Instruction Manual

DB05

Thermal mass flowmeter and controller for gases

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Operating instructions *DB05*

Part I: General operating instructions

This manual is valid for instruments with a serial number starting from 110 000

CE

Version: **E6_5**

For the latest information on our products, see our website at **www.pkp.de**

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This symbol alerts the user to important operating, maintenance and service information.

Important instructions

- Do not remove the red cover - it prevents damage to the system. A damaged hologram seal will expire the warranty.
- There are no serviceable parts under the cover
- Repairs must only be performed by qualified personnel

Attention

This device must be grounded.
The supply voltage is 18..30 Vdc (typically ±50 mV).

Subject to change

Due to our policy of ongoing product development, we reserve the right to change the information in this manual without notice.

Recycling

Note the existing regulations of your country.

Toxic, flammable gases and ATEX

In the case of toxic and flammable gases, the respective safety guidelines in each country must be followed. The *DB05* devices are not approved for use in Ex- zones. In the case of flammable and toxic gases, fittings and pipes intended for that purpose must be used. The responsibility for safe operation lies with the designer of the facilities.
The devices must not be used for explosive mixtures. (ATEX, detonating gas, consisting of O_2 and H_2).

Installation

Please note before the start-up:

- Do not use sealing tape or liquid sealant
- Piping must be cleaned before installation of instrument.

Products in this manual may contain metal or elastomeric seals, gaskets, O-rings or valve seats. It is the “user’s” responsibility to select materials that are compatible with their process and process conditions. Using materials that are not compatible with the process or process conditions could result in the devices leaking gas outside the pressure boundary of the device, resulting in personnel injury or death.
It is recommended that the user check the devices on a regular schedule to ensure that it is leak free as both metal and elastomeric seals, gaskets, O-rings and valve seats may change with age, exposure to process gas.

Power

If it becomes necessary to remove the instrument from the system, power tot he device must be disconnected.

Troubleshooting

OEM tool problems are often caused by various errors. Therefore, PKP recommends that you review both the manual of the OEM tool and our Troubleshooting Guide before removing the instrument from your system.

Table of contents

1. Introduction

Thank you for choosing devices from the *DB05 series*. These operating instructions will help you to install and operate the measuring devices. Please read through these instructions carefully before installing the devices. Our aim has been to write a full and practical guide. We would be grateful if you would notify us of any shortcomings or mistakes.
Please contact PKP if you have questions about any aspect of the products.

The core element of the DB05 thermal mass flow meter and controller is a CMOS sensor chip. The sensor and parts of the electronics are on one board and offer a number of advantages for the user.

1.10 Features of thermal mass flow meters and controllers

In developing and manufacturing the devices, we have focused primarily on customers and their applications. Our aim is to implement customers' requirements in the form of new developments or enhancements on an ongoing basis. The essential features are:

- ⇨ Compact design
- ⇨ Standardized digital and analog interfaces
- ⇨ Very fast and accurate measurement and control
- ⇨ Integrated temperature measurement and totalizer (standard)
- ⇨ Easy to maintain and service
- ⇨ Thanks to its modular design, the unit can be easily expanded to add additional functions
- ⇨ 3-year warranty
- ⇨ Matched options and accessories

1.11 Scope of warranty

Warranty for the *DB05* product line extends to material and manufacturing defects only.
Maximum warranty covers product replacement free of charge. The following causes of faults/ damage are not covered under warranty:

- ⇨ Use outside the operating limits
- ⇨ Damage due to corrosion
- ⇨ Mechanical damage in general
- ⇨ Contamination due to improper sealing
- ⇨ Contamination due to impure gasses or penetration of liquids
- ⇨ Damage to electronic components due by over-voltage or electrostatic discharges, and corrosion damage due to aggressive environments.
- ⇨ Functional failure due to incorrect operation or faulty parameterization
- ⇨ Drift in the calibration

1.12 Instructions and warnings

Read all of the operating instructions thoroughly before installing and commissioning equipment. Misconceptions and incorrect use can lead to breakage of the measuring device or risk of personal injury.

The installation, commissioning and operation and maintenance must be done by appropriately qualified personnel.

1.13 Scoppe of delivery

- ⇨ Thermal mass flowmeter
- ⇨ Operating instruction

1.14 The measurement principle

The thermal measurement principle is particularly suitable for the flow measurement and control of gaseous media. The most significant advantage is that the measurement process is largely independent of temperature and pressure. The displayed flow refers to the expanded gas volume at 0 °C and 1013.25 mbar absolute. On request, other reference temperatures can be provided for. Most gas suppliers in Europe base their volume data on 15 °C and 1013.25 mbar absolute. According to the ideal gas law, the gas volume will change by 0.35% per K.

Stated simply, the thermal measurement principle measures the heat transport by gas flowing past.

In the case of *DB05* mass flow measuring instruments, a constant heat input gives a flow-dependent temperature difference (∆T). Two temperature sensors are positioned in the measuring channel (T1, T2), one before the heating system (H) and one after it.

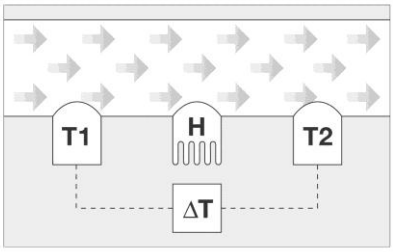


Figure 1: The measurement principle

If there is no flow, the heat spreads symmetrically in directions T1 and T2. The temperature difference T1-T2 is therefore zero.

