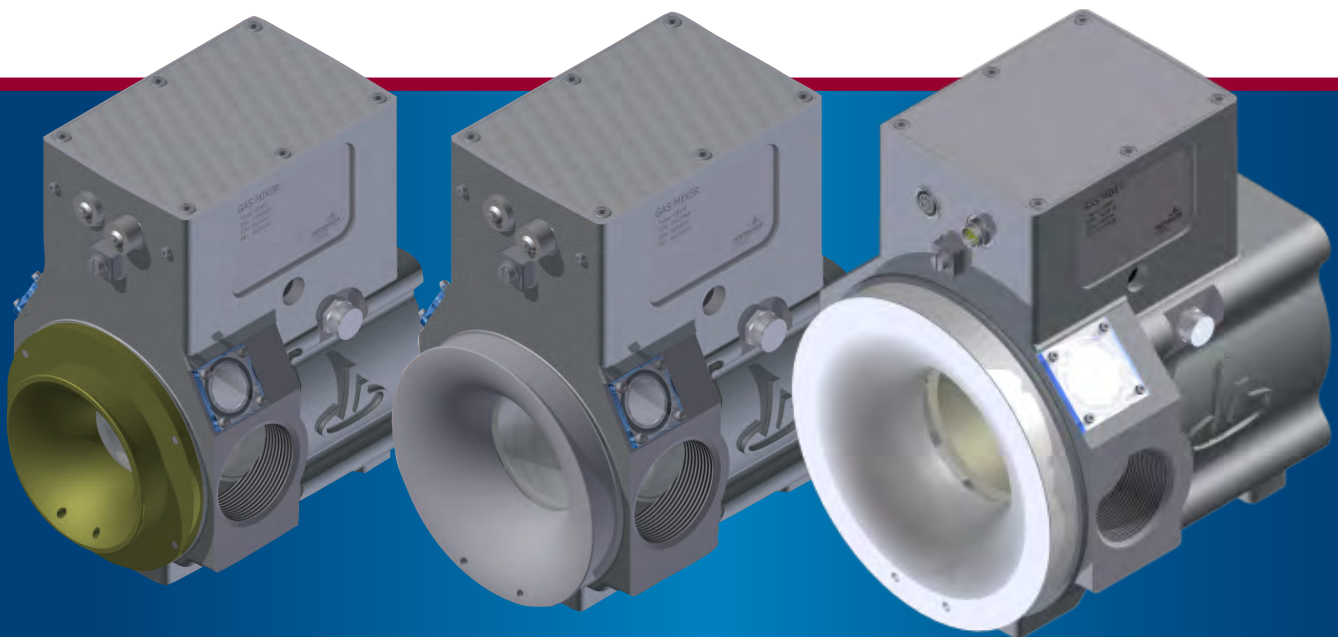


Operating Manual

Gas Mixer EquiCOM Series

EC15/30/60

altronic
HOERBIGER Engine Solutions



1.0 GENERAL INFORMATION

Original instruction manual Gas Mixer EquiCOM

Hoerbiger Ventilwerke GmbH und Co KG

Braunhubergasse 23

1110 Vienna, Austria

www.hoerbiger.com

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3.0 SAFETY

3.1 Safety precautions

Follow all local codes when installing the Gas Mixer EquiCOM. All components should be installed and/or inspected by factory-qualified personnel.

Ensure adequate ventilation in work area in order to prevent accumulation of gas caused by undetected leaks. Accumulations of natural gas or other hydrocarbon vapors can result in high-energy explosions that can damage or destroy structures and cause injury or death to nearby personnel.

An appropriately rated fire extinguisher must be kept in a readily accessible location during all phases of installation.

Observe all warnings found on the equipment. Ensure that warning labels are easily legible and not obstructed by dirt, grease or other equipment.

Do not install any component that appears to have been tampered with, subjected to high temperatures or damaged in any way. Installation of damaged component may result in gas leaks and/or improper operation of the Gas Mixer EquiCOM gas mixer.

Do not attempt to operate engine until thorough leak check has been completed. Use of an industry standard leak detection fluid is required on all gas connections, joints and flanges.

ALL LEAKS MUST BE FIXED PRIOR TO OPERATING ENGINE.

Gas Mixer EquiCOM gas mixer must be used within the temperature and pressure ranges specified in this manual or as otherwise dictated by component labeling. Operation outside of design temperature and pressure limits can result in fire, explosion and/or harm to personnel.

3.2 Special Safety Instructions for Gas Mixers

The Gas Mixer EquiCOM fasteners must be properly tightened and parts must be properly sealed. Exercise caution as some surfaces may become hot. The product must be grounded to avoid the risk of damage due to electrostatic discharge.

**WARNING: EXPLOSION HAZARD .
DO NOT DISCONNECT THIS DEVICE
UNLESS POWER HAS BEEN SWITCHED
OFF OR THE AREA IS KNOWN TO BE
NON-HAZARDOUS.**

4.0 FUNCTION and APPLICATION

4.1 Function

The main task of the Gas Mixer EquiCOM gas mixer is to mix gas and air to get an optimal combustion in a gas engine, see figure 1.

Air is sucked through the air inlet (nozzle) and the pressure in the Venturi tube decreases in accordance with the Bernoulli principle. Negative pressure draws gas in at the lowest flow area, and air and gas are mixed by the Venturi effect.

When using a zero pressure regulator, air and gas are supplied at the same pressure level and air/fuel ratio remains constant over the entire range of power output without changing the position of the Venturi tube. Higher loads cause higher combustion temperatures and, therefore, higher nitrogen emissions (NOx). To keep the NOx constant over the load, an increase of Lambda is necessary, which can be accomplished by changing the gap of the gas mixer. This adjustment can be made by a moveable Venturi tube driven by a stepper motor, which allows gaps between 0 and 13mm.

