Instruction Manual

PR 4000

Power supply/readout unit
for one Baratronò pressure transducer
or one mass flow controller/meter

Version: 01.12.96

Contents

1. General

1.1. Purpose

The PR4000 is a device which is specifically designed for operating gas flow controllers/meters and pressure sensors (power supply, display, interfaces).

The device is extremely flexible and can be configured either directly or using a PC.

1.2. Technical data

- Connectable sensors: flow controllers/meters and pressure sensors/controllers (single-channel)
- Digital interfaces: RS232, RS485, IEEE488 (optional)*
- Electrical isolation of digital interfaces
- Tested according to EN and CE standards
- 2 relays for limit monitoring
- Analog output (16-bit resolution)
- Gas counter (totalizer, optional)
- Leak test (optional)
- Freely selectable units (mbar...SCCM)
- Autozeroing
- Linearization (optional)
- Memory function for minimum and maximum values
- Non-volatile memory, i.e. the last setting remains stored after the device is switched off
- Resolution: 4.5 digits (16 bits)
- Accuracy: 0.01%, ±1 digit
TC, Input: 0.1 mV / K (R_{quelle} < 1 Ohm)
TC, Output: 0.075 mV / K
- Power supply for controllers or sensors: 24 V (1.0 A), ±15 V(0.8 A, opt. 1.5 A)*
- Mains power supply: 115/230 VAC, 60/50 Hz
- Ambient temperature: 15° - 40° C
- Storage temperature: -20° - 70°C
- Power input 60 VA/75 VA/115 VA (acc. to option)

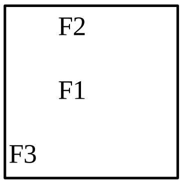
* Only one option can be installed at a time.

- Fuse Ratings:

	115VAC	230VAC
60 VA (± 15V, 0.5A):	T630mA	T315mA
75 VA (+ 24V, 1A):	T630mA	T315mA
115VA (± 15V, 1.5A):	T1A	T500mA

- Intern fuses:

	F1	F2	F3
60 VA (± 15V, 0.5A):	T1.4A	T1.4A	T100mA
75 VA (+ 24V, 1A):	T1A	T1A	T100mA
115VA (± 15V, 1.5A):	T2.5A	T2.5A	T100mA
Position:	Front		Rear



- Pollution Degree: II
- Installation Category: II
- Weight: approx. 1.5 kg
- Dimensions: 240 mm x 240.5 mm x 88.1 mm (L x W x H)

1.3. CE compliance

The device complies to actual european standards and has the CE label. The device was tested with the following standards:

- EN50011 emissions (group 1, class B)
- EN50082-2 disturbance
  IEC801-2
  ENV50140
  IEC801-4
  ENV50141
- EN61010 safety

1.4. Cables

The cables applied to the device, needs to fulfill some requirements:

1. The cable must have a shield, which covers all lines.
2. The connectors must have a metal case, which has contact to the cables shield on the hole circumference of the cable.
3. The connector must make contact to the devices case (ground), which encloses all lines.
4. This rules apply to all cables connected to the device (digital interfaces included).

The power cord must have a VDE label.

1.5. Service

In case of technical problems, please contact a MKS service facility, e.g.:

MKS Instruments, Schatzbogen 43, D-81829 München, Germany

2. Safety instructions

The device has been constructed using state-of-the-art technology and is extremely reliable.

It can nevertheless represent a hazard to the user or to third parties if:

- it is operated by unqualified persons
- it is not operated in the proper manner
- it is used for a purpose for which it is not intended

The Instruction Manual and the binding accident precautions, as well as the generally accepted rules of engineering practice, must be observed at all times in the interests of work safety and optimum functioning.

Only accessories authorized by the manufacturer are allowed to be used.

The device must not be operated in rooms containing potentially explosive atmospheres.

Only original spare parts and accessories are allowed to be used.

The device is only allowed to be opened by an MKS service technicians

When the device is open, there is a risk of electric shock and consequently danger to life. Internal fuses must always be replaced by an MKS service technician.

The power supply must always be disconnected before the device is cleaned.

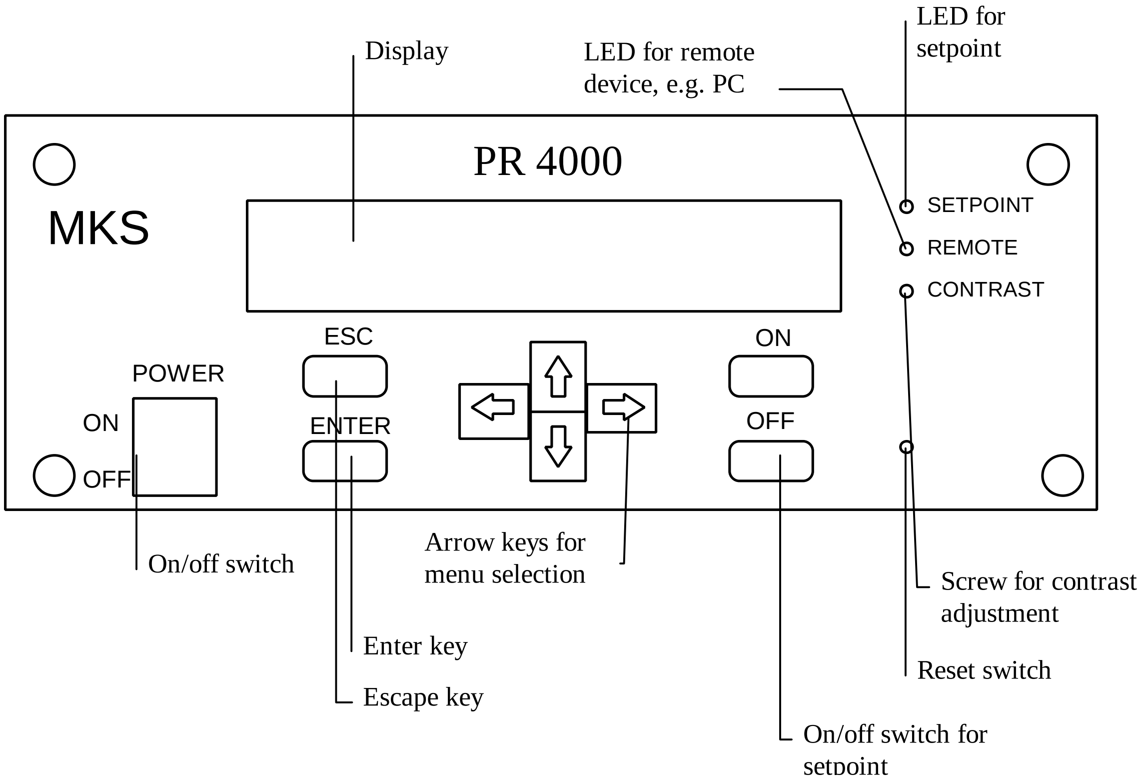
A dry cloth must be used to clean the device.

Failure to observe these safety instructions renders all warranty claims vis-à-vis the manufacturer invalid.

3. Installation and startup

3.1. Control elements and connectors

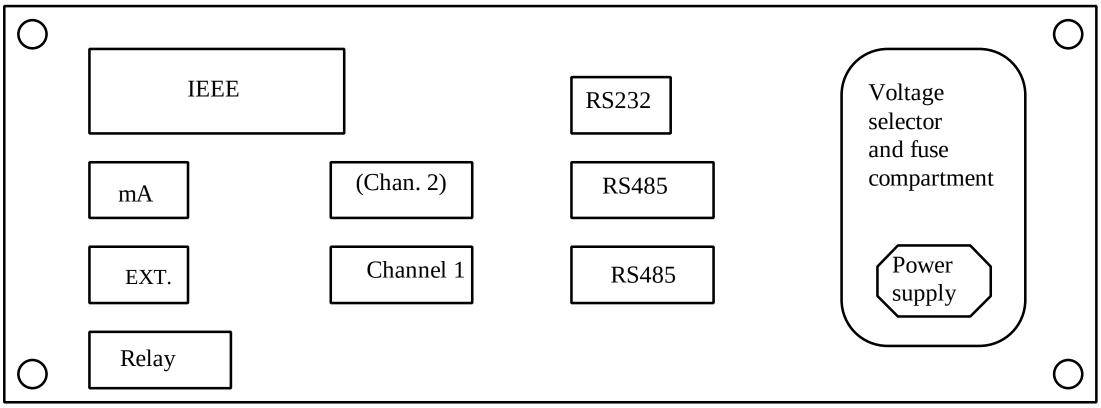
3.1.1. Front panel



3.1.2. Back panel

The layout of the back panel varies according to the installed option and interfaces. The back panel shown below is merely an example.