Flow rates > 0 create a temperature difference.
The sensor T1 at the inlet is cooled by the gas flowing past it, and the temperature of the second sensor T2 rises due to the heat drawn from the heating system.

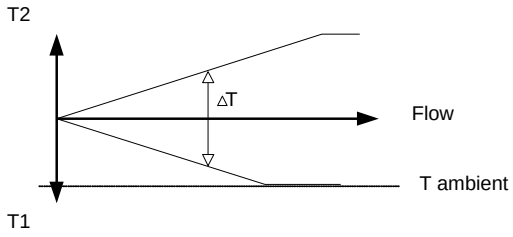


Figure 2: Sensor signals

The temperature difference is directly proportional to the mass flow.

1.15 CMOS technology

The *DB05* measuring and control devices are equipped with an innovative semiconductor sensor that sets new standards for accuracy, speed and measurement dynamics.
Thanks to the compact single-chip design, CMOS-based sensors are highly resistant to electromagnetic interference (EMC).
With CMOS technology (which we use), the sensor element, amplifier and A/D converter form a single unit on the silicon chip.

1.16 Block diagram

The following block diagram shows the structure of the device.

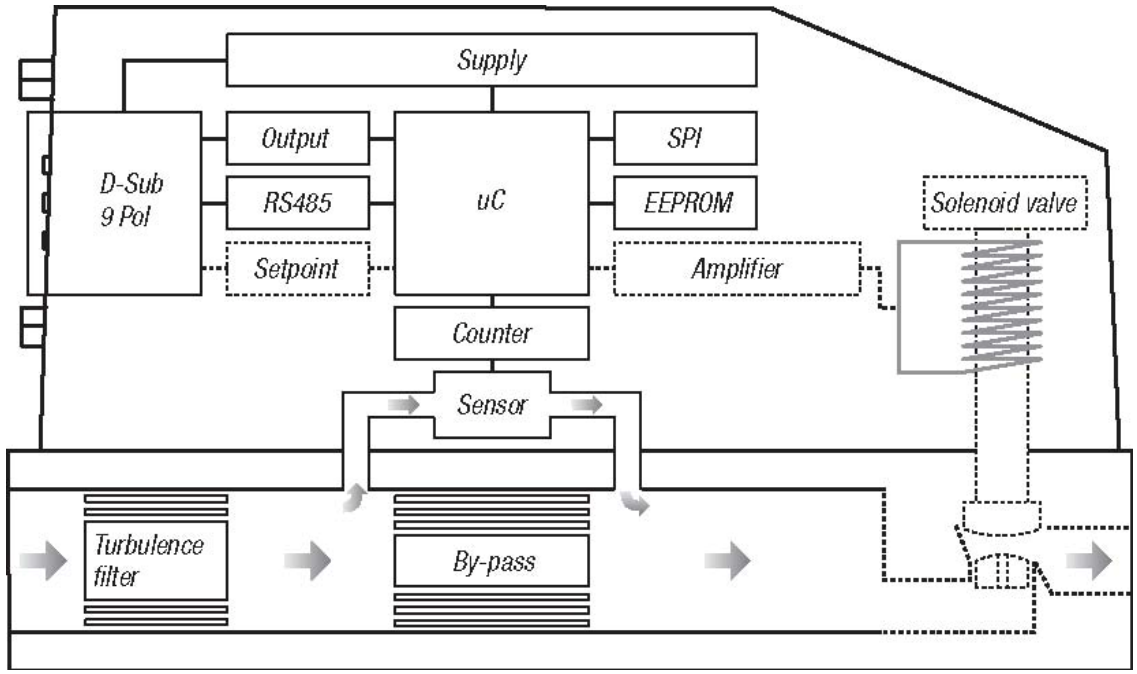


Figure 3: Block diagram

2. Technical data

2.10 General device specifications

Accuracy

Standard	±1.0% of full scale
Hi-Performance *GSM < 200 ln/min Air* *GSC < 150 ln/min Air*	±0.3% of full scale, ±0.5% of reading

Dynamics

Standard	1:50 (signal suppression less than 0.85% of full scale)
Hi-Performance	1:100 (signal suppression less than 0.8% of full scale)
Response time:	50 ms
Reproducibility:	±0,2% of full scale
Long-term stability:	< 1% of reading / year
Temperature coefficient:	< 0.025% FS measuring range type / °C
Pressure coefficient:	< 0.2% / bar of reading (typical N2)
Control stability:	±0,2% of full scale
Working pressure range:	0.2 - 11 bar a (GSC with valve type 4.5 and 8 max 8bar s)
Test pressure:	16 bar a
Storage conditions:	-20 to 80°C (-4 to 176 F), 0-95% RH, non-considering
Temperature range:	0 – 50 °C (32 bis 122 F), 0-95%, RH, non-considering *Do not expose device to direct sun light.*
Leakage rate	
Externally:	1 x 10^{-6} mbar*l/s He
Control valve:	1 x 10^{-6} mbar*l/s He
Warm-up time:	< 1 sec. for full accuracy