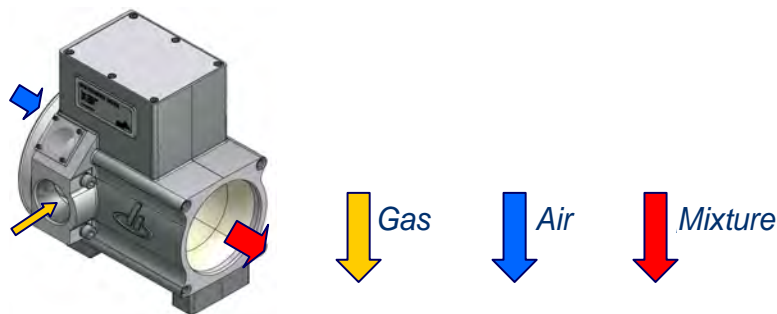


Figure 1: Gas Mixer EquiCOM schematic

4.2 Optimization of Venturi profile

EquiCOM series offers high mixture homogeneity without any mixing inserts and is therefore maintenance free. The optimized and patented shape of the venturi tube avoids flow separations and decreases pressure losses up to 20% compared to standard shapes, resulting in higher engine performance.

4.3 Calculation and Accuracy of Air/Fuel Ratio

A crown, see figure 2, adapts the Gas Mixer EquiCOM to the respective heating values of different qualities of gas, and optimizes the accuracy of the air/fuel ratio.

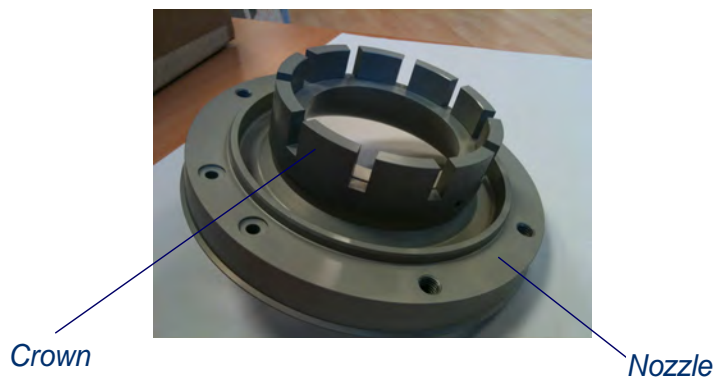


Figure 2: Nozzle and crown

The gas flow is adjusted by the flow area of the crown. For example, natural gas, or high heating value gases, require a small flow area, while biogases, or low heating value gases, require a large flow area.

Gases with extremely low heating values, do not require the use of the crown.

Through adaption, the minimal achievable air/fuel ratio and the accuracy of Lambda (change in Lambda per step) can be optimized.

