red-y for gasflow

Instruction manual red-y smart series

smart meter GSM

smart controller GSC

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

swiss technology made by vögtlin

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vögtlin instruments

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Version: **smart_5_3**

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Introduction

With red-y you get the latest, most modern CMOS sensor technology. CMOSens™ is a technology label and stands for a modern process in which the sensor and the signal processing are combined on a highly integrated chip.

This manual will familiarize you with the installation and operation of your red-y. We therefore ask you to read this manual carefully and to contact your sales partner with any questions or doubts.

We have prepared this manual very carefully in order provide you with appropriate and precise information and instructions. However, no liability is assumed for any errors.

User benefits

Ultimately, a technology only represents a means to an end. Therefore all of our efforts are aimed at the requirements and wishes of the user of this instrument and his measurement and regulation tasks:

- ⇨ *Compact, easy-to-install measurement or regulation unit*
- ⇨ Normalised input and output signals
- ⇨ Normalised supply voltage
- ⇨ Serial communication
- ⇨ CE approved
- ⇨ Measurement of the gas temperatur
- ⇨ Easy maintenance and service
- ⇨ Easy expansion of functionality
- ⇨ 3-year guarantee
- ⇨ Top performance in response, dynamics and accuracy
- ⇨ Matching options and accessories

Service and Quality

We continuously improve the quality of our products and services. Only with use does it ultimately become clear whether the right product has been selected. Thus, we attempt not only to propagate good service and high quality, but to live it every day.

Guarantee

The guarantee for red-y for gasflow products extends to material defects and production flaws. The guarantee maximum is the replacement of the equipment at no cost. Claims are omitted in the case of inappropriate use, external effects in general, excessive heat or dropping.

We are always grateful for information on existing defects, for suggestions for improvements, and for critiques.

Tips & Warnings

Before putting the instrument into use, these operating instructions should be read thoroughly. Improper use, errors for lack of understanding and the consequences arising from this, can lead to the destruction of the instrument or even the endangerment of personnel.

The equipment should be put into operation and serviced by appropriately qualified personnel only. The proper handling of the products is an absolute requirement for its trouble-free operation.

Electrostatic discharges can destroy electronic components of this measurement and regulation unit.

Content of this manual

This manual aims at a safe operation of red-y mass flow meters and controllers.

Each instrument is supplied full of charge with a CD containing the get red-y software as well as this manual.

A bit of theory

Measuring principle

The principle of thermal mass flow measurement is perfectly suited for the measurement of gas flows. One of the significant advantages is that the measurement is largely independent of pressure and temperature. By contrast to volumetric principles, pressure and temperature do not have to be additionally measured. Although the principle yields mass as a measurement result (e.g. g/min), most devices are calibrated to standard volumes (e.g. ln/min). One possible explanation is the fact that the comparability of the measurement results with other principles is given with this. Since the thermal flow measurement depends on the type of gas, in addition to the specific heat, the standard density (0°C, 1,01325 bar a) for the conversion to standard volume is also used.
With all design options of the measuring principle, there is always a heater and one or more temperature-measurement points and the gasflow draws heat from the heater.
With the red-y mass flow meter, a constant heating power ensures a temperature difference that is directly proportional to the gas flow rate. In the flume, a temperature measurement is followed by a heater, and then a temperature measurement again. The figure below illustrates this process.

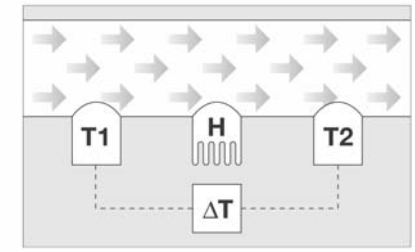


Figure 1: Measuring principle

If the flow rate=0, the heater H uniformly distributes the heat, for which the temperature difference T1-T2 equals zero. Two effects occur with the flow rate that lead to a temperature difference: First, the temperature sensor T1 at the entrance detects a lower temperature. This happens because of the cooling of the entering gas, which theoretically drops to the ambient temperature respective of gas. Secondly, the gas flowing over the heater carries heat to the temperature sensor T2, located after the heater, and thus increases this temperature.

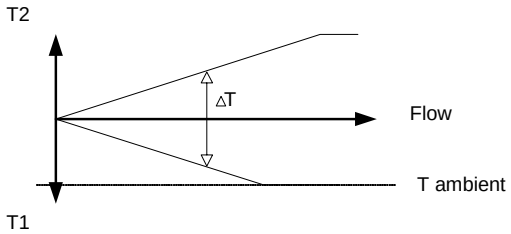


Figure 2: Sensor signals

The temperature difference is in direct proportion to the mass flow.

CMOS Technology

Red-y measurement and regulation units feature a new basic technology that sets standards for maximum precision sensor systems. The fusion of a semi-conductor chip with sensor technology results in a highly integrated system solution that is impressive for its excellent sensor precision, as well as digital intelligence and reliability.

The most notable advantages to the customer are the outstanding precision of the sensor, the rapid response time and a dynamic measuring range that no system has attained up until now. Thanks to the compact single chip design, CMOSensTM-based sensors are extremely resistant to electromagnetic interference (EMI), a significant technical advantage of this ultra modern sensor technology.

With CMOSensTM, the sensor element, amplifier and A/D converter form a unit on the same silicon chip.

The digital intelligence linked with the CMOSensTM sensor permits the emission of a fully calibrated, temperature-compensated output signal. The CMOSensTM 'intelligence' integrated onto the chip thus facilitates an extremely simple processing of the emitted measurement data. CMOS is a standard technology for the manufacture of integrated circuits.

CMOS chips are generally known as 'semi-conductor chips', 'silicon chips' or 'computer chips'. They are widely used in PCs, mobile telephones and many other information technology devices.

Block diagram

The following figure shows the principal function blocks:

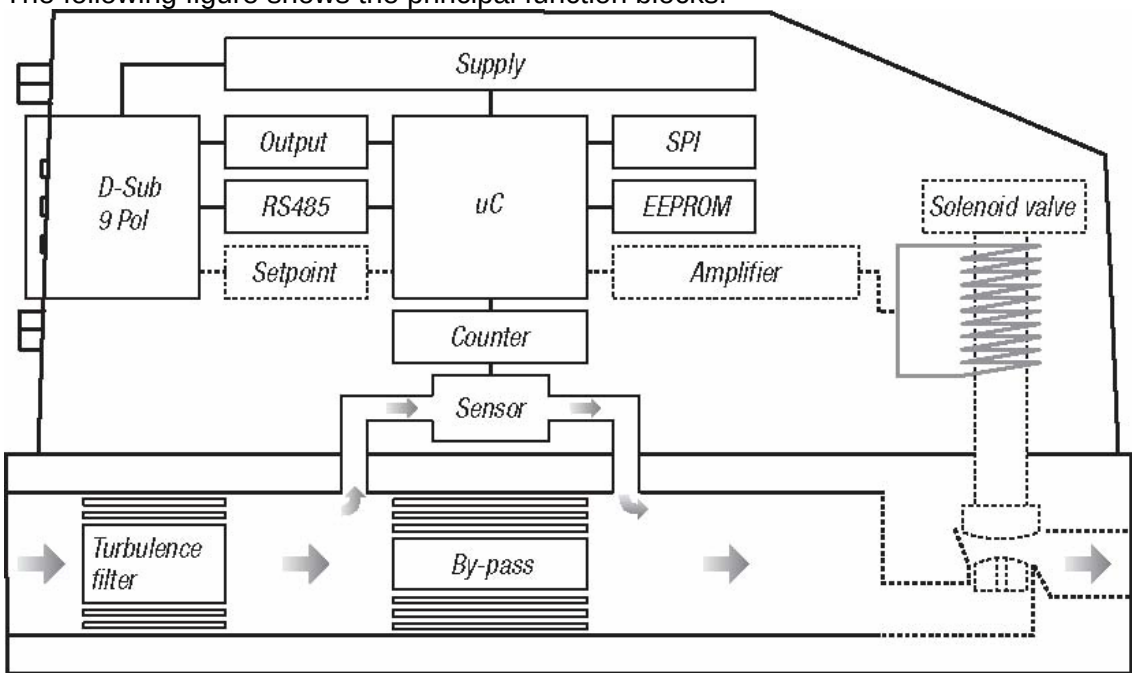


Figure 3: Block diagram

Technical informations

General specifications

Accuracy	
Standard	± 1.5% of full scale
Hi-Performance	± 0.3% of full scale, ± 0.5% of reading
Dynamic range	
Standard	1:30 within specified accuracy (Signal rejection below 2.8% of full scale)
Hi-Performance	1:100 within specified accuracy (Signal rejection below 0.8% of full scale)
Response time:	50ms
Repeatability:	± 0,1% of full scale
Longterm stability:	< 1% of reading / year
Temperature sensitivity:	< 0.025% / °K
Pressure sensitivity:	< 0.2% / bar (N2 typical)
Control stability:	± 0,1% of full scale
Operating pressure:	0.4 - 11 bar a
Test pressure	16 bar a
Operating temperature:	0 – 50 °C
Leak integrity	
Inboard/outboard:	1 x 10^{-8} mbar*l/s He
Control valve:	1 x 10^{-6} mbar*l/s He
Warm up time:	10 minutes for max. accuracy

Physical specifications

Materials of construction	
Model code A (Alu):	Aluminium, Stainless steel
Model code S (SS):	Stainless steel
Sensor:	Silicon, silicon oxide, silicon nitride, epoxy
Seals:	FKM, optional EPDM or PTFE
Mechanical connection (Type A, B, C):	Female G1/4" inlet and outlet, optional with fittings
Mechanical connection (Type D):	Female G1/2" inlet and outlet, optional with fittings
Elektrical connection: (Supply, analog, ModBus)	D-sub connector (male), 9-pin
Ingress protection:	IP-50

Electrical specifications

Supply voltage:	18..30Vdc (typ. ±50mV)
Supply current	
Massflow meter GSM:	max. 100mA

Massflow controller GSC:	max. 250mA
Analog signals	
Voltage:	0..5V, 1..5V, 0..10V, 2..10V, customer specific
Input resistor:	100 kOhm
Output load min.:	1 kOhm (@ 24 Vdc)
Current:	0..20mA, 4..20mA, customer specific
Input resisitor:	250 Ohm
Output load max.:	900 Ohm (@ 24 Vdc)
Digital communication:	RS-485, Protocol: ModBus RTU (Slave) optional ProfiBus DP-V0, DP-V1
Controls parameters:	freely adjustable by digital communication

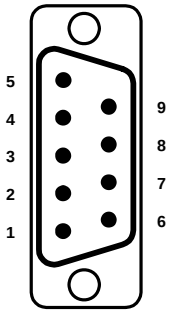
Measurement ranges

The red-y massflow meters and controllers are normally supplied with one of the following standard measuring ranges for air. Optional the instruments are available with a customer specific range and calibrated for a different gas.

Standard ranges

Code	*Range*	*Unit*	*Code*	*Range*	*Unit*
A1	25	mln/min	C2	5	ln/min
A2	50	mln/min	C3	10	ln/min
A3	100	mln/min	C4	20	ln/min
A4	200	mln/min	C5	50	ln/min
A5	500	mln/min	D2	50	ln/min
B2	500	mln/min	D3	100	ln/min
B3	1000	mln/min	D4	200	ln/min
B4	2000	mln/min			
B5	5000	mln/min			

Connector (ModBus, Supply, Analog signals)



1	Common (-)	0 Vdc Analog signals
2	Supply 0 Vdc	0 Vdc Supply voltage
3	Supply +24 Vdc	+24Vdc 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)

Analog Signals

The ranges for the analog input and output signals can be set with the free ‚*get red-y*' software. The ranges can be defined as current or voltage ranges. The maximum ranges are 0..20 mA and 0..10 V.

The analog signals have no potential isolation. 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.

Serial interface

In addition to the analog output signal *red-y* also offers a digital interface as standard. A large number of parameters are available, based on the ModBus protocol. The ‚Digital Communication ModBus' section contains detailed information about the correct electrical connection and the software parameters.

The digital interface has no potential isolation.

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.

Calibration

Each instrument is tested and calibrated on a fully automatic calibration equipment, traceable to european and american standards and the calibration data are stored in the non-volatile memory. As standard the calibration gas is air. Please consult your sales partner for calibrations with other gases.
The configuration and calibration data of each individual instrument are available on request.

Different gas data records

Device types offering storage capacity for up to 10 different gas data records are available. They may differ through different operating parameters (e.g. end value, medium, ...). A device may be calibrated for 1ln/min of air, 5ln/min of He and 2ln/min of Ar, for example.

Conversion factors for other gases

Each measuring and control device is calibrated fully automatically using a state-of-the-art calibration system. The values are converted internally according to the application. If the measuring medium is modified, the output signal can be corrected accordingly via conversion factors. If the required gas is not listed in the table (page 56), please contact your distribution partner. Depending on the medium these conversion factors generate an additional measurement error.

Note
Please note that the zero point error (offset display) will be higher if the device is not operated with the stored medium.

Pressure loss

The pressure loss in a thermal massflow meter is very small and depends on the gas, the operating pressure and the actual flow rate. The graphs in chapter 11 ‘annex’ show typical values for different gases at 20°C and 1013 mbara.
The pressure loss for a gas other than air is calculated according to the following formula:

$$\Delta p_{new} = \sqrt{\frac{\rho_{new}}{1.250}} \times \Delta p$$

Δp : *pressure _ loss*
ρ : *density*

Note that insufficient tube diameter or unsuitable fittings may cause a high pressure loss. The pressure loss in a massflow controller mainly depends on the control valve. The control valve must operate with the specified pressure drop for proper operation.
The graphs in chapter 11 ‘annex’ show the typical pressure loss in massflow meters of different sizes and with different gases.

Temperature compensation

Thermal massflow meters are almost unaffected by temperature and pressure variations of the measured gas. The temperature variations are detected by the sensor. Based on a three dimensional correction table the microprocessor then automatically corrects the output.

The temperature is measured with an accuracy of +/-1°C and can be read-out over the serial link.

Pressure compensation

Each individual instrument is calibrated for the specified working pressure. Changing pressure conditions degrades the accuracy.

Note that the proper function of a flow controller is not guaranteed if the pressure drop is too high or too small.

Response time

A unique feature of the CMOS-sensor is the extremely fast response time of 5ms. After 20 ms, measured values are within standard specification.