Channel 2 is not used in this version.



3.2. Scope of supply

The scope of supply of the PR4000 is as follows:

• Mains cable	(Order No. Y-0984492)
• Mating connector, incl. casing	(Order No. ZB-41)
• Instruction Manual (this document)	German (Order No. Y-1957785)
	English (Order No. Y-1958785)

3.2.1. Device version

Several different versions of the device are available, depending on the purpose for which it is to be used and on your particular requirements.

The five parts of the order designation are explained below:

PR4000	X	X	X	X	X

ISOLATION:	N = NONE I = INCLUDED
POWER SUPPLY:	1 = +/-15V@500mAmp 2 = +/-15V@1.5Amp 3 = 24V@1Amp
INPUT:	V = 0..5 / 0..10 VDC C = 4..20 mA / 0..20 mA
INTERFACE:	2 = RS232 5 = RS485 8 = IEC488
FUNCTIONALITY:	S = STANDARD E = EXTENDED
TYPE:	PR4000 = europe

Note: N = not available

Options cannot be retrofitted by the customer

Example:

The following are examples of order designations:

- PR4000-S2V1N — Version for first-time buyers
- PR4000-E2V1I — +/- 15V with V.24, electrical isolation and enhanced functions

3.3. Installation

The device must be installed in a dry, heated room.

The device must be installed such that air can circulate freely while it is in operation. Do not cover the openings at the back of the device and in the base.

3.4. Startup

Check that the voltage selector switch is set to the correct mains voltage.

The device must be connected to a standard socket outlet with the enclosed cable. If the power supply is isolated externally, the isolation components must be capable of switching at 0.5 A and 230 VAC.

Gas flow controllers and pressure sensors must be connected to the device according to the pin assignment of the connectors on the back panel. If necessary, a PC can be connected to the digital interface (RS232, RS485 or IEEE).

The Power switch must be set to ON in order to switch on the device. The *Actual Value/Setpoint* menu then appears on the display. All settings entered the last time the device was used are still stored.

The parameters must be configured according to your particular requirements before the device is started up for the first time. The procedures for setting these parameters are described in detail below.

4. Operation

4.1. The operating concept

The PR4000 is operated and configured by means of menus (two-line LCD). The menus are organized in a simple tree hierarchy (see 'The menu tree'). All the menus can be accessed and displayed easily: you can change from one menu to another using the up/down arrow keys or return to the main menu at any time by pressing the ESC key.

Switching on Edit mode

Edit mode can be switched on or off in the menus. You can enter numeric values in Edit mode, alter variables, etc. There are two ways of switching on Edit mode:

1. With the ENTER key
2. With the left/right arrow keys

When you switch on Edit mode, the cursor appears as a flashing underscore below the first or last alphanumeric character. You can move the cursor within a line using the left/right arrow keys or change the preset values with the up/down arrow keys.

If '9' is displayed and you press the up/down arrow keys again to scroll the number, the display automatically creates two digits ('10'); the same applies analogously in the opposite direction.

If, when you exit Edit mode by pressing the ENTER key, the value you have set is outside the valid range, the highest or lowest permitted value is stored instead.

Switching off Edit mode

You can switch off Edit mode again by pressing the ENTER key. The entered values are not stored until you press the ENTER key.

You can also exit Edit mode with the ESC key. In this case, however, the values are not stored.

Decimal point

The decimal point is needed to display floating-point numbers and can be set with the *Range (RNG)* function in the *Setpoint* menu. You can mark the decimal point in this menu with the left/right arrow keys and shift it with the up/down keys. The up arrow shifts the cursor to the left, while the down arrow shifts it to the right. The new decimal point setting takes effect in all the menus in which measured values or values directly referred to them are displayed. It does not affect device parameters, such as *Gain*.

Switching the setpoint on and off

You can switch the setpoint of a controller on and off with the ON and OFF keys. The OFF key has the highest priority of all keys for safety reasons. As soon as you switch off the setpoint, the output voltage becomes slightly negative (-0.5 V). This ensures that if a valve is fitted, it is closed.

Programming with a PC or terminal

All the values which appear on the display refer to processes that are taking place at a particular instant in time. Values that are programmed with a PC or terminal (connected to the digital interface) are displayed immediately. Example: If the setpoint is reprogrammed via the interface, this change is displayed instantly in all the menus concerned.

The keypad can be locked while you program with a PC or terminal.

Trigger functions

Trigger functions (functions which trigger an immediate system response) are displayed immediately (DONE or FAIL). The display time is 0.5 seconds.

Negative values

Negative values are displayed with a preceding minus sign. To enter a negative value, you must continue scrolling when the value 'zero' is displayed. All values from then on will have a negative sign. You can change negative values to positive values in the same way.

5. The menus

5.1. The menu tree

The PR4000 has the following menus:

1. Actual Value/Setpoint
2. Actual Value/Bargraph
3. Actual Value/Totalized (optional)
4. Autozero
5. Setpoint
6. Gain
7. Linearization (optional)
8. Input/Output Voltage
9. Maximum Limit/Minimum Limit
10. Limit Mode/Limit Memory
11. Reset Relays/Leak Test (optional)
12. Signal Processing Mode
13. Sensor and Interface
14. Device
15. Baud Rate and Parity
16. Reset

The menus are linear, in other words you cannot branch to submenus.

5.2. The Actual Value/Setpoint menu

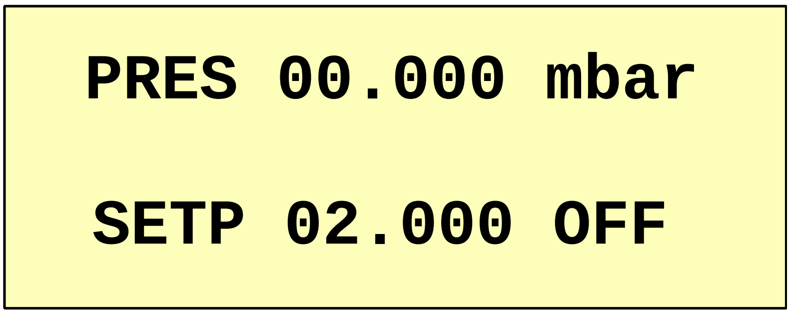


Fig. 1: The Actual Value/Setpoint menu

The first line shows the currently valid sensor value. The word 'PRES' in Fig. 1 indicates that the displayed value refers to the pressure of a pressure sensor. It is also possible to connect a flow controller (FLOW) or a temperature sensor (TEMP), etc. You can change the display mode in the *Sensor* menu.

Fig. 1 shows the measured value in millibars. You can set a different measurement unit in the *Setpoint* menu.

The setpoint can be switched on and off **in the second line** (ON/OFF).
It is set to OFF in Fig. 1. You can also alter the value of the setpoint here by switching on Edit mode (with the ENTER key) and then increasing it or reducing it with the up and down arrow keys respectively.

5.3. The Actual Value/Bargraph menu

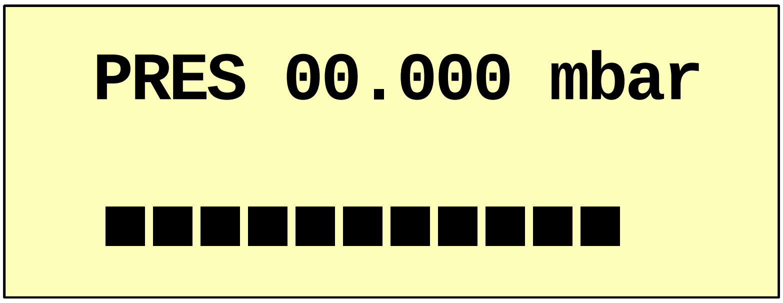


Fig. 2: The Actual Value/Bargraph menu

The first line of the menu shows the current pressure (for example).

The second line contains a semigraphic consisting of 16 bars. Each bar is made up of seven pixels in the vertical direction and five pixels in the horizontal direction.

