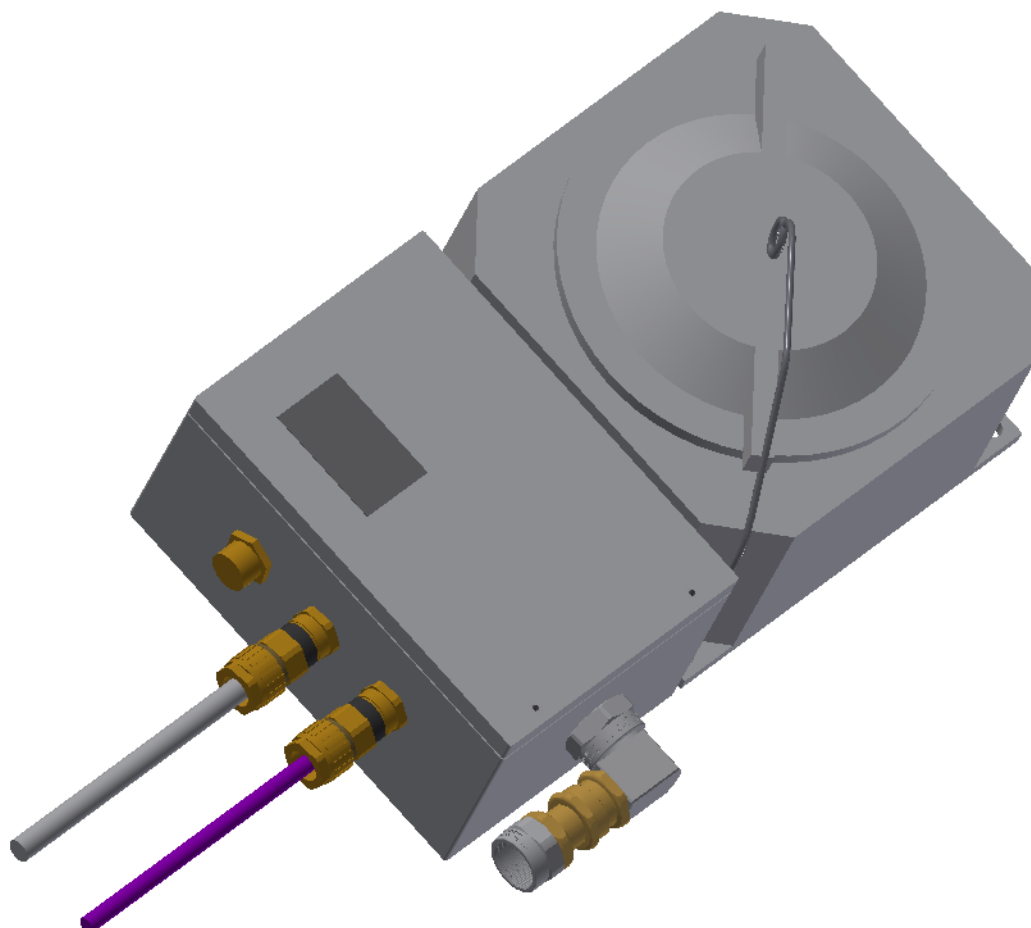
- The corresponding profibus protocol is referenced in “chapter 14 Specification” under “customer interface”.
- The power supply 24V input and the profibus signal have to be connected according to the wiring scheme.
- The cables enter the terminal housing by two certified glands according to the wiring scheme.
- Unused wires of the interface cable are connected to PE.