2.11 Mechanical specifications

Materials

Code A model (aluminum):	Anodized aluminum, stainless steel 1.4305
Code S model (stainless steel):	Stainless steel 1.4305
Sensor area:	Silicon, glass, epoxy
Seal material:	FKM, optional EPDM or FFKM
Mechanical connection (types A, B, C):	G1/4" female thread at both ends, optional with fittings (see appendix 'Accessories')
Mechanical connection (type D):	G1/2" female thread at both ends, optional with fittings (see appendix 'Accessories')
Electrical power supply:	9-pin D-Sub plug connector (male) (connections for supply, analog setpoint-actual values and ModBus RTU digital communication)

Protection class:	IP-50
Wetted parts	See appendix

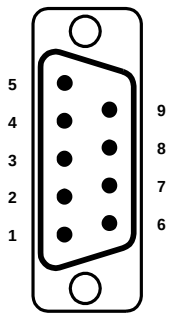
2.12 Electrical data

Supply voltage:	18..30 VDC (typically ±50 mV)
Current consumption	
Flow meter, GSM:	Max. 100 mA
Flow controller, GSC:	Max. 250 mA (8 mm valve: max. 300 mA)
Analog inputs and outputs	
Voltage: Input impedance: Minimum load:	0..5 V, 1..5 V, 0..10 V, 2..10 V, user-specific 100 kohm 1 kohm (at 24 Vdc)
Current: Input impedance: Maximum load:	0..20 mA, 4..20 mA, user-specific 250 ohm 900 ohm (at 24 Vdc)
Digital communication	
PROFIBUS	RS-485, protocol: ModBus RTU (slave) optional Profibus DP-V0, DP-V1
Control parameters:	can be set via digital communication

2.13 Measurement ranges (air)

	Measurement ranges (air), scale freely selectable	
flow meter:	from 0 ... 25 mln/min	to 0 ... 600 mln/min
	from 0 ... 600 mln/min	to 0 ... 6000 mln/min
	from 0 ... 6 mln/min	to 0 ... 60 mln/min
	from 0 ... 60 mln/min	to 0 ... 450 mln/min
flow controller:	from 0 ... 25 mln/min	to 0 ... 600 mln/min
	from 0 ... 600 mln/min	to 0 ... 6000 mln/min
	from 0 ... 6 mln/min	to 0 ... 60 mln/min
	from 0 ... 60 mln/min	to 0 ... 450 mln/min

2.14 Plug pin assignment (ModBus, power supply, analog signals)



1	**Common (-)**	GND analog signals
2	**Supply 0 Vdc**	0 VDC supply voltage
3	**Supply +24 Vdc**	+24 VDC supply voltage
4	**Output (+)**	Analog output, measured value
5	**Setpoint (+)**	Analog input, setpoint
6	**Tx+ RS-485**	RS-485 Output (Y)
7	**Tx- RS-485**	RS-485 Output (Z)
8	**Rx- RS-485**	RS-485 Input (B)

9	**Rx+ RS-485**	RS-485 Input (A)

2.15 Analog signals

The analog input and output signals are set at the factory.

The analog signals have no potential separation. Pin 1 and Pin 2 are connected internally. Potential differences have to be compensated with a suitable installation with external connections.

Note

Please note that suitable isolating transformers have to be used for potential differences between the analog and digital range on the system side.

2.16 Serial interface

In addition to its analog interface, the *DB05* has, as standard, a digital interface with the ModBus protocol. This interface enables access to numerous parameters.
In Part II of the operating instructions, 'Digital Communication', you will find all the information about the correct bus connection and the software parameters.

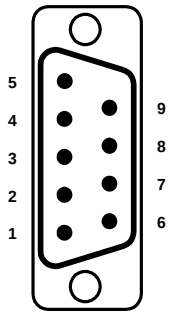
The digital interface has no potential separation.

Note:

Please note that suitable isolating transformers have to be used for potential differences between the digital communication and supply voltage on the system side.

2.17 Plug pin assignment, PROFIBUS

An optional Profibus-DP interface is available. The pin assignment for the 9-pin Sub-D plug connection is shown in the following table.



1	**NC**	-
2	**NC**	-
3	**RxD/TxD-P**	Data transmit / receive; data wire B
4	**CNTR-P**	Repeater control signal (RTS) (transmission-direction control)
5	**DGND**	Ground for data signals and VP
6	**VP / +5V**	Power supply +5 V
7	**NC**	-
8	**RxD/TxD-N**	Data transmit / receive; data wire A
9	**NC**	-

This website has further information about Profibus hardware:
http://www.profibus.com/

2.18 Calibration

Each measuring device is supplied with a factory calibration report. On request we can also provide DKD calibration (German Accreditation Body). The calibration is compatible with American and European standards. Each measuring device can store data for up to 10 types of gas or operational states.

2.19 Operation with other gases

Note
Please note that, among other effects, the zero-point error (offset display) will be higher if the device is not operated with the type of gas, for which it had been calibrated.

2.20 Pressure loss

The thermal mass flow meters and controllers have a low pressure drop. This depends mainly on the medium, the pressure conditions and the flow rate. Your sales partner has a calculation program. You will find the pressure-loss curves for the measuring devices at the end of this guide. In the case of a flow controller, the pressure loss of the valve itself must be taken into account. Please note that the size of the pipes has a large effect on the pressure loss. From around 60 ln/min, we recommend a pipe inside diameter of at least 10 mm.