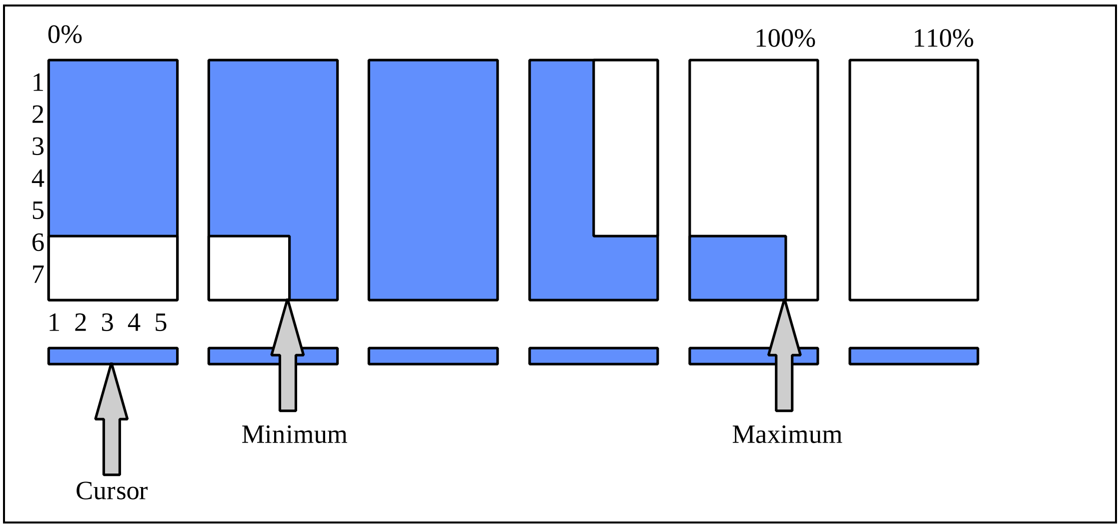


Fig. 3: Example of a semigraphic

The top part of the bar shows the current sensor value as a percentage of the upper range value (specified with the Range function). The limits are indicated in the bottom part. In the area between the limits, the complete bar is shaded.

5.4. The Actual Value/Totalized menu (optional)

```
FLOW-03.000 SCCM

T 0000001.506 CC
```

Fig. 4: The Actual Value/Totalized menu

The first line shows the gas flow, for example, in other words in this case the number of cubic centimeters of gas flowing per minute. You can select a different display in the *Sensor* and *Setpoint* menus.

The second line indicates the total gas flow computed by the gas counter over a specified period of time (up to 694.5 days). The result is referred to as the 'totalized value'.
If the sensor value is < 0, the totalizer stops counting (status = OFF). Negative values are thus not subtracted.

5.5. The Autozero menu

AUTO ZERO

RESET TOTALIZER

Fig. 5: The Autozero menu

The autozero function can be activated **in the first line**. To do so, switch on Edit mode in this menu and press the ENTER key. The system message 'DONE' then appears briefly to indicate that the autozero function was performed. You can only activate this function if the setpoint is switched off. If you attempt to activate autozero with the setpoint switched on, the word 'FAIL' will appear on the display.

You can activate the optional 'reset totalizer' function **in the second line** in the same way as the autozero function. The system message which appears is likewise 'DONE'. This function resets the totalizer (gas counter) to zero. You can activate it at any time.

5.6. The Setpoint menu

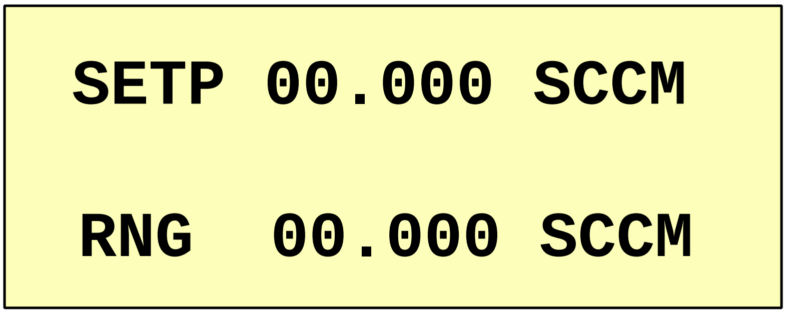


Fig. 6: The Setpoint menu

You can set the value of the setpoint **in the first line.**

The measurement unit, the range value and the decimal point can be set **in the second line**.

You must switch on EDIT mode in order to change the measurement unit. You can then mark the unit and select a new one with the up/down arrow keys.

Changing the measurement unit

You can set the following measurement units in the second line:

Table 1: Available measurement units				
µbar	mbar	bar		
mTorr	Torr	kTorr		
Pa	kPa			
mH2O	cH2O	PSI	N/m²	
SCCM/CC	SLM/L	SCM/CM	SCFH/CF	SCFM/CF
mA	V	%	C	

mHG == kTorr, mmHg == Torr
CC = cubic centimeter, L = liter, CM = cubic meter, CF = cubic foot
(the units after the "/" refer to the gas counter)

Setting the decimal point

For details of how to set the decimal point, please refer to chapter *4.1. The operating concept*.

Please note:
If you shift the decimal point, the change takes effect in all the menus in which measured values or values directly referred to them are displayed. It does not affect device parameters, such as *Gain*.

5.7. The Gain menu

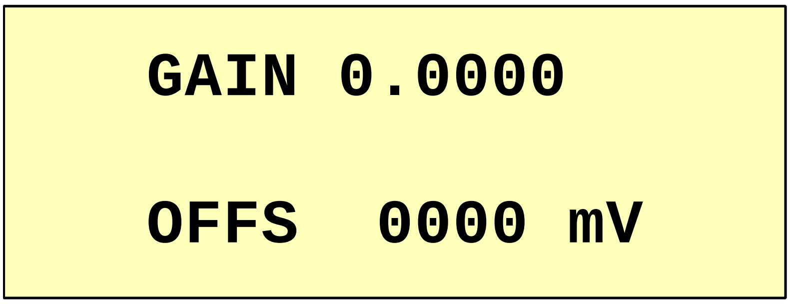


Fig. 7: The Gain menu

You can define correction values in the *Gain* menu.

You can set the gain value (e.g. the gas correction factor) in **the first line**.
This factor corrects the deviation of a gas flow controller if a gas other than N_2 is used.

The second line shows the value which is valid for the autozero function. You can also set the offset manually here. The offset is the fault voltage which is subtracted from the measured value.

5.8. The Linearization menu (optional)

```
XLIN     0  %
YLIN 00.000 bar
```

Fig. 8: The Linearization menu

You can define the linearization values for the X and Y-axes in the Linearization menu.

The first line shows the reference point in percent.

The second line contains the characteristic value. The interpolation values are distributed equidistantly along the X-axis (10 %).

5.9. The Input/Output Voltage menu (optional)

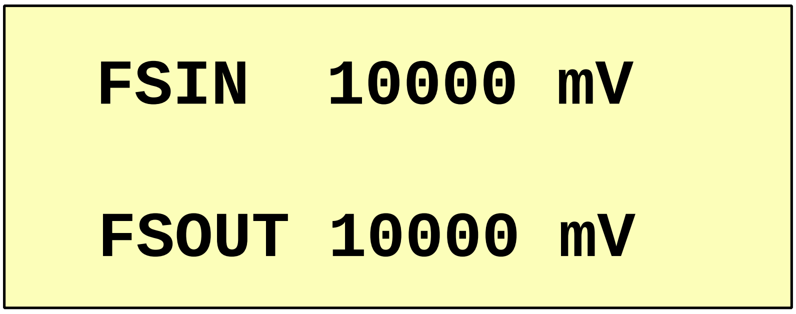


Fig. 9: The Input/Output Voltage menu

You can set the full-scale values for the output voltage (FSOUT; upper range value of the devices) and the input voltage (FSIN) in the Input/Output Voltage menu. Both the values themselves and the measurement units can be defined here.

You can set the measurement units shown in the table below for FSIN (input voltage) **in the first line**. If you are using the mA interface, you must set the resistances accordingly by altering the jumpers inside the device (they are preset by the manufacturer).

mV	m**A**	m**A 2**	m**A 5**	m**A 4**	m**A 24**	m**A 54**
	100Ω	200Ω	500Ω	100Ω	200Ω	500Ω
0 - 20 mA interface				4 - 20 mA interface		

You can set mV or µA as the measurement unit for FSOUT (output voltage) **in the second line**. Physical output is always a voltage.

5.10. The Maximum Limit/Minimum Limit menu

```
MAXL 00.000 bar

MINL 00.000 bar
```

Fig. 10: The Maximum Limit/Minimum Limit menu

You can define the limit values (maximum and minimum) for limit monitoring (relays) and the leak test in this menu.

You can only set the values here and not the measurement units.

5.11. The Limit Mode/Limit Memory menu

```
LIMIT MODE SLEEP

LIMIT MEMORY OFF
```

Fig. 11: The Limit Mode/Limit Memory menu

The limit mode can be set to one of the following **in the first line**: SLEEP, LIMIT, BAND or LEAK.

The meanings of the modes are explained in detail in chapter *7.3.1. Limit modes*.

The limit memory can be set to the ON or OFF status **in the second line**. This memory stores a non-recurrent limit violation. If the limit memory is set to ON, it registers a single violation of a limit value. Even if the limit is exceeded several times, only one violation is registered. Please refer to chapter *7.3.2. Limit memory* for further details.