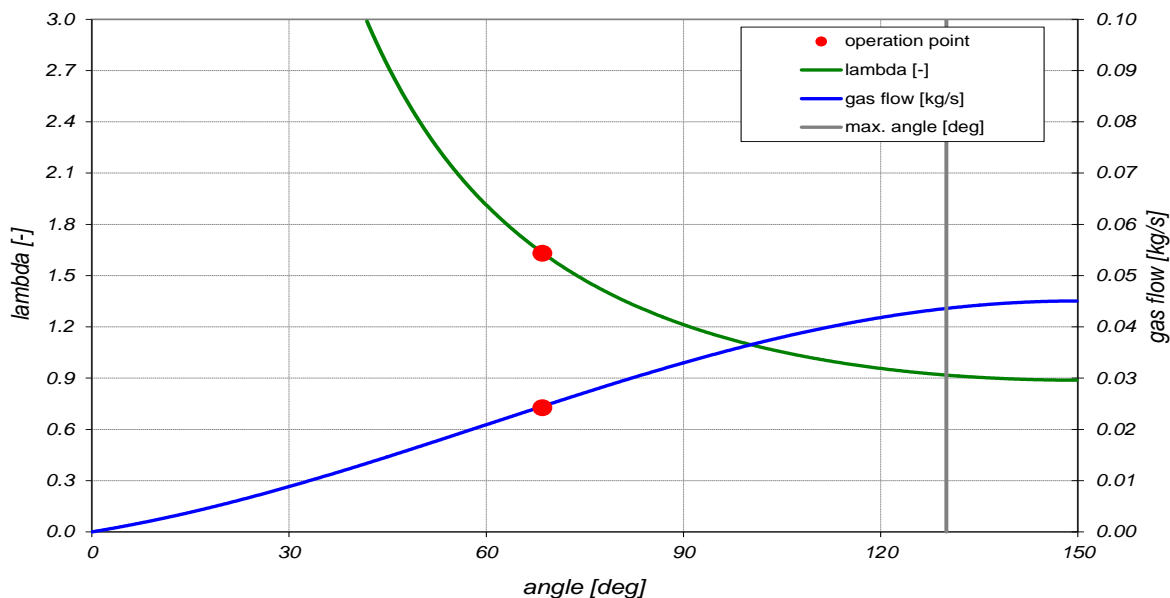


Figure 3: Calculation

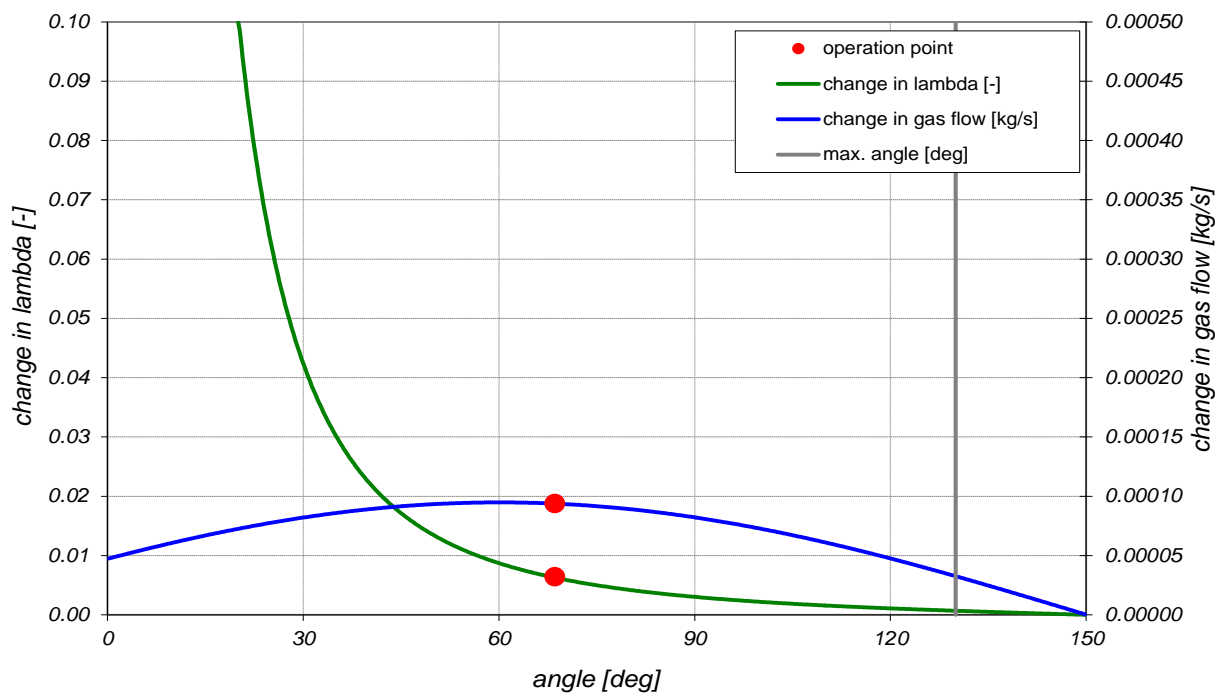


Figure 4: Calculation

With this optimization, changes in Lambda smaller than 1/100 per step are realistic.

Standard crowns for natural gas and biogas (70%CH₄/30%CO₂vol.) are available, and optimized crowns can be ordered. Contact Hoerbiger for information.

4.4 Power Output

Use table 1 to get the right size of EquiCOM for NG and Biogas (30% CO₂, 70% NG) for rich and lean burn (Lambda 1.6) conditions. For other gases and for calculation of crown, please contact Hoerbiger.

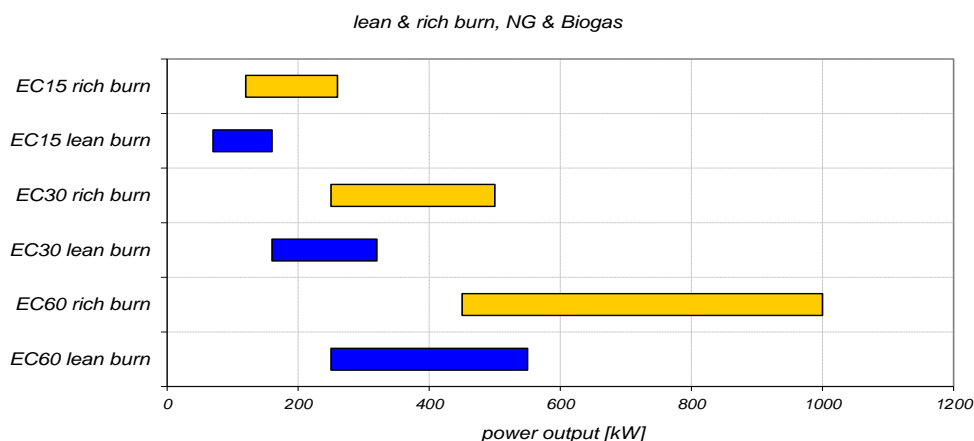


Table 1: Power Output

4.5 Applications

The Gas Mixer EquiCOM can be used in lean or rich conditions, depending on the dimensions of the crown.

Currently approved gas qualities:

Natural gas

Biogas

Other qualities of gas can be approved on demand.

Due to the corrosive components of gas, all parts that come in contact with the gas are coated with a special material.

A zero-pressure regulator is recommended for use upstream of a turbocharger (low pressure mixture formation) to keep the gas pressure at the level of the air pressure. This makes the Venturi principle possible.

The air filter and other components mounted upstream of the turbocharger cause loss of pressure. This current pressure, which is lower than ambient pressure, is passed to the zero-pressure regulator via a redundant connection, the Balance Line. The zero-pressure regulator can govern using the current air pressure at the gas mixer inlet.

The Gas Mixer EquiCOM can also be used downstream of the turbocharger (high pressure mixture formation). In this case, an equal-pressure regulator is required.

4.6 Assembling the Gas Mixer EquiCOM

The Gas Mixer EquiCOM is delivered from the factory with all above described parts and is fully programmed and ready for use. The device must be properly wired, see 3.3.

4.7 Operation

After wiring is completed, and the gas mixer is connected to a power supply, a defined procedure is executed:

reference run to find position closed

run for position of given analog input with every connection to power supply.

4.7.1 Analog input

From factory side, it's possible to set different analog input values between -10 and +10 Volts. Analog current values can be set by using a shunt resistant.

When using a setting of 2 to 10 Volts and a shunt of 500 Ohms, it's possible to use an input of 4 to 20mA.

The factory default setting is 0-10 Volts.

5.0 Product Description

5.1 Design

The gas mixer consists of some main components, which can be found in figure 5.

- housing
- nozzle
- Venturi tube
- crown
- power & I/O connector and RS485 or CANopen connector
- electronics and stepper motor
- window