2.21 Temperature compensation

Thermal mass flow meters measure the flow of gases, the result being largely independent of pressure and temperature. The sensor measures the gas temperature and, with the help of a 3-dimensional table of interpolation values, a correction factor is calculated automatically. The available output signal is thus temperature-compensated. The accuracy of the temperature measurment is ±1 C°.

2.22 Pressure compensation

During calibration, the specified operating pressure is allowed for. Changes to the pressure conditions may introduce an additional error. This is around ±0.2% per bar.
Please note that the control behavior is influenced by substantially different pressure conditions.

2.23 Response time

The CMOS sensor has a very fast response time of 50 ms. This is available directly at the output signal. In digital communications, the bus size and the speed are far more important in practice.

2.24 Control behavior

The control behavior can be adapted to suit the application. There are 3 sets of parameters (slow, medium and fast). At shipment, one set is pre-programmed as User 1, which corresponds to a “medium”.

Modifiable parameters:

Parameter set A:	User 1 (standard, corresponds to parameter set 'medium')
Parameter set B:	User 2 (corresponds to parameter set 'medium')

Fixed parameters:

Parameter set U:	Fast control with low overshoot
Parameter set V:	Medium control with minimal overshoot
Parameter set W:	Slow control with no overshoot

3. Installation and commissioning

3.10 What we supply

We ship the device with the following accompanying documentation:

- ⇨ Operating instruction

3.11 Mounting position and mounting location

We always recommend a horizontal mounting position. This can be upright, sideways or upside down. With a vertical mounting position, dependent on the type of gas and at gauge pressures above 5 bar, a zero-point offset can develop. This effect is caused by convection in stationary media.
With regard to mounting location, the following situations can cause problems:

- ⇨ Strong heat sources, or ambient temperatures outside the specification
- ⇨ Strong sources of electromagnetic radiation such as spark discharges
- ⇨ Humid environments and the associated condensation lead to damage of the electronic components
- ⇨ Particularly in the case of flow controllers, strong vibrations will cause unstable control.
- ⇨ In general, aggressive environments reduce the service life.
- ⇨ Liquid running backwards can penetrate into the measuring instrument. An elevated mounting location generally helps, or using check valves.

3.12 Requirements for pipework

The most common causes of faults concern the way that devices are connected to the gas supply.
Please note the following points:

- ⇨ The pipes must be absolutely clean. Please flush them **before** installing the measuring instruments!
- ⇨ Use appropriate pipe materials (pressure rating, durability)
- ⇨ Even when connected to fixed pipework, we recommend that the devices are mounted using the appropriate mounting holes
- ⇨ From 50 ln/min, please allow the following flow-calming sections:
- ⇨ Inlet: 10 x diameter; outlet: 5 x diameter
- ⇨ Use appropriate fittings (see chapter 3.13)
- ⇨ Malfunctions can be caused by unstable pressure controllers, pumps that oscillate, and volumes before and/or after the measuring device that are generally too small. Install an air reservoir with 2 liter volume in the feed pipe.

- ⇨ The size of the pipe must be matched to the measuring/control device. A diameter that is too small results in an increased pressure drop. From 60 ln/min, we recommend a pipe inside diameter of at least 10 mm.
- ⇨ Please note the grounding connections specified in a separate chapter
- ⇨ Check for any leaks before commissioning the devices
- ⇨ For maintenance work, we recommend that a bypass system is used. This is particularly important where the gas supply must not be interrupted

Sealants

The design of the devices enables sealing at the ends with O-rings or flat seals. It is **essential** that you avoid:

- ⇨ the use of sealing tape to seal threads. Small pieces can cause incorrect measurements and control-valve malfunctions. As well as that, if the device has to be checked or recalibrated, there will be an extra charge for the additional cleaning work.
- ⇨ sealing with liquid sealants will incur a higher cleaning charge for cleaning the device in an ultrasonic tank.

3.13 Recommended filter fittings:

We rcoment the appropriate fittings with 50µ filter.