5.12. The Reset Relays/Leak Test menu (optional)

```
RESET RELAYS

TIMEOUT 0000 sec
```

Fig. 12: The Reset Relays/Leak Test menu (mode 1)

Activating 'Reset relays' in **the first line** causes the trip limit relays to be reset (trigger function) if the limit memory option is set to ON in the *Limit Mode/Limit Memory* menu. Otherwise, this line has no meaning.

If LIMIT MODE is set to LEAK in the *Limit Mode/Limit Memory* menu, the first line contains the words 'Start Leak Test' instead of 'Reset Relays', as shown below:

```
START LEAK TEST

TIMEOUT 0010 sec
```

Fig. 13: The Reset Relays/Leak Test menu (mode 2)

You can set the timeout time for the leak test in both modes **in the second line** of the menu. Please refer to chapter *7.1. Leak test (optional)* for further details about the start procedure and the leak test itself.

5.13. The Signal Processing Mode menu

```
SIG. MODE INDEP.

DISPLAY  DIRECT
```

Fig. 13: The Signal Processing Mode menu

The signal processing mode (SIG. MODE) can be set **in the first line** to either independent (INDEP.) or external (EXTERNAL). EXTERNAL means that the setpoint is preset externally as an analog value via the EXTERNAL interface (pin 7). INDEP. means that the setpoint (SETP) is preset via the keyboard or the digital interface.

You can specify the display mode **in the second line:**

Display	**Suitable for**
DIRECT	Direct specification of the measured value (as measured)
LINEAR	Linearized measured value (cf. linearization table)

5.14. The Sensor and Interface menu

```
SENSOR  PRES   F
IFACE   RS485
```

Fig. 14: The Sensor and Interface menu

The following sensor types can be set **in the first line**:

Display	**Suitable for**
PRES	Pressure sensor
FLOW	Flow controller
VOLT	Voltage
CURR	Current
TEMP	Temperature sensor
VAL	Any
	No display

You can only change the sensor display mode in this menu. The sole purpose of the setting is to label the menu; it is not evaluated internally in any other way.

The sensor type is followed by the letter **P** (pressure) or **F** (flow). This letter indicates the connector assignment that has been configured in the PR4000.

The second line shows the interface: RS232, RS485, OPTION or NONE.

The software detects the interface installed in the PR4000 automatically; you cannot alter this setting. As OPTION interface an IEC 488 interface is currently available only.

5.15. The Device menu

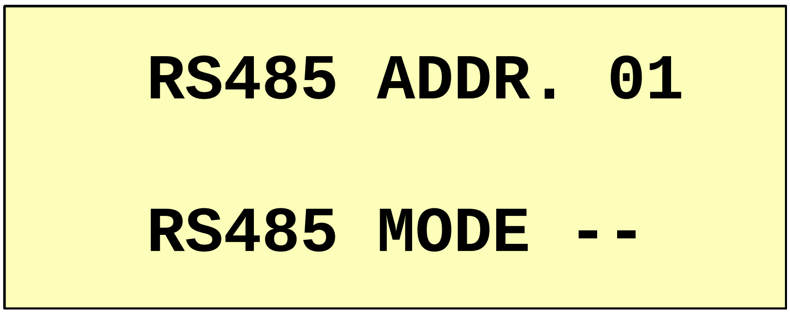


Fig. 15: The Device menu

You can specify the device address **in the first line** (RS485 and IEC 488 only).

The two dashes shown here **in the second line** after to the word MODE (**--**) indicate that you cannot enter a setting. Otherwise, the mode of the optional interface (e.g. IEC 488) can be set in this line. The interface which is currently configured is displayed.

5.16. The Baud Rate and Parity menu

```
BAUD RATE 9600

PARITY    ---
```

Fig. 16: The Baud Rate and Parity menu

The following data transfer rates (in baud) can be set **in the first line:**

110	**1200**	**2400**	**4800**	**9600**	**19k2**	**38k4**	**57k6**	**76k8**	**115k**

You cannot alter the baud rate of the OPTION interface.

You can set the parity **in the second line** (RS232 interface only).

The parity can be NONE, EVEN or ODD.

5.17. The Reset menu

```
RES: SYS LIN STS

STATUS: R
```

Fig. 17: The Reset menu

The first line (RES) indicates which parameters can be reset. You must return to Edit mode in order to do so.

Display	Result
SYS	Resets the complete system to the default parameters
LIN	Resets the linearization parameters, i.e. sets a straight line
STS	Resets the status bits in the second line

The error displays can only be reset by means of STS.

The following *states* can be shown **in the second line:**

Display	Meaning
T	Transmission error (on the serial interface)
O	Overflow error (the AD converter has reached its saturation limit)
R	Range error (value outside 0 - 110 % range)
H	High relay (active)
L	Low relay (active)

The error displays can only be reset by means of STS in the first line.

The letters 'H' and 'L' for high and low relay are only displayed if the relays are active.

6. Signal processing

The signal processing program carries out the following steps:

1. The setpoint is normalized.
2. The measured value (input) is normalized and the binary value is converted to a floating-point number.
3. The measured value (normalized input) is corrected with the gain and offset factors and normalized according to the following formula:

$$\text{Normalized actual value} = \frac{\text{GAIN} * (\text{normalized input} - \text{OFFSET})}{\text{FSIN}}$$

4. The display mode of the actual value is defined (e.g. linear).
5. The setpoint is output, corrected with the gain, FSIN, FSOUT and offset factors and renormalized according to the following formula:

$$\text{Output} = \left(\frac{\text{normalized setpoint}}{\text{GAIN}} + \frac{\text{OFFSET}}{\text{FSIN}} \right) * \text{FSOUT}$$

6. The actual value is displayed.

If the setpoint then fails to reach a value greater than zero or if the setpoint switch is set to OFF, a constant output voltage of -500 mV is output. This ensures that if a valve is open, it is closed safely.

7. Special functions

7.1. Leak test (optional)

You can start a leak test in the *Reset Relays/Leak Test* menu of the PR4000. This test determines whether a pressure drop/increase occurs in the system during a defined period of time, despite the fact that all valves are closed. Leaks are thus established by means of changes in pressure rather than the gas flow.

A timeout, which serves to monitor the process, is started simultaneously with the leak test. The leak test is based on the measured value (actual value) at the start time. It reveals whether the measured value remains within defined limits until the timeout expires or whether these limits are violated. The leak test can also be started via the digital interface.

Leak test procedure:

1. Set the setpoint to OFF.
2. Set LIMIT MODE to LEAK in the *Limit Mode/Limit Memory* menu.
   The words *'Leak Test'* appear in the first line of the next menu.
3. Enter the setpoint for the timeout in the *Reset Relays/Leak Test* menu.
4. Set the leak rate limits in the *Maximum Limit/Minimum Limit* menu.
   The current pressure value (actual value) is taken into account in the setpoint and compared with the limits, which are relative to this setpoint.
5. Start the leak test in the *Reset Relays/Leak Test* menu.
   To do so, switch on Edit mode and confirm the cursor position in the START LEAK TEST line by pressing Enter. This activates the leak test function. If the valve is set to ON, the word 'FAIL' will appear on the display. The PR4000 does not allow a leak test to be run if a valve is open, since this would be nonsensical.
6. The pressure value at the start of the leak test is shown in the Setpoint menu. The first line of this menu now contains the word 'LEAK' instead of 'SETP' (setpoint). 'LEAK' is the initial pressure value.

Please refer to chapter *7.3. Process monitoring (optional)* for further details about the leak test.

7.2. Linearization (optional)

The linearization function is based on a linearization table comprising 11 equidistant points: 0 %, 10 %, 20 %...100 %.

You can generate a linearization table by selecting a reference point (ref) on the X-axis and entering the associated Y-value (derived from the measured value of the sensor). The linearization function compensates the non-linearity of the sensor by linearly interpolating the values between the individual Y-points in the linearization table.

You can enter values in the linearization table either by specifying the individual X and Y-values in the *Linearization* menu or using a PC.

If an interface is available, the values can be entered in the linearization table automatically. In this case, the current X-value is preset and the autolinearization function activated. The PR4000 then automatically adopts the current measured value as the Y-value.

7.3. Process monitoring (optional)

7.3.1. Limit modes

Four different limit modes can be selected for process monitoring in the *Limit Mode/Limit Memory* menu of the PR4000:

SLEEP, LIMIT, BAND and LEAK.

SLEEP

No processes are monitored in SLEEP mode.

LIMIT

LIMIT mode is used to monitor the gas flow, to make sure it remains within the permitted operating limits. If the gas flow rises above the maximum limit or falls below the minimum limit, the corresponding relay is activated. The device interprets limit values as absolute values in LIMIT mode.