Control characteristics

The control caracteristics of the red-y massflow controllers can be adapted to the application. There are 5 sets of control parameters (for each gas table) with factory settings for the following control response:

User changeable parameter sets:

Set A: User 1 (Standard, corresponding to set V)
Set B: User 2

Fixed parameter sets:

Set U: Fast response with overshoot
Set V: Optimal response with slight overshoot (standard)
Set W: Slow response without overshoot

Mounting and Installation

General Informations

Check the packing box for damage. Should the packing be damaged, immediately notify the local carrier and inform your sales partner. Carefully check if the goods correspond to the packing list and that there are no missing or damaged parts.
The red-y series are accurate measuring instruments. For best performance carefully read the following recommendations. Check the instrument label and make sure that the massflow meter/controller suits the application.

Caution
The maximum working pressure must always be lower than specified test pressure.

Mounting

The preferred mounting position is horizontal, up right or hanging. For pressures > 5bar a vertical mounting position may cause an offset.
Avoid the installation in proximity of any source of thermal or electric radiation.
Avoid vibrations and mechanical stress.
Do not install the instrument at the lowest point of the piping to avoid an eventual backflow of liquids.

Piping

The correct piping is very important for the performance of measurement. Therefore carefully check the following points:

- ⇨ The piping must be absolutely clean.
- ⇨ The piping must conform in pressure and corrosion resistance.
- ⇨ Always fix the instrument on the body by means of fixing screws.
- ⇨ Avoid abrupt angles on the inlet. If this is not possible contact your sales partner.
- ⇨ Use appropriate fittings with O-ring seals and do not tighten the fittings holding the instrument by the cover.
- ⇨ Do allow a sufficient upstream buffer volume between the pressure regulator and the instrument, especially with higher flow rates. Do not use too small diameter piping as this creates a high pressure loss and may impare the performance of the instrument.
- ⇨ Carefully check the piping for possible leaks.
- ⇨ The instruments have a flow rectifier at the inlet. For flow rates > 50ln/min a straight tube of 10 times diameter is recommended.
- ⇨ For critical applications (uninterrupted gas supply) we recommend to install a bypass system to allow service on an instrument.

Sealants

The mechanical design of the devices ensures that screw joints with gaskets on the face side (O-rings, flat gaskets, ...) enable ideal connection. No sealants are therefore required:

- ⇨ Please do not use no liquid sealants! In non-hardened state a sealant may spread with the flow through the whole measuring device and seriously impair its function.
- ⇨ Do not use Teflon tape for sealing the threads! During screw joint removal this could lead to contamination of the valve and the sensor.

Electrical connection

We strongly recommend our standard cables. Please consult your sales partner. If you install your own cables, carefully read the connection instructions.
The installation has to comply with all relevant safety and EMC regulations.
We recommend the use of an EMC filter if the power supply cable exceeds 3m.
Avoid earth loops.
The power supply voltage must be in the range of 18 .. 30Vdc (ripple max. 50mV typ.).
Use cable of sufficient size to minimize the voltage drop.

Gas supply

Make sure your gas supply is absolutely clean, i.e. free from dust, oil, water etc.
If necessary install an upstream and eventually a downstream filter to avoid any damage to the instrument.
The capacity of the supply should be at least 2 times of the max. flow range.
Carefully choose your pressure controller and do not install your red-y directy to it.
The pressure must be sufficient to cover all pressure losses in the piping, fittings etc.
At very low flows the pressure controller might be oversized and work in an intermittent mode resulting in a strongly oscillating flow.

Do not apply pressure until the electrical connections are made. When applying pressure to the system, increase the pressure gradually and avoid pressure shocks.

If explosive or aggressive gases are to be used, purge the process with dry inert gas like Nitrogen or Argon.

Operation and service

Warm-up time

red-y is available for measurements immediately after the device is switched on. The measurement readings on the digital interface match the specified accuracy.
During operation via the analog inputs and outputs we recommend a warm-up time of 10 minutes.

Before turning on, please be sure that the wiring is correct and is installed according to the installation plan, and that the gas connections are also mounted in accordance with the installation instructions of the manufacturer.

Zero point check

Without any special specifications for the installation position of the device, the zero point is aligned at operating temperature and horizontal installation position before delivery. If the device is installed vertically, a value can be read out at a zero flow rate according to operating pressure. During the check, be completely sure that no gas is flowing. In the case of a shift in the zero point, please contact your sales partner.

Note
Please note that the zero point error (offset display) will be higher if the device is not operated with the stored medium.

Maintenance

With proper operation, red-y does not require any routine service at all. If the measurement value is in a quality-relevant range (e.g. ISO 9001), we recommend a periodic check of calibration. The interval depends strongly on use.

Cleaning in the case of contamination

Should there be suspicion of contamination (sudden deviation of measurement value in familiar processes, visible traces in the piping, etc.), try flushing the device with a dry inert gas. Depending on the contamination, it may be necessary to dismantle the device.

Tips:

- ⇨ **The guarantee lapses at all events with the dismantling of the device.**
- ⇨ Use only designated tools.
- ⇨ Handle the device and individual components with extreme care.
- ⇨ Ensure that the dismantling area is clean.
- ⇨ Never unscrew a torx screw..
- ⇨ Do not touch the electronic circuit board or electronic components under any circumstances.
- ⇨ After the cleaning, you should have the device checked by your sales partner at the first opportunity.

Flow splitter disassembly

If the body has become contaminated the flow splitter can be removed. Disassembly is different for the different device types:

Type A

- ⇨ First release the slotted screw in the center of the flow splitter (approx. 5 turns)
- ⇨ Unscrew the whole flow splitter with an Allan key

Type B, C

- ⇨ Unscrew the whole flow splitter with an Allan key

Type D

- ⇨ First unscrew the locking pin (underside of the body) with an Allan key
- ⇨ Unscrew the flow straightener with a suitable tool
- ⇨ Pull the flow splitter out of the body

Flow splitter assembly

- ⇨ Carry out the steps described above in reverse order
- ⇨ After correct assembly flush red-y with dry inert gas.
- ⇨ Check the correct function of the cleaned measuring instrument based on empirical values by checking the zero point and defined measurement readings, for example.

Returns

With the return of a measurement or regulation device, use the original packaging if possible, or other appropriate packing. Please inform us of the reason for the return in order to spare any unnecessary callbacks and delays.

Note
Should the device come in contact with dangerous substances, please clean the device carefully, notify us and pack the device tightly. Please fill out the contamination statement. You will find this document in the chapter ‘annex’ or on the enclosed CD.

Digital Communication ModBus

The digital communication with a red-y mass flow meter or controller offers the following advantages:

- ⇨ **More informations**
  Besides the mass flow you can read the gas temperature, total flow, alarm status, serial number etc.

- ⇨ **Access to device functions**
  Allowing you to adapt the controller behavior and other settings.

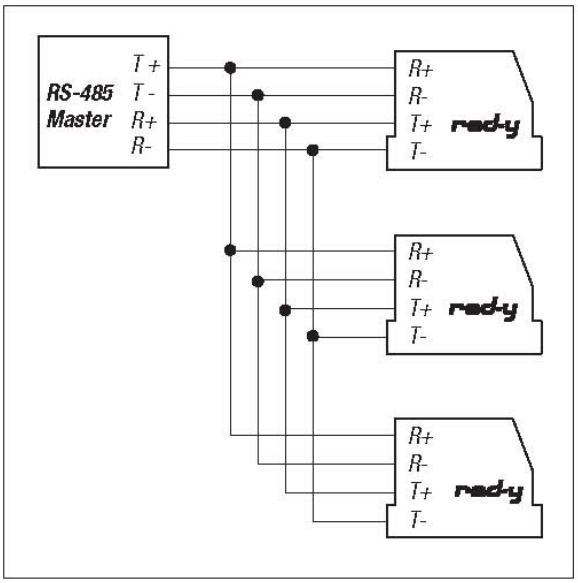
- ⇨ **Save costs**
  Due to a bus structure within a system of several instruments.

- ⇨ **Higher RFI immunity**
  Digital signals are less affected by RFI disturbances..

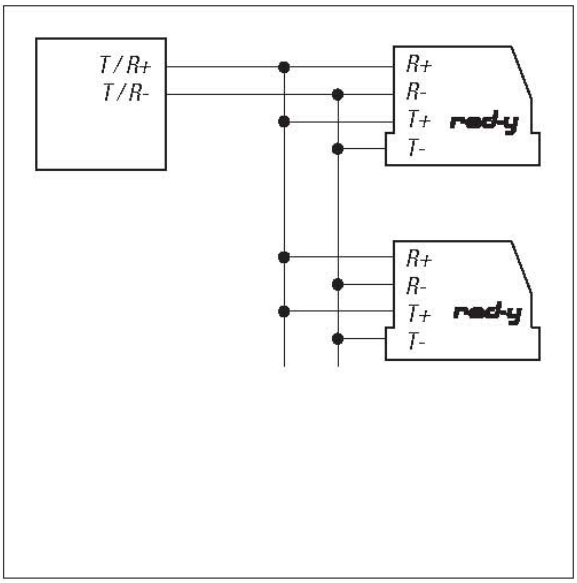
Digital interface

Red-y mass flow meters and controllers work on a serial communication RS-485 with a protocol ModBus RTU. A 2 or 4 wire connection is possible.

Note
To use the function ‚Firmware update' it is necessary to use a 4-wire connection. The communication wird bei dieser Betriebsart vollduplex mit Baudraten bis 57600 Bit/s durchgeführt.



4-wire communication (full duplex)



2-wire communication (half duplex)

Each red-y must be set to an individual address between 1 and 246 in order to communicate properly with your PC. With the free software 'get red-y' you can check the bus, read and if necessary change the address of an instrument.

On delivery time, each device has the same standard adress 247.

Interface cable

Using a RS-485/RS-232 converter the instruments can also be connected to a RS-232 port of a PC. The converter should be galvanically isolated.

With the interface cable ‚PDM-U' You are able to connect the devices to an USB port This item is also available from your red-y sales partner.

Communication parameters

Red-y works on the following communication parameter:

Communication speed:	9600 Baud
Start bit:	1
Data bits:	8
Stop bits:	2
Parity:	none
input buffer:	300 Bytes

Note:
There are master systems that are only able to generate 1 stop bit. In this case the second stop bit can be replaced by ‚mark parity'.

ModBus RTU

The ModBus protocol is a communication structure for a master-slave communication between intelligent instruments. It is used world wide and supported by most manufacturers of measurement and control instruments. Orginally it was introduced by MODICON. For further informations see www.modbus.org.

Protokoll

A ModBus message from master to slave consists of: Address, command (read or write), data and checksum (CRC). The following picture shows the structure of a complete command:

ADRESS	FUNCTION	DATA	CRC
1 Byte	1 Byte	0..252 Bytes	2 Bytes

The length of a command is limited to 256 bytes.

⇨ ADRESS
The ModBus adress of a device. Valid addresses are in the range of: 1..247
A broadcast to all devices goes to adress 0 => no answer from the instruments

⇨ FUNCTION

Function 03:	Read holding register
Function 06:	Preset single register
Function 16:	Preset multiple registers

⇨ DATA
This section holds information about address and data. Data types with several bytes, are

transmitted as follows:

16-bit integer	
Hi-byte	Lo-byte

32-bit integer			
Hi-word		Lo-word	
Hi-byte	Lo-byte	Hi-byte	Lo-byte

32-bit float			
Hi-word		Lo-word	
Hi-byte	Lo-byte	Hi-byte	Lo-byte

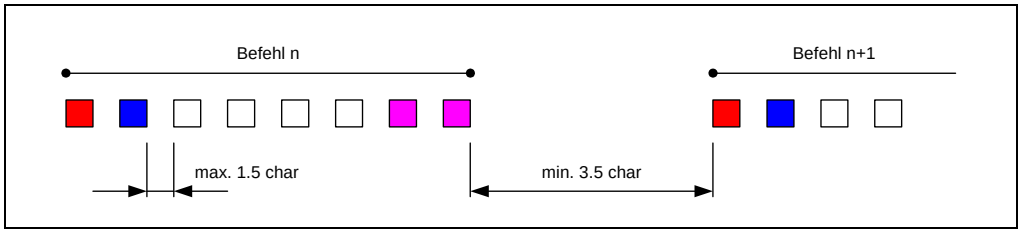
⇨ CRC
The chechsum is built over the whole command (excl. CRC).

CRC (16-bit integer)	
Lo-byte	Hi-byte

Note*:*
The CRC-bytes are transmitted in lo-hi-order (opposite order!).

Timing

Between two commands must be a pause of at least 3.5 characters. At a baud rate of 9600, this corresponds with a pause time of 4ms.
Within an instruction the characters may have a maximum distance of 1.5 characters. With a bit rate of 9600 Baud this corresponds to a time of approx. 1.7ms.



Data types

data type	*format*	*description*	*length [bytes]*
float32	f32	floating point, according to IEEE-754	4
string8	s8	sequence of symbols, null-terminated	8
string50	s50	sequence of symbols, null-terminated	50
uint8	u8	unsigned integer, 8 bits	1
uint16	u16	unsigned integer, 16 bits	2
uint32	u32	unsigned integer, 32 bits	4

Parameters

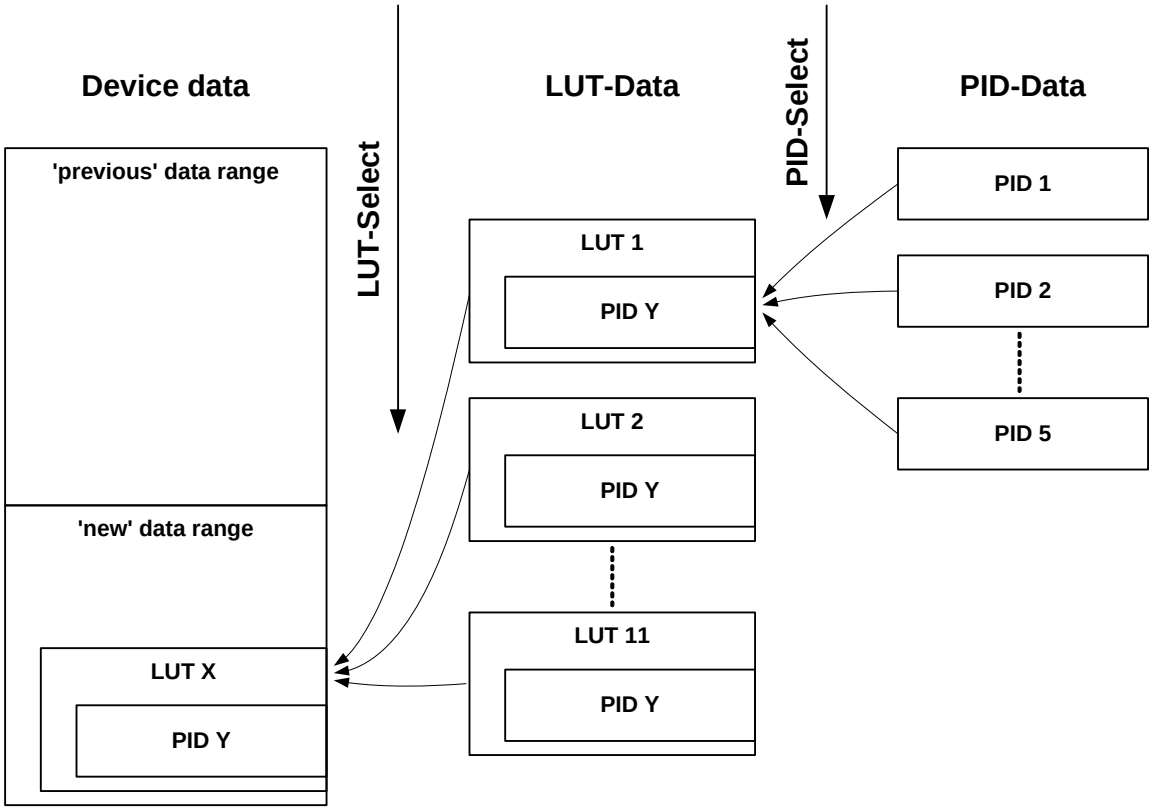
Numerous parameters can be read and written via the digital communication. They enable operation (actual and set value) and also device parameterization (gas type, measuring point ID, ...).
Additional parameters are integrated that are only accessible with associated permission and are therefore not documented in detail in this handbook.