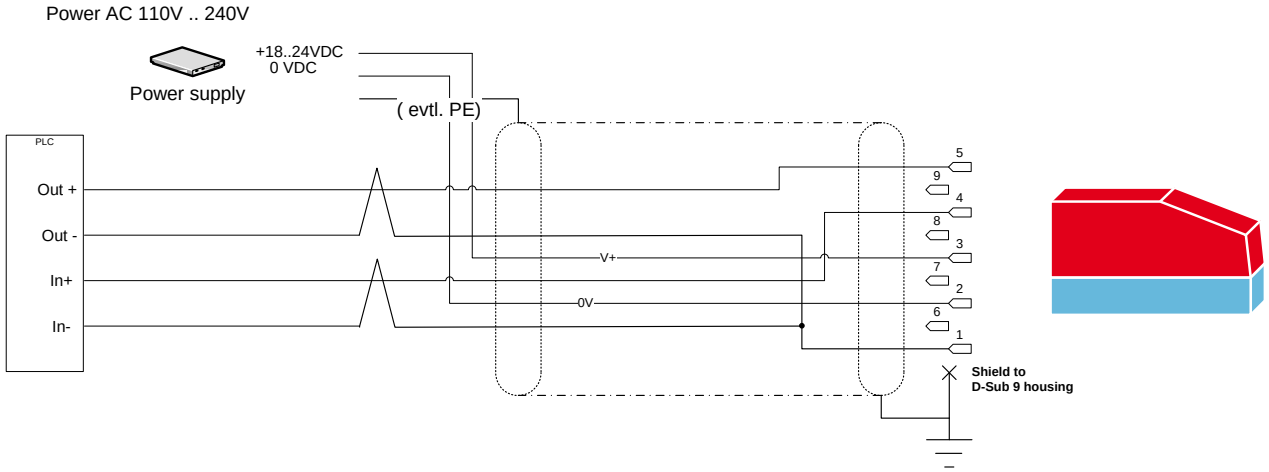
3.14 Filters / Gas cleanliness

We always recommend that a filter, or at least a fine-mesh sieve, is installed before the measuring devices. It often happens that solid matter such as welding residues, metal or plastic chips, rust, sealing tape, etc. affect the function.
In pressurized-air applications using compressors, the air must be dry and free of oil. Please ensure that a suitable processing unit is located before the devices. In the case of gases from cylinders, no special filtering is needed. For more information, see Operation / Maintenance on the following pages.

3.15 Electrical power supply

The supply voltage can be in the range +18..30 VDC and should have the smallest possible residual ripple (typically ±50 mV). Please check that the devices have been correctly wired before you connect them to the appropriate power supply. Unprofessional cable routing can result in troublesome voltage drops.

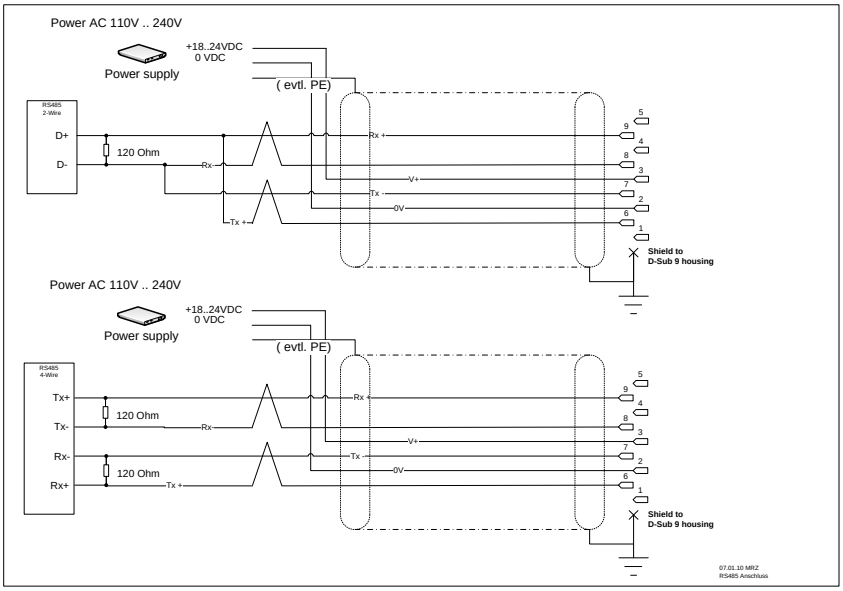
Cable for the analog signals
Optimum results are only achieved with the right wiring. Exclusively shielded and twisted cable should be used for connection to an analog measuring device (PLC).



For precise measurements we advise against combining the 0V-supply and comm wires. Please run the cable as shown above in the illustration.
We recommend only the 4..20mA current measurement. Keep the following in mind for voltage signals: high-ohm voltage inputs are susceptible to troubles (EMC) and long cables produce a voltage drop = measurement error

Cable for digital communication

Optimale Ergebnisse werden nur mit der richtigen Verdrahtung erziehlt. Use exclusively shielded and twisted cable material for connection to a RS485 interface.

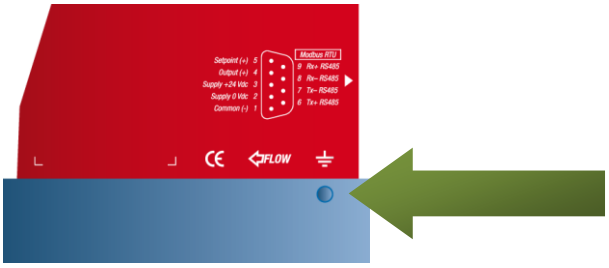


The 120 Ohm resistors are not built into the device. They must be provided externally and are absolutely essential for the RS485 current loop operation.

The resistors are already integrated in the PDM-U (USB-RS485 converter) interface, which is available as an accessory. This interface is ideal for use in the laboratory.