c) Grounding concept

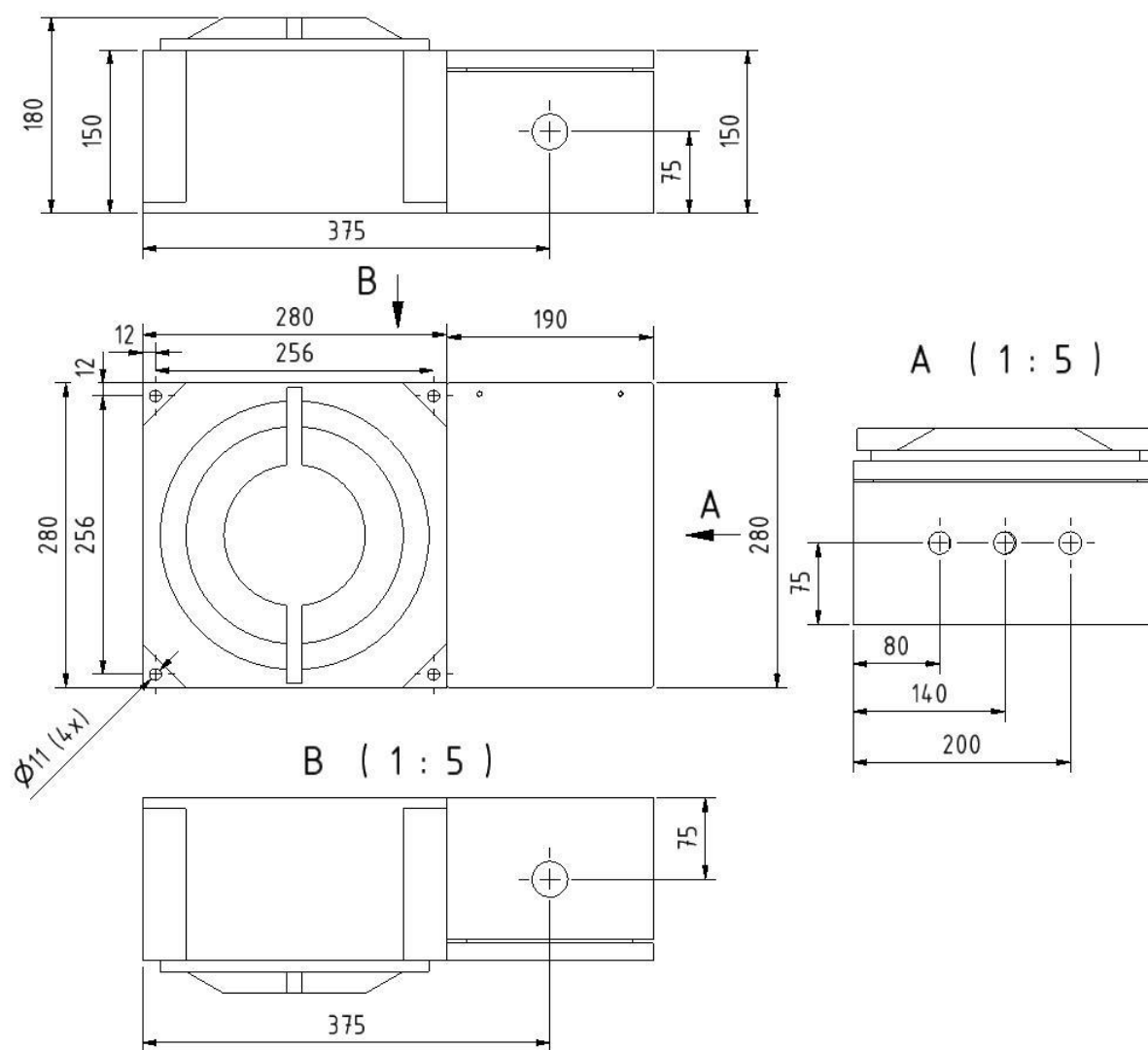
- The Ex d and Ex e compartment each include an external grounding clamp. Both have to be grounded to the cylinder on the same potential.

d) Commissioning and operation require that all electrical connections are done properly. The Evaluation Box must not be disconnected from the other system components unless the system is without power or the area is safe.