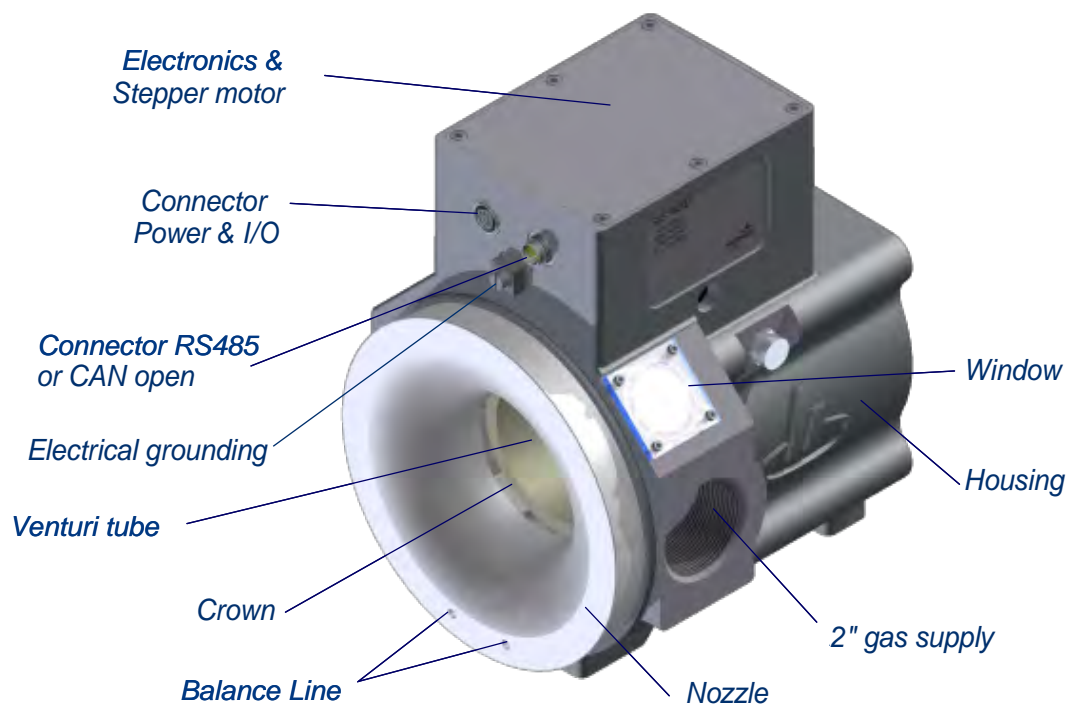


Figure 5: Gas Mixer EquiCOM main components

5.1.1 Housing assembly

The Gas Mixer EquiCOM gas mixer housing assembly is separated into two parts, the housing and the nozzle, which are assembled via four screws, see figure 6.

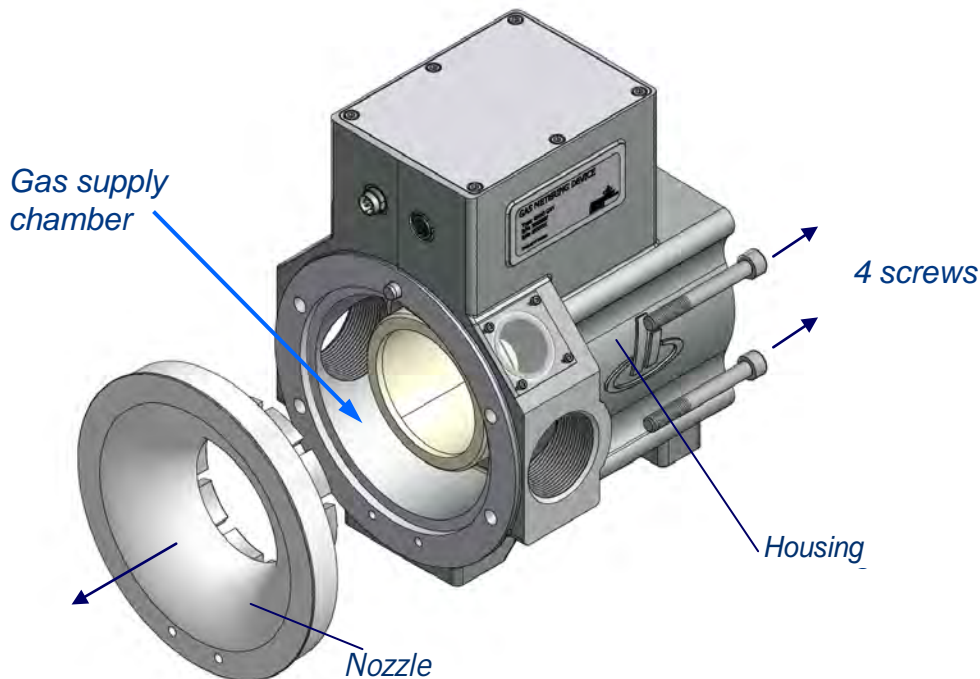


Figure 6: Gas Mixer EquiCOM housing assembly

The separation of the housing from the nozzle offers easy access to the gas supply chamber, and provides:

- easy maintenance of gas supply chamber; removal of residues caused by using contaminated gases
- easy change of crown for adaptation to different qualities of gas or to control the accuracy of the air/fuel ratio

Both parts of the assembly are sealed with O-rings. A bolt is used as an anti-twist device.

5.1.2 Changing of crown

Different crowns, with flow areas, are required for different gas qualities. The gas mixer is provided with a crown, calculated for customer requirements.

The customer can change the crown when using other gas qualities. Crowns for different gas qualities can be ordered from Hoerbiger.

Disassembling:

The four main screws, which connect the housing with the nozzle, have to be removed and the nozzle must be unmounted (see Figure 6). The three headless screws connecting the crown to the nozzle must be loosened so that the crown be changed.