3.16 Grounding

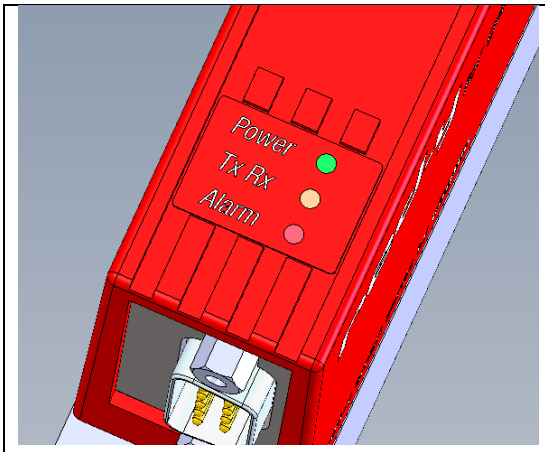
As a ground terminal, please use only the threaded hole shown. Make sure that the meter is grounded before connecting it to the power supply.



The metallic connector housing is connected to the equipment ground.
The maximum permissible fault voltage between supply 0Vdc and grounding must not exceed 30Vpeak.
The maximum permissible fault voltage between common and grounding must not exceed 30Vpeak.

3.17 LED Operating Status Display

The operating status can be read from LEDs



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Power

Illuminates when the device is correctly supplied and operational

TxRx

If the RxTx LED is flashing, it means the device is communicating on the digital Modbus interface

Alarm

If the red LED is flashing, there is a malfunction.
If the LED is continuously illuminated, there is a serious error and the device must be serviced.

Flashing Alarm:

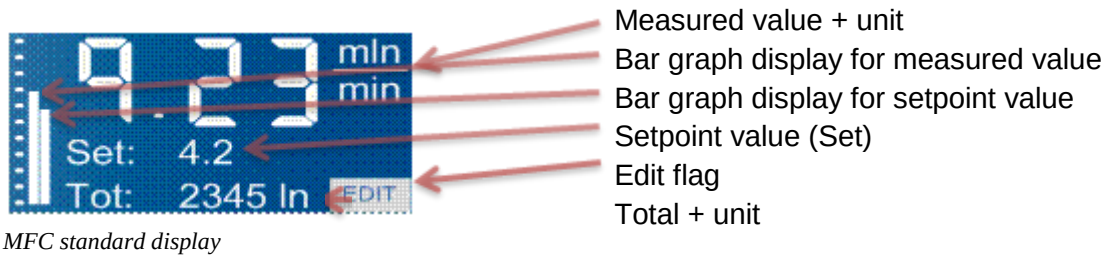
a. ***Power-Up Alarm:*** *The supply voltage to the device has been interrupted.*
b. ***No Parameter Values****: No parameters were found.*
c. ***Flow at Control Value 0%:*** *Despite a control value of 0% (Valve completely closed electrically) a flow greater than zero was measured. This can be an indication of a valve that is no longer sealing tight, an internal leak or a zero point offset. This alarm is only active in the case of a flow controller.*
d. ***No Flow at Control Value 100%:*** *Despite a control value of 100% (Valve completely open electrically) no flow was measured. This alarm is only active in the case of a flow controller. When the valve overload protection is switched on an alarm will only be set once. After the acknowledgement of the alarm it will no longer appear until you power on again.*
e. ***No Flow Change:*** *The control value for the valve was lowered or enlarged, but the measured flow does not change. This alarm is only active in the case of a flow controller.*
f. ***Analog Input Alarm:*** *The analog set point is outside the permitted range (21.6mA, or 10.8V)*
g. ***Current Input Alarm:*** *The current at the analog input is too high. It will be switched to the voltage input for 4 seconds in order to protect the circuit. This will be repeated until the current lies within the valid range.*

3.18 Display

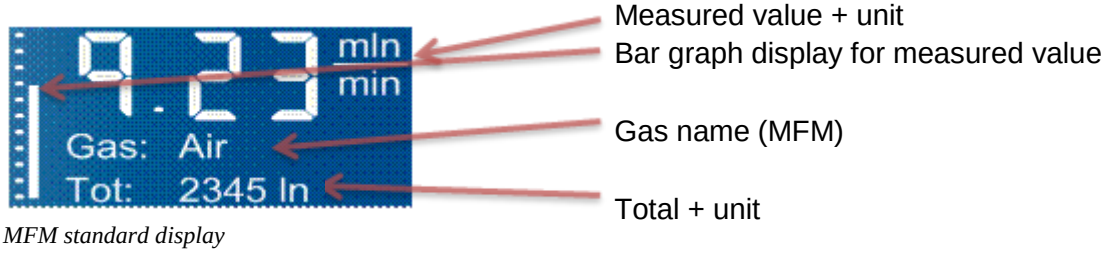
The device can be equipped with an optional display.

The display uses OLED technology with 132 x 64 pixels. Various display modes are possible on a diagonal of about 1 inch.
The display is linguistically neutral and is self-explanatory in both German and English.

The DB05 controllers have two buttons to the left of the display and two to the right. A setpoint value can be specified using these buttons. In order to enable the specified setpoint value, both buttons must be actuated simultaneously until the ‘EDIT’ sign appears in the bottom right-hand corner and the editing mode is activated. A setpoint value can be specified as long as this sign is lit. The value is adopted immediately and set by the controller. The Edit window turns off after a short time. The Edit mode also turns off after a further waiting period.



MFC standard display



MFM standard display

4. Operation and maintenance

4.10 Warm-up time

All instruments of DB05 line are immediately ready for use. There is no warm-up time.