10.1. Profibus Interface



Dimensions of the Evaluation Box for Profibus Interface



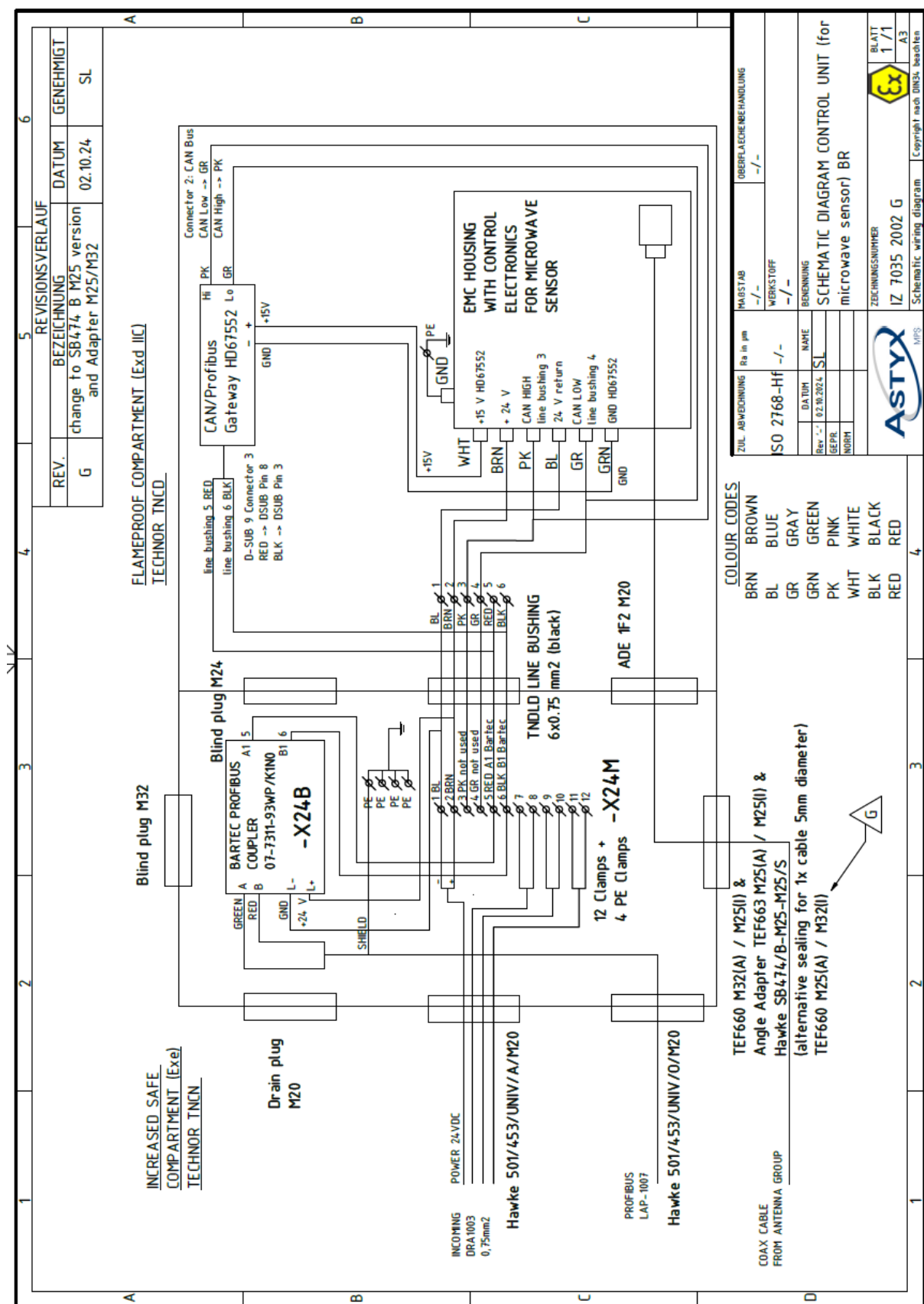
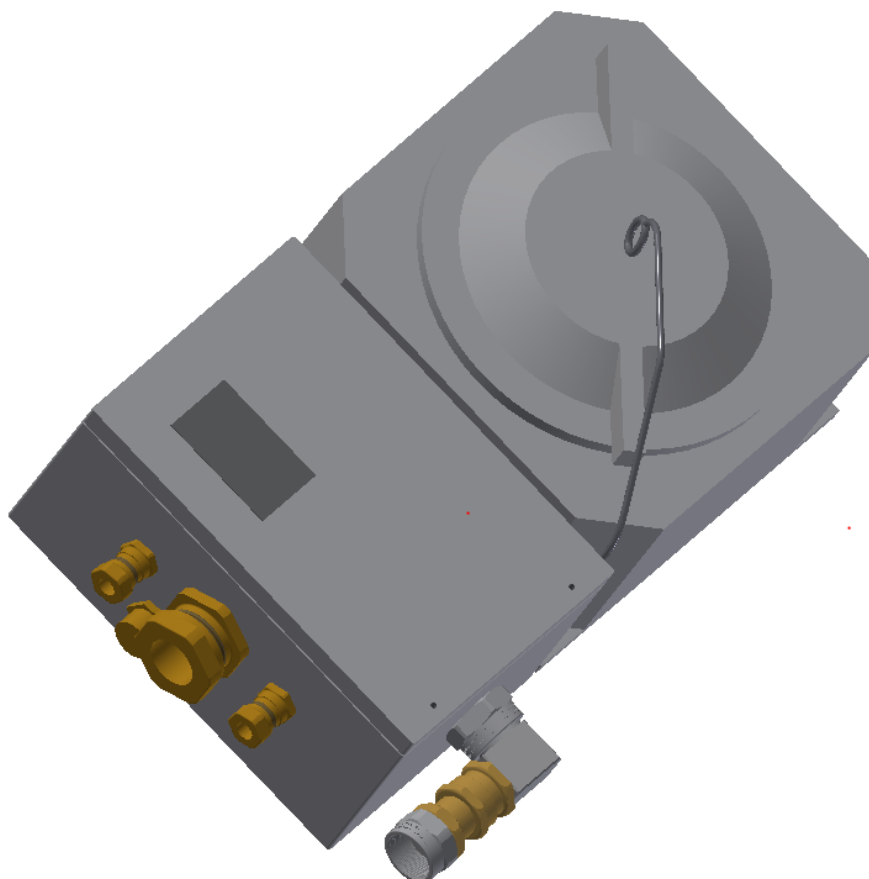
