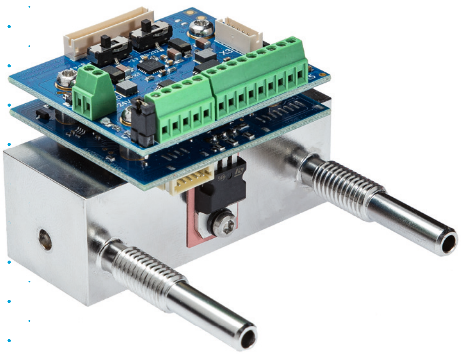
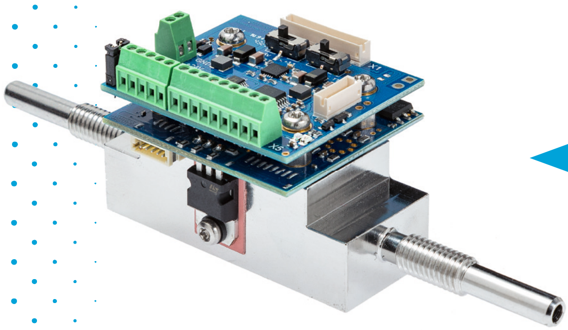
messkonzept
ANALYTICAL TECHNOLOGY



FTC320-OEM

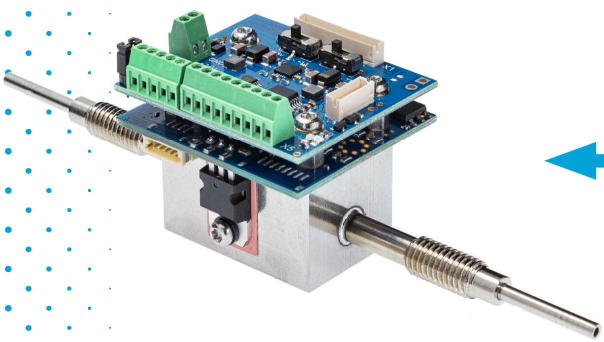
Gas ports ⌀ 6 mm pipe

Operating Manual



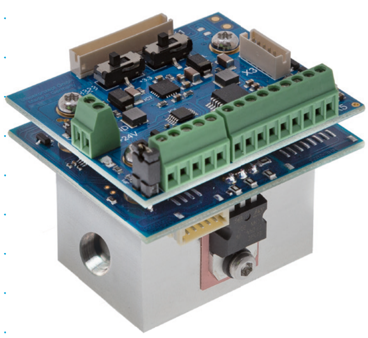
FTC150-OEM

Gas ports ⌀ 6 mm pipe



FTC152-OEM

Capillary gas ports ⌀ 1/8“



FTC180-OEM

Gas ports G1/8“ female thread

About this manual

Thank you for using the Messkonzept OEM device. It has been designed and manufactured using highest quality standards to give you trouble-free and accurate measurements.

This manual mainly describes the FTC320-OEM. All information also applies to the following devices: FTC150-OEM, FTC152-OEM and FTC180-OEM (see Table 1). Unless otherwise stated, they are all electronically identical, but have different block sizes and dimensions.

All information of technical nature and particulars of the product and its use (including the information in this manual) are given by Messkonzept with careful studies. However, it is acknowledged that there may be errors or omissions in this manual. Images and drawings may not be in scale. For the latest revisions to this manual contact Messkonzept or visit www.messkonzept.de Messkonzept welcomes comments and suggestions relating to the product and this manual.

Please Note!
The design of this instrument is subject to continuous development and improvement. Consequently, this instrument may incorporate minor changes in detail from information contained in this manual.

Important!
In correspondence concerning this instrument, please specify the type number and serial number as given on the type label on the right side of the instrument.

All correspondence should be addressed to:

Messkonzept GmbH
Niedwiesenstr. 33
60431 Frankfurt, Germany
Telephone: +49(0)69 530 564 44
Email: info@messkonzept.de
Website: https://messkonzept.de

Date of Release: 2026-01-27

Device	Article No.	Available variants
FTC320-OEM	A140B90xV003	B900 to B903, B907 and B908
FTC150-OEM	A131B90xV001	B900 to B903, B907 and B908
FTC152-OEM	A132B90xV002	B907 and B908
FTC180-OEM	A135B90xV004	B907 and B908

Table 1: Devices and variants covered by this manual

Available variant	Corrosion Protection	Condensation and Dust Protection	Low Flow Gas Sample
B900	–	–	–
B901	Included	–	–
B902	–	Included	–
B903	Included	Included	–
B907	–	Included	Included
B908	Included	Included	Included

Table 2: Attribute description of variants

All images are for illustrative purposes only and may differ from the actual appearance. We reserve the right to make technical changes and deviations in shape, colour and features.

Contents

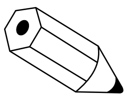
Chapter 1

Safety and general information

This section provides information and warnings which must be followed to ensure safe operation and to retain the instrument in safe condition. Read this section carefully before installing and using the OEM device.

1.1 Notes on Safety Instructions and Icons

This icon draws attention to application errors or actions that can lead to safety risks including the injury of persons or malfunctions or even possibly the destruction of the device.



This icon indicates an additional function or hint.

This symbol indicates hot surfaces (Symbol: W017 – ISO 7010)

This symbol indicates that the components are sensitive to electrostatic discharge (ESD).

1.2 Safety Instructions

Warning!

- For the safe operation of the device, please pay regard to all instructions and warnings in this manual.
- Only put the device into operation after it has been installed properly. A competent and authorized person is required for installation, connection and operation of the device. Please read and follow this manual for the installation.
- Defective devices must be disconnected from the process! This applies for apparent damages of the device, such as physical damages, but also in the case of observed malfunctions in the operation. Separate the device's gas-inlet and gas-outlet from the process and disconnect the power supply from the device.
- Repairs should only be carried out by Messkonzept.

Warning!

- **Beware of the hot surface of the heating elements, which can reach temperatures of up to 95℃, and the metal body of the device, which can reach temperatures of up to 65℃. A risk assessment is strongly recommended in order to determine effective protective measures.**

Warning!

- **Make sure that the electrical installation protection against accidental contact adheres to the applicable safety regulations. The device must be connected to protective earth before all other connections.**

1.3 Intended Use

- The FTC-series of gas analyzers offer high-precision measurement and detection of non-corrosive, dust-, condensate-, aerosol- and oil mist-free gases. Condensate and corrosive tolerant variants are available on request. For more detailed information and solutions about this regard. Please contact info@messkonzept.de.
- Upon installation, the protection class has to be considered. OEM-devices with protection class IP00 demand thermal insulation and electric isolation, as well as mechanical protection for operation.
- FTC-series gas analyzers **do not have** a metrology marking in the sense of EU directive 2014/32/EU. Therefore, they cannot be used in e.g. medical or pharmaceutical laboratory analyses or in the manufacture of pharmaceuticals in pharmacies based on a doctor's prescription.
- The specifications of the device and its manual have to be observed strictly. Please fill out questionnaire for registration of your measuring task, if your intended use does not comply with intended use described above. Based on the information given in the questionnaire Messkonzept will examine the measuring task and possibly authorize it. The questionnaire can be found in the download area on our website https://messkonzept.de/ under 'Measuring Task'.
- Combustible gases: The inner gas path of the detector is checked for leaks during production. The supply of flammable gases is permitted, but the tightness of the connections and the detector must be checked before commissioning and regularly during operation. Gas leaks can cause an explosive atmosphere!
- Ignitable gases: Our appliances are designed in such a way that ignition will not occur if gases up to temperature class T3 are supplied during correct operation; the maximum surface temperature is below 200 °C. A fault in the appliance can lead to ignition. Users of our appliances must always carry out an individual risk assessment before use, from which the necessary protective measures must be derived and implemented. The use of flame arresters as part of the individual concept for handling flammable mixtures is strongly recommended. We will be happy to provide you with an individual quotation if you require flame arresters.

1.4 Disposal Instructions

The device must not be disposed of as municipal waste (domestic waste). If the device needs to be disposed of, please contact your local waste disposal company or send it directly to us with sufficient postage. We will dispose of the components properly and in an environmentally friendly manner.

Chapter 2

Basic Knowledge

2.1 Thermal Conductivity Detector (TCD)

Thermal Conductivity Detectors (TCD) have been used in the chemical industry since the 1920s as the first process gas analyzers for the quantitative composition of gas mixtures. Every gas has a unique heat conductivity that is governed by its molar mass and viscosity. The measurement is based on the principle that the thermal conductivity of a gas mixture is dependent on the thermal conductivity of its gas components and their fractional amounts in the mixture. Thus, the concentrations of different components of a gas mixture can be calculated from the thermal conductivity.

The main advantage of the TCD's measurement principle compared with the wide spread infrared analysis technique is that it is not limited to gases with a permanent dipole moment. It can identify noble gases (He, Ar, Ne, etc.) as well as homonuclear gases such as H_2 and N_2. Furthermore, it is robust and cost effective. The principle of thermal conductivity measurement works best if the analyzed gas components' thermal conductivity vary greatly. For TC measurement based analysis, one of the following conditions must be met:

- The mixture contains only two different gases (binary mixture), e.g. CO_2 in N_2 or H_2 in N_2.
- The thermal conductivity of two or more components is similar but different than that of the measuring gas, e.g. measuring H_2 or He in a mixture of O_2 and N_2 (quasi binary mixture.)
- The mixture contains more than two gases and the volumetric fractions of all but two components (or component groups) are constant over time.
- The mixture contains more than two gases, of which all but two components' concentrations can be determined through other measurement principles.

The thermal conductivity of gases rises with temperature and the slope of the increase with temperature is different for different gases. Upon request, it can be checked whether the temperature of heat sink and/or source should be changed in order to improve the accuracy or to avoid cross-sensitivity effects.

Cross-sensitivity is the sensitivity of the measurement on other gases different than the measured component.

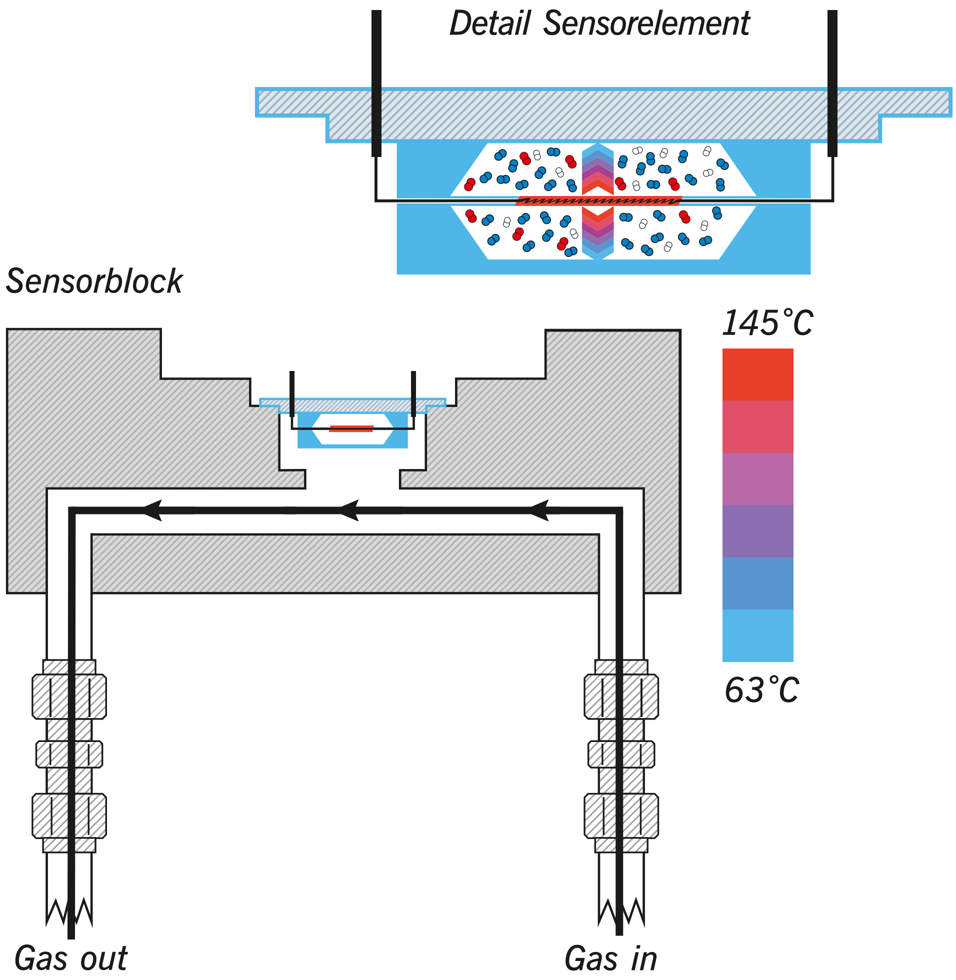


Figure 2.1: Schematic drawing of thermal conductivity measurement. The sensor is mounted in the stainless steel block that is kept at a constant temperature.

The FTC320-OEM contains a TC sensor that analyzes the quantitative composition of gas mixtures. The measurement is based on the heat transfer between a heat source and a heat sink.

The measuring gas is led through a stainless steel block that is kept at a constant temperature of 63°C (for most applications). The block temperature is stabilized using a control loop - it serves as a heat sink of constant temperature. A micro mechanically manufactured membrane with a thin-film resistor serves as heat source. A control loop stabilizes the membrane temperature at 145°C (for most applications).

Above and below the membrane two small cavities are etched into the silicon. These cavities are filled with measuring gas by diffusion. The surfaces opposite to the membrane are thermally connected with the heat sink. Through maintaining a constant temperature gradient between the two opposite surfaces, the heat flow is dependent of the gas mixture's thermal conductivity alone. Hence the voltage needed to keep the membrane temperature constant is a reliable measure for the thermal conductivity of the mixture and can be used further to determine the gas mixture's composition.