4.11 Maintenance / Calibration check

When operated properly, *DB05* devices do not require any routine maintenance. We recommend that the calibration is checked after 12 months, however. If it still within tolerance, this time interval can be extended. The timing of the periodic check is the customer's responsibility.
With every device that is still functional, a calibration report of the actual condition is produced before the device is recalibrated or repaired. The measuring device is recalibrated when it is out of tolerance.

4.12 Cleaning to remove contamination

Depending on the type of contamination, on-site cleaning of the measuring or control device may be possible. As a first step, we recommend flushing with N_2 or dry air. If it is contaminated with liquids (ex. oil), pure Ethanol (100%) can be used. Please rinse after cleaning the device with valve position 100% open with dry air or nitrogen for approximately 15 min. to dry all liquids. With a flow controller, it is helpful if you operate it with the *get red-y* software to open the valve. A mechanical opening of the valve is not possible.
To do this, you need an **AC adapter plug and an interface cable**.
Please consult your sales partner.

Notes:

- ⇨ **The warranty is null and void if covered was removed.**
- ⇨ Only use the proper tools.
- ⇨ Be careful when handling the device and the individual components.
- ⇨ Make sure that the disassembly environment is clean.
- ⇨ Never loosen any Torx screws.
- ⇨ On no account must you touch the circuit board or electronic components without first grounding yourself and the surroundings. Electrostatic discharges can destroy components.
- ⇨ After cleaning, you should have the device checked or if necessary recalibrated by your sales partner at the next opportunity.

4.13 Return

When returning a measuring or control device, use the original packaging if possible, or other suitable packaging. So that we may serve you quickly, we would be grateful if you briefly describe the possible causes of the faults.

Note
If the device has come into contact with aggressive or toxic gases, please ensure that it is properly cleaned/flushed before returning the device to us. Please always complete the contamination declaration form. You will find these in the appendix or in the enclosed CD.

5. Appendix

5.1 Pressure conversion table

Conversion table for devices of pressure

	bar	mbar	PSI	Pa	hPa	Torr
1 bar =	1	1000	14.50377377	100‘000	1000	750
1 mbar =	0,001	1	0,01450377	100	1	0.75
1 PSI =	0.068947	68.947	1	6894.8	68.948	51.715
1 Pa =	0,00001	0,01	0.0001450377	1	0,01	0.007500
1 hPa =	0.001	1	0.01450377	100	1	0,75
1 Torr =	0.00133322	1,33322	0.01933	133.32	1.333	1

5.2 Troubleshooting

In the following table we have compiled fault symptoms, their possible causes and suitable measures. If you do not recognize your fault symptom, or the proposed measures were not successful, please consult your sales partner.
If you are planning to return a product, please refer to the chapter 'Returns'.

If you have to remove the measuring or control device from the pipeline, please observe any flushing procedures and the relevant safety guidelines.

You will find a guide on how to remove and clean the devices in the chapter 'Operation and maintenance'.

5.3 Measurement & control of flow rate

Error	Possible causes	Measures
Output signal is larger than the setpoint	Valve is contaminated and cannot close fully	Flush the valve. Please consult PKP
	The setpoint and actual-value signals were set differently, ex. setpoint 0-20 mA / actual value 4-20 mA	Please consult PKP
Output signal is smaller than the setpoint	The gas supply is too low. The counter pressure is too high	Increase the inlet pressure.
Analog setpoint is not acquired	Incorrect electrical connection	Please check that the pin assignments are correct
Analog output stays at 4 mA or 0/1 V		Change the swich-on setpoint in the menu “analog signal”. Below this set value, the device shows zero flow
Output signal is 21.6 mA / 5.4 or 10.8 V (only with measuring devices)	Flow is too high (Overflow)	Reduce the flow rate. If necessary, the full scale can be extended on site. Please consult your sales partner
	Device is heavily contaminated	Please consult PKP
	Sensor faulty	Please consult PKP

Error	Possible causes	Measures
Flow is shown despite setpoint zero	Valve is leaking, contaminated	Please consult PKP
	Sensor contaminated	Please consult PKP
	The device is being operated with a different gas from its calibration	Please consult PKP
	Offset due to mounting position	Particularly with small measurement ranges, heavy gases and gauge pressures > 5 bar, a zero-point offset can occur where the mounting position is vertical >> chimney effect. Where possible, mount the device horizontally
	'Power-up' setpoint is enabled	In this case the device controls to a defined setpoint as soon as it is powered with 24 V. Disable the ‘power-up' setpoint or enter a setpoint value 0
No digital communication is possible	Several devices with the same address have been connected to a bus. During operation, the address of several devices was changed with the 'All address 247' button	Please consult PKP
	The power-supply device is too weak to power several devices simultaneously	Use a power supply with a higher power rating (see datasheet 329-3010_ml_cablePSD.pdf 'Power Supply Devices'). Please consult your sales partner
	You are working with devices from different generations Serial number < 110,000 Serial number > 110,000	In mixed-mode operation, only the PDM-U digital cable with USB port can be used
	The USB port has not been assigned	Assign the correct COM port in the Device Manager on your computer. Warning: Please: no higher than 9!
	You are working with an interface converter that may require level matching	Refer to the connection diagram for the digital connection. Please consult PKP
	Faulty circuit board	Please consult PKP
No flow, despite the setpoint being above zero	The control mode is set incorrectly	Change the control mode to 'Automatic' in the 'Signals' menu