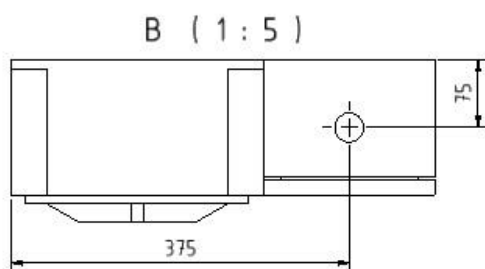
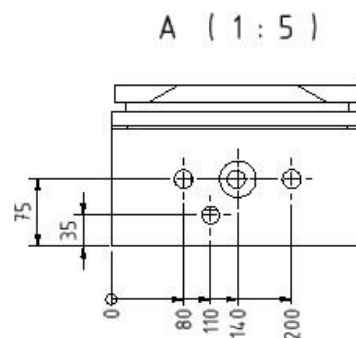
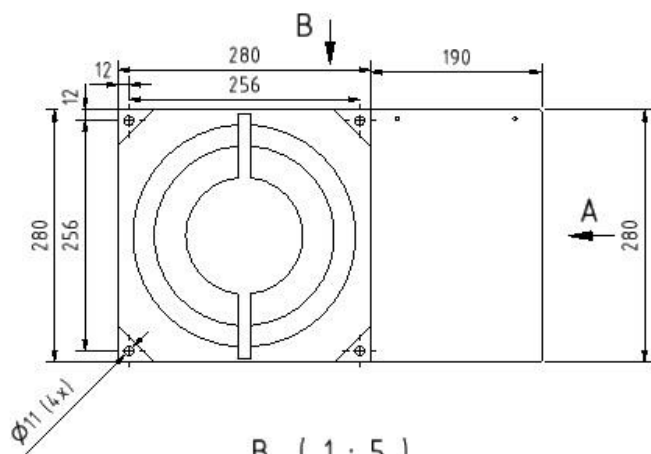
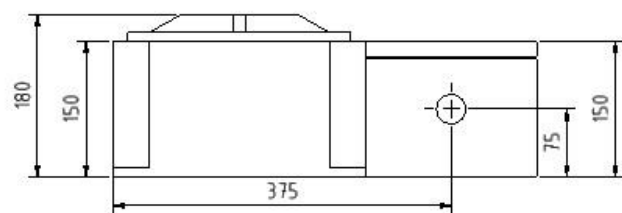