2.2 Measuring Range

Table 2.1 lists common gas pairs and their measuring ranges.

Measuring Gas	Carrier Gas	Basic range	Smallest range	Smallest range at end
H_2	He	20% - 100%	20% - 40%	85% - 100%
H_2	CH_4	0% - 100%	0% - 0.5%	98% - 100%
H_2	N_2 or air	0% - 100%	0% - 0.5%	98% - 100%
H_2	Ar	0% - 100%	0% - 0.4%	99% - 100%
H_2	CO_2	0% - 100%	0% - 0.5%	98% - 100%
He	N_2 or air	0% - 100%	0% - 0.8%	97% - 100%
He	Ar	0% - 100%	0% - 0.5%	98% - 100%
CH_4	N_2 or air	0% - 100%	0% - 2%	96% - 100%
CH_4	Ar	0% - 100%	0% - 1.5%	97% - 100%
O_2	N_2	0% - 100%	0% - 15%	85% - 100%
O_2	Ar	0% - 100%	0% - 2%	97% - 100%
NH_3	H_2	0% - 100%	0% - 5%	95% - 100%
N_2	Ar	0% - 100%	0% - 3%	97% - 100%
N_2	CO_2	0% - 100%	0% - 3%	97% - 100%
CO	H_2	0% - 100%	0% - 2%	99% - 100%
Ar	N_2 or air	0% - 100%	0% - 3%	97% - 100%
Ar	CO_2	0% - 100%	0% - 50%	80% - 100%
CO_2	N_2 or air	0% - 100%	0% - 3%	96% - 100%
CO_2	Ar	0% - 100%	0% - 20%	50% - 100%
SF_6	N_2 or air	0% - 100%	0% - 2%	96% - 100%

Table 2.1: The measuring ranges for typical gas compositions analysed with the FTC devices are given in Vol. %.

2.3 Basic Range and Smallest Range

This section explains the concept of the basic range and how the smallest ranges in the table above relate to the specifications in table 2.1.

2.3.1 Basic Range

The basic range refers to the full concentration range over which a gas pair can be linearized. For most gases, this is 0–100 Vol.%. Calibration for the basic range is performed at both endpoints using pure gases. For example, in the case H_2 in N_2, calibration would be done with pure H_2 and pure N_2.

2.3.2 Other Calibration Ranges

If only a part of the basic range is relevant for a specific application, a smaller calibration range can be used. For instance, if only concentrations up to 10 Vol.% H_2 in N_2 are of interest, calibration can be performed using pure N_2 and a 10% H_2/N_2 mixture. This reduces the linearity error for the concentrations relevant in this application and can lead to a larger linearity error outside the relevant range. The linearity error is specified as 1% of the calibrated range.

2.3.3 Smallest Range

There is a limit to how much the calibration range can be reduced before it no longer improves measurement accuracy. This limit is referred to as the smallest range. Within this range, the linearity error is already so small that further narrowing the range would not yield any practical benefit, as other factors (e.g., repeatability, drift) become the dominant sources of uncertainty. The smallest range is therefore used as a reference for accuracy. Many specifications are expressed as a percentage of this range—most commonly 1% of the smallest range.
Example: H_2 in N_2.

For a smallest range of 0–0.5 Vol.%, 1% corresponds to 50 ppm. For a smallest range of 98–100 Vol.%, 1% corresponds to 200 ppm.

These smallest ranges are defined such that all specifications (linearity, repeatability, etc.) are met within them.

2.4 Basic calibration knowledge

2.4.1 Offset and Gain Calibration

The aim of calibration is to ensure that the measured concentration matches the specified test gas concentration. This is achieved by the correct adjustment of two calibration parameters, called "offset" and "gain", which correspond to the ordinate intercept and the slope of a linear equation calculated in the device. Figures 2.2 and 2.3 explain how offset and gain correction works.

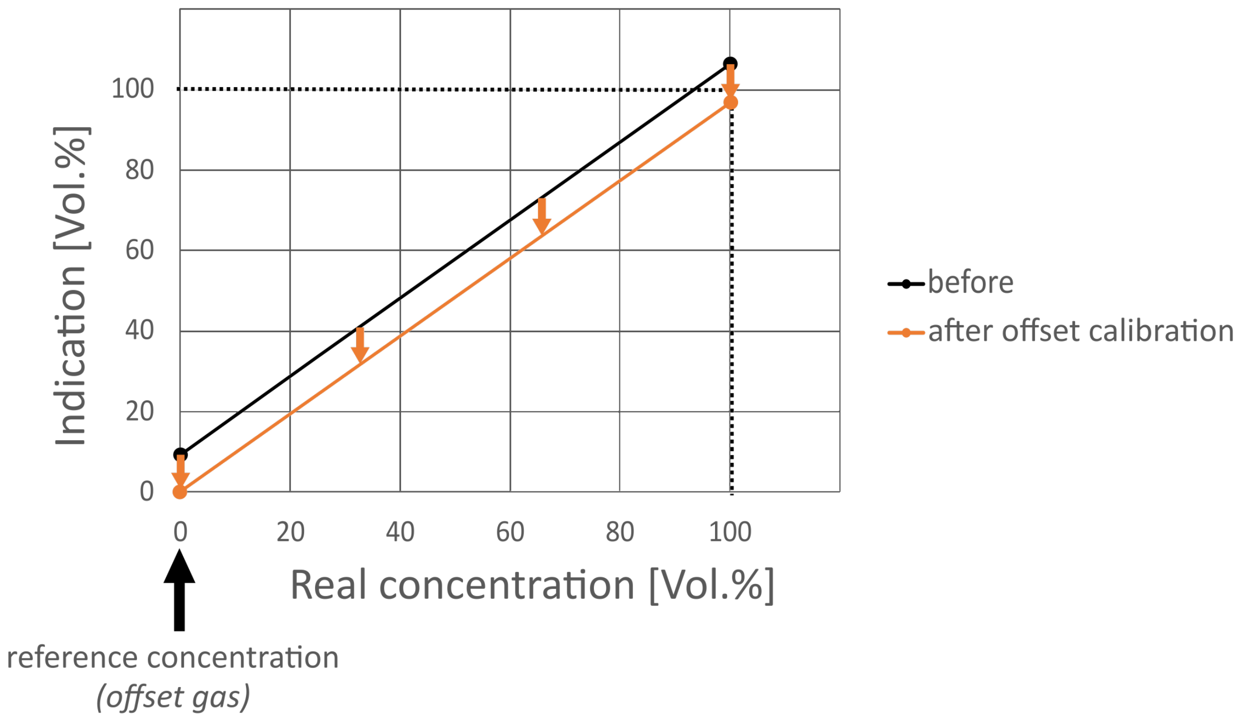


Figure 2.2: Offset calibration

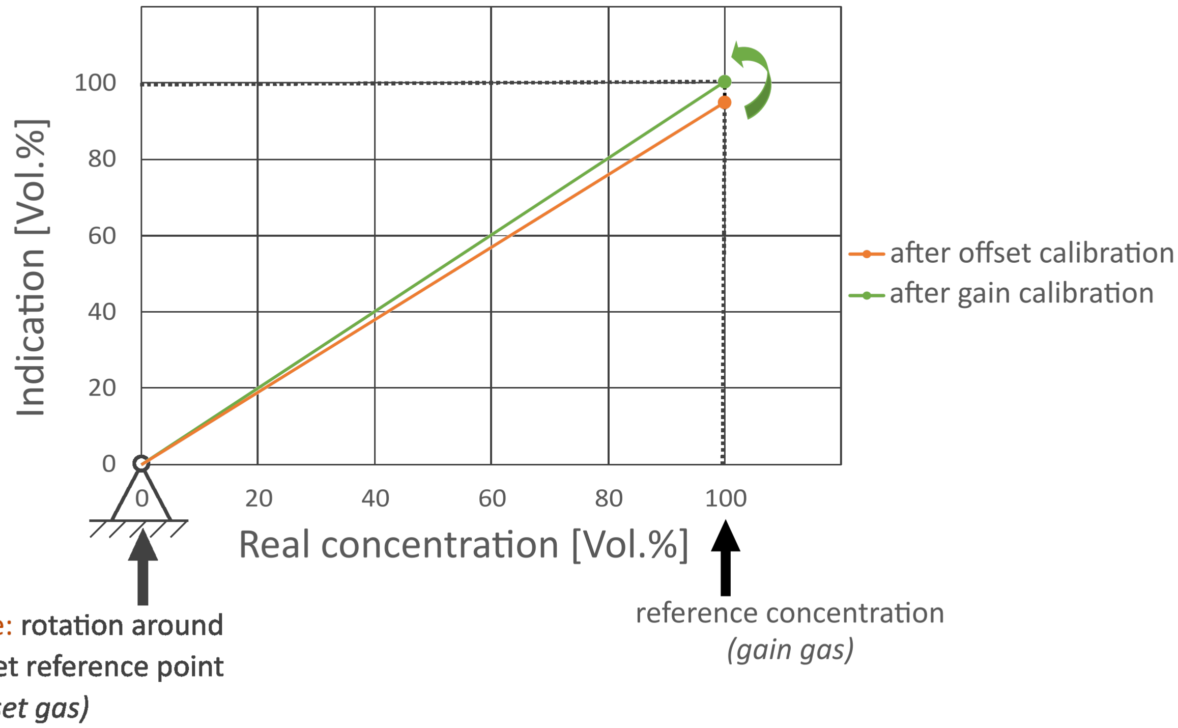


Figure 2.3: Gain calibration after offset calibration.

For a determination of offset and gain a two-point calibration must be performed. The concentration of the offset test gases should be close to the start-point, and the concentration of the span (Gain) test gas should be close to end-point of the measuring range (a difference of ±10% of the measuring range from the start- or end-point is permissible). For instance, when measuring H_2 in O_2 at a measuring range from 0 Vol.% – 100 Vol.%, use pure O_2 as offset test gas (Offset Gas = 0 Vol.% H_2 in O_2) and pure H_2 as the gain test gas (Gain Gas = 100 Vol.% H_2 in O_2).

Two-point calibration always requires an offset calibration directly before a gain calibration! **A onepoint calibration, in which only a new offset value is determined, is sufficient in most cases.** It is suitable for correcting drift or changes in operating parameters such as flow rate, pressure, or dew point. Compared to the offset, the gain is stable over years and practically unaffected by changes in flow or pressure. In the case of a pure offset calibration, a test gas with any concentration in the measuring range can be used but must be set before starting the offset calibration.

2.4.2 Performance check with test gas

During a performance test, the response of the device to a test gas that is within the measuring range is monitored and recorded. In contrast to a calibration, the settings of the device are not changed. An inspection of the recorded performance test might uncover phenomena that can be obscured by repeated calibration. This applies, for example, to a persistent signal drift or a periodicity in the signal curve due to unsteady flow, pressure, or dewpoint. The correct indication of the test gas is almost always sufficient to prove that the device is working properly.

2.4.3 Influence of a pressure change of 10 hPa

The signal change caused by a pressure increase of 10 hPa starting from different absolute pressures is specified. The influence of pressure changes increases below 800 hPa. Above 1200 hPa, the influence of pressure changes decreases.

		Absolute Pressure		
Linearisation	**Gas Concentration**	**800 hPa**	**1000 hPa**	**1200 hPa**
H_2 in N_2	0 Vol.% H_2 (=100Vol.% N_2)	27 ppm/10hPa	19 ppm/10hPa	15 ppm/10hPa
	100 Vol.% H_2	207 ppm/10hPa	138 ppm/10hPa	99 ppm/10hPa
He in N_2	0 Vol.% He (=100Vol.% N_2)	44 ppm/10hPa	31 ppm/10hPa	23 ppm/10hPa
	100 Vol.% He	184 ppm/10hPa	122 ppm/10hPa	87 ppm/10hPa
O_2 in N_2	0 Vol.% O_2 (=100Vol.% N_2)	1381 ppm/10hPa	984 ppm/10hPa	752 ppm/10hPa
	100 Vol.% O_2	2389 ppm/10hPa	1614 ppm/10hPa	1185 ppm/10hPa
CO_2 in N_2	0 Vol.% CO_2 (=100Vol.% N_2)	-272 ppm/10hPa	-193 ppm/10hPa	-146 ppm/10hPa
	100 Vol.% CO_2	-286 ppm/10hPa	-215 ppm/10hPa	-166 ppm/10hPa

Table 2.2: Influence of a pressure increase of 10 hPa

2.4.4 Test Gas Quality

A test gas of sufficient quality for your application should be used for performance testing and calibration. For calibration, Messkonzept uses gases with the following purities:

Gases	H_2	He	N_2	Ar	O_2	CO_2	CH_4
Purity	5.0	5.0	5.0	4.6	4.5	4.5	3.5

Table 2.3: Recommended calibration gas purities.

The gas purities are selected so that the devices comply with the specifications for the smallest measuring range. Messkonzept recommends gases of the same purity for on-site calibration. If your own requirements differ, please choose the appropriate gas purity. Please contact Messkonzept if you would like advice.

2.4.5 Criteria For Test and Calibration

Carry out a test or calibration under - as far as possible - similar physical conditions to those used for the measurement, e.g. pressure, flow, temperature, filtration, dew point, etc.

A performance test and, if necessary, calibration with test gases is required if one of the following criteria is met:

- After new installation of the device or after it was serviced.
- After changes to the sample preparation system and outlet that affect, for example, pressure, flow, temperature, filtration, dew points, etc.
- In a regular cycle, depending on the desired accuracy - but at least once a year! To determine the appropriate time interval, we recommend starting with a more frequent recorded performance test and determining the optimum interval from these results. The time between tests/calibrations can be in the range of:
  - months for a measurement task in the basic or medium measuring ranges.
  - days to weeks for small measurement (low- or sub-vol%) ranges.
  - directly before each measurement if maximum accuracy is required.