The example below illustrates the potential configuration of a parameter.

Name of parameter	`register address`	write	access level
		read	access level
Description of parameter			
Data format			

Datenstruktur

The data structure was fundamentally revised and restructured.



‚Previous' data area

Compatibility with existing devices was a key issue. Many registers are accessible via identical addresses. Some registers were removed or moved into the ‚new' data area.

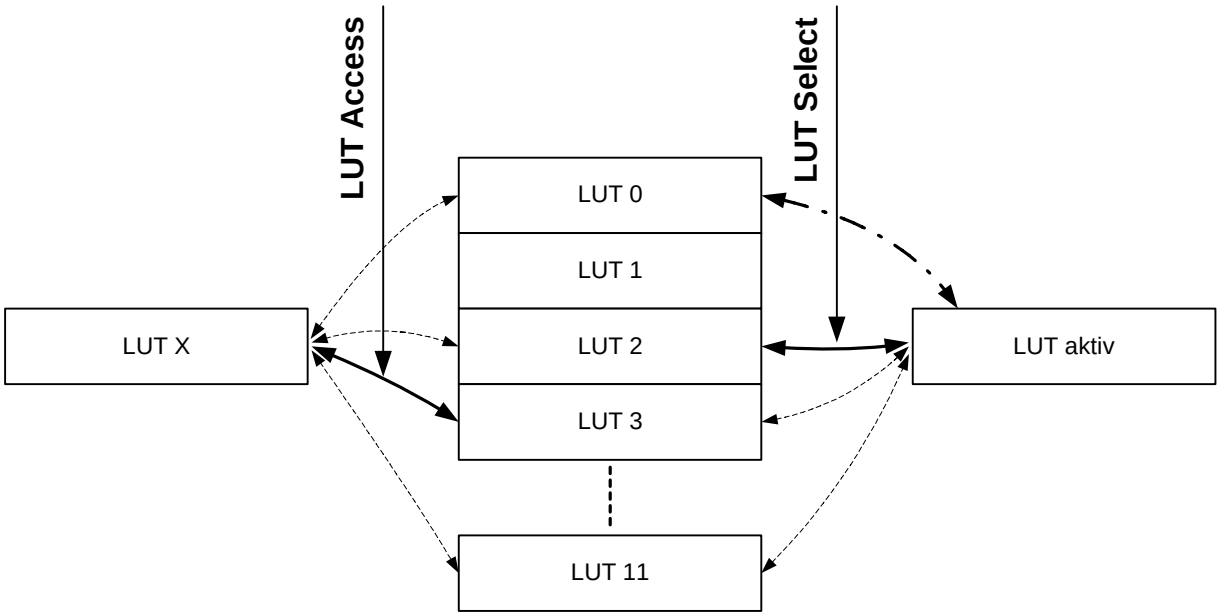
‚New' data area

This is where new device functions are stored. In addition the number of selectable gas types was extended to 10. All data that depend on the gas type were moved to the LUT area (e.g. totalizer, sensor amplification, ...)

LUT data

The LUT data area contains all data that depend on the gas type. This is available 11 times on the device, although only areas 2..11 are accessible for the user.

The active gas type is selected via the ‚LUT Select' register.



A data pointer can be set via the ‚LUT Access' register. It enables data to be read from or written to any LUT data area. Data access can be realized independent of the active LUT.

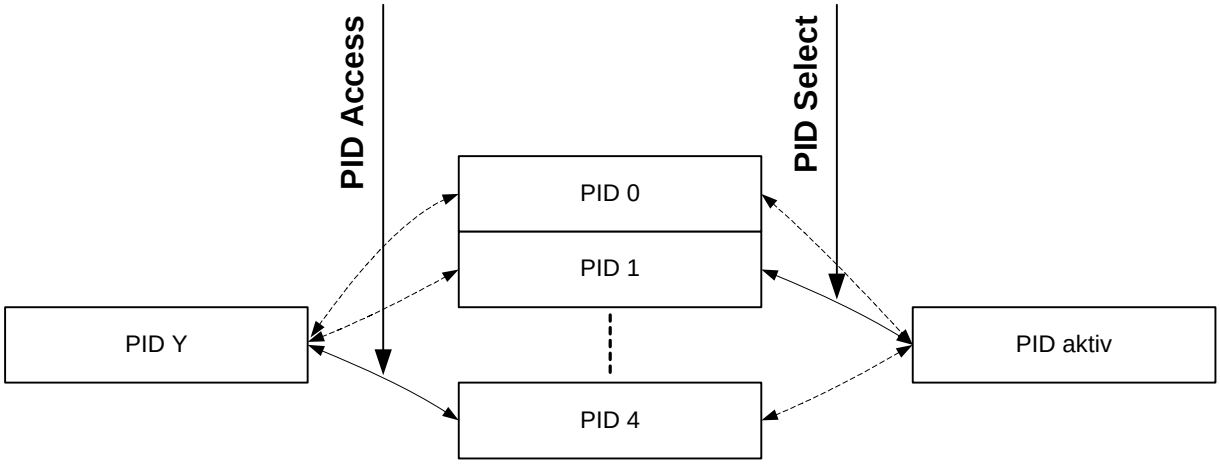
Remark:

If the data pointer ‚LUT Access' is set to 0, data access is always redirected automatically to the active LUT.

PID data

For every gas type (LUT) 5 different data records are available for control adjustments.

The parameter set is activated via the ‚PID Select' register.



A data pointer can be set via the ‚PID Access' register. It enables data to be read from or written to any PID data area. Data access can be realized independent of the active PID data record.

Parameter overview

In order to ensure compatibility with existing devices, many register are still accessible via the ‚old' address. These addresses are highlighted in gray and shown in italics.
For new projects it is advisable to use the new register addresses.

Name	*Description*	*Register*	*ModBus*
Gas flow	Measured value of gas flow	0x0000..0x0001	0000
Temperature	Measured value of temperature	0x0002..0x0003	0002
Totaliser	*Total gas flow*	*0x0004..0x0005*	*0004*
Setpoint gas flow	Control setpoint of gas flow	0x0006..0x0007	0006
Analog input	Measured value of analog input	0x0008..0x0009	0008
Valve control signal	Actual value of the valve control	0x000a..0x000b	000a
Alarms	Alarm status	0x000c	000c
Hardware errors	Indicator for possible malfunction	0x000d	000d
Control function	Selection of the controller mode	0x000e	000e
Device adress	ModBus device adress	0x0013	0013
Measuring range	*Calibrated mesuring range (flow)*	*0x0014..0x0015*	*0014*
Measuring unit	*Engineering unit of mesured value*	*0x0016..0x0019*	*0016*
Name of fluid	*Name of the measured gas*	*0x001a..0x001d*	*001a*
Serial number	Serial number of the electronic module	0x001e..0x001f	001e

Name	Description	Register	ModBus
Version number hardware	Development stage of the electronic module	0x0020	0020
Version number software	Development stage of the software (firmware)	0x0021	0021
Save setpoint immediate	Save setpoint value immediate to EEPROM	0x0022	0022
Type code 1	Device type description (part 1)	0x0023..0x0026	0023
Analog output manual	Manual setting of the analog output	0x0028..0x0029	0028
Parameter K_P	*Control parameter gain*	*0x002e..0x002f*	*002e*
Parameter K_I	*Control parameter integral*	*0x0030..0x0031*	*0030*
Parameter K_D	*Control parameter differential*	*0x0032*	*0032*
Parameter N	*Control parameter non-linearity valve*	*0x0033*	*0033*
Soft reset	Restarts the device	0x0034	0034
PID Select	Selection of control parameter set	0x0035	0035
Type code 2	Device type description (part 2)	0x1004..0x1007	0023
Power-up alarm	Activation of the power-up alarm function	0x4040	4040
Power-up alarm Setpoint	Setpoint of power-up alarm	0x4041..0x4042	4041
Totaliser scaling factor	*Scaling factor of the totaliser*	*0x4046..0x4047*	*4046*
Totaliser unit	*Engineering unit of the totaliser*	*0x4048..0x404b*	*4048*
Cutoff	*Zero point suppression*	*0x404c..0x404d*	*404c*
Reset hardware errors	Reset hardware error bits	0x404f	404f
Save mode setpoint	Save mode of setpoint value	0x4050	4050
Reverse flow detection	Threshold for detection	0x4052..0x4053	4052
Signal type analog output	Signal type of the analog output	0x4084	4084
Signale type analog input	Signal type of the analog input	0x4085	4085
Delay hardware error	Delay time for the plausibility check at a hardware error	0x4087	4087
LUT Select	Selection of gas table	0x4139	4139
Measuring point	Name of measuring point	0x5000	5000
Voltage output activ	Switch the analog output signal between current and voltage range	0x5500	5000
Voltage input activ	Switch the analog input signal between current and voltage range	0x5504	5504
Customer specific current input low	Low value for customer specific current input signal	0x5505	5505
Customer specific current input high	High value for customer specific current input signal	0x5507	5507

Name	Description	Register	ModBus
Customer specific voltage input low	Low value for customer specific voltage input signal	0x5509	5509
Customer specific voltage input high	High value for customer specific voltage input signal	0x550B	550B
Customer specific current output low	Low value for customer specific current output	0x550D	550D
Customer specific current output high	High Value for customer specific current output	0x550F	550F
Customer specific voltage output low	Low value for customer specific voltage output	0x5511	5511
Customer specific voltage output high	High value for customer specific voltage output	0x5513	5513
PID Access	Data access pointer to control parameter set	0x5FF7	5FF7
LUT Access	Data access pointer to gas table	0x5FFF	5FFF
LUT ID	Identifier gas table	0x6000..0x6001	6000
Measuring range	Calibrated measuring range (flow)	0x6020..0x6021	6020
Name of fluid (long)	Name of the measured gas (long name)	0x6022..0x603A	6022
Name of fluid	Name of the measured gas	0x6042..0x6045	6042
Measuring unit	Engineering unit of mesured value	0x6046..0x6049	6046
Gain	Gain of sensor	0x6120	6120
Heat power	Heat power of sensor	0x6121	6121
Dynamic	Dynamic of measuring range	0x6122	6122
Cutoff	Zero point suppression	0x6123..0x6124	6123
Control parameter K_D	*Control parameter differential*	*0x6202..0x6203*	*6202*
Control parameter K_P	*Control parameter differential*	*0x6204..0x6205*	*6204*
Control parameter K_I	*Control parameter integral*	*0x6206..0x6207*	*6206*
Control parameter N	*Control parameter non-linearity valve*	*0x6208*	*6208*
Totaliser 1	Total gas flow (resettable)	0x6380..0x6381	6380
Totaliser 2	Total gas flow (not resettable)	0x6382..0x6383	6382
Totaliser scaling factor	Scaling factor of the totaliser	0x6384..0x6385	6384
Totaliser unit	Engineering unit of the totaliser	0x6386..0x6389	6386

Detaild explanation

Gas flow	0x0000..0x0001	write	no access
		read	user
Measured value gas flow.			
value **f32**			

Temperature	0x0002..0x0003	write	no access
		read	user

Measured value temperature [°C].

Note:
Due to self-heating this temperature may be slightly higher range than the effective gas temperature at the device inlet.

value **f32**

Setpoint gas flow	0x0006..0x0007	write	user
		read	user

Setpoint of the controller.
To activate the setpoint, the controller mode (register 0x000e) has to be in mode 0 (automatic) or in mode 1 (ModBus).
The controller operates only with this setpoint if the power-up alarm (register 0x4040) is not active.
In this case the value is stored in the non-volatile memory and is still present after a power loss.
With the power-up alarm activated the setpoint will be lost at a power loss.

value **f32**

Analog input	0x0008..0x0009	write	no access
		read	user

Analog setpoint input for the controller. Manufacturer configuration as voltage [V] or current [mA]. The converted input value is always loaded into the register, whether the controller works in analog or digital mode.

value **f32**

Valve control signal	0x000a..0x000b	write	user
		read	user

Contains the actual control value for the valve whether the control value is generated from the controller (automatic mode) or manually set via ModBus. If the register control mode (0x000e) is defined as mode 10 the control value is immediately loaded into the register. In any other modes the value is stored in a buffer and becomes active when control mode 10 has been activated.
It is possible to adjust directly the position of the control valve [0...100%].

value **f32**

Alarms	0x000c	write	no access
		read	user

Indicates the alarm messages in a bit map. The bit pattern depends on the status of the instrument and the detected alarms. If an alarm condition is no longer valid the corresponding bit is automatically erased.

value **u16** (bits 15...0)

Bit #	***Description***
0	Indicates a negative flow (flow value < 0)
1	Indicates a negative flow exceeding the backflow setpoint. The bit remains set until a positive flow is detected.
2..14	not used
15	Indicates a hardware error (register 0x000d). This bit is therefore an OR-function of all hardware errors.

Hardware errors	`0x000d`	write	no access
		read	user

Indicates eventual malfunctions during operation of the instrument. This Information persists even the problem has been solved and has to be reset with the parameter 'Reset hardware error' (`0x404f`).