BAND

This mode is similar to LIMIT mode, except that the limit values are interpreted as deviations from the setpoint. The minimum limit represents a negative deviation.

LEAK

LEAK mode combines process monitoring with a timeout, in order to detect possible leaks in the system (see also chapter *7.1. Leak test (optional)).*

Monitoring starts two seconds after a mode has been selected (exception: leak test).

The relay logic depends on the active monitoring mode:

Mode	Relay condition
SLEEP	Relay 1 (low relay) represents the (valve) status of the channel. Relay 2 (high relay) is always inactive.
BAND	Relay 1 (low relay) represents the (valve) status of the channel. Relay 2 (high relay) is activated if the actual gas flow is outside the defined band.
LIMIT	Relay 1 (low relay) is activated as soon as the gas flow falls below the specified minimum limit. Relay 2 (high relay) is activated as soon as the gas flow rises above the specified maximum limit.
LEAK	Relay 1 (high relay) is activated for the specified timeout duration. It is deactivated again when the timeout expires. Relay 2 (low relay) is activated if a leak occurs, i.e. if a limit value is violated.

Truth table:

Mode	Relay	Valve	Minimum limit violated	Maximum limit violated	Relay condition
SLEEP	1	OFF	X	X	Inactive
SLEEP	1	ON	X	X	Active
SLEEP	2	X	X	X	Inactive
BAND	1	OFF	X	X	Inactive
BAND	1	ON	X	X	Active
BAND	2	X	NO	NO	Inactive
BAND	2	X	X	YES	Active
BAND	2	X	YES	X	Active
LIMIT	1	X	NO	X	Inactive
LIMIT	1	X	YES	X	Active
LIMIT	2	X	X	NO	Inactive
LIMIT	2	X	X	YES	Active

Mode	Relay	Leak	Timeout	Limit memory	Relay condition
LEAK	1	X	Not active	X	Inactive
LEAK	1	X	Active	X	Active
LEAK	2	YES	Active	X	Active
LEAK	2	NO	Active	X	Inactive
LEAK	2	X	Expired	OFF	Inactive
LEAK	2	YES	Expired	ON	Active
LEAK	2	X	Expired	ON	Inactive

X = Any

There is a hysteresys of 0.5 % of full scale, before the relays will switch back.

7.3.2. Limit memory

The limit memory function in the *Limit Mode/Limit Memory* menu can be set to either ON or OFF. The meanings of these two states are as follows:

Limit memory OFF	The relays reflect the actual condition. They are activated if the limit value is exceeded. If the measured value returns to within the permitted limits, the relays are deactivated again.

Limit memory ON	If the limit value is violated just once in either direction, a relay is activated and remains active. It can be reset with the reset function in the *Reset Relays/Leak Test* menu.

7.4. Autozero

The autozero function can only be selected if the setpoint is set to OFF.

It causes the instantaneous measured value to be adopted as the offset. The zero value is corrected computationally with this offset (error). The correction algorithm is described in detail in chapter *6. Signal processing*.

You can activate the autozero function via the digital interface (only if the setpoint is set to OFF).

7.5. Process safeguarding

When the device is switched on (i.e. when the Power switch on the front panel is set to ON), all the interface signals present at this time are initially inactive (the setpoint is set to -0.5 V and the relays remain inactive).

When the device is switched off (i.e. when the Power switch on the front panel is set to OFF), all the output channels are deactivated and remain inactive.

7.6. The digital interface

The following signals can be applied to the digital interface (see also chapter *9.5. Relay connector*) and the corresponding functions activated:

• VALVE ON	Setpoint ON/OFF	The valve is open if pin 4 of the relay connector is also open and the setpoint is set to ON. If pin 4 is closed (i.e. applied to chassis), the valve is also closed. In addition, 5 - 15 V must be applied to pin 12.
• AUTOZERO	Activate	Pin 5 closed
• RES	Totalizer = zero	Pin 6 closed
• START LEAK	Start leak test	Pin 7 closed

7.7. Interfaces

The following interfaces can be installed in the device:

- RS232 Point-to-point connection via RS232
- RS485 Protocol via RS485
- OPTION e.g. IEC 488
- NONE No interface

The software automatically detects and displays the installed interface.

The interface type determines the meanings of the parameters:

RS232

Address (*Device* menu):	Not used
Mode (*Device* menu):	Not used
Baud rate (*Baud Rate and Parity* menu):	Used
Parity (*Baud Rate and Parity* menu):	Used
7 data bits and 1 stop bit	

RS485

Address (*Device* menu):	Device address
Mode (*Device* menu):	Not used
Baud rate (*Baud Rate and Parity* menu):	Used
Parity (*Baud Rate and Parity* menu):	Not used

OPTION (e.g. IEC 488)

Address (*Device* menu):	Device address
Mode (*Device* menu):	Interface mode
Baud rate (*Baud Rate and Parity* menu):	Not used
Parity (*Baud Rate and Parity* menu):	Not used

Requests and commands are always transferred in blocks, rather than as individual characters.

7.7.1. RS232 interface

The RS232 interface is a serial interface in accordance with the RS232 specifications.

The interface is active if it is displayed on the device.

7.7.2. RS485 interface

The RS485 interface is a serial interface in accordance with the RS485 specifications, with additional electrical isolation. The protocol conforms to DIN 66348, Part 2.

The interface is active if it is displayed on the device.

7.7.3. Option (IEC 488)

The IEC 488 interface is available as an option. It is active if the word 'OPTION' is displayed on the device.

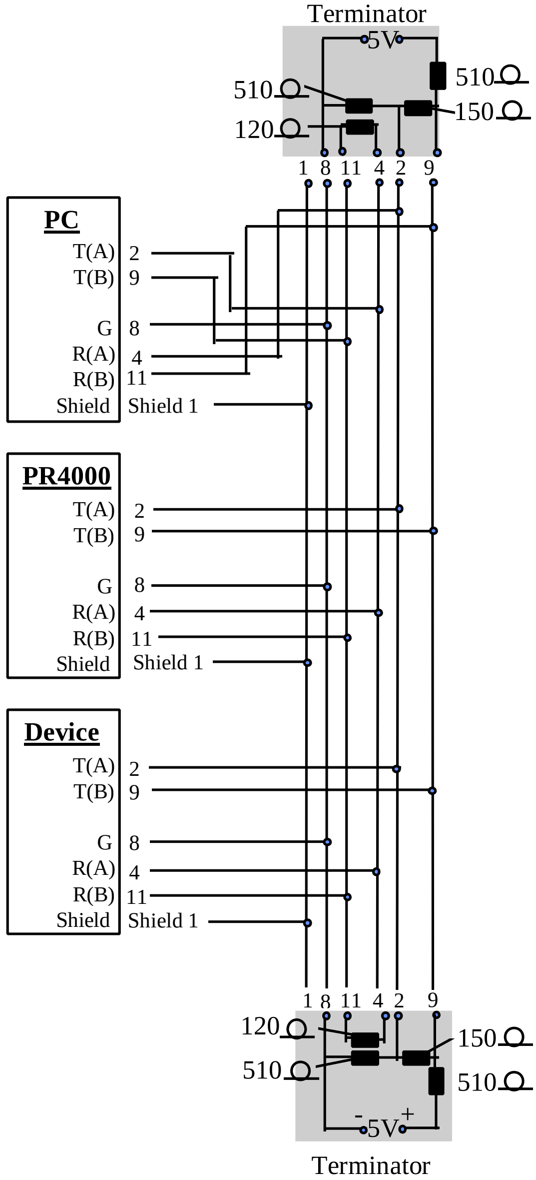
The interface supports the following IEC 488 functions:

AH1, SH1, L2, T4, SR0, PP0, RL0, DC0, DT0, C0

8. External communication

8.1. Structure of the multipoint interface according to DIN 66 349 Part 2

The connection structure between the PR4000 and the master (e.g. a PC) as well as another device via a bus interface is shown below:



8.2. Protocols

8.2.1. RS232 interface

The protocol is a simple command/answer sequence with no buffering. The various commands and answers are described in detail in chapter *8.3. Commands*. If the language definition does not include a defined answer, a dummy answer is sent: CR (carriage return, hex 0x0D).

A command answer, CR (carriage return, hex 0x0D) is returned. The carriage return is also used as a tail character. The maximum message length is 12 characters; separators such as blanks, tabs, etc. are not allowed. It is advisable to keep strictly to the ASCII formats.

An RS232 telegram consists of a send text, a received text and a tail character:

stxt CR
rtxt CR

8.2.2. RS485 interface

The protocol conforms to DIN 66348 Part 2. The various commands and answers are described in detail in chapter *8.3. Commands*. If the language definition does not include a defined answer, a dummy telegram is sent.