Chapter 3

Installation of the Instrument

3.1 Mounting

Caution!
Do not put the device into operation until it has been properly installed. A competent and authorized person is required for installation, connection and operation of the device.

Warning!
Beware of the hot surface of the heating elements, which can reach temperatures of up to 95 °C, and the metal body of the device, which can reach temperatures of up to 65 °C. A risk assessment is strongly recommended in order to determine effective protective measures.

Warning!
Make sure that the electrical installation protection against accidental contact adheres to the applicable safety regulations. The device must be connected to protective earth before all other connections.

3.1.1 Insulated screw Mounting

The bottom view of the OEM devices shows four M3 thread holes, which can be used to fix the detector (see Figure 3.1). Do not mount directly on heat conductive surface. Use insulating spacers (min. 4mm thick) and stainless-steel screws, to minimize the heat dissipation from the 63 °C hot detector body.

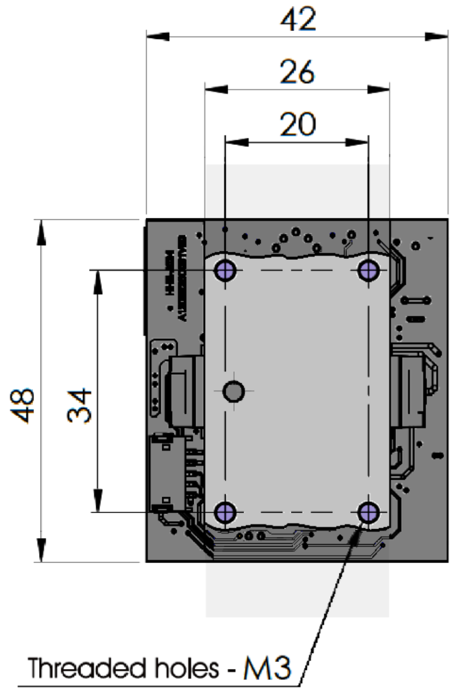


Figure 3.1: Dimensions of the four mounting points with M3 screws for all OEM devices

3.1.2 Bulkhead Mounting

For bulkhead mounting, two spacers and two M8 nuts are available upon request (see Figure 3.2).

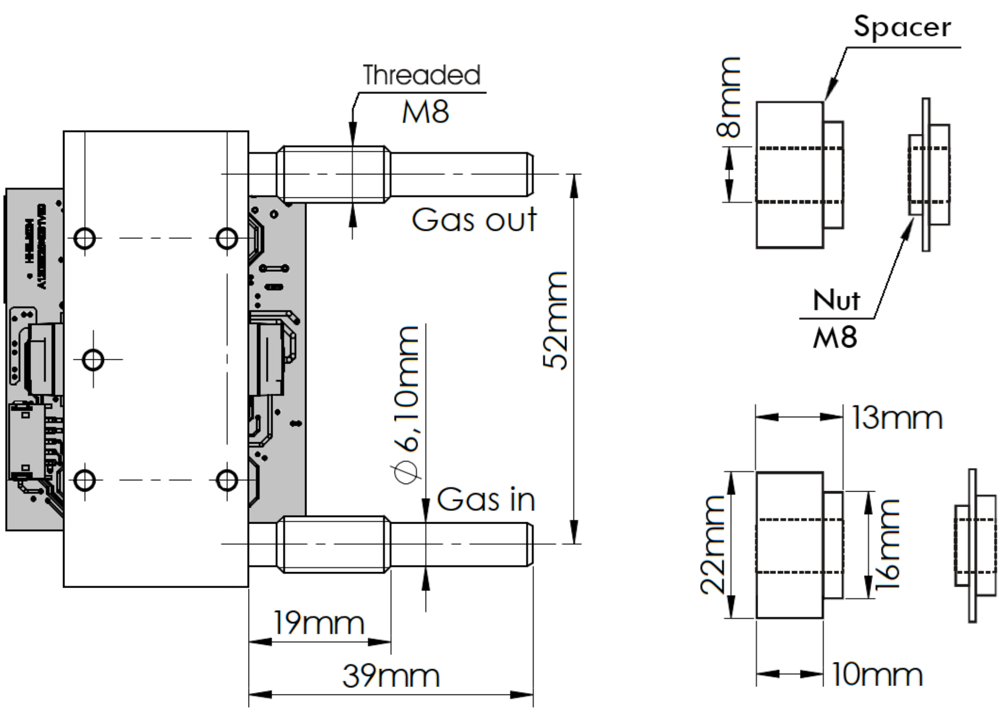


Figure 3.2: Dimensions of the FTC320-OEM for mounting on 6 mm tubes.

3.2 Housing and insulation

Thermal insulation and Electromagnetic protection

The OEM device must not be exposed to any air flow, e.g. from fans. That's why Messkonzept strongly recommends using housing for the OEM device. The immediate ambient atmosphere must not be corrosive. The use of additional insulation is optional, but may become necessary for ambient temperatures below 0 °C. Do not use flammable material for insulation. It should be temperature-resistant up to 120 °C. The circuit boards must not be covered by the insulation. The system is equipped with a thermal fuse that interrupts the current to the heaters when the temperature rises above 110 °C. Please consider the waste heat from other appliances in the vicinity. They must not cause a temperature rise above 50 °C in the ambient.
The OEM device does not meet Electromagnetic Compatibility (EMC) requirements without proper shielding and housing. It is the customer's responsibility to implement EMC measures.

3.3 Gas Connections

3.3.1 Overview of gas connections

The inner gas duct is heated up to 63 °C (versions with higher temperatures available on demand). Condensation in the sample gas lines and connections must be strictly avoided. Heated lines and connections can be used in order to prevent condensation. With proper heated lines and connections, a dew point up to 50 °C is permissible.

Warning!
The gas led into the device must not contain any dust, condensate or potentially condensing matter unless the OEM device unit is equipped with a filter membrane protecting against condensate and dust. Liquid droplets or dust will immediately destroy the sensor element upon contact. If your gas sample may not be dust-, condensate- or corrosion-free, please state this in your request and we will provide you with a suitable OEM device unit (see Tables 1 and 2).

3.3.2 Gas Connections of the FTC320-OEM and FTC150-OEM

The FTC320-OEM and FTC150-OEM devices have gas inlet and outlet tubes with an outer diameter of 6.10 mm, which are designed for a compression fittings (see figures 3.3 and 8.1 onwards).

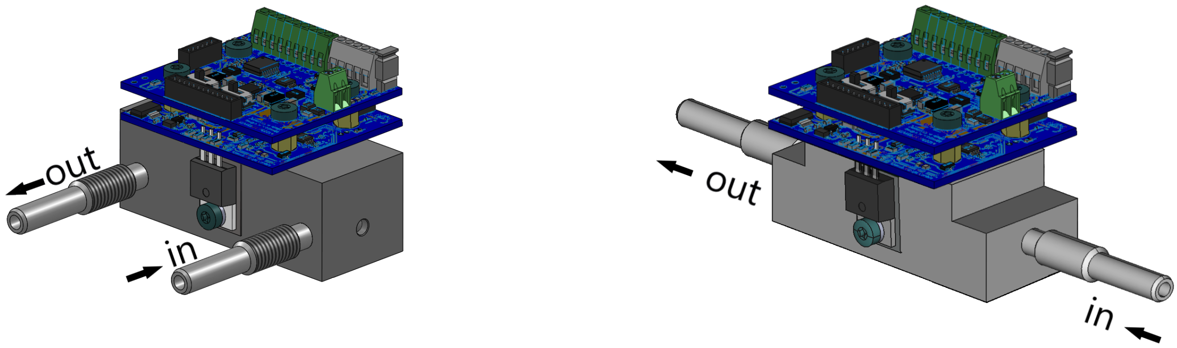


Figure 3.3: View of the FTC320-OEM from the bottom.

3.3.3 Gas Connections of the FTC152-OEM

The FTC152-OEM device has gas inlet and outlet tubes with an outer diameter of 1/8 inch (3.18 mm) that are designed for a compression fitting (see figures 3.4 and 8.9 et seqq.).

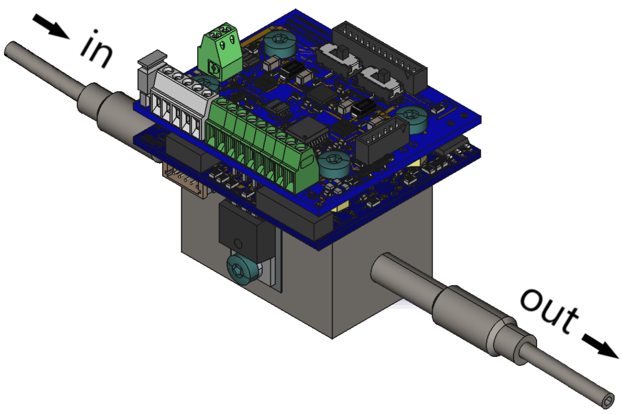


Figure 3.4: Gas Connections of the FTC152-OEM

3.3.4 Gas Connections of the FTC180-OEM

The gas inlet and outlet connections on the FTC180-OEM device are designed for screw-in fittings with G1/8 inch internal thread (see figures 3.5 to 3.7 and 8.13 et seqq.).

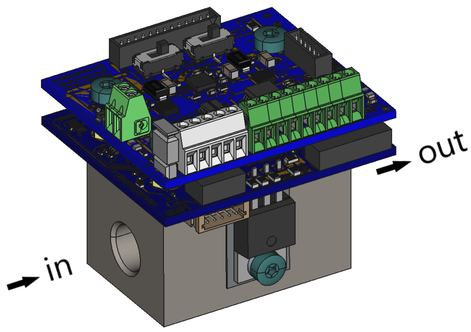


Figure 3.5: Gas Connections of the FTC180-OEM

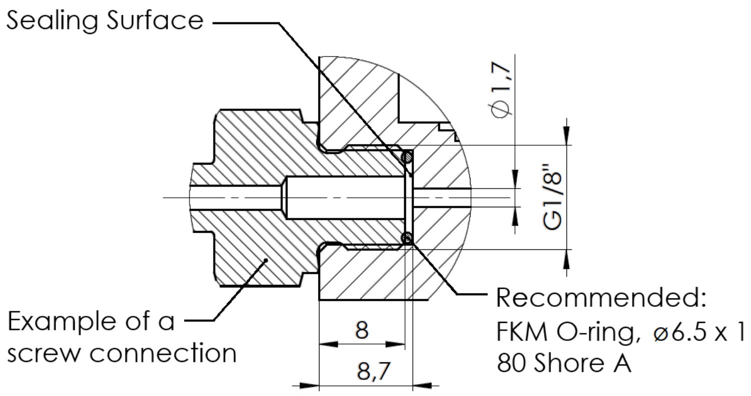


Figure 3.6: This is an example of a basic O-ring seal screw connection for the FTC180-OEM.

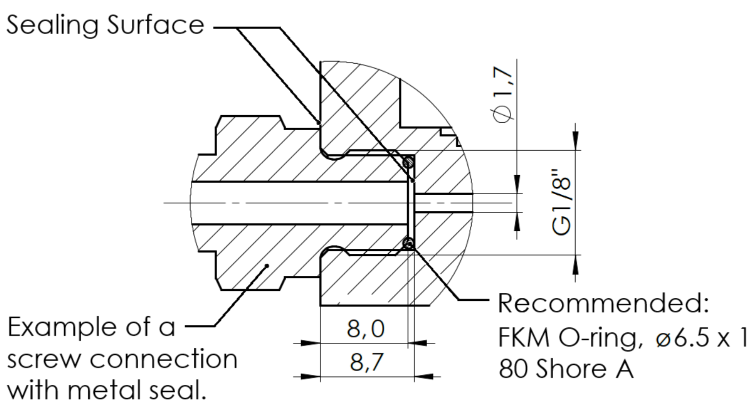
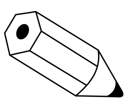


Figure 3.7: This is an example of a permanent metal-to-metal seal screw connection for the FTC180-OEM.



Recommendation: To ensure a gas-tight connection, the manufacturer's installation instructions for the screw-in fittings must be followed.
To avoid dead volume, it is advisable to position an additional O-ring on the inner sealing surface (see Figures 3.6 to 3.7).

3.4 Electrical Connection

Figure 3.8 shows the electric connectors of the OEM devices. Connections are to be realized with cabels of from 20 AWG to 22 AWG which fit into the screw terminals.