All alarm messages are reset if the instrument is switched off and activated again at power on if an alarm persists.

value **u16** (bits 15...0)

The following table explains the individual error bits:

Bit #	***Description***
0	Power-up alarm If the instrument is switched off with activated Power-up alarm and switched on again, then the active setpoint will be the readjusted power-up setpoint. (see parameter power-up alarm setpoint). This status will only be checked at power-up.
1	Alarm analog setpoint Raised if the analog setpoint is outside the valid range (21.6mA, 10.8V). This alarm is only active if the instrument is a flow controller.
2	Zero point or leakage alarm Raised If at a valve control signal of 0% (Valve electrically closed) a flow is measured. Possible causes are: An incompletely closed valve, internal leakage or a zero drift. This alarm is only active if the instrument is a flow controller.
3	No gas / jammed valve alarm Raised if at a valve control signal of 100% (valve electrically fully open) no gas flow is measured. This alarm is only active if the instrument is a flow controller.
4	No reaction Raised if the valve control signal is raised or lowered and no variation of the gas flow is measured. Possible causes are: Jammed valve, changed pressure conditions or valve too small (after a change of gas). This alarm is only active if the instrument is a flow controller.
5	Sensor communication error Raised if a communication problem occurs between the sensor and the electronic module. In this case the measurements are probably wrong.
6	not used
7	EEPROM access check Raised if access errors to the EEPROM are detected. In this case the correct function of the instrument is no longer guaranteed.
8	not used
9	not used
10	Current input overload Raised if current at analog input exceeds 25mA.
11	The sensor serial number does not match the loaded gas data. The valve is closed, the actual value is set to 0.
12..15	not used

Control function	0x000e	write	user
		read	user

Selection of the controller mode and the source of the setpoint.

Value **u16**

Value	*Description*
0	Automatic setpoint selection The source of setpoint is automatically selected, i.e.: As standard the analog setpoint (voltage or current signal) is active. If a digital setpoint is sent (via ModBus) automatically the red-y switches to 'Digital mode' and the analog setpoint is disabled.
1	Digital setpoint Activates the digital setpoint via digital communication. (ModBus, ProfiBus)
2	Analog setpoint (standard setting) Selects the analog signal as setpoint source.
10	Direct adjustment of the valve signal Deactivates the automatic control mode. Sets the valve control to the value of register 'valve control signal' (0x000a..0x000b).
20	Setpoint 0% Sets the setpoint to 0%.
21	Setpoint 100% Sets the setpoint to 100%.
22	Valve fully closed Deactivates the automatic control mode. Sets the valve control to 0% (Valve fully closed).
23	Valve fully open Deactivates the automatic control mode. Sets the valve control signal to 100% (Valve fully open).
30	Test mode analog output Deactivates the automatic control mode and sets the valve control to 0%. Forces the analog output signal to the value in the register 'Analog output manual' (0x0028).
31	Test mode DAC Deactivates the automatic control mode and sets the valve control to 0%. Forces the analog output signal to the value in the register 'Analog output DAC' (0x0028).

Device adress	0x0013	write	user
		read	user

Defines the device address with which the instrument can be addressed within a ModBus structure. Up to 247 different addresses can be assigned in a ModBus system.

Attention:
In a system, in which several devices are connected with each other via ModBus, all instruments must have different addresses. Otherwise communication errors occur and the system will no longer function.

value **u16** consists of two u8
u8 (bits15..8) not used (should be forced to zero)
u8 (bits7..0) device address.

standard settings: 247

Serial number	0x001e..0x001f	write	no access
		read	user

Clear and unique serial number of the electronic part of the measuring instrument (PCB).

value **u32**

Version number hardware	0x0020	write	no access
		read	user

Version number of the hardware (PCB).

Bit 15..8: type
Bit 7..4: version
Bit 3..0: subversion

example: 4.0.0

value **u16**

Version number software	0x0021	write	no access
		read	user

Different development stages of the software are documented with unequivocal version numbers.

Codierung:
Bit 15..8: type
Bit 7..4: version
Bit 3..0: subversion

example: 4.3.7

value **u16**

Save setpoint immediate	0x0022	write	user
		read	user

The setpoint value is stored in the EEPROM. This can be useful if automatic set value storage is disabled (‚set value storage characteristics').

Remark:
The function ‚Power-up set value' can be used to start the device with a defined set value.

value **u16**

value	meaning
0	no function
>0	Save setpoint value immediate to EEPROM

Type code 1	0x0023..0x0026	write	no access
		read	user

Name of the instrument type / instrument code.

value **s8**

Analog output manual	0x0028..0x0029	write	user
		read	user

This function lets you check the connected evaluation of the of the analog measuring value.
It is possible to write and read in this register at all times. The value set in this register is first output via the current interface upon activation (register control mode 0x000e =30).

value **f32**

Soft reset	0x0034	write	user
		read	no access

A software reset of the measuring or control instrument takes place if any chosen value is written in this register.

Attention
The soft reset is first performed after the response to this command was returned to the master.

value **u16**

PID Select	0x0035	write	user
		read	user

The controller consists of altogether 5 complete control parameter sets (see the corresponding documentation). Three of these sets were defined by the manufacturer and cannot be changed by the user (so-called manufacturer control parameter sets). Two sets can be changed at wish by the user (so-called user control parameter sets).

One set is used for the current control. This setting can be saved in EEPROM and is available again with the next activation. This set can be read, changed and re-written via ModBus access. Afterwards, the controller immediately works with the modified set.

Function of the pre-defined control parameter sets:
Due to the flow end values, the correspondingly applied control valve and the pressure ratios, these sets receive different values for the parameters P, I, D, F and N. We will discuss the function of the individual parameters later on in this manual. The aim is to provide the controller with the following different properties with the three sets:

U	Fast response time with the corresponding overshooting (fast response)
V	Medium response time with a low overshooting tendency.
W	Slow response time without overshooting (slow response)

Value **u16**

Auswahl	*Typ*
0	User control parameter set 1 (default)
1	User control parameter set 2
2	Manufacturer control parameter set U
3	Manufacturer control parameter set V
4	Manufacturer control parameter set W

Type code 2	0x1004..0x1007	write	no access
		read	user

Name of the instrument type / instrument code.

value s8

Power-up alarm	0x4040	write	user
		read	user

Activation of the power-up alarm function If the alarm is deactivated, the instrument behaves according to its standard or EEPROM settings after an operational disruption or reset. The following operations are performed in case of an operational disruption or reset if the power-up alarm is activated:

- ⇨ -The power-up alarm setpoint (register 0x4041..0x4042) is used as the new setpoint. The last 'normal' setpoint is overwritten in this process.
- ⇨ -The power-up alarm bit is set to one in the register hardware error (0x000d).

However, these operations are only performed when the control mode (register 0x000e) is set to 1 (digital). Otherwise, only the alarm flag is set. In each case, the power-up alarm bit remains on 1 until it is explicitly deleted (see description 'Hardware errors').

value u16

Value	*Description*
0	activates the power-up alarm
1	deactivates the power-up alarm

Power-up alarm Setpoint	0x4041..0x4042	write	user
		read	user

Defines the setpoint, which is to be set automatically after an operational disruption or a reset of the instrument if the power-up alarm was configured accordingly.
If this value is changed and the instrument is already in power-up alarm mode, the changed alarm setpoint first becomes effective after the next operational disruption or reset.

value **f32** alarm setpoint between 0 and full scale value.

Reset hardware errors	0x404f	write	user
		read	user

Resets the alarm states of the instrument that occurred during operation. The meaning of the individual error bits are described in the register hardware errors (0x000d).

Error bits cannot be set manually as they are always a consequence of faulty operating states.
If you want to reset an error bit in the register hardware error (0x000d), the corresponding bit is set here in this register (0x404f). If a bit remains on zero, the error bit is also not changed.

Value **u16** (bit15..0) whereby each bit stands for a specific error to be deleted

Save mode setpoint	0x4050	write	user
		read	user

Specifies whether the set value is automatically stored in the E²PROM.

The service life of a EEPROM depends on the number of write cycles. The guaranteed number of write cycles is 1 million. If the set value is set every 10 minutes, the resulting service life is 19 years.

If the set value is set at significantly shorter intervals, automatic storage should be disabled.

Value **u16**

Value	*Description*
0	manual save mode
1	automatic save mode

Reverse flow detection	0x4052..0x4053	write	user
		read	user

This function allows the detection of negative mass flows. This function is intended for measuring instruments and only makes little sense in control operation. **The function has to be enabled by the manufacturer.**

Negative flows are detected and the corresponding alarm flags (0x000C) are set (with and w/o hysteresis).
Negative flows are detected and signalled with the analog signal output (with hysteresis).

In this register, you can set an alarm threshold in the range from 0% to 20% of the maximum flow

Value **f32**

Signal type analog output	0x4084	write	user
		read	user

Defines the format and the range for the analog output.

Im Register (0x5500) wird definiert, ob Spannung oder Strom ausgegeben wird.

value **u16**
The following possible defaults are available:

value	*signal format and range*
0	0..20 mA / 0..5 V
1	4..20 mA / 1..5 V
2	4..20 mA / 1..5 V
3	0..20 mA / 0..10 V
4	4..20 mA / 2..10 V
5	user defined (Register 0x550D/0x550F, 0x5511/0x5513)

Signale type analog input	0x4085	write	user
		read	user

Defines the format and the range for the analog input.

Value **u16**
Register (0x5500) defines the output as voltage or current.

value	*signal format and range*
0	0..20 mA / 0..5 V
1	4..20 mA / 1..5 V
2	4..20 mA / 1..5 V
3	0..20 mA / 0..10 V
4	4..20 mA / 2..10 V
5	user defined (Register 0x5505/0x5507, 0x5509/0x550B)

Delay hardware error	0x4087	write	user
		read	user

Sets the minimum time in seconds during which a plausibility error has to occur constantly in operation before the corresponding error bit is set in the register hardware error (0x000d).

value **u16** input range: 0..600 seconds

LUT Select	0x4139	write	user
		read	user

Specifies, which gas data set is to be used.

Up to 11 different calibration data sets can be saved in the instrument. They have to be created by the manufacturer.

Anmerkung:
The first available gas data set is stored in section 2.

value **u16** input range: 2..11 (Default: 2)

Measuring point	0x5000	write	user
		read	user

Tag name of the measuring point.

value **s50**

Baud rate	0x5200	write	user
		read	user

Selects the baud rate for serial communication over ModBus.

value **u16**
possible baud rates:

value	*baud rate*
0	300
1	600
2	1200
3	2400
4	4800
5	9600 (default)
6	19200
7	38400
8	57600

Voltage output activ	0x5500	write	user
		read	user

Switches the analog output format between current and voltage.

Register (0x4084) defines the active format and range.

Value **u16**
Possible settings:

value	*function*
0	current output format
1	voltage output format

Voltage input activ	0x5504	write	user
		read	user

Switches the analog input format between current and voltage.

Register (0x4085) defines the active format and range.

Value **u16**
Possible settings:

value	*function*
0	current input format
1	voltage input format

Customer specific current input low	0x5505	write	user
		read	user
Defines the lower value for the user defined current input range. The value must be between 0 [mA] and the upper Value (0x5507).			
value f32			

Customer specific current input high	0x5507	write	user
		read	user
Defines the higher value for the user defined current input range. The value must be between the lower value (0x5505) and 20 [mA].			
value f32			

Customer specific voltage input low	0x5509	write	user
		read	user
Defines the lower value for the user defined voltage input range. The value must be between 0 [V] and the upper value (0x550B).			
value f32			

Customer specific voltage input high	0x550B	write	user
		read	user
Defines the higher value for the user defined voltage input range. The value must be between the lower value (0x5509) and 10 [V].			
value f32			

Customer specific current ouput low	0x550D	write	user
		read	user
Defines the lower value for the user defined current output range. The value must be between 0 [mA] and the upper value (0x550F).			
value f32			

Customer specific current output high	0x550F	write	user
		read	user
Defines the higher value for the user defined current output range. The value must be between the lower value (0x550D) and 20 [mA].			
value f32			

Customer specific voltage output low	0x5511	write	user
		read	user
Defines the lower value for the user defined voltage output range. The value must be between 0 [V] and the upper value (0x5513).			
value f32			

Customer specific voltage output high	0x5513	write	user
		read	user
Defines the higher value for the user defined voltage output range. The value must be between the lower value (0x5511) and 10 [V].			
value f32			

PID Access	0x5FF7	write	user
		read	user
Sets the data pointer to the required data set for read/write operations. The data pointer has no effect on the function of the instrument.			
value **u16** input range: 0..11			

LUT Access	0x5FFF	write	user
		read	user
Sets the data pointer to the required data set for read/write operations. The data pointer has no effect on the function of the instrument.			
value **u16** input range 2..11			

LUT ID	0x6000..0x6001	write	no access
		read	user
Unique identifier of the gas table. This value is a time stamp from lookup calculation.			
value **u32**			

Measuring range	0x6020..0x6021	write	no access
		read	user
Range of the selected gas data set.			
value **f32**			

Name of fluid (long)	0x6022..0x603A	write	user
		read	user
Long Name of the selected gas data set.			
value **s50**			

Name of fluid	0x6042..0x6045	write	no access
		read	user
Name of the selected gas data set.			
value s8			

Measuring unit	0x6046..0x6049	write	no access
		read	user
Measuring unit of the selected gas data set.			
value s8			

Gain	0x6120	write	no access
		read	user
Gain on the sensor.			
value **u16**			

Heat power	0x6121	write	no access
		read	user
Heat power on the sensor.			
value **u16**			

Dynamic	0x6122	write	no access
		read	user

Dynamic of the measuring range. The measuring range is limited by the dynamic. The smallest measuring value is calculated by:

$$Value = \frac{Range}{Dynamic}$$

value **u16**

Cutoff	0x6123..0x6124	write	user
		read	user

This register can be used to suppress the measured mass flow downwards. If the measured value is smaller than the value set here, the output is zero instead of the measurement reading.

The measured value is additionally limited through the dynamics of the measuring range.

value f32, default 0

Control parameter K_D	0x6202..0x6203	write	user
		read	user

Differential-part of the PID loop.

value **f32**
The value must be in the range of 0..10’000

Control parameter K_P	0x6204..0x6205	write	user
		read	user

Proportional-part of the PID loop.

value **f32**
The value must be in the range of 0..10’000

Control parameter K_I	0x6206..0x6207	write	user
		read	user

Integral-part of the PID loop.

value **f32**
The value must be in the range of 0..10’000

Control parameter N	0x6208	write	user
		read	user

Non-linear part of the PID loop. This value compensates the bounce of the valve.

Notification:
This compensation only takes place with a setpoint value larger than zero.

value **u16**
The value must be in the range of 0..8’000

Totaliser 1	0x6380...0x6381	write	user
		read	user

Total amount of gas flow since last reset.

Any value can be written in this register. The totaliser then starts from this value.