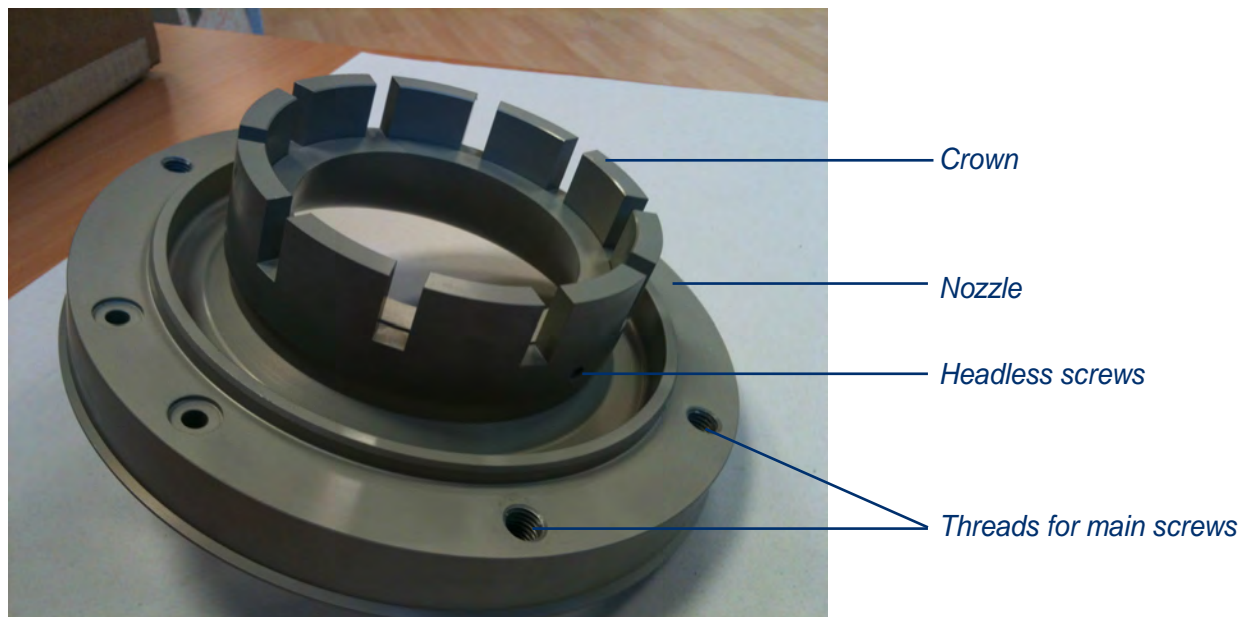


Figure 7: Nozzle and crown

Please note: The last pitch of the headless screw thread is pressed during factory assembly. The headless screws can not be completely removed due to safety reasons.

Reassembling:

Headless screws must be tightened with a torque of 1 Nm. When remounting the nozzle and crown, care must be exercised to make certain that O-rings are properly sealed. Please use appropriate grease for all sealing elements and be aware of shearing. Align the nozzle with the adjust pin and tighten the four main screws with a torque of 10 Nm.

After reassembly, a leakage check must be performed by the customer.

5.2 Sealing points and monitoring

To ensure safety in operation, two independent sealing systems are applied.

After sealing system one, designed as O-ring sealing system, a plug with an air vent membrane is used for reduction of gas pressure in case of a malfunction of the sealing system. This connection can also be used for monitoring of leakage.

Sealing system two is a rotary shaft seal and prevents the electronic and stepper motor chamber from contact with the gas. The chamber is also equipped with an air vent membrane.

Through monitoring of leakage, which has to be done by the customer, it is possible to use the gas mixer in hazardous zones (ATEX Zone 2).

Alternatively, a pressure drop measurement can be done once per year. Hoerbiger recommends using the monitoring connection (M12x1.5) for this test. Testing pressure level and drop is dependent on application. Please contact Hoerbiger for more detailed information.

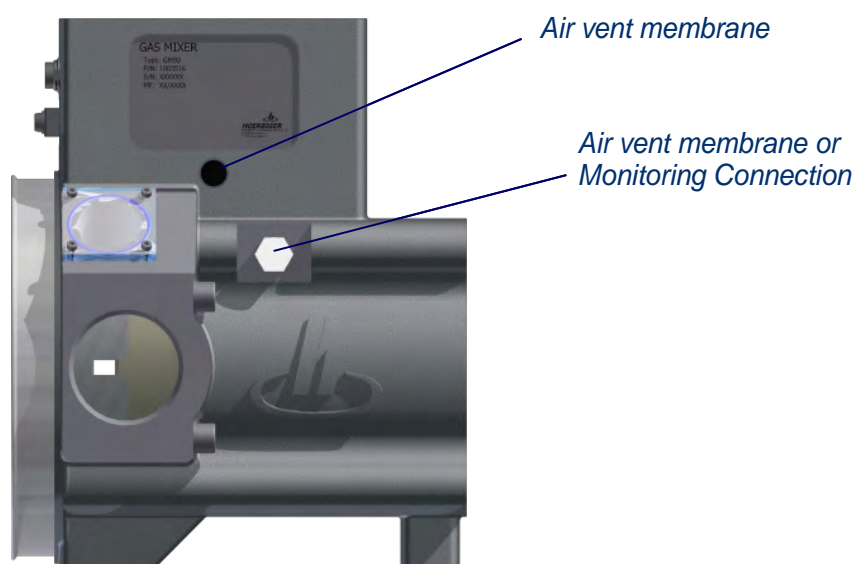


Figure 8: Sealing system and air vents

5.3 Connectors

The Gas Mixer EquiCOM is supplied with two 8-pin connectors, one for power supply, outputs and analog input (male), and one for communication with RS 485 4-wire or CANopen (female). The usage of communication connector without CANopen is not necessary.

Used connectors:

power supply, outputs and analog input: Lumberg 0315-1 U (male)

RS 485 or CANopen: Lumberg 0305-1 U (female)

Counter connectors can be ordered as soldering version or pre-configured with 10m shielded cable.

5.4 Electronics

5.4.1 Stepper motor control

The stepper motor control is a compact and effective constant-current power stage. It is used to control the stepper motor and can be ordered in two different versions:

Communication via RS485 4-wire

Communication via CANopen

The stepper motor control is connected to both connector and to the “level limiter” electronics.

Technical data of stepper motor control

Power supply 12-24V DC

RS485 4-wire or CANopen

1 analog input +10/-10V

Outputs: 3 Open Collector, 24 V / 0,5 A max.

protection: overvoltage, under voltage and temperature of cooling element > 80 °C

The stepper motor control is completely programmed in respect to customer's requirements. No later changes are required for standard use.

5.4.2 Level limiter electronics

The level limiter electronics is connected with an end position switch and the stepper motor control. It ensures a defined run to "position closed".

5.5 Stepper motor

The Gas Mixer EquiCOM includes a high quality stepper motor with a resolution of 0.9 deg/step. In combination with the stepper motor control, the resolution can be improved to ¼ steps (0.225 deg/step), allowing for high and reproducible control accuracy.

5.6 Service interface

The second connector (female) is used for service interface RS485 4-wire. This service interface can be used to parameterize the stepper motor control and stepper motor, after installing software.

Digital outputs, the range of analog input, stepper motor torque, speed... can be changed here.

All changes should only be done in accordance to Hoerbiger specifications.