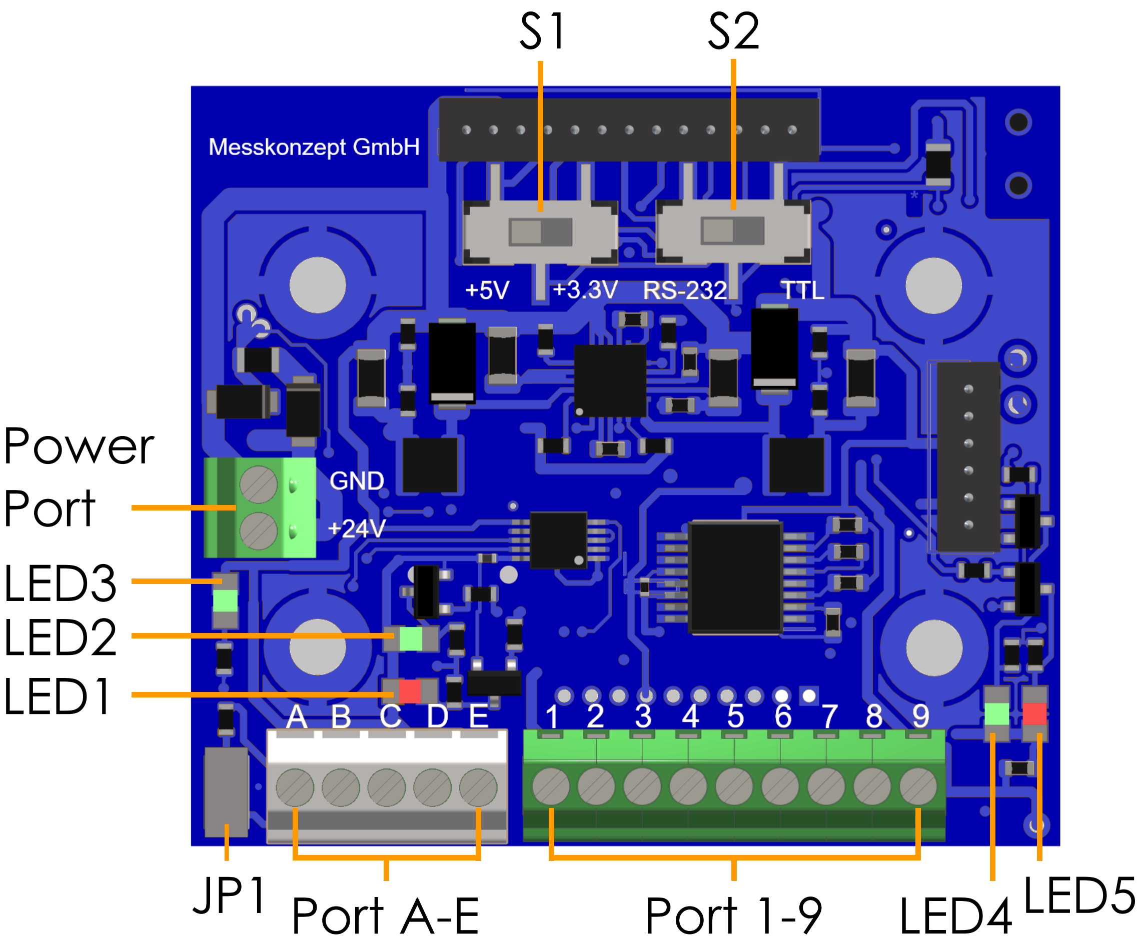


Figure 3.8: The electrical connections of OEM devices.

3.4.1 Interface setup

You may need to change the switch combinations of S1 and S2 (see Figure 3.8 and Table 3.5) to select the voltage level for UART serial communication. **Verify the switches' positions before connecting external hardware that may be damaged by too high voltage signals!**

The following table explains possible switch combinations, the orientation reference used (Up/Down) is the same as in Figure 3.8.

Mode		Switch combinations	
Name	Voltage levels	Position of switch 1 S1	Position of switch 2 S2
RS-232	-6.5 V to +6.5 V	N/A	RS-232 (left)
TTL	0 V to +5 V	+5 V (left)	TTL (right)
TTL	0 V to +3.3 V	+3.3 V (right)	TTL (right)

Table 3.1: Possible switch combinations for the OEM device: S1 and S2

Label	Description
A	RS-485: A signal
B	RS-485: B signal
C	RS-232: RX
D	RS-232: TX
E	RS-232: Ground

Table 3.2: Screw Terminal A–E

Label	Description
1	Analog input 1
2	Analog Ground
3	Analog input 2
4	RXD (TTL Level)
5	TXD (TTL Level)
6	Ground digital
7	Analog output 1
8	Ground analog
9	Analog output 2

Table 3.3: Screw Terminal 1–9

Label	Description
LED 1 (red)	RS-485 receiving data
LED 2 (green)	RS-485 transmitting data
LED 3 (green)	Power LED
LED 4 (green)	RS-232 transmitting data
LED 5 (red)	RS-232 receiving data

Table 3.4: LED Description

Label	Description
Power	+24V and GND
S 1	Select UART TTL Level (3.3V or 5 V)
S 2	Select RS-232 or TTL
JP 1	RS-485 Termination Resistor 120 Ohm

Table 3.5: switches etc. Description

Three green and two red LEDs are located on the PCB (see Figure 3.8). The green LED3 should be permanently on when the device is switched on correctly (see Table 3.4).

The green LED2 flashes to indicate successful data transmission via RS-485, while the red LED1 flashes to indicate successful data reception via RS-485. If the red LED1 or green LED2 is permanently on, this indicates a communication error, so please check the cable connections and the voltage level settings (see Table 3.6). If the device is the only one on the bus using RS-485, use JP1 as a 120 Ohm terminating resistor.

The green LED4 flashes to indicate successful data transmission via RS-232, while the red LED5 flashes to indicate successful data reception via RS-232.

3.5 Analogue Voltage Output

The Analogue outputs can be used to output the currently measured gas concentration as an analogue voltage between 0-10V.

The FTC320-OEM is equipped with two analogue outputs: These two non-isolated outputs with a range of 0V to 10V are named Analogue Output 1 and Analogue Output 2. Figure 3.8 shows where to connect the Analogue Outputs.

The Analogue Outputs can be set to different modes. These modes, shown in Table 3.6, can be set for each output separately.

Output Mode	Voltage Range	Error Indication
0V - 10V	Output voltage range 0V - 10V Cutoffs 0V - 10.5V	—
0V - 5V	Output voltage range 0V - 5V Cutoffs 0V - 5V	—
2V - 10V (Err)	Output voltage range 2V - 10V Cutoffs 1.9V - 10.25V	Error value 1.5V

Table 3.6: The available modes of the analogue outputs.

The output mode pre-selected in your instrument can be found in the manufacturing Protocol shipped with the device. If you are unsure or you lost the device protocol, please contact Messkonzept.

3.6 Analogue Input

The OEM device has two non-isolated analogue inputs. When necessary user can connect analoge signal to this two non-isolated analogue inputs. These are referred to as analogue input 1 and analogue input 2 (see Figure 3.8 and Table 3.3).The Analogue inputs may be used to read a voltage signal (0-10 V) from an external signal source. This feature is typically used to let the OEM device compensate the gas measurement for cross-sensitivities to disturbances that can not be directly measured by the OEM device itself.

The analogue inputs are typically not be pre-configured by Messkonzept. Their configuration is only done upon request.

Please see the manufacturing protocol shipped with the device to find out if and how the inputs are configured in your device.

The output mode as well as the input can be configured using SetApp 3.0, a software offered by Messkonzept. For more information, please read the SetApp 3.0 manual.

Chapter 4

Communication

4.1 Overview

In this chapter a short introduction into the digital communication with the FTC320-OEM is given. The aim is to give you a quick overview of the available features and help you choose the right digital interface for your needs. For more detailed information, please look into the separate documentation on SetApp 3.0 or the manual on Serial Communication, respectively. Both are available from the Messkonzept homepage.
After connecting SetApp 3.0 to the OEM device, you can see the currently measured signal in the main plot window, see Figure 4.1 digital interface to use depending on your requirements. For more detailed information, please look into the separate documentation on SetApp 3.0 or the manual on Serial Communication, respectively. Both are available from the Messkonzept homepage.

Depending on your application you may want to use either the RS-232 interface, the RS-485 interface, or both simultaneously. Both interfaces grant access to all approximately 500 internal device parameters through different communication protocols, which each have their own advantages/disadvantages.

4.1.1 RS-232 or 3.3V / 5V TTL:

- Human-readable Serial Communication (ASCII characters)
- Quick troubleshooting, laboratory scale experimental setups
- SetApp 3.0 (user interface with timeline plot, calibration, data logger, change parameters, backup & restore all parameters)
- Integration into PLC or other software systems requires some programming to interpret the custom communication protocol

4.1.2 RS-485:

- ModBus-RTU
- Easier integration into PLC or other software systems
- Multiple devices on the same bus possible

Following, in section 4.2 the parameter list of the FTC320-OEM and special commands, relevant to both RS-232/TTL or RS-485 communication, are introduced. In subsection 4.4.2 and subsection 4.4.5 more specific information about both interfaces are given, each highlighting some key features and giving some practical application examples.

4.2 Parameter List and Special Commands

The FTC320-OEM has approximately 500 internal parameters. Some of these parameters are read-only, such as the measured gas concentration values or raw signals. Other parameters can be written to change the device configuration. One parameter takes a special role: P12 is used to trigger tasks/actions, such as a calibration routine.

Proceed with caution when setting any parameters or triggering actions! Improper handling of parameters may misconfigure your device to show wrong measurement values or even cause permanent physical damage to the device.

Following you find a short-list of some important parameters, most of which are going to be used later in this chapter.

- **P0** *Serial Number*: Serial number of the device. It may be helpful to read out this value to test the bus communication or to identify a device amongst others on the same bus
- **P1** *Concentration5*: Calibrated gas concentration (in ppm) of channel 5 (Thermal Conductivity measurement)
- **P12** *Perform Task*: Triggers special commands when set to specific values, e.g. the value 250 will trigger offset calibration of channel 5. After execution of the command is completed, the value of the parameter is automatically reset to 0.
- **P496** *Offset_Gas5*: Test gas concentration (in ppm) used for offset calibration of channel 5 (Thermal Conductivity measurement).
- **P497** *Gain_Gas5*: Test gas concentration (in ppm) used for gain calibration of channel 5 (Thermal Conductivity measurement)

Setting parameter P12 to certain values triggers internal routines (special actions).
Table 4.1 shows some actions triggered by P12.

Command	Executed Procedure
P12=F250	Calibrate Offset extern channel 05
P12=F251	Calibrate Gain extern Channel 05

Table 4.1: Actions triggered by P12

For a complete list of all parameters and special commands, **please see your device's manufacturing protocol and read the Serial Communication Manual.** This manual can be downloaded from the messkonzept.de website.

4.3 Communication via SetApp 3.0 software

SetApp 3.0 is a free software solution for our clients, designed for easy communication with the FTC320-OEM. The software can be downloaded from the Messkonzept website. RS-232 (which can also be set to TTL level) must be connected to a Windows PC in order to use SetApp 3.0.

To give a quick introduction to SetApp 3.0, here are some short examples showing how to read measurement values and how to calibrate (see Chapter 5.4). **Please refer to the SetApp 3.0 manual for more information.** The SetApp 3.0 manual can be downloaded from the messkonzept.de website.

4.3.1 Main Plot in SetApp 3.0

After SetApp 3.0 has been connected to the FTC320-OEM, the currently measured signal can be seen in the main plot window (see Figure 4.1).

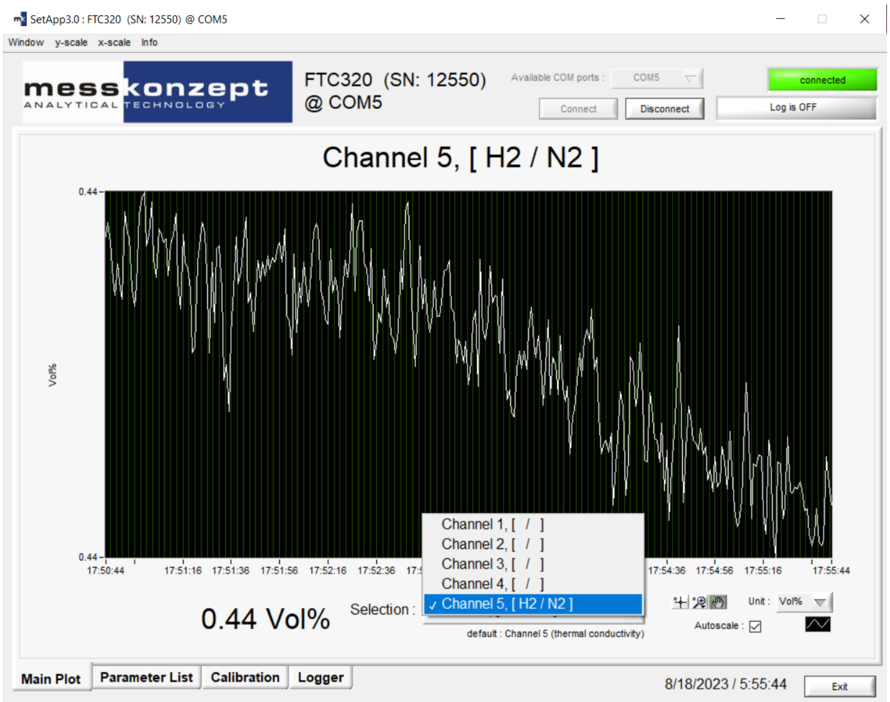


Figure 4.1: Main Plot view in SetApp 3.0

4.3.2 Save parameters to file

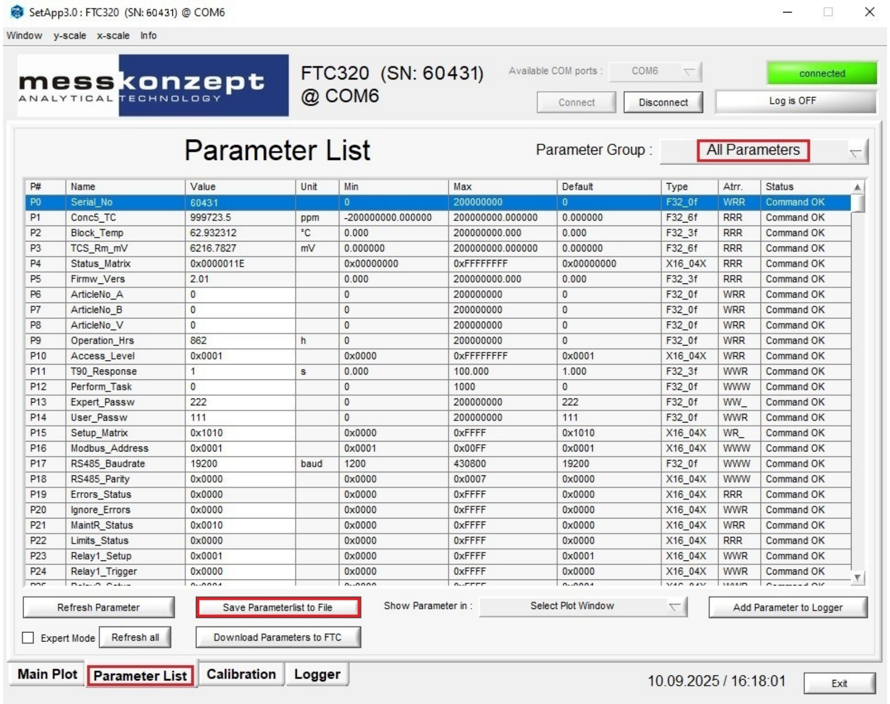


Figure 4.2: Parameter view in SetApp 3.0

The parameter list can be exported from the device by clicking the respective buttons at the bottom of the window. This feature is essential for the remote maintenance offered by Messkonzept. Note that this feature cannot be used if the device is in Multigas Mode. Please contact Messkonzept if you require assistance.