Error	Possible causes	Measures
	There is no gas flow or pressure	Open the gas supply, or check the inlet and the outlet pressure
	The control parameters are not set correctly	In menu ‘overview click the ‘Graph Tool’ menu, or in the main menu under Extras/’Graph Tool’, a window will open with which the control parameters can be reset. As shipped from the factory, the parameters are already set Default settings: N = 2000 KP = 1000 Ki = 600 Kd = 0
After about 10 seconds, the controller 'clicks' clearly audibly at short intervals	There is no gas flow, although a setpoint is being applied	Ensure that gas can flow; check the inlet and outlet pressure
Control is unstable	Pressure reducer is faulty, not suitable for the control range, or of poor quality	Use a buffer volume after the pressure reducer as a buffer, or a suitable pressure reducer
	Process pressure fluctuates greatly	Use a buffer volume after the pressure reducer.
	Gas supply with pulsating pump	Use a buffer volume after the pump as a buffer, or choose a pulsation-free pump.
	Outlet pressure too high	Check your process pressures before and after the device
	Buffer volume is too small	Use a larger buffer volume
	Power-supply device is faulty or not suitable	Particularly in the case of devices with serial numbers < 110,000, unstable power supplies can result in malfunctions.
	Control parameters are not optimal	Correct the control parameters in the 'Graph Tool' menu as follows: In the case of excessive overshoot: reduce Kp Too slow: increase Kp General oscillation: reduce Ki
	Contamination	Flush the valve. Please consult PKP
	Wrong flow direction	Please check the flow-direction indicator on the back of the body
	Potential differences	Please refer to the 'Grounding' section in the guide

Error	Possible causes	Measures
Flow rate does not meet expectations	Leakage	Flow rate > than reference Leakage between measuring device and your reference Flow rate < than reference Leakage upstream of the measuring instrument
	Contamination	With contamination by sealing tape, for example, it is possible that the flow divider is partially blocked. In this case the device displays more than the reference. Please consult your sales partner
	The device is being operated with a different gas than calibrated.	Connect the intended gas, or change the type of gas in the 'Calibration' menu
	Inlet pressure is too low	Check your inlet and outlet pressures
Device becomes very warm	There is a setpoint signal at the flow controller, although no gas is connected	- check the pressure in your gas supply
Valve opens to 100% with each setpoint, no flow is displayed or the displayed flow remains constant	Sensor is faulty	Please consult PKP
Pulsating control after setpoint is applied	Wrong flow direction	Please note the flow-direction indicator on the back of the body

5.4 Wetted parts DB05

Instrument ***Gerät***	**series SN > 110 000**	
Version *Ausführung*	Aluminium	Stainless steel *Edelstahl*
Body *Grundkörper*	Aluminium[1]	1.4305
Body: O-Rings *Grundkörper: O-Ringe*	FKM (Standard), EPDM, PTFE	
Flow divider *Strömungsteiler*	Aluminium[2]	1.4305
Manual valve: Body, spindle, nozzle *Handventil: Grundkörper, Spindel, Düse*	Ms58	1.4305
Manual valve: Needle *Handventil: Nadel*	1.4112	
Manual valve: O-Rings *Handventil: O-Ringe*	FKM (Standard), EPDM	
Control valve *Regelventil*	1.4305/1.4105/1.6908	
Control valve: O-Rings *Regelventil: O-Ringe*	FKM (Standard), EPDM	
Sensor material *Sensormaterialien*	Silicon, silicon oxide, silicon nitride *Silizium, Siliziumoxid, Siliziumnitrit* Epoxy	
Sensor packaging	Aluminium[2]	1.4305

Abbreviation ***Kurzbezeichnung***	**Designation** ***Bezeichnung***	**Remarks** ***Bemerkungen***
Aluminium1	Anticorodal 100/ Stanal 32	Anodized Eloxiert
Aluminium2	Anticorodal 100	Untreated Unbehandelt
EPDM	–	Ethylene-propylene-diene-monomer rubber Ethylen-Propylen-Dien-Kautschuk
Epoxy	–	Adhesive for sensor fixation, protection for wire bonding Klebstoff für Sensorfixierung, Schutz für Bonddrähte
FKM	–	Fluor rubber Fluor-Kautschuk
PBT	Pocan	Polybutylene terephthalate Polybutylenterephthalat
PTFE	Chemraz	Polytetrafluoroethylene Polytetrafluorethylen
Sainless Steel Edelstahl	-	1.4305

5.5 Contamination clarification

When returning equipment to us, please complete all sections of the following declaration. In particular, the reason for return, in the case of contamination the nature of the residues and the cleaning, as well as information on any possible hazards.	
Devices	
Model code:	
Serial number:	
Reason for return:	
Type of contamination	
Device was in contact with:	
It was cleaned by us with:	
To protect our employees and for general safety during transport, it is vital to clean devices properly and to use appropriate packaging.	
Can you provide further information on the contamination?	Inert (no hazard) Corrosive Caustic/acid Must not come into contact with moisture Oxidizing Toxic Other hazards: _____
Legally binding declaration	
We hereby confirm the correctness and completeness of the above information.	
Company:	
Address:	
Phone:	
Contact person:	
Date:	
Signature:	