The telegram has a more complex structure than that of the RS232 protocol. It consists of a head, the actual send text (stxt) and a tail character:

head	stxt	tail

8.2.3. Optional interface

The protocol is a simple command/answer sequence which is transmitted on the IEC 488 bus. The various commands and answers are described in detail in chapter *8.3. Commands*. If the language definition does not include a defined answer, a carriage return (hex 0x0D) is generated instead.

The telegram has exactly the same structure as that of the RS232 interface.

8.3. Commands

8.3.1. Structure of the Remote Interface Language

The Remote Interface Language allows to communicate with the PR4000 via the actual interface by for example a PC. This language has a simple command reply structure. All commands may be transmitted either in (a special) binary format or as ASCII code.

The elements of the syntax description is shown here:

stxt:	Send text (from PC)
rtxt:	Received text (to PC)
[]	Optional element (e.g. [A] means A is optional)
|	Alternative of different elements (e.g. A|B means A or B)
@xxx:	Bytes with fixed format (e.g. @cmd)
(float):	Binary format of a value
0x0004	Hexadecimal numeric format

Examples for ASCII formats:

BYTE:	000	Decimal string of three characters
WORD:	+00000	Decimal string of five characters and a sign
LONG:	000000.0000	Floating point with eleven characters
FLOAT:	+0.00000	Floating point with six characters and a sign

How to handle byte formats:

This is a typical format of a byte with a fixed format.

p	1	d5	d4	d3	d2	d1	d0

The first bit of each byte is the parity bit and cannot be reprogrammed. The second bit is normally a one, in order to get a printable character. The bits d5 to d0 can be used for programming.

If, for example, the bits d4 and d2 should be set, you get this binary representation: 01010100b which is equal to the hexadecimal value: 0x54. If go through a ASCII table with this value, you will get the character ‘T’, which may be entered right on the command line. Some simple parameters are shown as hex. Constants, e.g. 0x31. In this case enter the corresponded ASCII character ‘1’ on the command line.

8.3.2. Special byte formats

@cmd:

p	1	d5	d4	d3	d2	d1	d0

Only one of bits d5 - d2 is allowed to be set at any given time. If several bits are set, only the one with the highest priority is taken into account. Bit d5 has the highest priority and bit d2 the lowest priority.

The bits have the following meanings when set:

p: Parity bit
d5: Actual value sent
d4: Setpoint (external) sent
d3: Totalized value (total gas flow over a defined period of time) displayed
d2: Digital I/O sent
d1. Setpoint set to ON or OFF
d0: Totalizer (gas counter) reset

A total of four bytes are available for binary transfers - one header byte and three useful data bytes.

Special binary format

@head

p	1	b3d7	b3d6	b2d7	b2d6	b1d7	b1d6

@byte 1

p	1	b1d5	b1d4	b1d3	b1d2	b1d1	b1d0

@byte 2

p	1	b2d5	b2d4	b2d3	b2d2	b2d1	b2d0

@byte 3

p	1	b3d5	b3d4	b3d3	b3d2	b3d1	b3d0

The header byte is filled with:

bits 7 and 6 of byte 3 = bits 5 and 6,
bits 7 and 6 of byte 2 = bits 3 and 4,
bits 7 and 6 of byte 1 = bits 1 and 2.

Status bytes of the PR4000

@sts1 (Status 1)

The bits have the following meanings when set:

p	1	d5	d4	d3	d2	d1	d0

p: Parity bit
d5: General error (see status bit 3 for further details)
d4: Overflow (see status bit 2 for further details)
d3: Setpoint set to ON and valve open
d2: Parameter modified by user
d1. Relay 1 active
d0: Relay 2 active

If the status has been read, bits d2, d4 and d5 are reset to zero. All the other bits represent current values.

@sts2 (Status 2)

The bits have the following meanings when set:

p	1	d5	d4	d3	d2	d1	d0

p: Parity bit
d5: Analog input (1) too high (>+11 V)
d4: Analog input (1) too low (<-11 V)
d3: Analog input (1) >110 %
d2: Analog input (1) < 0

EXTERNAL mode only

d1. Analog input (0) too high (>+11 V)
d0: Analog input (0) too low (<-11 V)

Analog input (1) = setpoint (in external mode)
Analog input (0) = measured value (actual value)

@sts3 (Status 3)

The bits have the following meanings when set:

p	1	d5	d4	d3	d2	d1	d0

p: Parity bit
d5: Reserved
d4: Reserved
d3: Reserved
d2: Command execution error
d1. Data transfer error
d0: Totalizer overflow
If the status has been read, bits d1 and d2 are reset to zero. All the other bits represent current values.

@sts4 (Status 4)

The bits have the following meanings when set:

p	1	d5	d4	d3	d2	d1	d0

p: Parity bit
d5: Digital input 5, reserved
d4: Digital input 4, reserved
d3: Digital input 3, start leak test
d2: Digital input 2, reset integrator
d1. Digital input 1, autozero
d0: Digital input 0, valve ON/OFF

d0 to d5 are the actual digital inputs.

The digital inputs are also transferred together with the measured value by the command 0x22 (direct access).

8.3.3. Commands

8.3.3.1 Command syntax

The binary float format conforms to IEEE 754. The command syntax and notation are described in more detail in chapter *8.3.1. Structure of the Remote Interface Language*. Commands and answers are represented as follows in this chapter:

stxt: Text sent by master (PC)
rtxt: Answer from PR4000

Commands begin with the hexadecimal number corresponding to an ASCII character (e.g. 0x23). This is followed by the ASCII character itself (e.g. (#)) and finally a plain text description of the command ('Start signal processing').

Bytes in commands are abbreviated as 'b'. Example: setpoint.b3 denotes byte 3.

In the command 'head, setpoint.b3, setpoint.b2, 0x00head, setpoint.b1, setpoint.b0, 0x00', 'setpoint' consists of 8 bytes: 2x@head, setpoint.b3, setpoint.b2, setpoint.b1, setpoint.b0, 2x 0x00, whereby the value of the last byte is zero because it is not used.

Example:
The master (PC) sends 10 bytes in this example: command, @cmd, 8 bytes for the setpoint (optional). The binary format of the setpoint consists of 4 bytes (floating-point number in accordance with IEEE 754). The following answers are possible, depending on the bits which are set in @cmd: measured value (actual value) or setpoint or DigOutDigIn or optionally the totalized value.

8.3.3.2. General commands

0x21 (!) Update all values

stxt:	0x21@cmd [setpoint]
rtxt:	@sts1 [actual value]|[setpoint]|[DigOut/DigIn]|[totalized value]

Setpoint:

Binary (float): @head, setpoint.b3, setpoint.b2, 0x00 @head, setpoint.b1, setpoint.b0, 0x00

ASCII FLOAT

Measured value (actual value):

Binary (float): @head, actual value.b3, actual value.b2, 0H, @head, actual value.b1, actual value.b0, 0x00

ASCII FLOAT

Setpoint:

Binary (float): @head, setpoint.b3, setpoint.b2, 0x00, @head, setpoint.b1, setpoint.b0, 0x00

ASCII FLOAT

DigOut/DigIn (8 bits DigOut, 8 bits DigIn):

Binary (unsigned): @head, 0x00, DigOut/DigIn

ASCII: WORD

DigIn	Bit
VALVE ON/OFF	db0
AUTOZERO	db1
RESET TOTALIZER	db2
START LEAK TEST	db3
ONE|OUT	db4
FLOW|PRES	db5
OPTIONAL	db6
OPTIONAL	db7

DigOut	Bit
RELAY0	db0
RELAY1	db1
CAL SWITCH0	db2
CAL SWITCH1	db3
OPTIONAL	db4
CLOSE VALVE	db5
OPTIONAL(PDR)	db6
OPTIONAL(PDR)	db7

Totalized value (optional):

Binary:	Cf. ASCII
ASCII:	LONG

0x22 (“) Direct access to sensors

This command writes directly in the digital/analog converter and stops signal processing. A restart can be initiated with command 0x23.

stxt:	0x22 Outgoing data
rtxt:	Incoming data

Outgoing data:

ASCII	Not applicable
out =	Output channel 1
out2 =	Output channel 2

Incoming data:

Binary (float):	@head, in.b1, in.b0, DigIn, @head, in2.b1, in2.b0, @
ASCII	Not applicable
in =	Input channel 1
in2 =	Input channel 2
0x000 =	Full-scale deflection; 0xFFFF = + full-scale deflection.

0x23 (#) Start signal processing

stxt:	0x23
rtxt:	CR (carriage return; no return)

Commands 0x21 and 0x24 also start signal processing.