Please refer to the SetApp 3.0 manual for more information. The SetApp 3.0 manual can be downloaded from the messkonzept.de website.

4.4 Communication via RS-232 and TTL

4.4.1 Communication via the RS-232 interface (e.g. Tera Term)

4.4.2 RS-232 and TTL logic signal encoding

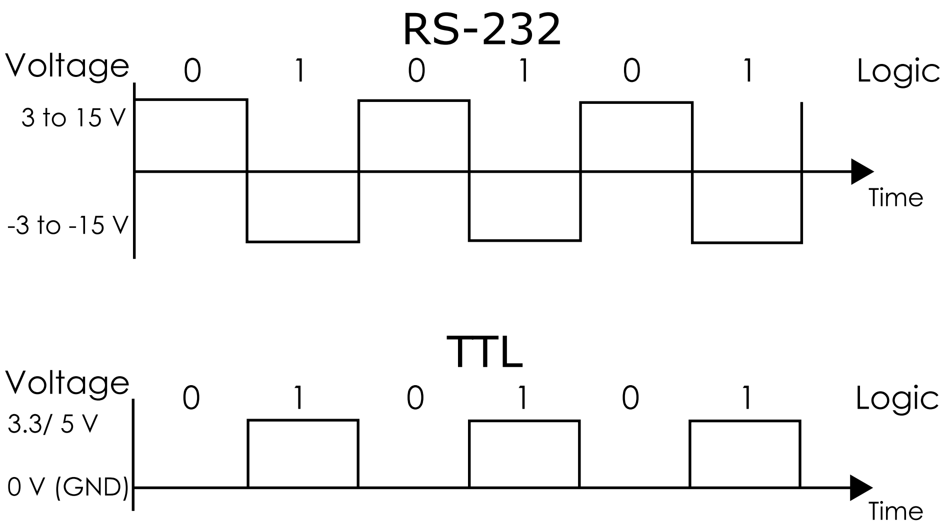


Figure 4.3: Logic signal encoding of RS-232 and TTL (3.3 V or 5 V)

The OEM device provides serial communication at selectable voltage levels that can be adapted to your system.
RS-232 is an industry standard for serial communication. It enables data transmission between the OEM device and a variety of computing or control systems.
TTL serial communication is commonly used for short-distance embedded or laboratory applications. Some microcontrollers use TTL level (3.3 V or 5 V).

4.4.3 RS-232 communication in a terminal emulator (e.g. Tera Term)

When connected via the RS-232 or TTL level interface, a terminal emulator such as Tera Term, may be used to interact with the FTC320-OEM. All device parameters and device functions can be reached through this interface.

The settings for the RS-232 (8N1) communication are:

- Baudrate: 19.2 Kbps
- Parity: none
- Stop bits: 1
- Transmit Carriage Return [CR] to execute a command

The basic commands for parameter handling are shown in Table 4.2 below. **Commands** in are written in bold font, while parameter numbers are underlined. *Passed values* are indicated in italic font. ”Pn” is an abbreviation for "Parameter number”.

Action	Command	Example
Get parameter name	**P**(Pn)**N**	**P**2**N** (Get name of parameter 2)
Get parameter value	**P**(Pn)**?**	**P**1**?** (Get value of parameter 1)
Set parameter value	**P**(Pn)=**F***set_value*	**P**496=**F***0* (Set parameter 496 to value 0)

Table 4.2: Different commands and their actions

A command is executed by sending a [CR] (carriage return). You may need to adjust the settings of your terminal emulator to send a [CR] when you hit the Enter-Key in your terminal emulator.

Two special commands: **mk?** and **pk?** can be used to check if connection to a device was successful. As a response to these commands the FTC320-OEM will read back general device information either in multiple-line (mk?) or single-line output (pk?), see Figure 4.5.

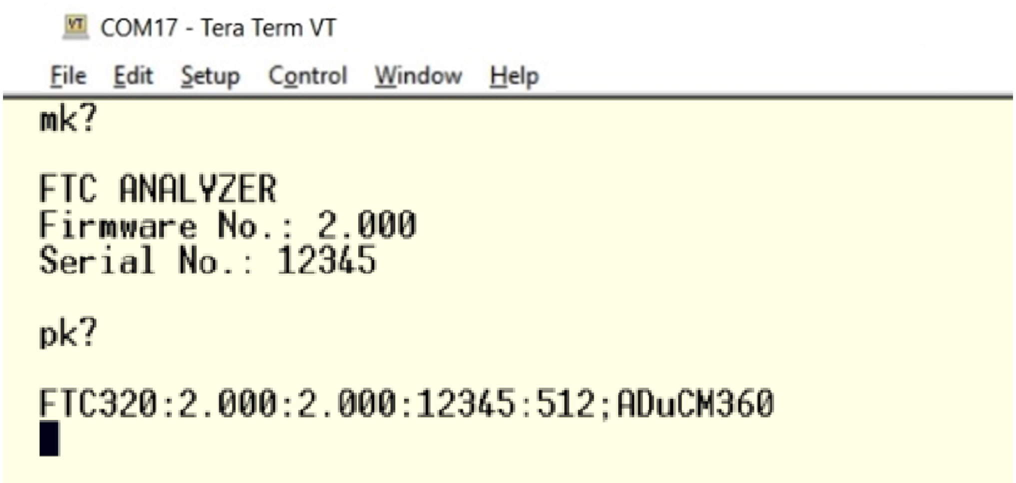


Figure 4.4: Response of the FTC320-OEM to the special comands mk? and pk?

4.4.4 Reading measurement values

The currently measured gas concentration by the thermal conductivity channel (channel 5) can be read from Parameter P1 using the command **P1?** followed by [CR] (carriage return), see Figure 4.5.

Here the connected device is showing a gas concentration of 585646.9 ppm. The FTC320-OEM handles all gas concentration values in the physical unit ppm (parts per million) internally. Divide by 10000 ppm/Vol.% to get the concentration as 58.56 Vol.%.

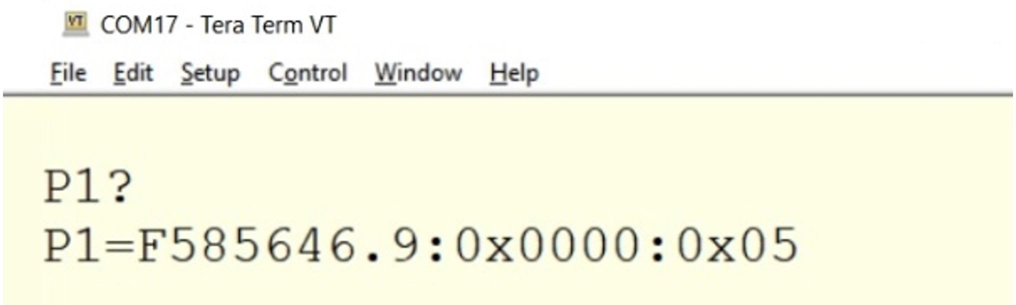


Figure 4.5: The commands *P1?* followed by [CR] reads out the currently measured gas concentration in the unit ppm

In Table 4.3 the complete response syntax to parameter query is explained briefly. Please review the manual on Serial Communication with the FTC320 for more detailed information.

P1	=	F	585646.9	:	0x0001	:	0x05
Queried parameter, here 1		Datatype, here float (F)	Value, here 58.56 Vol. %		Device status-bitmask		Command status

Table 4.3: Response of the FTC320-OEM to the query **P1?**

4.4.5 RS-485 interface

This chapter only gives a small introduction into the use of the Modbus with the FTC320-OEM. More detailed information on the Modbus communication, including bus configuration parameters and a complete list of all registers, can be found in the Manual on Serial Communication.
Using the RS-485 interface all parameters in the FTC320-OEM can be accessed similarly as through the RS-232 interface. The main difference is in the used communication protocol: The Modbus-RTU standard is used.

If the device is the only one on the bus using RS-485, use JP1 as a 120-ohm terminating resistor.

4.4.6 RS-485 Bus Setup (Modbus)

RS-485 allows for reliable serial communication, especially in environments that require long-distance data transmission and noise immunity. The used Modbus RTU standard allows for easy integration into a great variety of systems.

RS-485 supports multi point connection, allowing multiple devices to communicate over the same network.

The default setting for the RS-485 communication are:

- Baudrate: 19.2 Kbps
- Parity: none
- Stop bits: 1
- Address: 1

Parameter 16 (P16) is used to change the ModBus address (default: 1). Each address on a bus with multiple devices must be unique.

4.4.7 Function Codes

The FTC320-OEM uses the following function codes:

- **03 (0x03) Read Holding Registers**
  - Read device parameters (*parameter list*, same as in RS-232 communication) in 32-bit format, either float32 or UINT32. Two Modbus Registers combined in big-endian notation (ABCD) yield the complete parameter value
  - Register Address = Parameter Number * 2
    e.g. Gas concentration measured by thermal conductivity (P1, see parameter list):
    start address: 2, number of registers: 2, format: float32
- **04 (0x04) Read Input Registers**
  - addresses 000-026: short-list of most important device parameters formatted in float32

- addresses 100-126: short-list of most important device parameters formatted in INT16/UINT16 (with decimal shift)

- **08 (0x08) Diagnostics**
- **16 (0x10) Write Multiple Holding Registers**
  - Write device parameters (*parameter list*, same as in RS-232 communication) in 32-bit format, either float32 or UINT32. The two Modbus Registers that make up one parameter should be written in the same write operation, using big-endian notation (ABCD).
  - Register Address = Parameter Number * 2
    e.g. Perform Task (P12, see parameter list):
    start address: 24, number of registers: 2, format: UINT32

⚠ Proceed with caution when writing to the Holding Registers! You may misconfigure your device to give a wrong measurement indication or even damage the hardware of your device! Messkonzept will accept no liability for damage caused by improper configuration.

4.4.8 Reading measurement values

The current gas concentration measured by thermal conductivity (channel 5) can be read by:

- Function code: 3 (Read Holding Registers)
  Start address: 2
  Number of registers: 2
  Interpret as: float32, big-endian (ABCD)

Note that the gas concentration is represented in the unit ppm. You can convert the number to Vol.% by dividing it by 10000 ppm/Vol.%.

Modbus Holding Registers

Address (dec)	Address (hex)	Parameter number	Parameter Name	Data type	read/write
0	0x0000	0	Serial_No	UINT32	r/w
2	0x0002	1	Conc5_TC	float32	r/-
4	0x0004	2	Block_Temp	float32	r/-
6	0x0006	3	TCS_Rm_mV	float32	r/-
8	0x0008	4	Status_Matrix	UINT32	r/-
10	0x000A	5	Firmw_Vers	float32	r/-
12	0x000C	6	ArticleNo_A	UINT32	r/w
14	0x000E	7	ArticleNo_B	UINT32	r/w
16	0x0010	8	ArticleNo_V	UINT32	r/w
18	0x0012	9	Operation_Hrs	UINT32	r/w
20	0x0014	10	Access_Level	UINT32	r/w
22	0x0016	11	T90_Response	float32	r/w
24	0x0018	12	Perform_Task	UINT32	r/w
26	0x001A	13	Expert_Passw	UINT32	r/w
28	0x001C	14	User_Passw	UINT32	r/w
30	0x001E	15	Setup_Matrix	UINT32	r/w
32	0x0020	16	Modbus_Address	UINT32	r/w
34	0x0022	17	RS485_Baudrate	UINT32	r/w
36	0x0024	18	RS485_Parity	UINT32	r/w
38	0x0026	19	Errors_Status	UINT32	r/-
40	0x0028	20	Ignore_Errors	UINT32	r/w
42	0x002A	21	MaintR_Status	UINT32	r/-
44	0x002C	22	Limits_Status	UINT32	r/-
46	0x002E	23	Relay1_Setup	UINT32	r/w
48	0x0030	24	Relay1_Trigger	UINT32	r/w
50	0x0032	25	Relay2_Setup	UINT32	r/w

Table 4.4: Excerpt from the Serial Communication Manual: The holding registers contain all device parameters.

Chapter 5

Calibration Instructions

5.1 Overview

This section explains how the readjustment of the device should be planned and carried out on site (see chap. 2.3 onwards for the basics). Different installation, dew point, pressure, flow rate and test gas quality can lead to a shift in the indication right from the start. In addition, the reading may vary by 2% of the smallest measuring range per week, e.g., measuring H_2 in N_2, the drift per week may be 100 ppm for low H_2 concentration.