Notification:
The totalizer value is stored in the EEPROM every 10 minutes. In the event of a voltage interruption adding up continues from the last stored value.

value **f32**

Totaliser 2 (not resettable)	0x6382...0x6383	write	no access
		read	user

Total amount of gas flow, not resettable.

value **f32**

Totaliser scaling factor	0x6384..0x6385	write	no access
		read	user

The totalizer assumes that the measured value unit has a time base of 1/min. The totalizer can be re-scaled to any unit via a scaling factor.

$$M_{Totaliser\,[y]} = F_{Factor} * M_{Totaliser\,[x\ /\ \mathrm{min}]}$$

Legende:
- $M_{Totaliser[y]}$: Added up gas quantity converted via the associated scaling factor
- F_{Factor}: Scaling factor (definition see totalizer sum scaling factor register)
- $M_{Totaliser[x/min]}$: Gas quantity totalizer value relative to time base 1/min

In this way it is possible to select any unit for the totalizer sum.

Example:
The device measures flow with the unit ‚ln/min'. With a scaling factor of 1 shows the totalizer shows ‚ln'.

Value f32
Default 1

Totaliser unit	0x6386..0x6389	write	no access
		read	user

Unit of the totaliser value.

value s8

Different Memories

The controller has three different memories respectively data sources:

- ⇨ EEPROM (configuration data, etc.)
- ⇨ RAM (measuring values, etc.)
- ⇨ ROM (fix-coded data, firmware)

Saving Data in non-volatile-memory

Certain register contents are saved in the non-volatile memory (EEPROM). They are written to the memory, if data value changes.

Since the number of write accesses to an EEPROM is limited, continuous writing of values may shorten the lifetime of the EEPROM.

Example:
With a write cycle of 1 s an EEPROM with a typical service life of 1 million write cycles would have an expected lifetime of 11.5 days.

Note:
The set value is excluded from this rule. The ‚set value storage characteristics' register (`0x4050`) can be used to define whether a change in value is stored in the EEPROM.

Controller characteristics

Controller structure

The controller consists of a linear and a non-linear part. The linear part of the controller consist of the following components:

- ⇨ Proportional part K_P
- ⇨ Integral part K_I
- ⇨ Differential part K_D

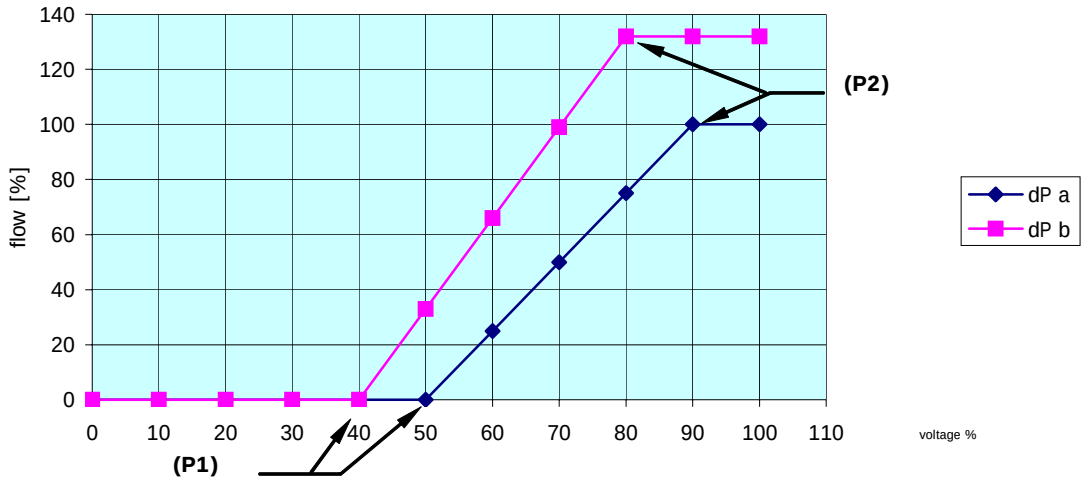
The non-linear part is:

- ⇨ Non-linearity (N)

Valve characteristics curve

In its work range, the valve characteristics curve has almost linear characteristics. Here, the valve does not use the entire adjustment value range from 0% to 100%. The operating points P_1 (opening point) and P_2 (max. possible flow) depend on the inlet pressure and the pressure difference across the valve (dP a < dP b).

Typical valve characteristic



Function of the individual parameters

Non-linearity N

The parameter non-linearity N compensates the dead zone in the area 0% to DA%. This compensation only takes place with a setpoint default larger than zero. With setpoint defaults larger than zero, a value generated by N is added to the controlling signal generated by the linear control algorithm. Naturally, the value N may never be larger or equal the value P1.

Controller setting

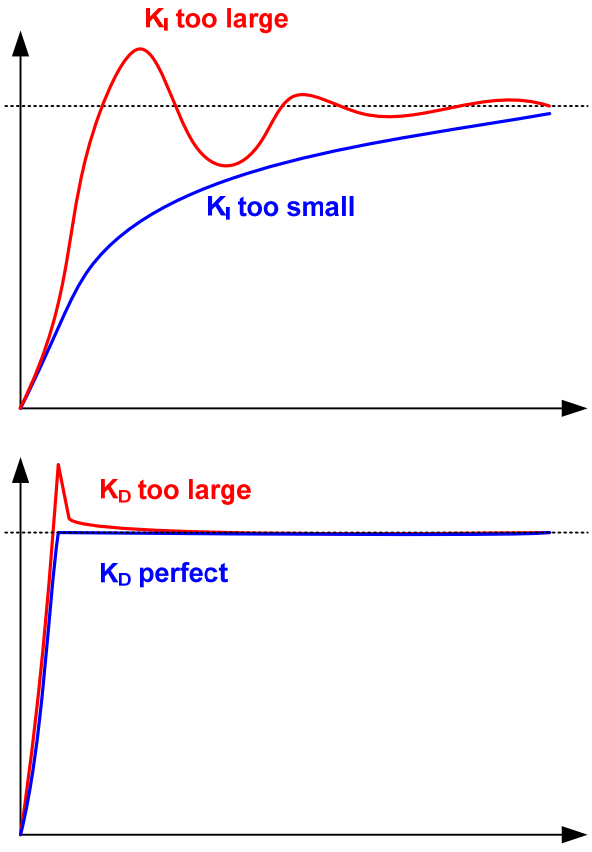
We recommend setting the individual controller parameters as follows:

1. Control parameter N
2. Control parameter K_P
3. Control parameter K_I
4. Control parameter K_D

Setting control parameter N

1. Connect the controller electrically (warm-up time) and establish the operating conditions (pressure ratios) as far as possible.
2. The ‚get red-y' software provides access to control parameter sets A and B.
3. Set the control parameters to the following values: K_P= 0; K_I= 0; K_D= 0; N= 0
4. Set the set value to 5% of the end value.
5. Increase parameter N in steps of 100 until flow occurs.
6. Set N to 80% of the value found in this way. N remains the same for all sets.

Setting control parameter K_P

1. Set K_P to 3000.
2. Set K_I to 600.
3. Set K_D to 200.
4. The control characteristics are assessed through different set value variations.
5. 

Software 'get red-y'

Introduction

'Get red-y' is a configuration software that lets you control and change instrument parameters easily. In addition, you can check your interface cabling with 'get red-y', map the bus structure and modify instrument addresses if required. We provide the software free of charge on the enclosed CD or you can download it at http://www.red-y.com. 'Get red-y' works on IBM-compatible computer systems with the operating systems Windows NT/2000/98.

Installation

After inserting the CD, you can select, which programs or manuals you want to install and/or open.

With a manual installation, proceed as follows:
The enclosed CD contains a directory called 'get red-y'. Open this directory and start the program [setup.exe]. Menus guide you through the installation.

Functions

'Get red-y' provides the following function blocks:

- ⇨ Configuration of the serial computer interface
- ⇨ Setting the program language
- ⇨ Scanning and mapping the bus structure
- ⇨ Integrating individual instruments into the bus structure
- ⇨ Reading out the instrument-specific hardware and software versions
- ⇨ Displaying the measuring value, the totaliser and the temperature of a instrument
- ⇨ Setting setpoint values
- ⇨ Resetting the totaliser
- ⇨ Selecting the control parameter sets
- ⇨ Setting the PI control parameters and checking their function mode
- ⇨ Selecting the corresponding calibration data record
- ⇨ Optional data recording (fee required)
- ⇨ Optional gas mixing (fee required)

Direct help

The functions within the program are described in the help menu
.

Digital Communication ProfiBus

This document describes device data access via ProfiBus communication. The detailed function of the individual registers is described in section ‚Digital Communication ModBus'.

Cyclical communication DP-V0

Information is exchanged between the master and the slaves in a predefined message cycle. The scope of the information is configured in advance (offline) with a software tool. To this end functionality information is required for all devices.

Note
Cyclical data are NOT stored in the EEPROM (from firmware 4.3.8). After a power failure other parameters may be active until cyclical data traffic has been re-established.

Device master data file (GSD)

The GSD is the mandatory ‚identity card' of a ProfiBus device. It contains the device characteristic data, information about its communication capability, and additional information about diagnostic values, for example.
For cyclical exchange of measurement readings and control variables between field devices and the automation system the GSD is sufficient for device integration.

Acyclical communication DP-V1

Field devices are becoming increasingly complex and can be configured for different situations. This information is exchanged in parallel with the cyclical communication as required. The data exchange is triggered by the master during runtime.

Note
Acyclical data are stored in the EEPROM. A distinction is made between data that are stored with each write access (i) or only in the event of a change (c).

Indexed addressing

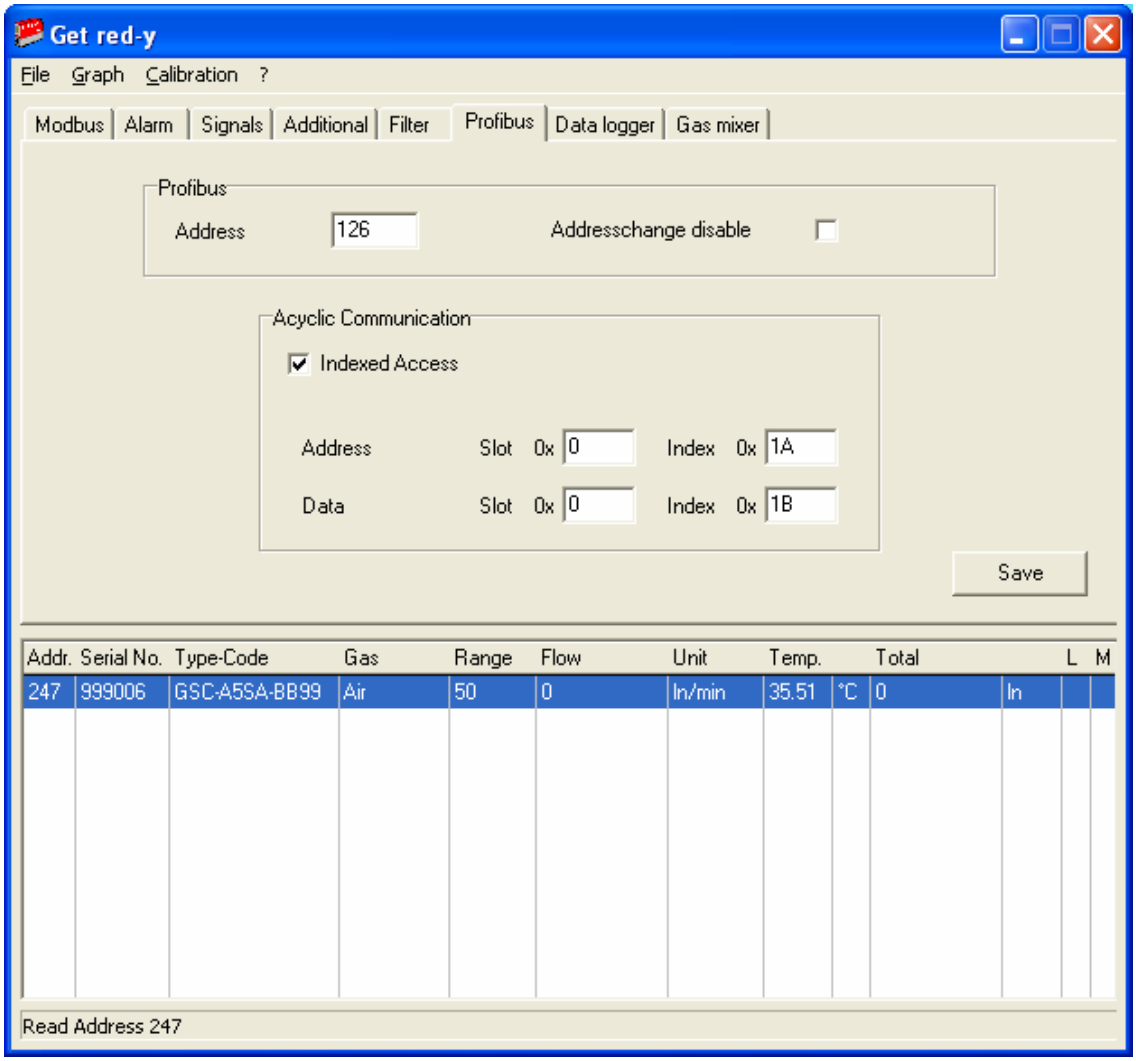
Due to the large number of parameters, different control systems may not be able to address all parameters. Indexed addressing was therefore realized.

These can be activated in ‚get red-y', so that an address slot and a data slot is available. Both are allocated to a slot/index. In order to communicate with the device, the address slot with the required slot/index must be used for write access. The address slot expects a value in format u16. The high-order byte refers to the slot, the low-order byte to the index.

The write or read operation is then carried out in the data slot. The parameter format can be found in the table on page **Fehler! Textmarke nicht definiert.**.

Note
If indexed addressing is activated, only the address and data slot is accessible for acyclical communication.

Definition of address and data slot
The address and data slots are defined in ‚get red-y':



The slot can be in the range `0x00..0xFF`, the index in range `0x00..0xFE`.

Control systems
The implementation of acyclical communication may differ depending on the control system. The manufacturer of the respective control system should provide associated instructions.

Siemens S7
Acyclical communication is handled via the following modules:

- ⇨ SFB 52 RDREC read data record
- ⇨ SFB 53 WRREC write data record

The description can be found in the associated documentation.

Register

Data types

The register documentation refers to the following data types:

data type	*format*	*description*	*length [bytes]*
float32	f32	floating point, according to IEEE-754	4
string8	s8	sequence of symbols, null-terminated	8
string50	s50	sequence of symbols, null-terminated	50
uint8	u8	unsigned integer, 8 bits	1
uint16	u16	unsigned integer, 16 bits	2
uint32	u32	unsigned integer, 32 bits	4

Addresses

The following table lists the data that are accessible via ProfiBus.