0x24 ($) Update sensor

stxt:	0x24 Setpoint
rtxt:	Measured value (actual value)

Setpoint:

Binary (float):	@head, setpoint.b3, setpoint.b2, 0x00, @head, setpoint.b1, setpoint.b0, 0x00
ASCII	FLOAT

Measured value (actual value):

Binary (float):	@head, actual value.b3, actual value.b2, 0x00, @head, actual value.b1, actual value.b0, 0x00
ASCII	FLOAT

0x25 (%) Change format

This command switches the format between binary and ASCII.

stxt:	0x25 nfrmt
rtxt:	CR (carriage return; no return)

nfrmt:

0x30 =	Binary (special binary format)
0x31 =	ASCII

0x26 (&) Read status byte 1

stxt:	0x26
rtxt:	@sts1

0x27 (‘) Read status byte 2

stxt:	0x27
rtxt:	@sts2

0x28 (() Read status byte 3

stxt:	0x28	Reset when the byte is read
rtxt:	@sts3	

0x29 ()) Read status byte 4

stxt:	0x29	Reset when the byte is read
rtxt:	@sts4	

0x2A(*) Reset system to default values

stxt:	0x2A
rtxt:	CR (carriage return; no return)

0x2B(+) Reset linearization (optional)

stxt: 0x2B
rtxt: CR (carriage return; no return)

0x2C (,) Reset relay

stxt: 0x2C
rtxt: CR (carriage return; no return)

0x2D (-) Reset status 3

stxt. 0x2D
rtxt: CR (carriage return; no return)

0x2E (.) Reset totalizer

stxt: 0x2E
rtxt: CR (carriage return; no return)

0x2F (/) Start leak test

stxt: 0x2F
rtxt: CR (carriage return; no return)

0x30 (0) Autozero

This function interprets the actual measured value as zero and calculates a new offset.

stxt: 0x30
rtxt: CR (carriage return; no return)

0x31 (1) Autofullscale

This function interprets the actual measured value as the full-scale deflection and calculates a new gain.

stxt: 0x31
rtxt: CR (carriage return; no return)

0x32 (2) Autolinearization

This function interprets the actual measured value as the Y-value for linearization (optional).

stxt:	0x32 Interpolation point
rtxt:	CR (carriage return; no return)

Interpolation point:

Binary, ASCII: (@ + value)
X-value for linearization

8.3.3.3. Commands which set process parameters

0x40 (@)Set setpoint

stxt: 0x40 Setpoint
rtxt: CR (carriage return; no return)

Setpoint:

Binary (float):	@head, setpoint.b3, setpoint.b2, 0x00, @head, setpoint.b1, setpoint.b0, 0x00
ASCII	FLOAT

0x41 (A) Valve ON/OFF

stxt: 0x41 ON/OFF status
rtxt: CR (carriage return; no return)

ON/OFF status:

Binary, ASCII:	0x30...0x31	0 = OFF, 1 = ON

0x42 (B) Set range

stxt: 0x42 Range
rtxt: CR (carriage return; no return)

Range:
Changes the range parameter.

Binary (float):	@head, range.b3, range.b2, 0x00, @head, range.b1, range.b0, 0x00

0x43 (C) Set measurement unit

stxt: 0x43 Measurement unit
rtxt: CR (carriage return; no return)

Measurement unit:

Binary:	@ + value (0-20)	The index (0 - 20) corresponds to the order of the measurement units
ASCII:	BYTE	

You can set the following measurement units:

Table 1: Available measurement units				
µbar=0	mbar=1	bar=2		
mTorr=3	Torr=4	kTorr=5		
Pa=6	kPa=7			
mH2O=8	cH2O=9	PSI=10	N/m²=11	
SCCM/CC=12	SLM/L=13	SCM/CM=14	SCFH/CF=15	SCFM/CF=16
mA=17	V=18	%=19	C=20	

mHG == kTorr, mmHg == Torr
CC = cubic centimeter, L = liter, CM = cubic meter, CF = cubic foot

0x44 (D) Set gain

stxt: 0x44 Gain
rtxt: CR (carriage return; no return)

Gain:
Binary (float): @head, gain.b3, gain.b2, 0x00, @head, gain.b1, gain.b0, 0x00
ASCII: FLOAT

0x45(E) Set offset

stxt: 0x45 Offset
rtxt: CR (carriage return; no return)

Offset:
Binary (integer): @head, 0x00, offs.b1, offs.b0
ASCII: WORD

0x46 (F) Set linearization table (optional)

stxt: 0x46 Reference Y-axis
rtxt: CR (carriage return; no return)

Reference:
Binary: (@+ value) X-value for linearization (0 - 10)
ASCII: BYTE

Important: This reference format is mandatory!

Y-axis:
Binary (float): @head, ylin.b3, ylin.b2, 0x00, @head, ylin.b1, ylin.b0, 0x00
ASCII: FLOAT

0x47 (G) Set full-scale deflection for input voltage

stxt:	0x47 fsin	Changes the FSIN parameter
rtxt:	CR (carriage return; no return)	

Input voltage:

Binary (unsigned): @head, 0x00, fsin.b1, fsin.b0

ASCII: WORD

0x48 (H) Set measurement unit for input voltage

stxt:	0x48 Measurement unit
rtxt:	CR (carriage return; no return)

Input voltage measurement unit:

Binary. ASCII: 0x30...0x36

You can set the following measurement units for FSIN (input voltage):

mV	m**A**	m**A 2**	m**A 5**	m**A 4**	m**A 24**	m**A 54**
	100Ω	200Ω	500Ω	100Ω	200Ω	500Ω
0 - 20 mA interface				4 - 20 mA interface		

The index (0 - 6) corresponds to the order of the units.

0x49 (I) Set full-scale deflection for output voltage

stxt:	0x49 fsout
rtxt:	CR (carriage return; no return)

Output voltage:

Changes the FSOUT parameter

Binary (unsigned@head, 0x00, fsout.b1, fsout()

ASCII: WORD

0x4A (J) Set measurement unit for output voltage

stxt:	0x48 Measurement unit of output voltage
rtxt:	CR (carriage return; no return)

Output voltage measurement unit:

Binary.	ASCII: 0x30...0x31	mV and µA are the valid measurement units for FSOUT

0x4B (K) Set maximum limit

stxt: 0x4B maxlim
rtxt: CR (carriage return; no return)

maxlim:
Changes the MAXL parameter

Binary (unsigned): @head, max_lim.b3, max_lim.b2, 0x00, @head, max_lim.b1, max_lim.b0, 0x00
ASCII: FLOAT

0x4C (L) Set minimum limit

stxt: 0x4C minlim
rtxt: CR (carriage return; no return)

minlim:
Changes the MINL parameter

Binary (unsigned): @head, min_lim.b3, min_lim.b2, 0x00, @head, min_lim.b1, min_lim.b0, 0x00
ASCII: FLOAT

0x4D (M) Set limit mode

stxt: 0x4D Limit mode
rtxt: CR (carriage return; no return)

Limit mode:
Binary, ASCII: 0x30...0x33 — The valid limit modes are SLEEP, LIMIT, BAND and LEAK. The index (0 - 3) corresponds to the order of the units.

0x4E (N) Set limit memory (optional)

stxt: 0x4E Limit memory
rtxt: CR (carriage return; no return)

Limit memory:
Binary, ASCII: 0x30...0x31 — OFF = 0; ON = 1

0x4F (O) Set timeout (optional)

stxt: 0x4F Timeout in seconds
rtxt: CR (carriage return; no return)

Timeout
Binary (unsigned): @head, 0x00, timeoutb1, timeoutb
ASCII: WORD

0x50 (P) Set signal processing mode

stxt: 0x50 Signal processing mode
rtxt: CR (carriage return; no return)

Signal processing mode:
Binary, ASCII: 0x30...0x31 Index for signal processing mode:
0 = independent, 1 = external

0x51 (Q) Set display mode

stxt: 0x51 Display
rtxt: CR (carriage return; no return)

Display:
Binary, ASCII: 0x30...0x31 Index for display mode (0..1)
0 = direct; 1 = linearized

0x52 (R) Set sensor type

stxt: 0x52 Sensor type
rtxt: CR (carriage return; no return)

Day of measured value:
Binary, ASCII: 0x30...0x36 Index for sensor type (0)

You can set the following sensor types:

Display	Sensor type	Setting
PRES	Pressure sensor	0
FLOW	Flow controller	1
VOLT	Voltage	2
CURR	Current	3
TEMP	Temperature sensor	4
VAL	Any	5
	No display	6

0x53 (S) Set interface parameters (optional)

stxt: 0x53 Baud [parity]
rtxt: CR (carriage return; no return)

Baud:
Binary, ASCII: 0x30...0x39 Baud index (0..9)

Parity:
Binary, ASCII: 0x30...0x32 Parity index (RS232 only, 0...2)

Baud rate

110	1200	2400	4800	9600	19k2	38k4	57k6	76k8	115k
0x30	0x31	0x32	0x33	0x34	0x35	0x36	0x37	0x38	0x39

The valid parity values are NONE (0x30), EVEN(0x31) and ODD (0x32).