This section explains how the readjustment of the device should be planned and carried out on site (see Chapter 2.3 et seq. for more information).

5.2 Gas Supply during Calibration

Ensure that the appropriate test gas has fully entered the device before performing an offset or gain calibration. You should monitor the signal for stability to ensure this. After activating the calibration routine, a sampling phase of 10 seconds begins. Keep the gas supply stable and continuous during this phase.

Please note that any large change in flow, pressure or concentration, for example when opening a valve for the test gas flow, will cause a certain disturbance to the thermostated measurement in the FTC320-OEM. This is particularly the case if you accidentally had a very high gas flow, even for a very short time. It may take a while for the temperatures in the FTC320-OEM to reach equilibrium again and for the measurement indication to provide a stable and reproducible value in the ppm range.

5.3 Use of Substitute Gases

Instead of using toxic or explosive gases for calibration, substitute gases may be used. A substitute gas has (at a certain concentration) the same thermal conductivity as the test gas it is substituting, such it can also be used for the calibration instead. Please contact Messkonzept for details on possible substitute gases for your application.

5.4 Calibrating using the SetApp 3.0 software

Calibration of the instrument can be performed conveniently through the user interface of SetApp 3.0. Before starting with the actual calibration, please read the general information on calibration given in subsection 2.4.1. Also, please take note of the more detailed "Instructions" page which can be accessed from on the calibration tab in SetApp 3.0 - another resource for information is the user manual for SetApp 3.0.

First, choose the channel to be calibrated from the drop-down menu at top right of the calibration tab, see Figure 5.1. Enter the offset gas concentration (the test gas concentration to which the measurement will be adjusted by calibration) and choose the unit (Vol% or ppm).

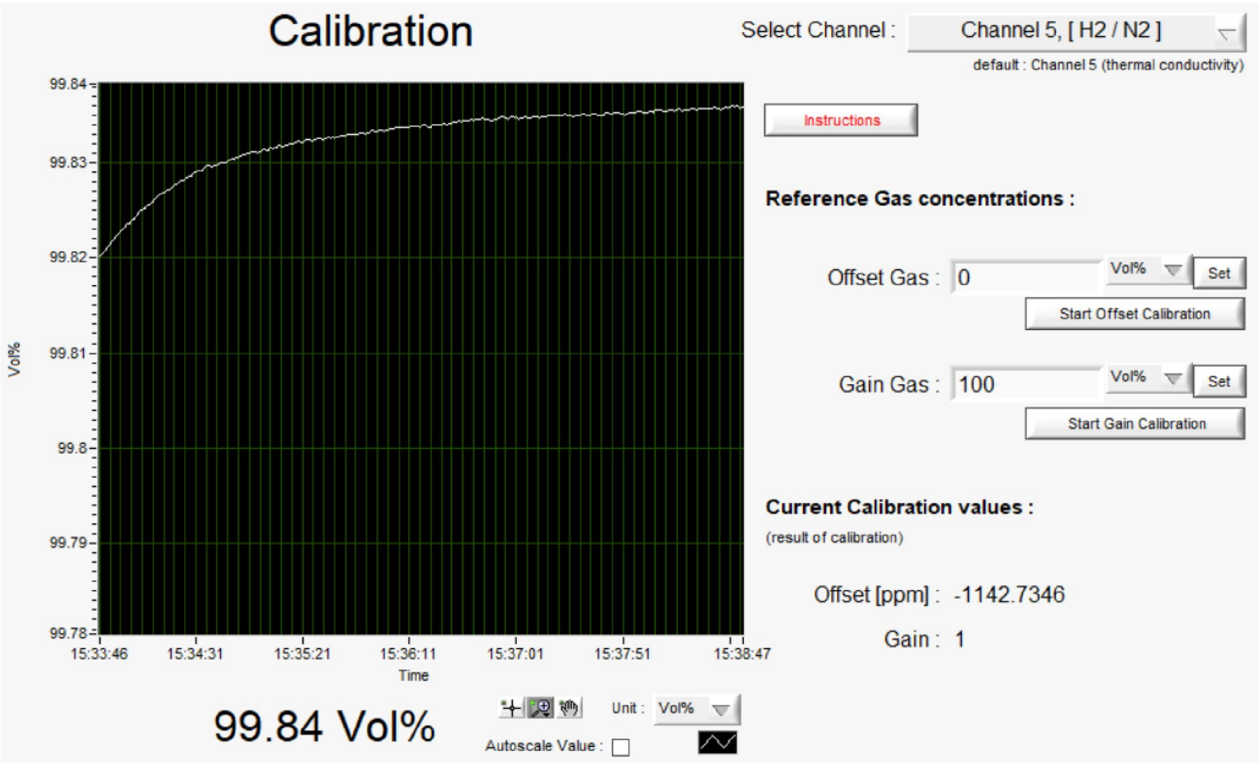


Figure 5.1: After a sudden change in flow, pressure or gas concentration it may take some minutes for the measurement to stabilize to ppm precision.

Apply the test gas used for offset calibration and wait for the measurement to stabilize (watch the plot on the left). The time for stabilization depends strongly on the dead volume in the gas duct leading to the device. To observe the value with high precision, change the unit to ppm (selection below the plot window). When the measurement has stabilized, click on **Start Offset Calibration**. The sampling takes 10 seconds. After that, the measurement indication should equal the reference gas concentration.

For thermal conductivity measurement, a single point (offset) calibration is typically sufficient.

If you wish to also calibrate the gain, please do so **after** prior offset-calibration.

Always do an offset calibration first before doing a gain calibration!

In most cases an offset calibration alone is sufficient for the proper performance of the device! First check if there is a deviation before possibly calibrating!

The suggested procedure is different for measurement of O_2 with an external electrochemical sensor (typically routed over channel 1). This sensor should only be gain-calibrated (without prior offset-calibration). Typically this is done with air (20.95 Vol.% O_2 in dry air) at the same flow rate that is used in typical operation in your process.

5.5 Calibrating via the RS-232 interface

5.5.1 Calibration via RS-232

Before starting with the actual calibration, please read the general information on calibration given in subsection 2.4.1. Following, the commands for calibration via RS-232 (can be TTL level) are explained on a practical example. We assume a device with measuring range 0-40 Vol% Ar in CO_2 using the following test gases:

- start point: 100 Vol.% CO_2 (= 0 Vol.% Ar in CO_2)
- end point: 39.93 Vol.% Ar in CO_2 (see Figure 5.2)

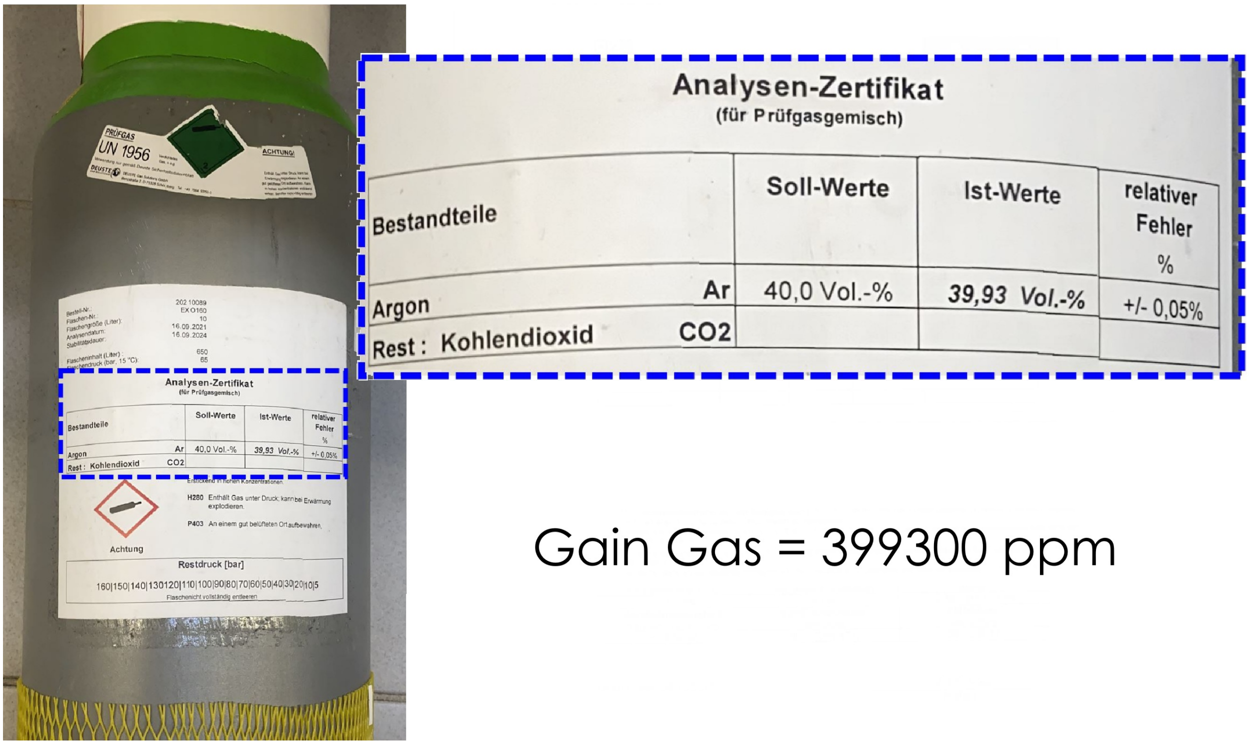


Figure 5.2: Test gas bottle used for checking / calibration of the range's end point. The imprint on the bottle shows the concentration value, here 39.93 Vol. % = 399300 ppm.

1. Set gain- and offset- test gas concentration values.

P496=F0

P	496	=	F	0
	Parameter "Offset test gas (channel 5)"			0 ppm

P497=F399300

P	497	=	F	399300
	Parameter "Gain test gas (channel 5)"			399300 ppm

2. Apply offset test gas to the FTC320-OEM and wait for the signal to stabilize, you may read out the currently measured concentration signal by sending **P1?** to the device repeatedly.
3. Calibrate Offset.

   P12=F250

P	12	=	F	250
	Parameter "Special Command"			Task "Calibrate Offset"

   Calibration sampling takes 10s. The device will answer with "P12=F0" when the calibration is completed. Please verify if the calibration was successful by reading out the measurement value using the command **P1?** again. Now the indication should equal the previously configured "Offset Gas" concentration (here: 0 ppm).
4. Apply your gain-gas concentration to your device and wait for signal to stabilize (5-10 mins). If the measurement value already satisfies your precision requirements, there is no need for a gain calibration.
5. If not: Calibrate Gain.

   P12=F251

P	12	=	F	251
	Parameter "Special Command"			Task "Calibrate Gain"

   Please verify if the calibration was successful by reading out the measurement value again using command **P1?**. In our example the device should now be showing a value of 399300 ppm.

   To be absolutely sure that gain calibration was successful over the whole range, you may want to apply the offset test gas once more to see that the indication is still showing correctly (here: 0 ppm).

Always do an offset calibration first before possibly doing a gain calibration! Reversing the procedure would result in a worse calibration result! In most cases an offset calibration alone is sufficient for the proper performance of the device! First check if there is a deviation before possibly calibrating!

Custom Software

You may need to create own software to interface with the device, e.g. to perform automatic calibrations or other interactions via RS-232. If you want to design such software, please read the Serial Communication manual for more detailed information about all device parameters.

5.6 Calibrating via the Modbus/RS-485 Interface

The RS-485 interface can also be used to calibrate the FTC320-OEM. The procedure is the same as for the RS-232 communication, as explained in subsection 5.5.1, only the parameter values are instead written into holding registers. See Table 5.1 for a translation of the parameter numbers to holding registers.

Address (dec)	Address (hex)	Parameter number	Parameter Name	Data type	read/write
24	0x0018	12	Perform_Task	UINT32	r/w
992	0x03E0	496	Offset_Gas5	float32	r/w
994	0x03E2	497	Gain_Gas5	float32	r/w

Table 5.1: Excerpt from the Serial Communication Manual: Holding Registers needed for calibration of the thermal conductivity channel (channel 5).

For a detailed example of the calibration procedure via RS-485, please see the Serial Communication Manual found on the Messkonzept website.

Chapter 6

Troubleshooting

6.1 General information

If you encounter any issues with the device, stop the process immediately and disconnect the device from the gas flow. Be particularly careful with flammable, toxic or other hazardous gases.

If you experience any issues, please follow the steps in the troubleshooting log below. Save the results for any further communication with us via email at info@messkonzept.de.
Please note that you must follow the order of the log, and interrupt the troubleshooting process if an error cannot be resolved.

6.2 Procedures for resolving issues

Step 1:
Ensure that the device is properly powered. Check whether LED3 is off or lit up in a steady green glow. Refer to Chapter 3.4, Figure 3.8 and Tables 3.2 to 3.5 for more information. Please check the power supply and wiring. Then check the LED3 status again.

Step 2:
Ensure that the serial communication is established (see Chapter 3.4, Figure 3.8 and Tables 3.2 to 3.5). If using SetApp 3.0 or RS-232 communication, check the status of LED1 and LED2. If using RS-485 communication, check LED4 and LED5.
The LEDs are off when no communication is taking place via this interface. They flash when communication is taking place. If one of LEDs 1, 2, 4 or 5 remains lit, this indicates a fault.
Ensure that the communication cables are connected correctly (see Chapter 3.4, Figure 3.8 and Tables 3.2 to 3.5). Then check the status of the LEDs again.

Step 3:
Please check the basic value parameters P1, P2 and P3 (see Chapter 4) and ensure that their values are within the expected range.
The block temperature P2 (Block_Temp, unit: ℃) should be between 62 and 64 after the heating phase. Otherwise, there is an issue with the device's heating. Check the insulation (see chapters 3.1 and 3.2).