Changes can cause improper operation of gas mixer and software updates.

5.7 Pin assignment

5.7.1 Power supply and I/O

Pin	Color	Pin assignment
1	Magenta	Output 1
2	Red	Power supply 24V +
3	Green	Output 2
4	White	Power supply 24V +
5	Black	GND (24V-)
6	Grey	Output 3
7	Blue	Analog Input
8	Brown	GND (Input -)

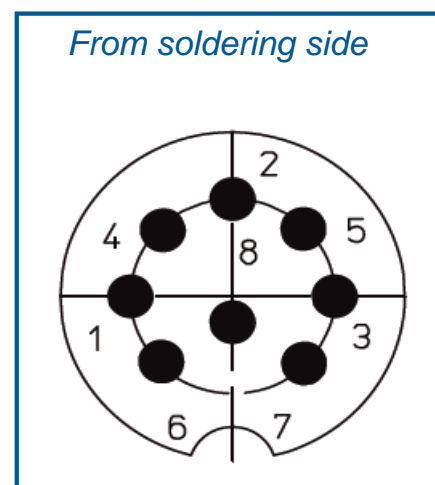


Figure 9: Pin assignment for power and I/O connector

Default settings for I/O are:

Output 1: error

Output 2: ready

Output 3: in motion

5.7.2 Analog Input: 0-10V

Communication: RS485 and CANopen

Pin	Color	RS485 Signal	CAN OPEN Signal
1	Magenta	TX-	CAN low (Can-)
2	Red	TX+	CAN high (Can+)
3	Green	RX-	n.c.
4	White	RX+	n.c.
5	Black	Ground	Ground
6	Grey	-	-
7	Blue	-	-
8	Brown	Ground	Ground

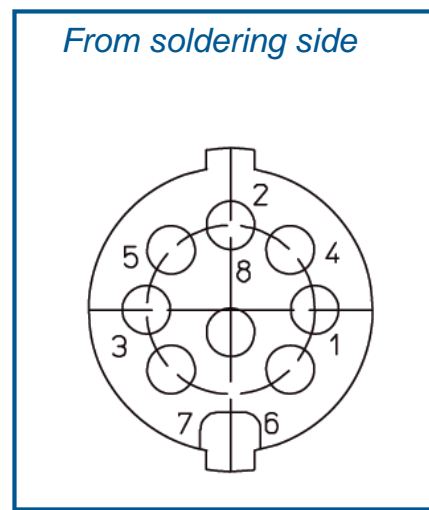


Figure 10: Pin assignment communication

5.8 Installation dimensions

This table shows the main dimensions of the gas mixer:

Device	Air inlet	Gas inlet	Mixture outlet	Dimensions flange
EC60	Ø 200mm, nose Ø 204mm	2" redundant	125mm	Ø 178mm, M12 x 1,75 (4x)
EC30	Ø 140mm, nose Ø 144mm	2" redundant	100mm	Ø 135mm, M8 x 1,25 (4x)
EC15	Ø 100mm, nose Ø 104mm	2" redundant	100mm	Ø 135mm, M8 x 1,25 (4x)