Mode

Different memory characteristics are defined for write access:

r read only (parameter can only be read)
s special (set value is handled separately via register 4050)
i immediate (value is stored in the EEPROM with each write access)
c changed (value is stored in the EEPROM whenever there is a change)
- (value is not stored in the EEPROM)

Register			***ProfiBus cyclic***		***ProfiBus acyclic***			
Description	***Address [hex]***	***Format***	***Module***	***Read [hex] Write [hex]***	***Mode***	***Slot [hex]***	***Index [hex]***	***Length [dez]***
Gas flow	0000	f32	Flow Rd ---	43 83 00 00 00 ---	r	00	00	4
Temperature	0002	f32	Temperature Rd ---	43 83 00 00 02 ---	r	00	02	4
Setpoint gas flow	0006	f32	Setpoint Rd Setpoint Wr	43 83 00 00 06 83 83 00 00 06	s	00	06	4
Analog input	0008	f32	Analog Input Rd ---	43 83 00 00 08 ---	r	00	08	4
Valve control signal	000A	f32	PWM Signal Rd ---	43 83 00 00 0A ---	i	00	0A	4
Alarms	000C	u16	Alarm Info Rd ---	43 81 00 00 0C ---	r	00	0C	2
Hardware errors	000D	u16	HW Error Rd ---	43 81 00 00 0D ---	r	00	0D	2
Control function	000E	u16	Control Mode Rd Control Mode Wr	43 81 00 00 0E 83 81 00 00 0E	c	00	0E	2
Device adress	0013	u16	--- ---	--- ---	i	00	13	2
Serial number	001E	u32	SerialNumber Rd ---	43 83 00 00 1E ---	i	00	1E	4
Version number hardware	0020	u16	--- ---	--- ---	r	00	20	2
Version number software	0021	u16	SW Version Rd ---	43 81 00 00 21 ---	r	00	21	2
Save setpoint immediate	0022	u16	--- ---	--- ---	-	00	22	2
Type code 1	0023	s8	DeviceTypeCode1 Rd ---	43 87 00 00 23 ---	i	00	23	8
Analog output manual	0028	f32	--- ---	--- ---	i	00	28	4

Register			ProfiBus cyclic		ProfiBus acyclic			
Description	Address [hex]	Format	Module	Read [hex] Write [hex]	Mode	Slot [hex]	Index [hex]	Length [dez]
Soft reset	0034	u16	--- ---	--- ---	-	00	34	2
PID Select	0035	u16	PID Select Rd PID Select Wr	43 81 00 00 35 83 81 00 00 35	c	00	35	2
Type code 2	1004	s8	DeviceTypeCode2 Rd ---	43 87 00 10 04 ---	i	10	04	8
Power-up alarm	4040	u16	--- ---	--- ---	i	40	40	2
Power-up alarm Setpoint	4041	f32	--- ---	--- ---	i	40	41	4
Reset hardware errors	404F	u16	--- HW Error Reset Wr	--- 83 81 00 40 4F	-	40	4F	2
Save mode setpoint	4050	u16	--- ---	--- ---	i	40	50	2
Reverse flow detection	4052	f32	--- ---	--- ---	i	40	52	4
Signal type analog output	4084	u16	--- ---	--- ---	i	40	84	2
Signale type analog input	4085	u16	--- ---	--- ---	i	40	85	2
Delay hardware error	4087	u16	--- ---	--- ---	i	40	87	2
LUT Select	4139	u16	Lut Select Rd Lut Select Wr	43 80 00 41 39 83 80 00 41 39	c	41	39	1
Measuring point	5000	s50	Tag Name Rd ---	43 B1 00 50 00 ---	i	50	00	50
Voltage output activ	5500	u16	--- ---	--- ---	i	55	00	2
Voltage input activ	5504	u16	--- ---	--- ---	i	55	04	2
PID Access	5FF7	u16	--- ---	--- ---	c	5F	F7	2
LUT Access	5FFF	u8	Lut Access Rd Lut Access Wr	43 80 00 DF 00 83 80 00 DF 00	c	DF	00	1
LUT ID	6000	u32	--- ---	--- ---	i	60	00	4
Measuring range	6020	f32	Flow Range Rd ---	43 83 00 60 20 ---	i	60	20	4
Name of fluid (long)	6022	s50	Gasname Rd ---	43 B1 00 60 22 ---	i	60	22	50
Name of fluid	6042	s8	Gas Rd ---	43 87 00 60 42 ---	i	60	42	8
Measuring unit	6046	s8	FlowUnit Rd ---	43 87 00 60 46 ---	i	60	46	8
Gain	6120	u16	--- ---	--- ---	i	61	20	2
Heat power	6121	u16	--- ---	--- ---	i	61	21	2
Dynamic	6122	u16	--- ---	--- ---	i	61	22	2
Cutoff	6123	f32	--- ---	--- ---	i	61	23	4
Control parameter K_D	6202	f32	--- ---	--- ---	i	62	02	4
Control parameter K_P	6204	f32	--- ---	--- ---	i	62	04	4
Control parameter K_I	6206	f32	--- ---	--- ---	i	62	06	4
Control parameter N	6208	u16	--- ---	--- ---	i	62	08	2

Register			ProfiBus cyclic		ProfiBus acyclic			
Description	Address [hex]	Format	Module	Read [hex] Write [hex]	Mode	Slot [hex]	Index [hex]	Length [dez]
Totaliser 1	6380	f32	Totalisator Rd ---	43 83 00 63 80 ---	i	63	80	4
Totaliser 2	6382	f32	TotalisatorN Rd ---	43 83 00 63 82 ---	i	63	82	4
Totaliser scaling factor	6384	f32	--- ---	--- ---	i	63	84	4
Totaliser unit	6386	s8	TotalisatorUnit Rd ---	43 87 00 63 86 ---	i	63	86	8

Troubleshooting

In the following table, we have compiled possible error situations, their causes and possible remedies. If the error on your measuring or control instrument is not listed, please contact your distribution partner or return the instrument. Please observe the recommendations in the chapter 'Returns'.
If you need to open the pipe system due to the suggested measures, observe all required rinsing processes and the hazard potential of systems under pressure in general.

In the chapter 'Operation and Maintenance', you will find illustrated instructions about disassembling and cleaning the instruments. Observe the proper procedure.

Error	Possible cause	Measures
Output signal remains at 4 mA or 1 V	No gas	Check: ⇨ Is the gas supply working? ⇨ Are all shut-off valves open?? ⇨ Are any filters clogged?
	Contamination	Open the pipe system and check it for possible contaminations including the installed filters. If you detect contamination, check the instrument as well. If you think the valve is contaminated as well, contact your service representative. Send in the instrument for repair or obtain a new control valve cartridge.
No output signal (0 mA or 0 V)	Electrical supply	Check: ⇨ Is the supply connected and Ok? (+ 24 V DC)? ⇨ Are connection cables interrupted? ⇨ With present digital evaluation: Does the digital communication still work?
	Evaluation	Make sure whether there is also no signal at the input of your evaluation.
	Defect circuit board	In case the digital evaluation still functions, the error description can be specified further for the necessary repair. Send in the instrument as described.
Communication loss	Electrical supply	Check: ⇨ -Is the supply connected and OK (+ 24 V DC)? ⇨ -Are connection cables interrupted? With present digital evaluation: ⇨ -Does the digital communication still work?
	Evaluation	Check: ⇨ Did You change the device address? ⇨ Do different devices have the same address? ⇨ Did You change the baud rate? Try to get a connection with ‚get red-y'.
	Defect circuit board	In case the digital evaluation still functions, the error description can be specified further for the necessary repair. Send in the instrument as described.
Flow despite a setpoint of zero	Valve leaks	The instrument or at least the valve is contaminated. Open the pipe system and check it for possible contamination. Contact your distribution partner. Either send in the instrument for repair or exchange the control valve cartridge.
	Control circuit does not work properly	Separate the connection cables from the instrument and open the casing cover. Then pull out the valve plug, replace the cover and reconnect the connection cable. If the actual value is zero now, check the control parameters. For control purposes, select one of the provided standard sets.
	Defect circuit board	In case the digital evaluation still functions, the error description can be specified further for the necessary repair. Send in the instrument as described.
	Offset though installation	A zero point offset may occur with vertical position installation position and higher pressures.

No flow despite a setpoint lager than zero	No gas	Check: ⇨ Is the gas supply working? ⇨ Are all shut-off valves open? ⇨ Are any filters clogged?
	Contamination	Open the pipe system and check it for possible contaminations including the installed filters. If you detect contamination, check the instrument as well. If you think the valve is contaminated as well, contact your service representative. Send in the instrument for repair or obtain a new control valve cartridge.
	Control circuit does not work properly	Separate the connection cables from the instrument and open the casing cover. Then pull out the valve plug, replace the cover and reconnect the connection cable. If the actual value is zero now, check the control parameters. For control purposes, select one of the provided standard sets.
	Control parameters	Check the control parameters and use one of the provided standard sets for control purposes.
	Defect circuit board	In case the digital evaluation still functions, the error description can be specified further for the necessary repair. Send in the instrument as described.
Actual value smaller than setpoint	Gas supply	Check the gas supply. Does the pressure P1 specified on the type plate correspond to the actual one? Did you observe the recommendations for dimensioning the pipe system?
	Contamination	Open the pipe system and check it for possible contaminations including the installed filters. If you detect contamination, check the instrument as well. If you think the valve is contaminated as well, contact your service representative. Send in the instrument for repair or obtain a new control valve cartridge.
	Control parameters	Check the control parameters and use one of the provided standard sets for control purposes.
Actual value unstable	Gas supply	Check the gas supply for constant pressure or any elements that destabilise the system. Did you observe the recommendations for dimensioning the pipe system?
	Contamination	Open the pipe system and check it for possible contaminations including the installed filters. If you detect contamination, check the instrument as well. If you think the valve is contaminated as well, contact your service representative. Send in the instrument for repair or obtain a new control valve cartridge.
Control unstable	Gas supply	Check the gas supply for constant pressure or any elements that destabilise the system. Especially a too small dimensioned pressure reduction can produce very negative influences. With very small flows with an oversized gas supply, sporadic pressure changes (ON-OFF function pressure reduction) can also lead to unstable pressure characteristics. Did you observe the recommendations for dimensioning the pipe system?
	Contamination	Open the pipe system and check it for possible contaminations including the installed filters. If you detect contamination, check the instrument as well. If you think the valve is contaminated as well, contact your service representative. Send in the instrument for repair or obtain a new control valve cartridge.
	Setpoint default unstabl	Check the setpoint default.
	Control parameter	Check the control parameters and use one of the provided standard sets for control purposes.

Flow doesn't meet expectations	Conversion factor not considered	Check the gas type specified on the type plate. If it does not correspond to the one that is actually used, you have to consider the corresponding conversion factor. You can check the programmed gas type with the software 'get red-y'.
	Contamination	Open the pipe system and check it for possible contaminations including the installed filters. If you detect contamination, check the instrument as well. If you think the valve is contaminated as well, contact your service representative. Send in the instrument for repair or obtain a new control valve cartridge.
	Leak	Do not use any liquid leak detector liquids for determining leaks inside the instrument. Helium leak detectors or gas sniffers are ideal. If you suspect a leak inside the measuring instrument, contact your service representative or send in the instrument for repair.
Control parameters cannot be changed	No more communication	Check the communication
	Wrong parameter set	Select the correct parameter set
Substantial heat build-up on the control casing	Setpoint default without gas supply	Try to avoid this state over longer periods if possible. Your instrument might get damaged in the long run.
	Control parameters	Check the control parameters and use one of the provided standard sets for control purposes.

Annex

Pressure loss

The following images illustrate the pressure loss, measured over the body.