The measured value P1 (Conc5_TC, unit: ppm) should be in the range 0–1,000,000, and the raw signal of the measured value P3 (TCS_Rm_mV, unit: mV) should be in the range 1,000–7,000.

Step 4:
If these values are outside the above ranges, reset P498 to 0 and P499 to 1.
If parameter P1 (Conc5_TC) then displays a plausible value, calibrate the device.

If one of the steps described above does not achieve the desired effect, please do not hesitate to contact us at info@messkonzept.de. For a comprehensive error analysis, it is helpful if you send us the current parameter list for the device. You can easily download this from the device using the SetApp 3.0 programme (see Chapter 4.3.2).

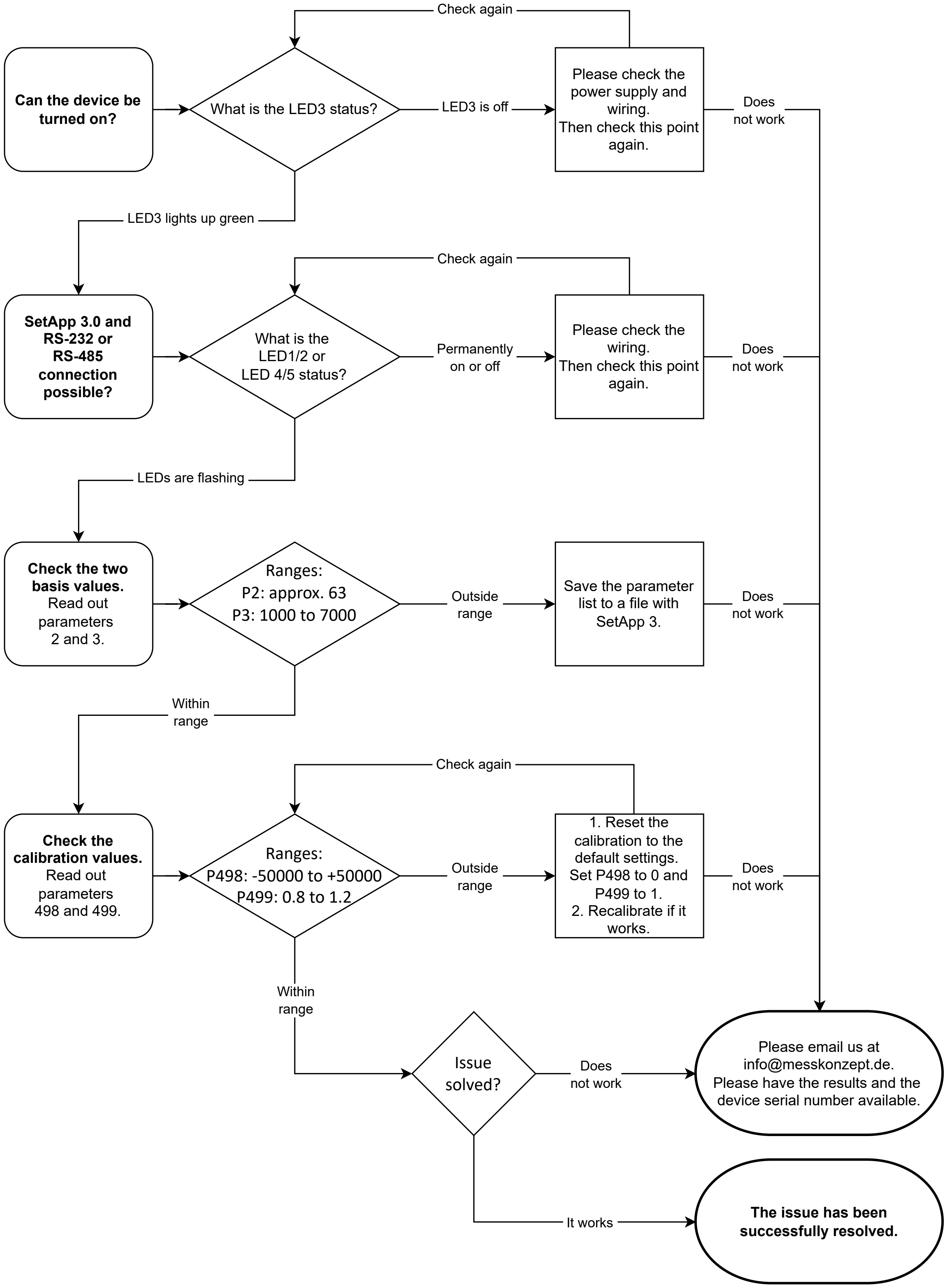


Figure 6.1: Troubleshooting Flowchart

6.3 Report errors to Messkonzept GmbH

If you contact Messkonzept GmbH (info@messkonzept.de), please provide an error description. Please include the following information in the description of the error:

- the serial number of the device
- No RS232/RS485 communication?
- Is there no 0–10 V signal at all?
- Is the 0–10 V signal incorrect?
- Did it work before, or are you currently installing a new device now?
- Did you just calibrate?
- Did anything happen/change in the environment?

Chapter 7

Specifications

7.1 Specification of Thermal Conductivity Measurement

Attribute	**Range/ Precision**
Linearity	< 1% of range
Warm up time	Approx. 20 min; up to 1h for highest precision
T90 time, for example, using H_2 in N_2	< 1 sec (at the recommended flow rate)
Noise	< 1% of smallest range
Drift of offset (zero point)	< 2% of smallest range per week
Drift of span	< 0.2% of smallest range per week
Repeatability	< 1% of smallest range
Error due to change of ambient temperature	< 1% of smallest range per 10°K
Error due to change of flow within the recommended ranges	< 1% of within recommended range given in Table 7.2

Table 7.1: Specification of TC measurement

7.2 Flow and Calibration Specifications

Please note that all flow rates are valid at atmospheric pressure (see Tables 7.2).
Recommendation: Calibrate the devices at the flow rate and pressure at which measurements takes place.
Recommended range: deviation of less than 1% of the smallest measuring range.
Permissible range: deviation of less than 1% of the smallest measuring range, if the measurement flow is equal to the calibrated flow.

Article No.	Calibrated at	Recommended Value	Recommended Range	Permissible Range
A140B900V003 A140B901V003	60 l/h	60 l/h	40 l/h – 80 l/h	10 l/h – 120 l/h
A140B902V003 A140B903V003	60 l/h	60 l/h	40 l/h – 150 l/h	10 l/h – 300 l/h
A140B907V003 A140B908V003	10 l/h	10 l/h	3 l/h – 20 l/h	1 l/h – 60 l/h
A140B907V003 A140B908V003	30 l/h	30 l/h	20 l/h – 40 l/h	1 l/h – 60 l/h

Table 7.2: Specifications of the variants of the **FTC320-OEM**

7.3 Materials of OEM devices Exposed to The Measured Gas

The following materials come into contact with the measurement gas in all devices:
- Stainless Steel AISI 316L (1.4404)
- FKM
- Epoxy
- Gold (Au)
- Silicon (Si)
- Silicon nitride (Si_3N_4)

Additional material in the OEM product variants that comes into contact with the measured gas.
The information listed in Table 7.3 applies to the OEM devices listed in Tables 1 and 2.

Available variant	Material
B900	—
B901	Inert Polymer
B902	PTFE
B903	Inert Polymer, PTFE
B907	PET, PEEK
B908	Inert Polymer, PET, PEEK

Table 7.3: Additional material of the product variants

7.4 Electrical Specifications

Inputs and Outputs	Feature	Property
Analogue Input 1 and 2	Voltage range	0 to 10 V
	Reference potential	ground
	Input resistance	approx. 50 kOhm
	Resolution	24 bit
Analogue Output 1 and 2	Voltage output maximum	0 to 10.5 V
	Reference potential	ground
	Load resistance	min. 50 kOhm
	Resolution	16 bit
	Accuracy	0.1 V
Power Supply	Voltage range	24 V DC, Permissible range 21 V to 30 V
	Max. current	1 A
	Typical current draw	800 mA
	Protective measure	PELV (Protective Extra Low Voltage)

Table 7.4: Electric Specifications

7.5 Ambient Conditions

Attribute	Conditions
Operating temperature	Below 0 °C (32 °F): insulation may be required (see Chapter 3.2) Up to 50 °C (122 °F)
Storage temperature	-25 °C to 70 °C (-13 °F to 158 °F)
Humidity	non-condensing

Table 7.5: Environmental conditions

7.6 Permissible Conditions of The Sample to Be Measured

Attribute	Conditions
Pressure (absolute)	For flammable and toxic gases: maximum 300 kPa (3 bar absolute). For other gases: maximum 1000 kPa (10 bars absolute).
Gas temperature (at 60 l/h)	Maximum of 80 °C at ambient temperature of 25 °C Maximum of 50 °C at ambient temperature of 50 °C
Dust, aerosols, oil mist, fluids	Avoid at all costs (e.g. via separator/filter), the option "Protection against condensate and dust" can prevent impairment of the measuring capability (B902, B903, B907 and B908; see Tables1 and 2).
corrosive gases	Only with corrosion-tolerant design and after consulting Messkonzept (B901, B903, and B908; see Tables 1 and 2).
Humidity and Water (condensate/drops)	Condensation must be prevented in the entire gas sample path. The "Protection against condensate and dust" option can prevent the sensor element from being destroyed by water (B902, B903, B907 and B908; see Tables 1 and 2).

Table 7.6: Properties of the sample gas

7.7 Dimensions and Weights of the OEM devices.

Attribute	FTC320-OEM A140B90xV003	FTC150-OEM A131B90xV001	FTC152-OEM A132B90xV002	FTC180-OEM A135B90xV004
Dimensions WxHxD [mm³]	74 x 45 x 64	42 x 45 x 144	42 x 45 x 156	42 x 45 x 48
Weight [g]	330	288	206	185

Table 7.7: Dimensions of OEM devices

Chapter 8

Views of the device

Device	Article No.	Figure No.
FTC320-OEM	A140B90xV003	8.1 to 8.4
FTC150-OEM	A131B90xV001	8.5 to 8.8
FTC152-OEM	A132B90xV002	8.9 to 8.12
FTC180-OEM	A135B90xV004	8.13 to 8.16

Table 8.1: Illustration of the various OEM devices.

The 3D STEP models of the various OEM devices are available on request from Messkonzept GmbH.

All images are for illustrative purposes only and may differ from the actual appearance. We reserve the right to make technical changes and deviations in shape, colour and features.

8.1 View of the FTC320-OEM

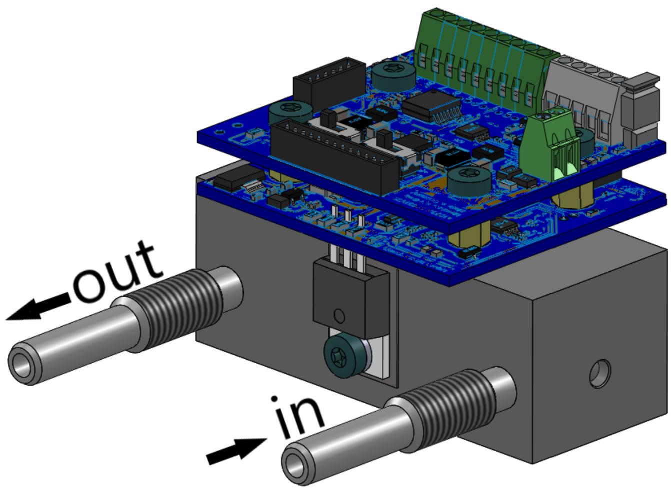


Figure 8.1: View of the FTC320-OEM.

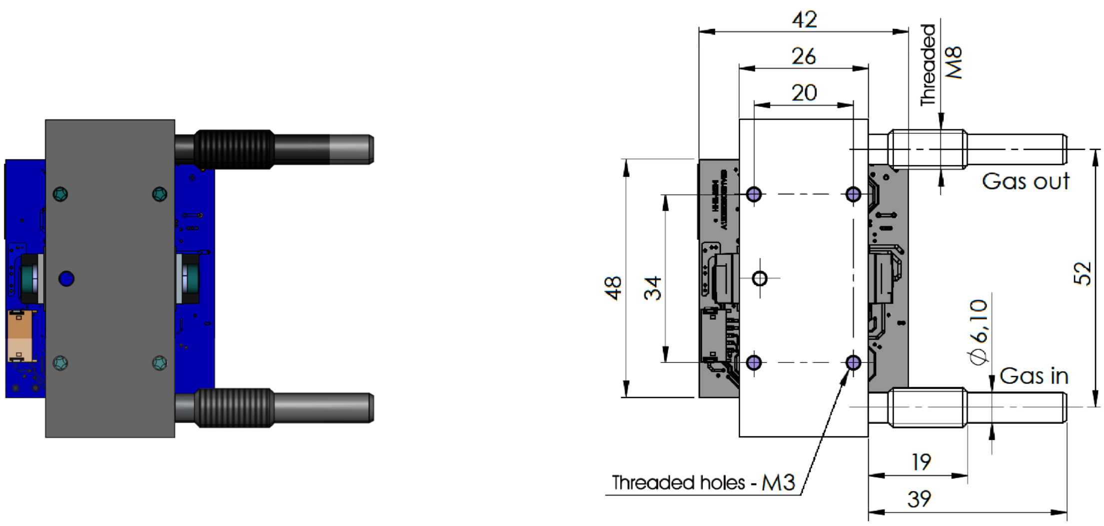


Figure 8.2: View of the FTC320-OEM from the bottom.