Figure 1

10.2. Analog Output Interface



Dimensions of the Evaluation Box for Analog Output Interface



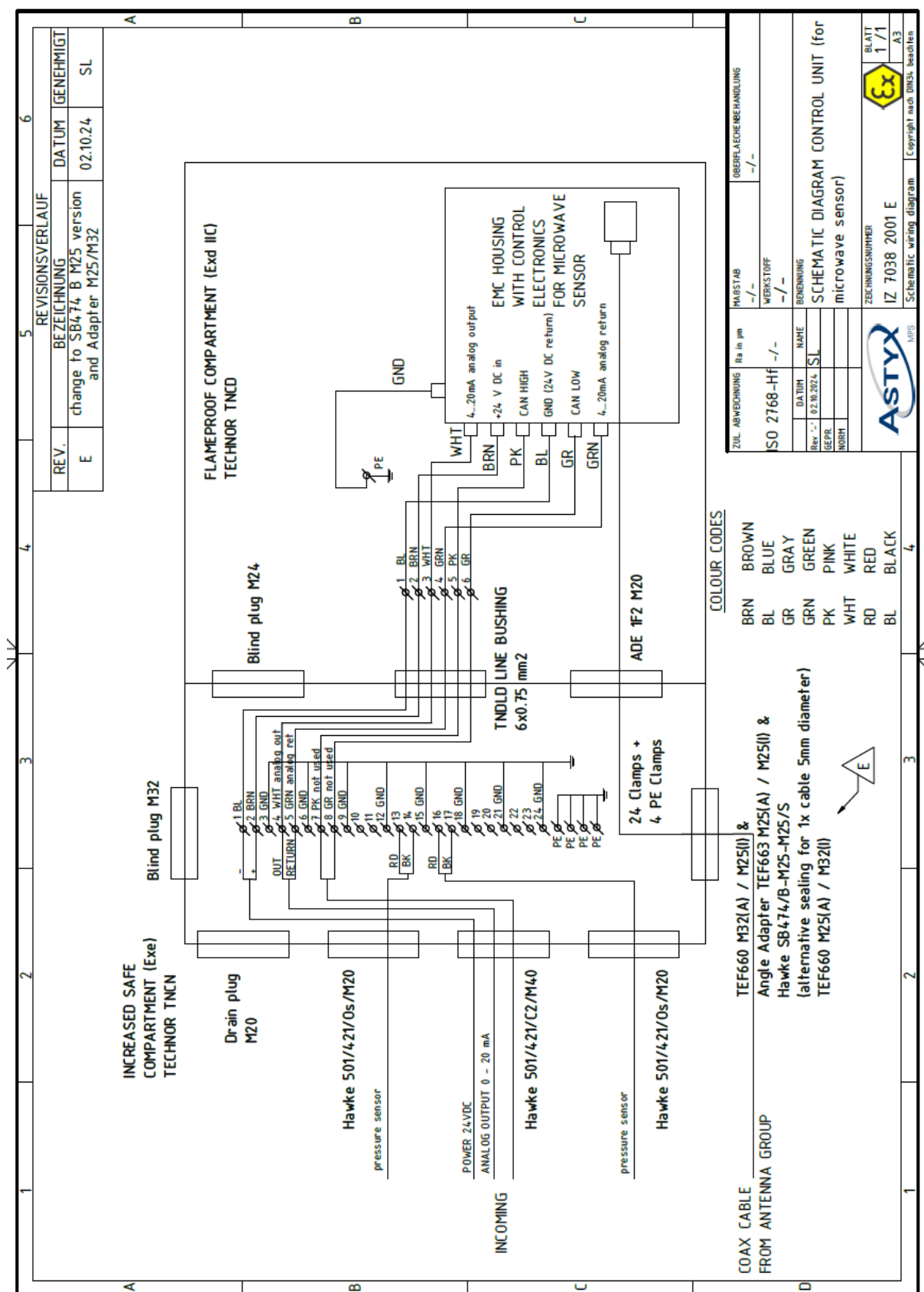


Figure 2



Warning!

- Voltages higher than 30 VDC applied to any of the electrical connection points might damage the sensor electronics.
- Mechanical contact between antenna and piston will damage the sensor.
- Calibration of the sensor in a cylinder with identical geometrical properties (bore, piston geometry) is required after mounting.
- Fluid on top of the piston or in the antenna will influence measurements and might cause unexpected offset changes in the output signal.
- Opening of enclosures or disassembly of the microwave sensor is allowed to authorized staff only.



Danger!

- An ESD discharge from the piston rod to the microwave antenna has to be prevented, as it might damage the evaluation box.
- Never power up the sensor outside the grounded cylinder or without proper shielding against electromagnetic radiation (refer to local authorities for applicable regulations).
- A damaged sensor (antenna or evaluation Box) may not be powered or used

11. Handling

- Due to the weight and nature of the antenna and the housing precautions have to be taken to avoid damages to the equipment and individuals.
- The antenna and the housing must be protected to avoid damage during transport, handling and installation. The antenna and the enclosure shall be packed in a proper manner that no damage during shipment can occur.

12. Inspection / Maintenance

12.1. Antenna sub-assembly

- The antenna sub-assembly has to be protected from strong contamination (grease, dust, etc.).

12.2. Evaluation Box sub-assembly

- Both flameproof Ex d and increased safe Ex e compartments are manufactured of stainless steel and therefore are no subject to corrosion.