Table 2: Main dimensions

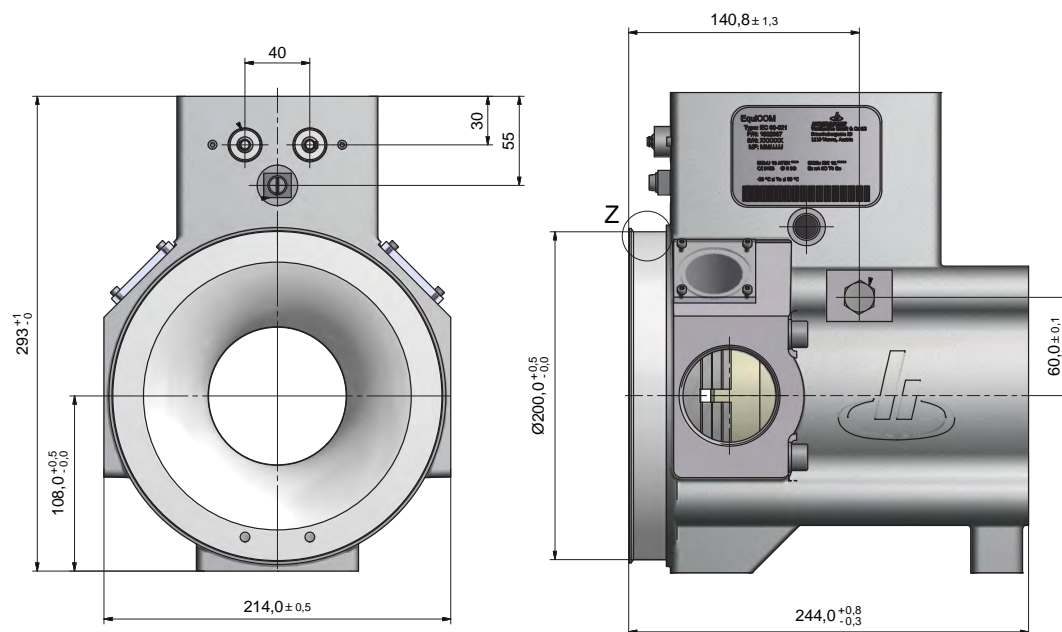


Figure 11: Gas Mixer EquiCOM main dimensions

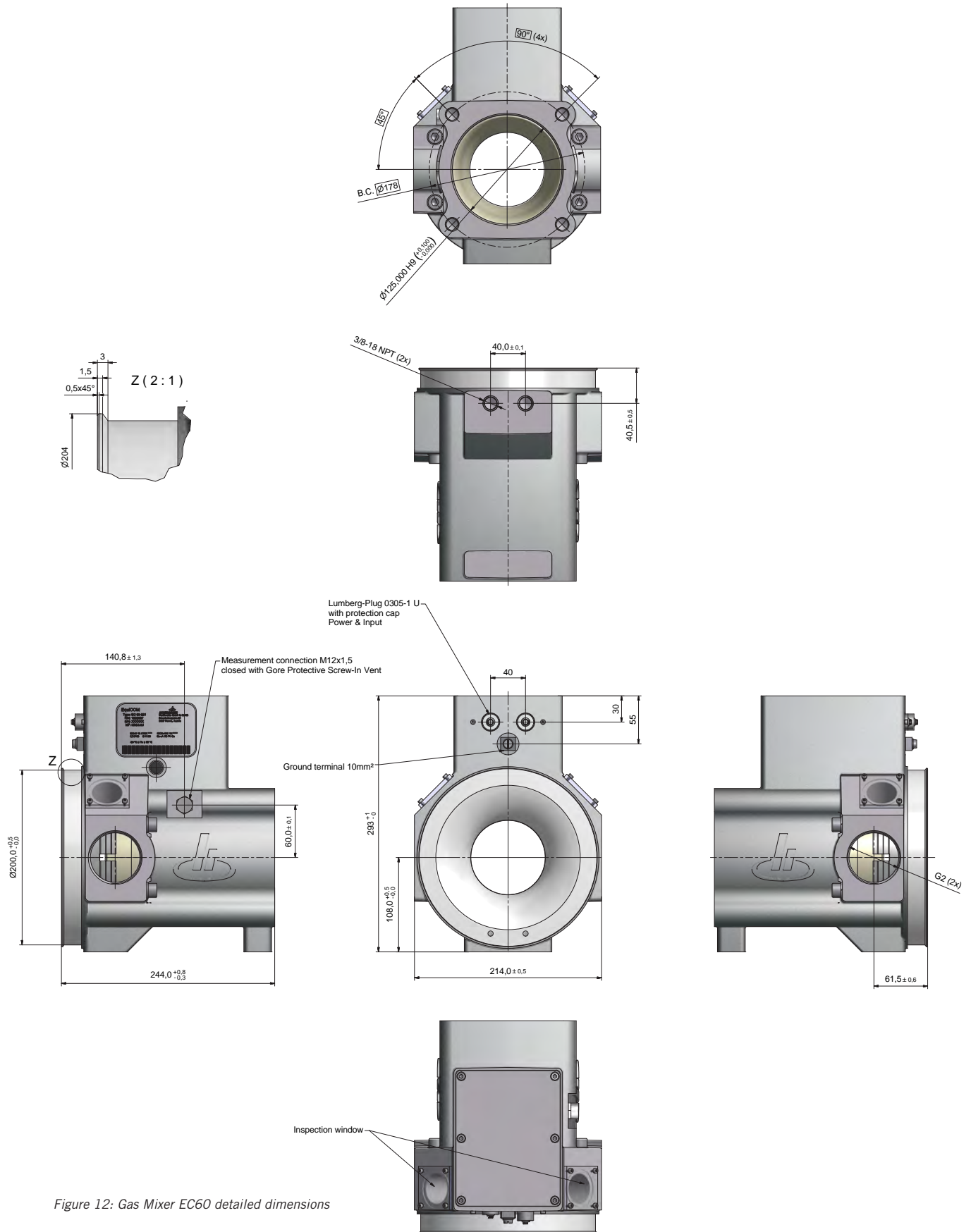


Figure 12: Gas Mixer EC60 detailed dimensions

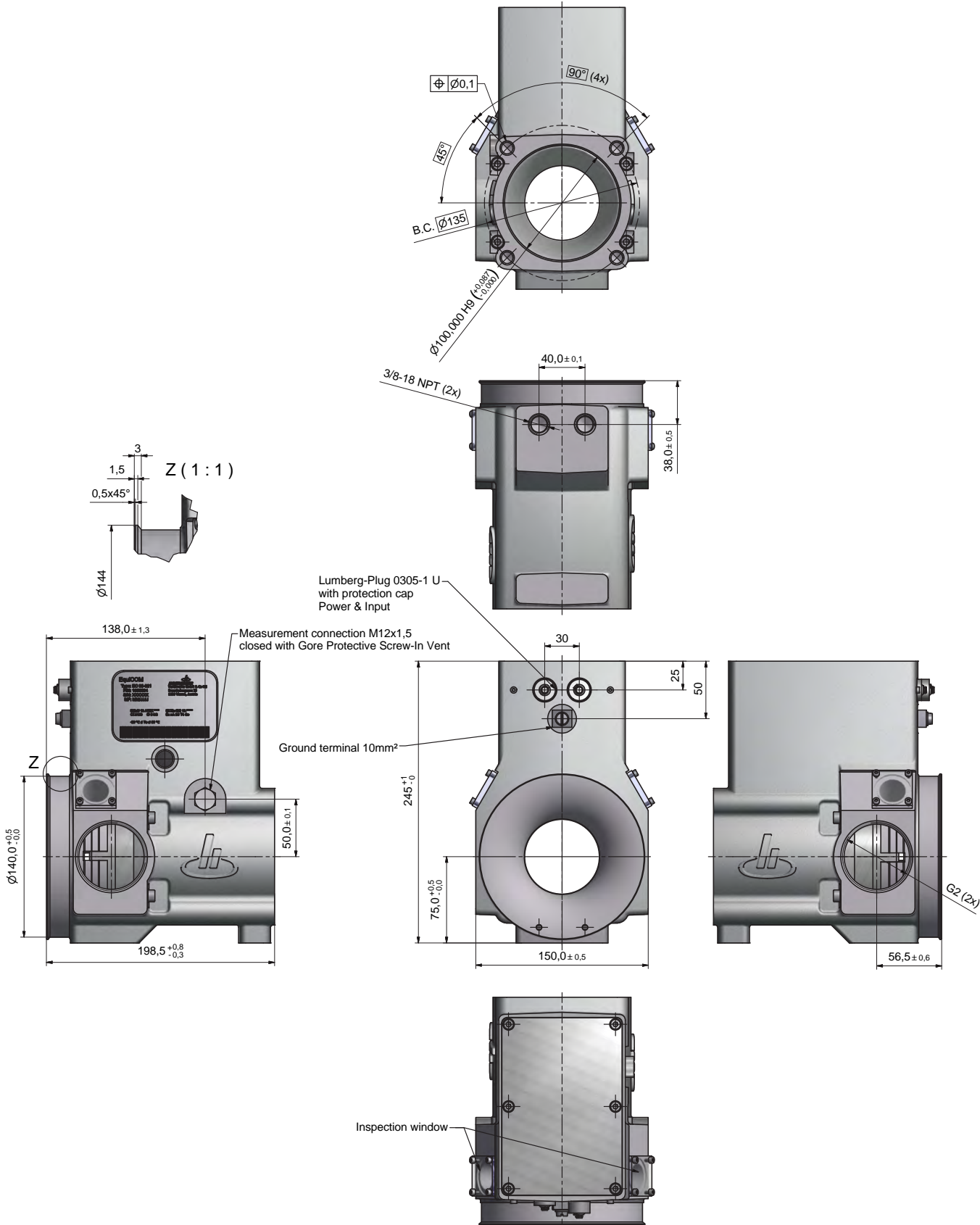


Figure 13: Gas Mixer EC30 detailed dimensions

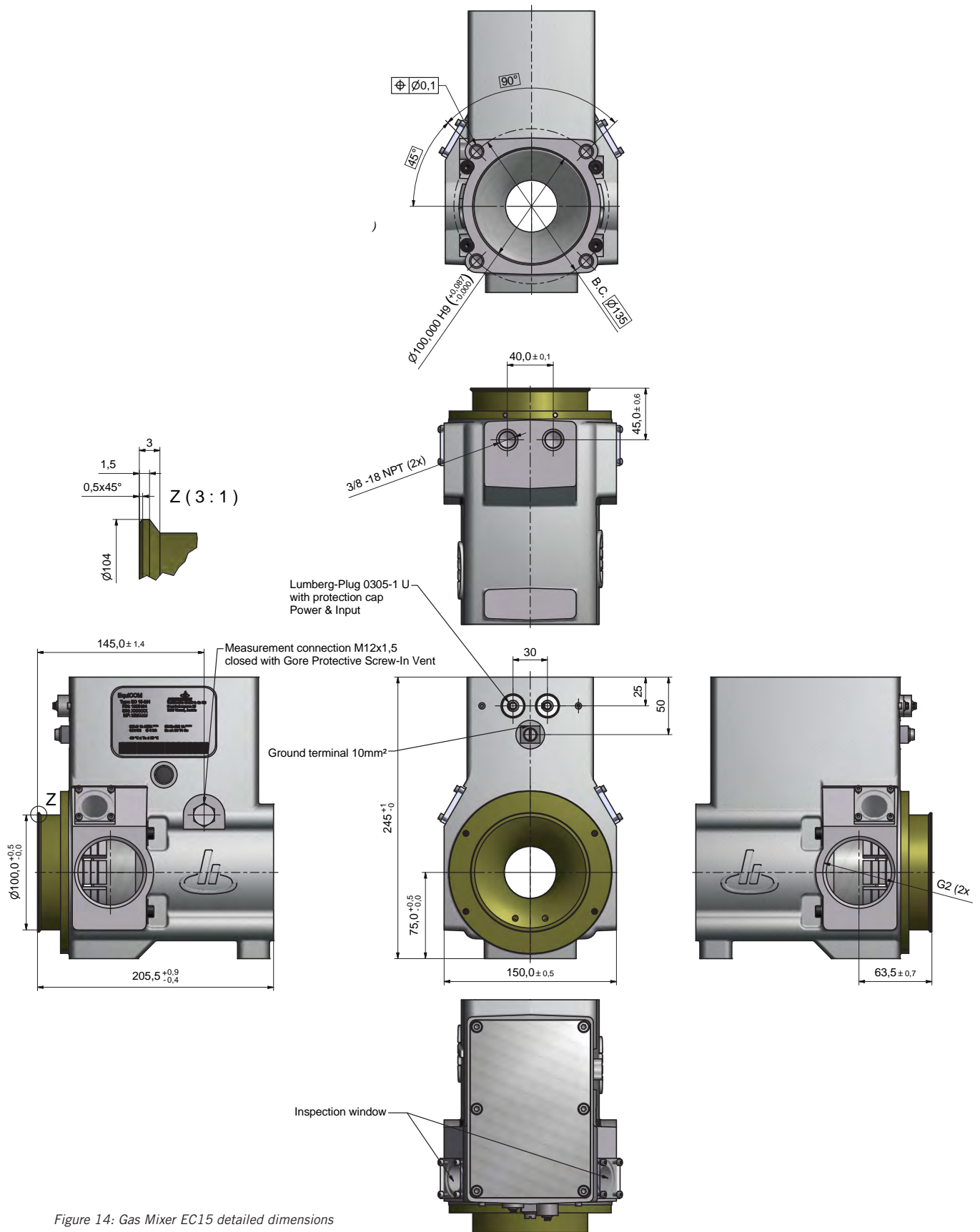




Figure 14: Gas Mixer EC15 detailed dimensions

6.0 Regulatory compliance and environmental specification

Agency listings:

ATEX  II 3G
IECEX Ex nA IIC T4 Gc


Operation temperature: -20 to +80°C

Ingress protection: IP 65

Suitable for operation with natural gas and biogas, other gases on inquiry.

7.0 Error handling and maintenance

7.1 If any error occurs, please disconnect from power supply and reconnect. If the problem still exists, please contact your dealer or Hoerbiger.

7.2 Maintenance

The gas mixer is maintenance free.

When using contaminated gases, stiff running or failing of Venturi tube can occur. If stiff running is observed, please contact Hoerbiger for further information or return Gas Mixer EquiCOM to Hoerbiger. Any maintenance on the gas mixer that requires opening the device must be performed by Hoerbiger-trained personnel only.

8.0 Accessories

8.1 Spare parts

If spare parts are needed, please contact Hoerbiger.

8.2 Accessories — The following parts can be ordered from Hoerbiger:

- Counter connector Lumberg 0315-1
- Preassembled (10m shielded cable) counter connector
- Adapter from Lumberg 0305-1 U to SUB-D 9-pin for RS485 or CANopen communication
- Adapter from SUB-D 9-pin to USB for communication between step per motor control and PC
- Crowns for NG and Biogas
- Other crowns on demand

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