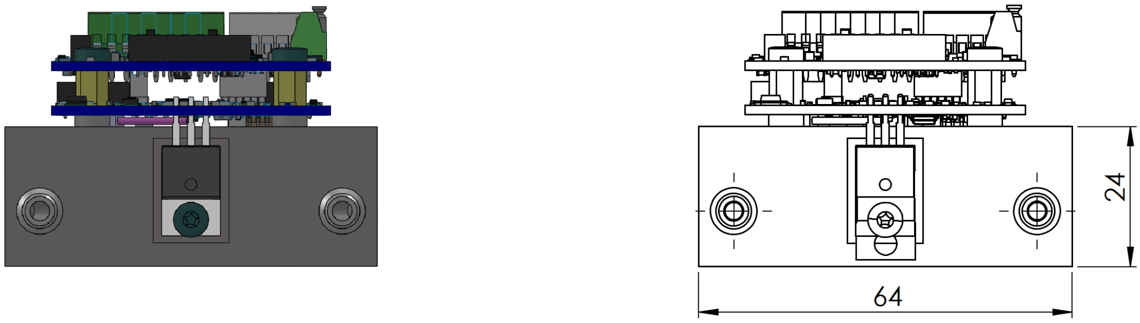


Figure 8.3: View of the FTC320-OEM from the front side.

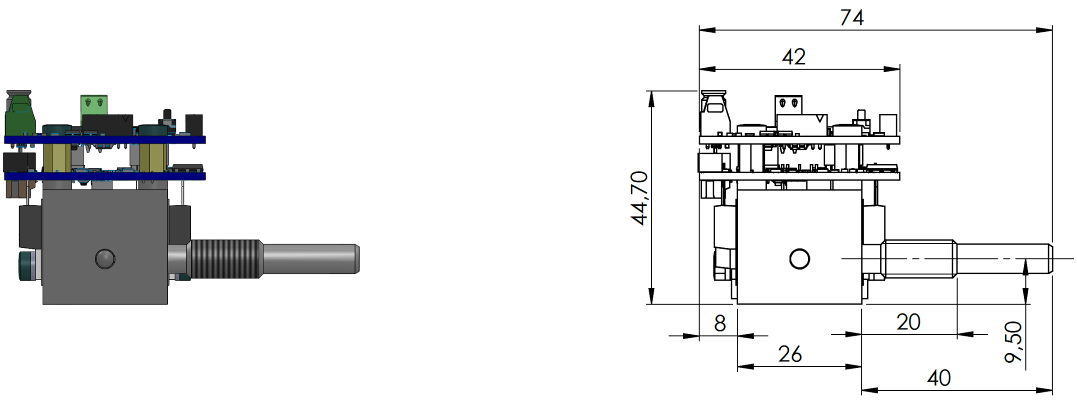


Figure 8.4: View of the FTC320-OEM from the left side.

8.2 View of the FTC150-OEM

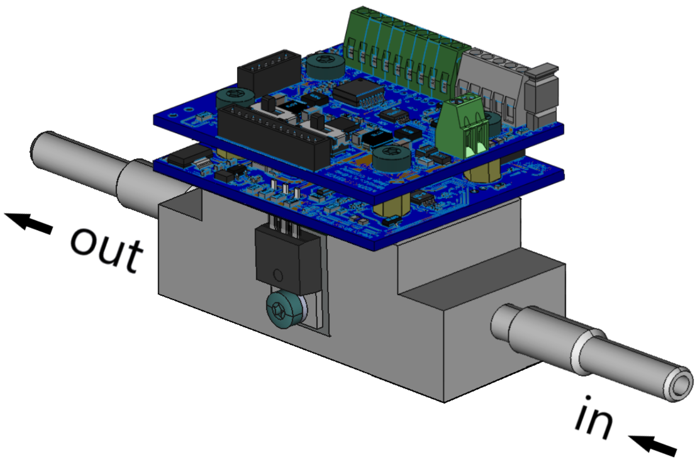


Figure 8.5: View of the FTC150-OEM.

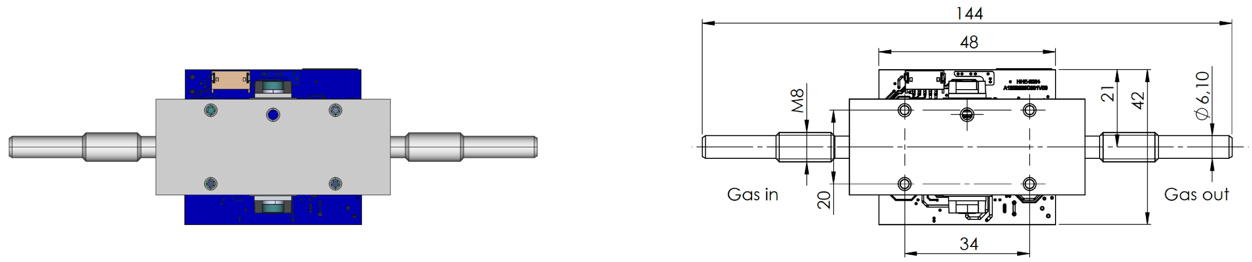


Figure 8.6: View of the FTC150-OEM from the bottom.

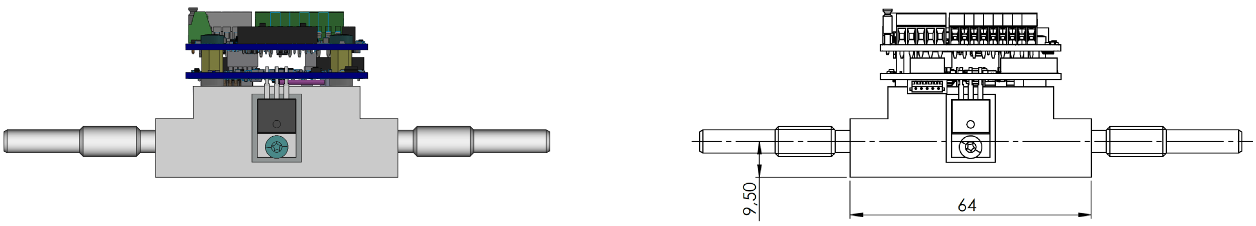


Figure 8.7: View of the FTC150-OEM from the front side.

Figure 8.8: View of the FTC150-OEM from the left side.

8.3 View of the FTC152-OEM

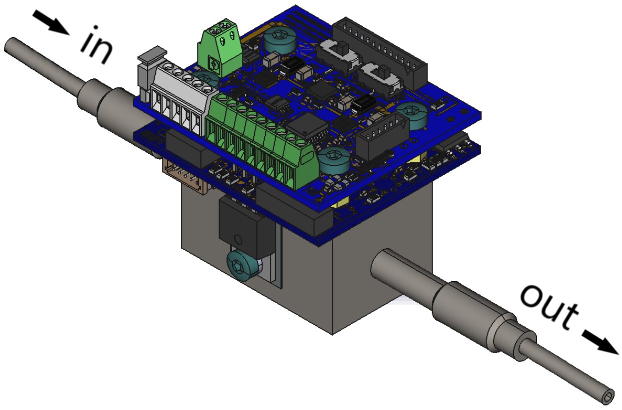


Figure 8.9: View of the FTC152-OEM.

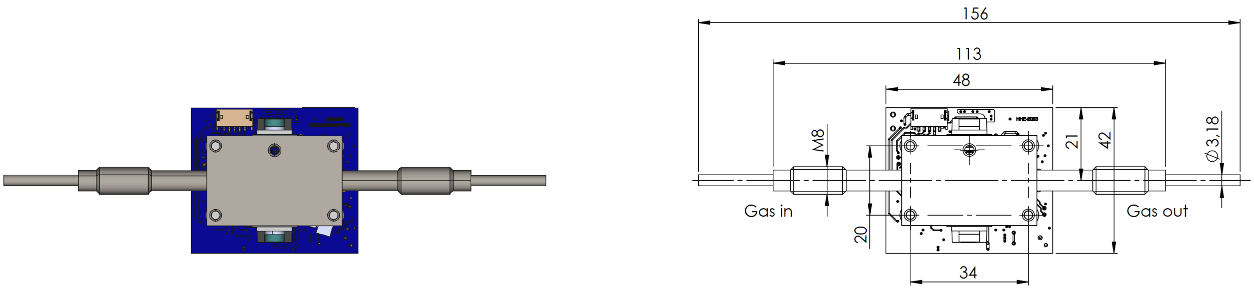


Figure 8.10: View of the FTC152-OEM from the bottom.

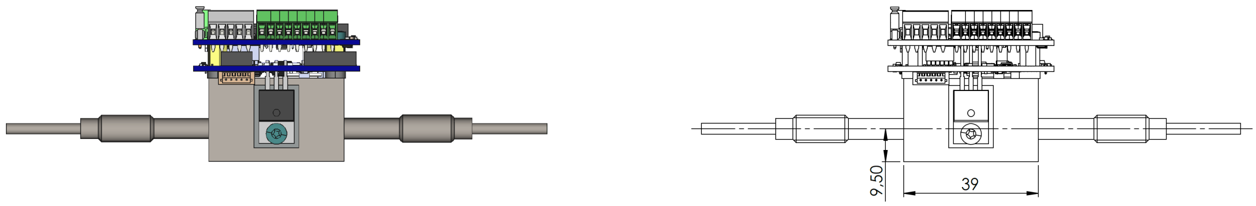


Figure 8.11: View of the FTC152-OEM from the front side.

Figure 8.12: View of the FTC152-OEM from the left side.

8.4 View of the FTC180-OEM

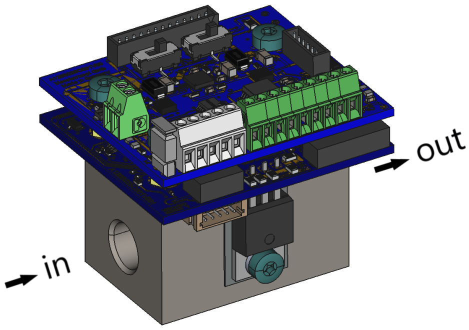


Figure 8.13: View of the FTC180-OEM.

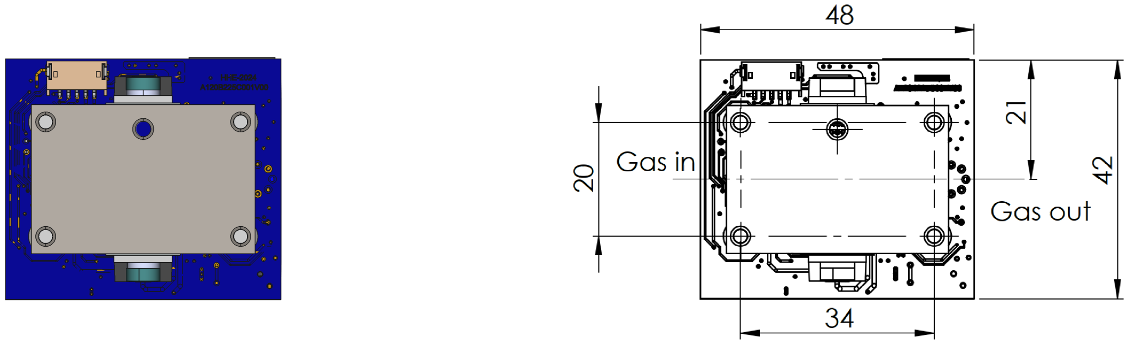


Figure 8.14: View of the FTC180-OEM from the bottom.

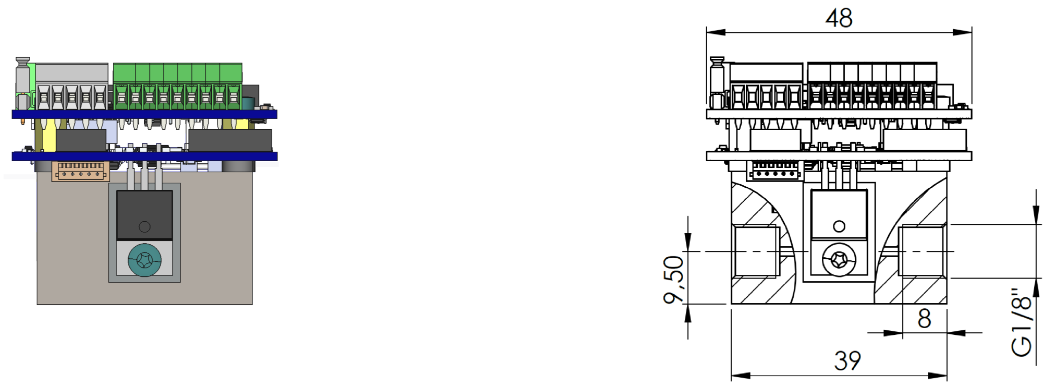
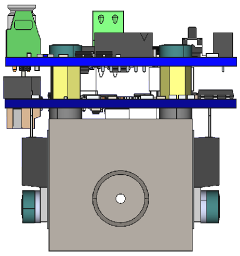


Figure 8.15: View of the FTC180-OEM from the front side.



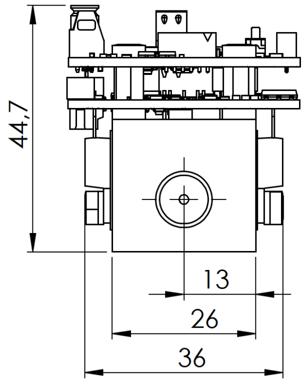


Figure 8.16: View of the FTC180-OEM from the left side.

Messkonzept GmbH
Analytical Technology

Niedwiesenstr. 33
60431 Frankfurt
Germany

Telefon +49 69 53056444
Fax +49 69 53056445

info@messkonzept.de
www.messkonzept.de

Managing Director
Dr. Axel-Ulrich Grunewald
Place of jurisdiction Frankfurt HRB 49940

VAT ID: DE211207233

messkonzept
ANALYTICAL TECHNOLOGY