- Apply copper grease to threading of lid, bolts and threaded holes etc.



- For maintenance the supplier recommends to apply EN 60079-17 and EN 60079-1 standards.
- It is vital to apply fresh copper grease or similar approved greases after threading contact has been disassembled and they will be assembled again.
- If any damage is found, the enclosure should be put out of service and the manufacturer should be contacted.

13. Operation

Special conditions for the safe operation of the MPMS:

- The cylinder is completely assembled.
- The antenna sub-assembly is installed.
- The ATEX protection category „Zone 2“ of the environment is given permanently for the antenna sub-assembly.
- The system consisting of antenna, Evaluation Box, and cylinder is calibrated.
- The antenna is in flawless condition.
- A damaged Evaluation Box may not be installed or operated.
- The operating temperatures for the MPMS are described in Chapter 14
- The operator guarantees that the installation was performed observing all relevant regulations.
- The MPMS may only be operated in cylinders approved by the MPMS manufacturer.
- The Ex e- and Ex d-housings may only be opened and connected by authorized personnel in a safe and clean environment.

14. Specification

You will find the current valid Technical Specification of our sensors on our Homepage under following link:

www.astyx-mps.de

15. Declaration of Conformity Antenna

You will find the current valid Declaration of Conformity for all different Antennas on our Homepage under following link:

www.astyx-mps.de



16. Declaration of Conformity Evaluation Box

You will find the current valid Declaration of Conformity Evaluation Box at our Homepage under following link:

www.astyx-mps.de