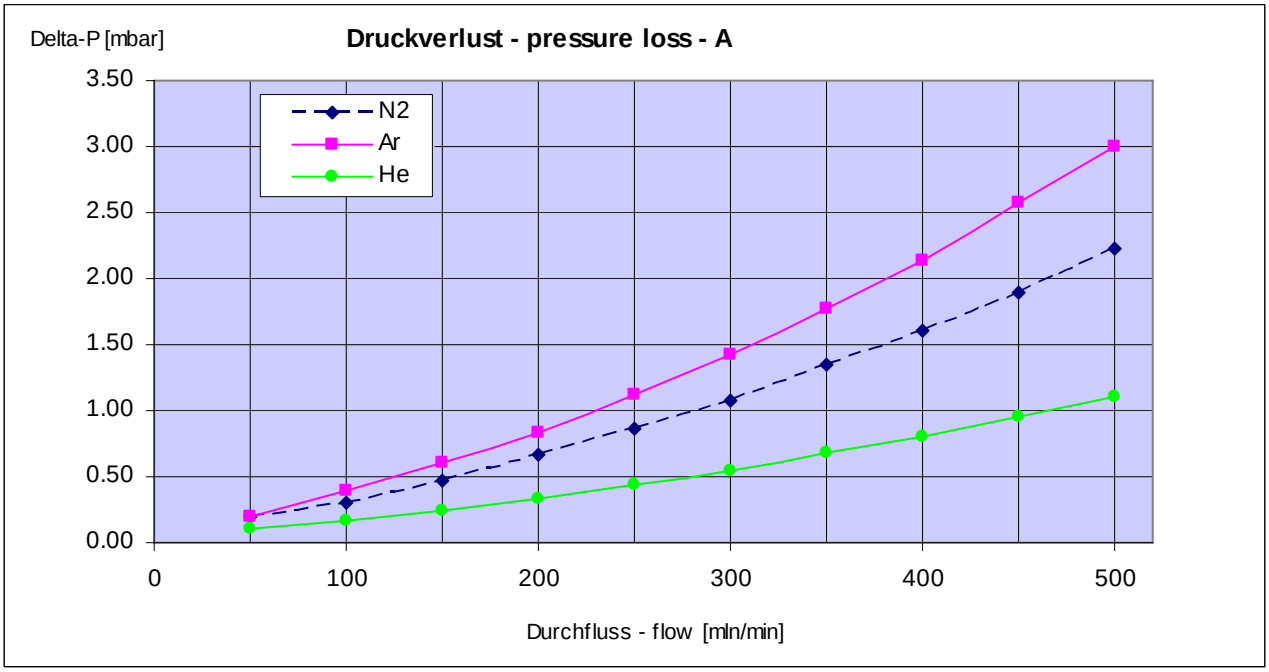


Figure 4: Pressure loss Typ - A

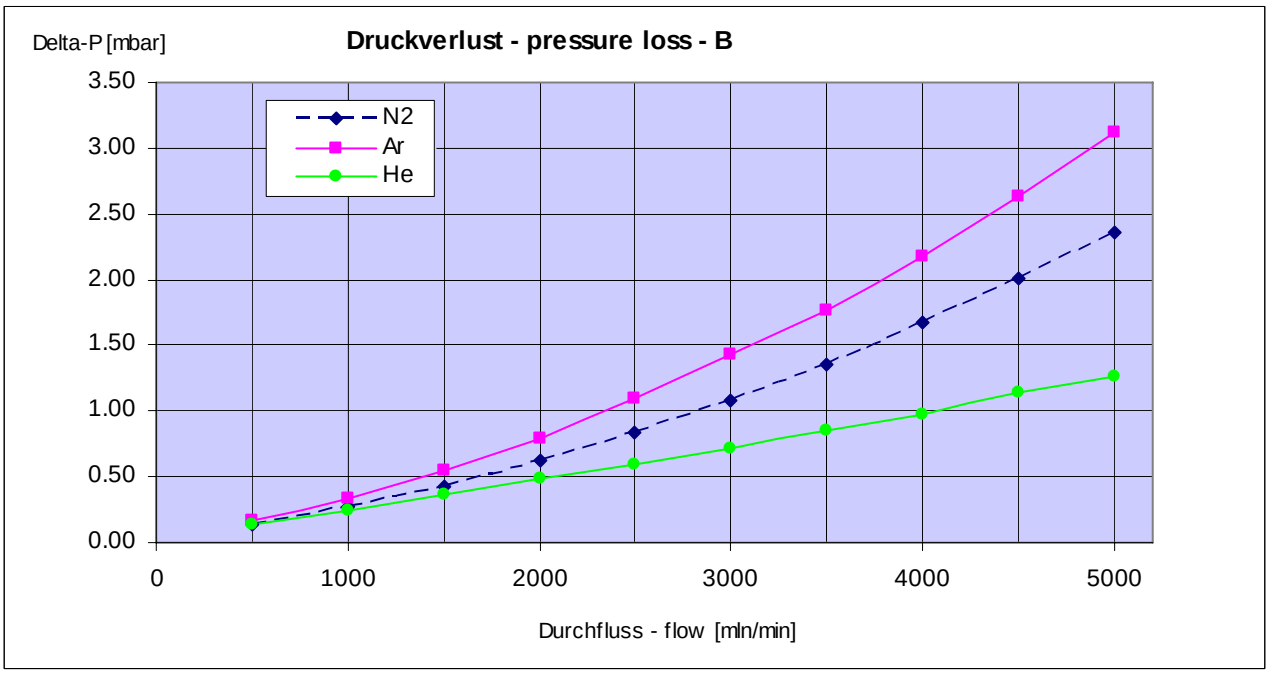


Figure 5: Pressure loss Typ - B

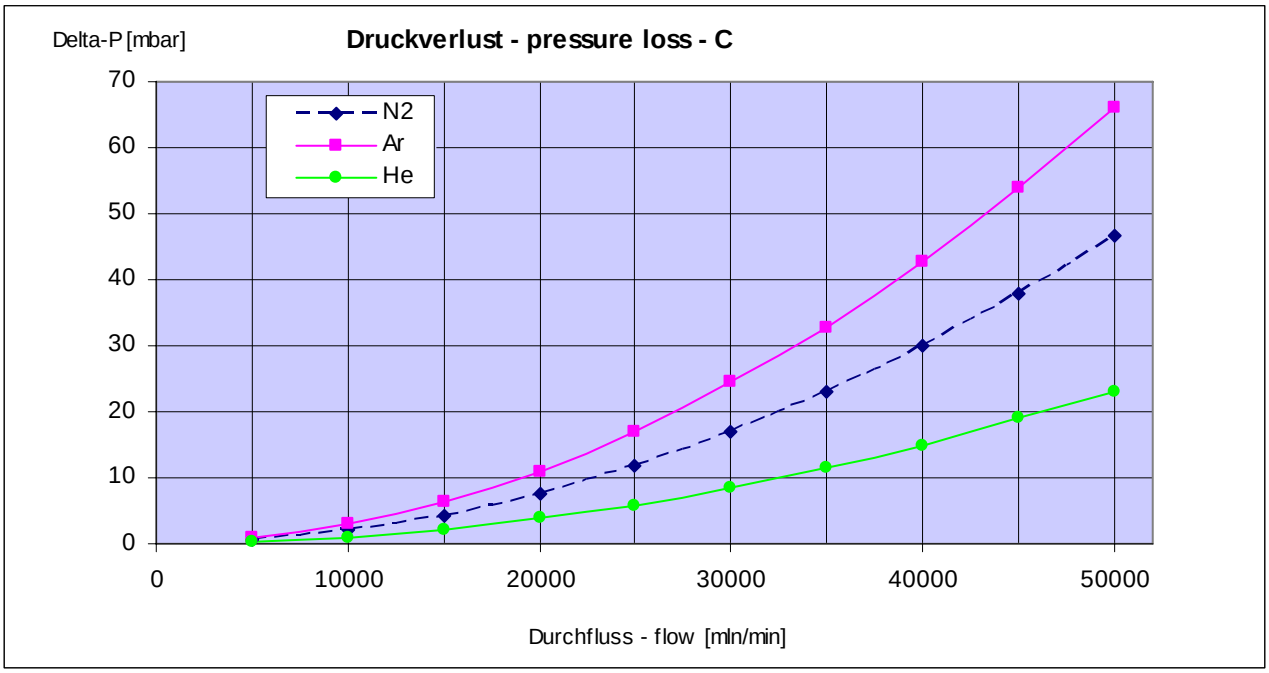


Figure 6: Pressure loss Typ - C

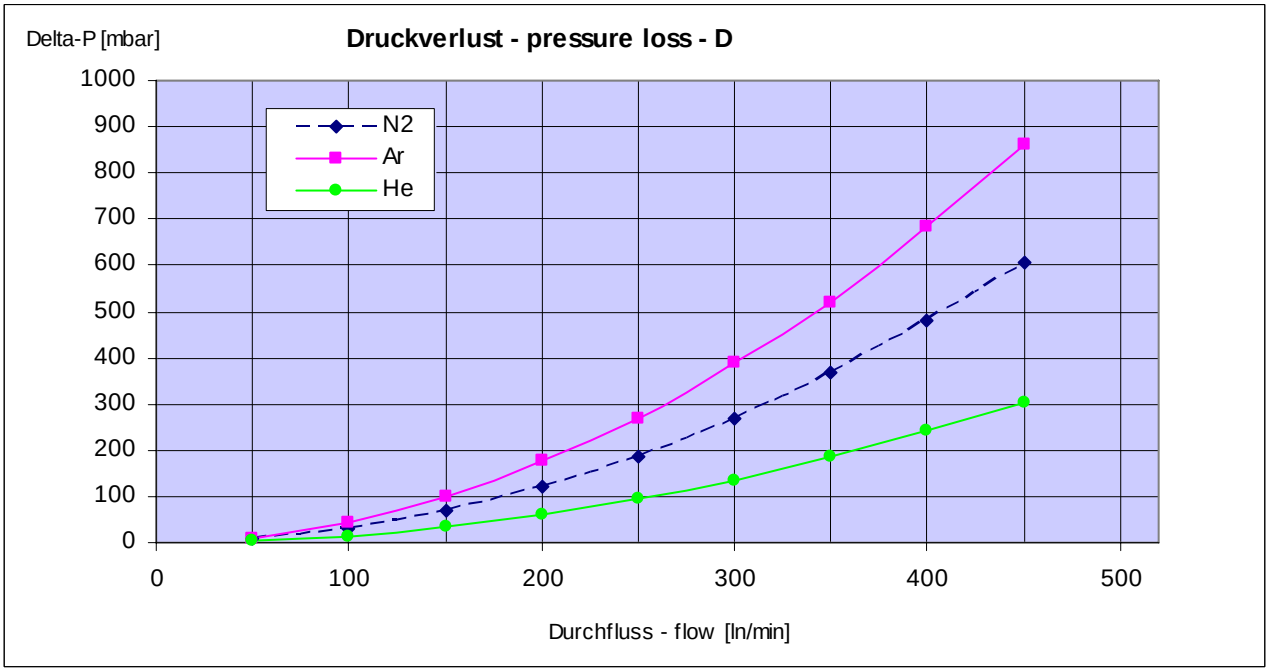


Figure 7:Pressure loss Typ - D

Gas conversion factors

Conversion factors can be used if a device is operated with an ‚external' gas. Please note in this case the zero point may be offset, and the specified accuracy may no longer apply.

Name	*chem. Symbol*	*Density*	*Conversion factor*	*Remark*
Air	Air	1.293	0.998	
Argon	Ar	1.784	1.27	
Propylene	C3H6	1.915		
Propane	C3H8	2.012	0.32	
Butane	C4H10	2.705		
Methane	CH4	0.7175		
Carbonmonoxide	CO	1.25		
Carbondioxide	CO2	1.977	0.7	
Hydrogen	H2	0.0899	ca. 10	
Helium	He	0.1785	ca. 9	
Nitrogen	N2	1.250	1	
Nitrousoxide	N2O	1.978		
Oxygen	O2	1.429	0.992	absolut oel- und fettfrei
Sulfur Hexafluoride	SF6	6.626		

These factors are continuously verified and optimized. They are mainly used for selection the measuring ranges.

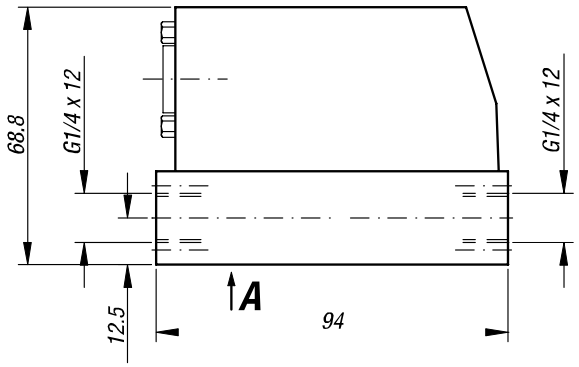
Example

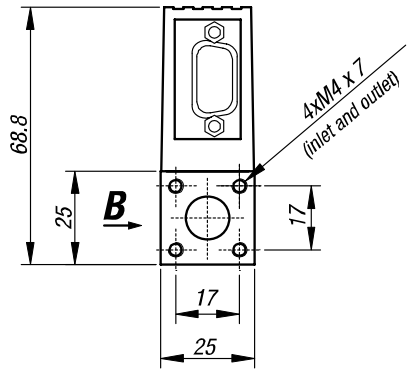
A device is calibrated with 5 ln/min of air. In what range can CO2 be measured?

Solution:
CO2 range = air range * conversion factor = 5 ln/min * 0.7 = 3.5 ln/min

Dimensions

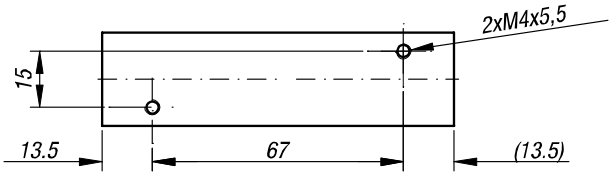
GSM, Typ A, B, C



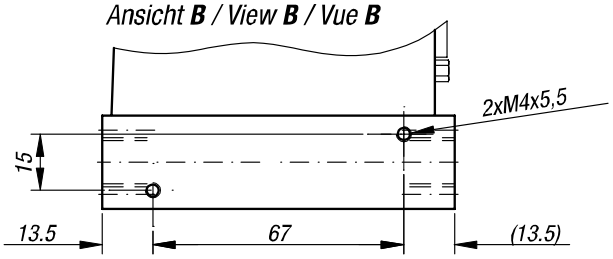


Befestigung / Mounting / Fixation:

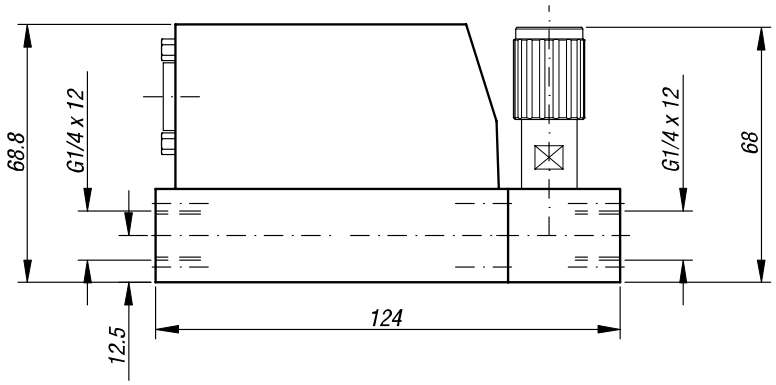
*Ansicht **A** / View **A** / Vue **A***

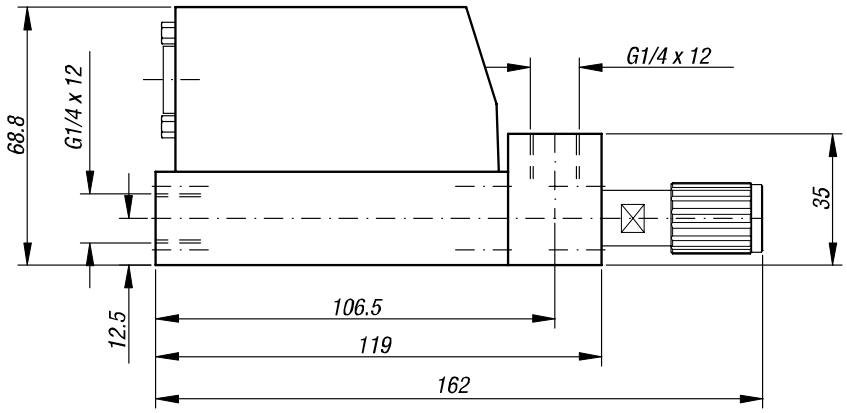


*Ansicht **B** / View **B** / Vue **B***

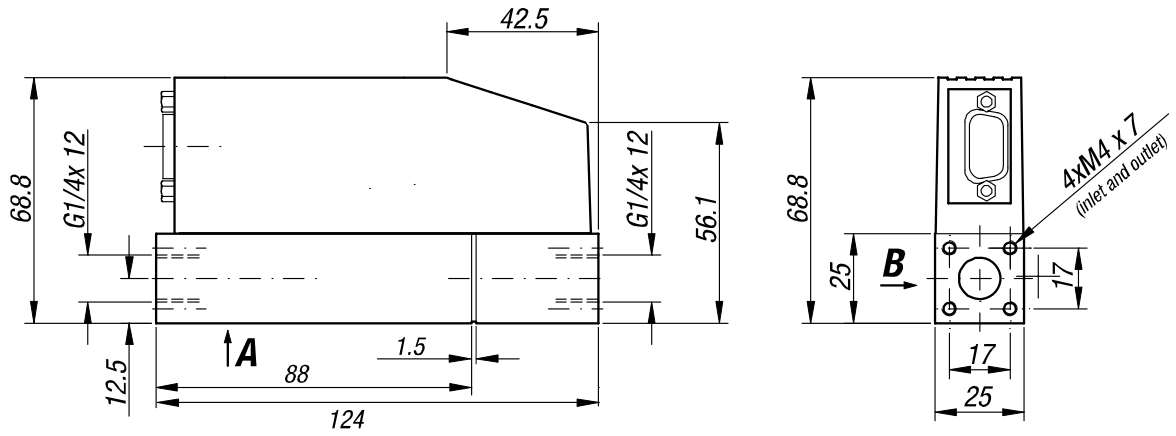


Mit Handregelventil / With manual valve / Avec vanne manuelle:

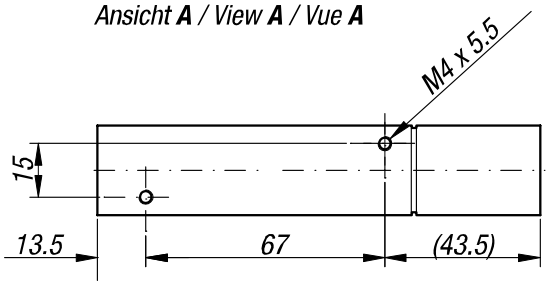




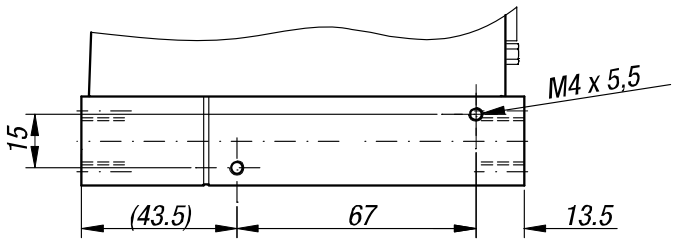
GSC Typ A, B, C



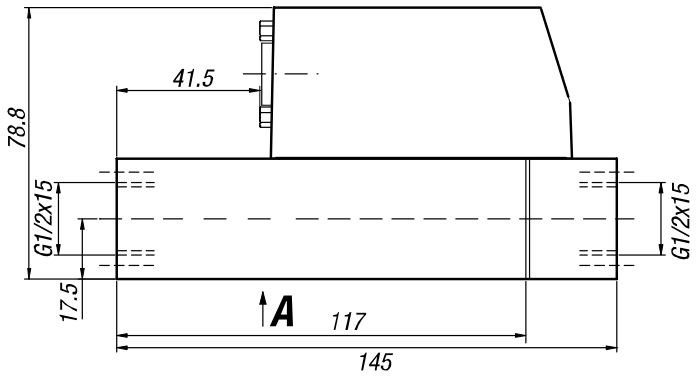
Ansicht **A** / View **A** / Vue **A**

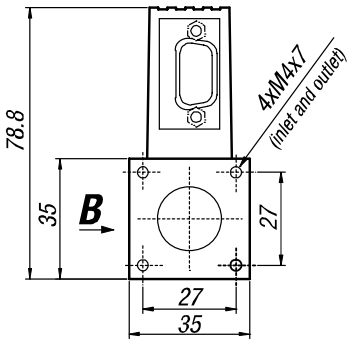


Ansicht **B** / View **B** / Vue **B**



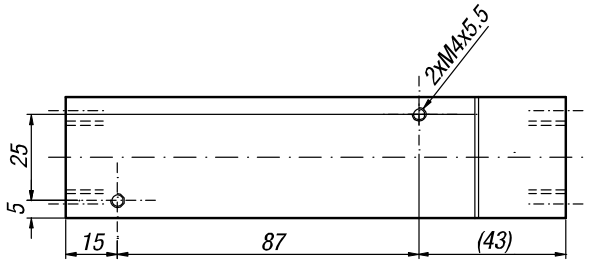
GSM, GSC Typ D



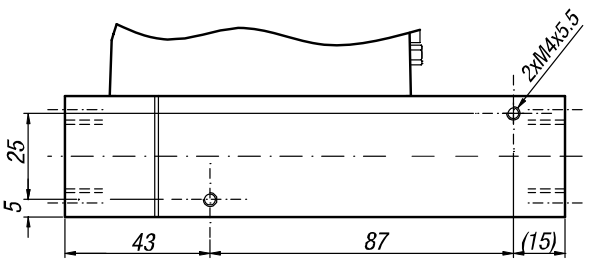


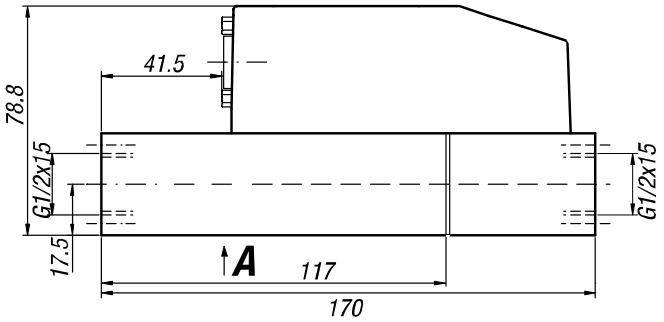
Befestigung / Mounting / Fixation:

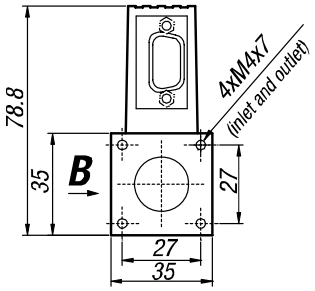
*Ansicht **A** / View **A** / Vue **A***



*Ansicht **B** / View **B** / Vue **B***

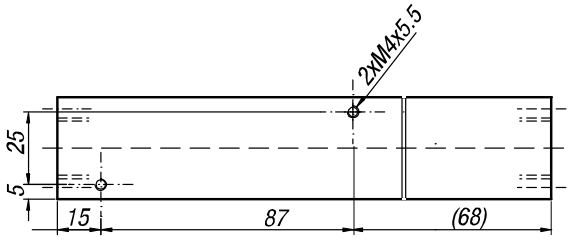




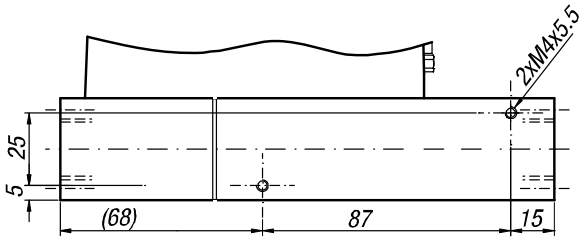


Befestigung / Mounting / Fixation:

*Ansicht **A** / View **A** / Vue **A***



*Ansicht **B** / View **B** / Vue **B***



Accessories

We offer a comprehensive range of cables, modules and power supply units for smooth operation of mass flow meters and controllers from the '*red-y smart series*'.

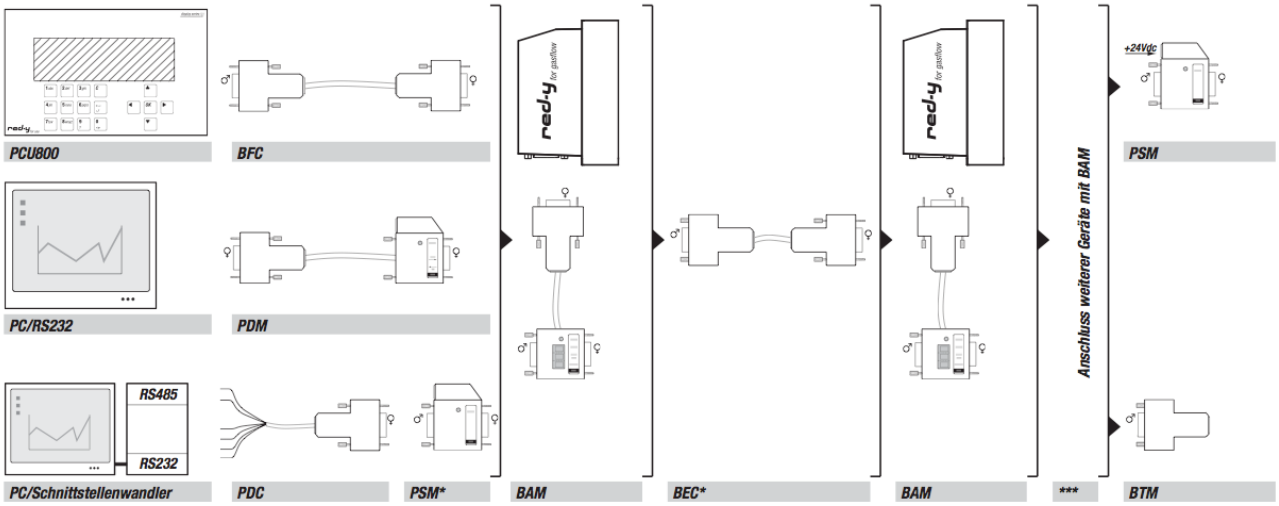


Abbildung 8: Übersicht Zubehör

Detailed information for the individual products can be found on the Internet under www.red-y.com.

Communication cable PDM-U

Driver installation

- ⇨ The driver can be found on the CD-ROM or online under www.red-y.com.
- ⇨ Connect the communication cable to the USB port.
- ⇨ Windows will automatically detect a new **USB device** and request a driver.
- ⇨ Specify the driver location (CD-ROM or directory on hard disk)
- ⇨ If warning is displayed regarding missing driver certification, please ignore it and continue!

- ⇨ Windows automatically detects a new **serial port** and requests a driver.
- ⇨ Specify the driver location (CD-ROM or directory on hard disk)
- ⇨ If warning is displayed regarding missing driver certification, please ignore it and continue!

Installation of the communication cable is complete.

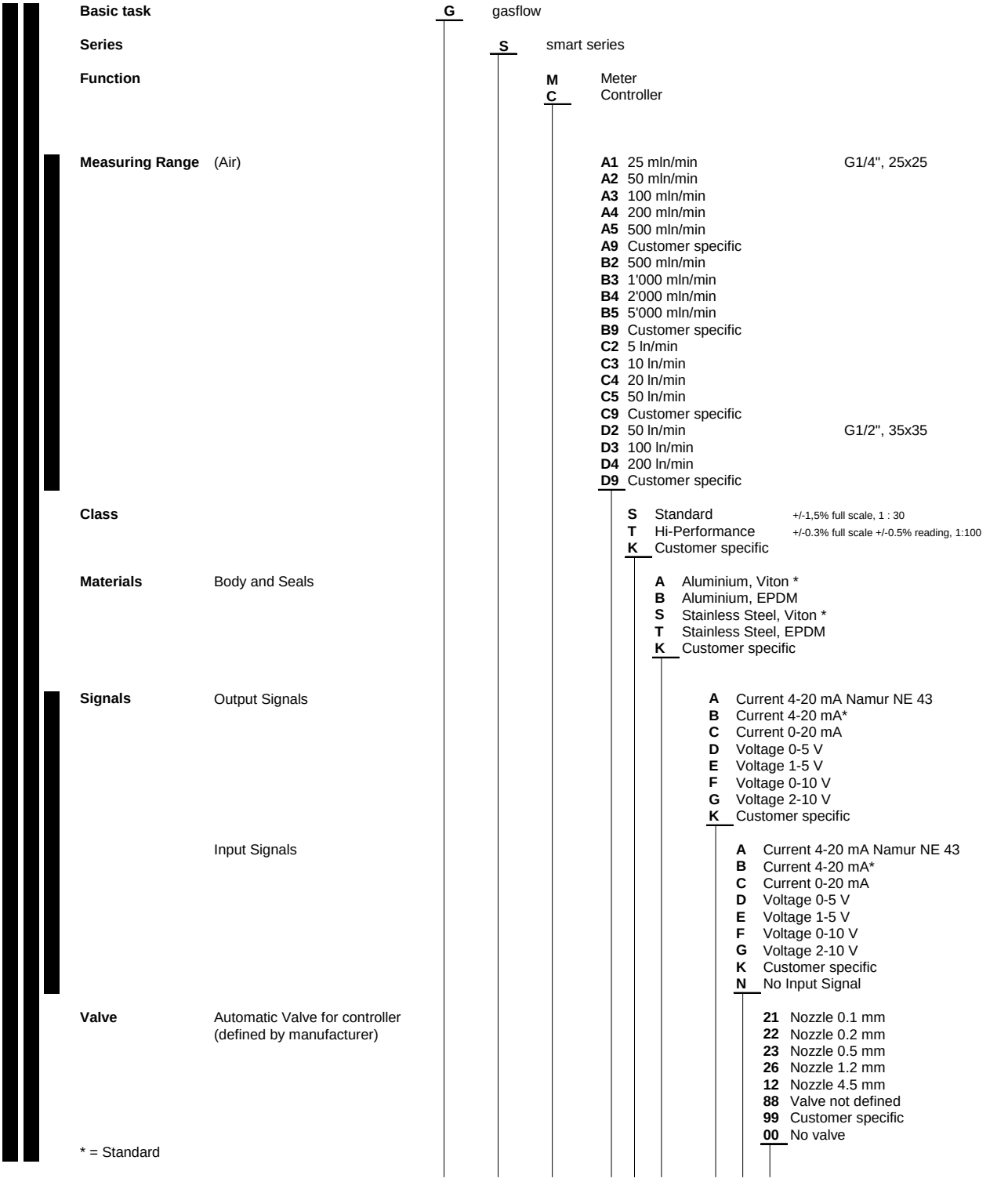
Changing the COM port

In some cases the communication cable is installed with a very high COM port number. The current version of ‚get red-y' supports ports up to COM10. It may therefore be necessary to rename the COM port.

- ⇨ Call up the Control Panel and select System
- ⇨ Select Device Manager
- ⇨ Select ports (COM and LPT)
- ⇨ Select USB Serial Port (COMx), Properties, Port Settings, Advanced
- ⇨ A new COM port can be selected here

The serial port is now active under the new COM port.

Type code



Version 10/2007

Contamination declaration

With return of devices, please fill out the following statement completely, especially the reason for the return, the type of residue and cleaning in the case of soiling, as well as indication of hazards.

Devices:	
Type code:	
Serial number(s):	
Reason for the return:	
Kind of contamination:	
Device came in contact with:	
Cleaned by us with:	

For the protection of our employees and for general safety during transport, proper cleaning and the use of an appropriate packing are mandatory.

Can you provide any further information on the contamination?	○ inert (no danger) ○ corrosive ○ caustic ○ must not come in contact with moisture ○ oxidizing ○ other hazard:
Legal Declaration	

We hereby affirm the accuracy and completeness of the above information.

Company:	
Address:	
Telephone:	
Contact person:	
Date:	
Signature:	

On behalf of the entire red-y for gasflow team, we thank you for your understanding.