0x54 (T) Set device address (optional)

stxt: 0x54 Device address
rtxt: CR (carriage return; no return)

Address:
Binary: @ + value (1-31)
ASCII: BYTE

0x55 (U) Set interface mode (optional)

stxt:	0x55 Interface mode
rtxt:	CR (carriage return; no return)

Interface mode:

Binary:	@ + value (0...maximum interface mode)
ASCII:	BYTE

0x57 (W) Display menu with specified index

stxt:	0x57 Menu
rtxt:	CR (carriage return; no return)

Index for displayed menu:

Binary:	@ + value (0...16)	Corresponds to order of menu tree (see chapter *5.1. The menu tree*)
ASCII:	BYTE	

8.3.3.4. Commands which read process parameters

0x60 (`) Read setpoint

stxt:	0x60
rtxt:	Setpoint

Setpoint:

Binary (float):	@head, setpoint.b3, setpoint.b2, 0x00, @head, setpoint.b1, setpoint.b0, 0x00
ASCII:	FLOAT

0x61 (a) Read valve ON/OFF

stxt:	0x61
rtxt:	oos

oos:

Binary, ASCII:	0x30...0x31	ON/OFF status 0 = OFF; 1 = ON

0x62 (b) Read range

stxt:	0x62
rtxt:	Range

Range:

Binary (float):	@head, range.b3, range.b2, 0x00, @head, range.b1, range.b0, 0x00
ASCII:	FLOAT

0x63 (c) Read measurement unit

stxt:	0x63
rtxt:	Measurement unit

Measurement unit:

Binary :	@ + value (0 - 23)
ASCII:	BYTE

0x64 (d) Read gain

stxt:	0x64
rtxt:	Gain

Gain:

Binary (float):	@head, gain.b3, gain.b2, 0x00, @head, gain.b1, gain.b0, 0x00
ASCII	FLOAT

0x65 (e) Read offset

stxt: 0x65
rtxt: Offset

Setpoint:

Binary: (int) @head, 0x00, offsb1, offsb0
ASCII: FLOAT

0x66 (f) Read linearization table

stxt: 0x66 Reference
rtxt: ylin

Reference:

Binary: @ + value (0...23) Inverse curve from K onwards
ASCII. BYTE

ylin:

Binary (float): @head, ylin.b3, ylin.b2, 0x00, @head, ylin.b1, ylin.b0, 0x00
ASCII: FLOAT

0x67 (g) Read full-scale deflection of input voltage

stxt:	0x67
rtxt:	Full-scale deflection of input voltage

Full-scale deflection of input voltage:

Binary (integer):	@head, 0x00, fsinb1, fsinb0
ASCII:	WORD

0x68 (h) Read measurement unit of input voltage

stxt:	0x68
rtxt:	Measurement unit of input voltage

Measurement unit of input voltage:

Binary, ASCII:	0x30...0x36	The index (0 - 6) corresponds to the order of the units.

The valid measurement units for FSIN (input voltage) are listed in the table under *0x48 (H) Set measurement unit for input voltage*.

0x69 (i) Read FSOUT

stxt:	0x69
rtxt:	FSOUT

FSOUT:

Binary (integer):	@head, 0x00, fsoutb1, fsoutb0
ASCII:	FLOAT

0x6A (j) Read measurement unit of output voltage

stxt:	0x6A
rtxt:	Measurement unit of output voltage

Measurement unit of output voltage:

Binary, ASCII:	0x30...0x31

mV and µA are the valid measurement units for FSOUT (output voltage).

0x6B (k) Read maximum limit (MAXL)

stxt:	0x6B
rtxt:	maxlim

maxlim:

Binary (float):	@head, max_lim.b3, max_lim.b2, 0x00 @head, max_lim.b1, max_lim.b0, 0x00
ASCII:	FLOAT

0x6C (l) Read minimum limit (MINL)

stxt: 0x6C
rtxt: minlim

minlim:

Binary (float):	@head, min_lim.b3, min_lim.b2, 0x00 @head, min_lim.b1, min_lim.b0, 0x00
ASCII:	FLOAT

0x6D (m) Read limit mode

stxt: 0x6D
rtxt: Limit mode

Limit mode:

Binary, ASCII:	0x30...0x33	Index for limit mode (0...3) The valid limit modes are SLEEP, LIMIT, BAND and LEAK

0x6E (n) Read limit memory

stxt: 0x6E
rtxt: Limit memory

Limit memory:

Binary, ASCII:	0x30...0x31	Index for limit memory 0 = OFF, 1 = ON

0x6F (o) Read timeout

stxt:	0x6F
rtxt:	Timeout

Timeout:

Binary (unsigned): @head, 0x00; timeout.b1, timeout.b0 Timeout in seconds

ASCII: WORD

0x70 (p) Read signal processing mode

stxt:	0x70
rtxt:	Signal processing mode

Signal processing mode:

Binary, ASCII:	0x30, 0x31	Index for signal processing mode 0 = independent, 1 = external

0x71(q) Read display mode

stxt:	0x71
rtxt:	Display

Display:

Binary, ASCII:	0x30, 0x31	Index for display mode 0 = direct; 1 = linearized;

0x72 (r) Read sensor type

stxt:	0x72
rtxt:	Sensor type

Day of measured value (actual value):

Binary, ASCII:	0x30...0x36	Index for day of measured value (0...6)

The valid settings for the sensor type are listed in the table under *0x52 (R) Set sensor type*.

0x73 (s) Read interface type

stxt:	0x73
rtxt:	Interface type, baud, parity

Interface type:

Binary,	ASCII: 0x30...0x33	Index for interface type 0 = no interface; 1 = RS232; 2 = RS 485; 3 = OPTION

Baud:

Binary, ASCII: 0x30...0x39	Index for baud rate (0...9)

The valid settings for the baud rate are listed under
0x53 (S) Set interface parameters.

Parity:

Binary, ASCII: 0x30...0x32	Index for parity (0...2) NONE = 2, EVEN = 0, ODD = 1

0x74 (t) Read device address

stxt:	0x74
rtxt:	Device address

Device address:

Binary:	@ + value (1-31)
ASCII:	BYTE

0x75 (u) Read interface mode

stxt:	0x75
rtxt:	Interface mode

Interface mode:

Binary:	@ + value (0...maximum interface mode)
ASCII:	BYTE

0x76 (v) Read ID

stxt: 0x76
rtxt: ID string

0x7B ({) Lock keyboard

stxt: 0x7B
rtxt: CR (carriage return; no return)

0x7D(}) Unlock keyboard

stxt: 0x7D
rtxt: CR (carriage return; no return)

9. Pin assignment of connectors on the back panel

9.1. Channel 1 (flow configuration)

Pin	Assignment	Pin	Assignment
1	---	9	setpoint remote sense (input for remote sensor)
2	actual value (anain [0])	10	---
3	/valve close **	11	---
4	/valve open *	12	signal ground
5	power ground	13	---
6	- 15 V	14	---
7	+ 15 V	15	chassis
8	setpoint (anaout [0])		

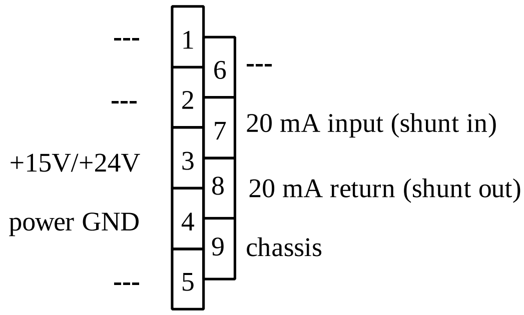
* Only connected to EXTERNAL connector
** Jumper selection: - connected to EXTERNAL connector
- connected to "Valve closed" of PR4000 (default setting)

9.2. Channel 1 (pressure configuration, optional)

Pin	Assignment	Pin	Assignment
1	NC	9	NC
2	signal (anain [0])	10	NC
3	NC	11	NC
4	NC	12	signal ground
5	power ground	13	NC
6	- 15 V	14	*bypass remote zero
7	+ 15 V	15	chassis
8	rem.zero out of rng *		

* Only connected to EXTERNAL connector

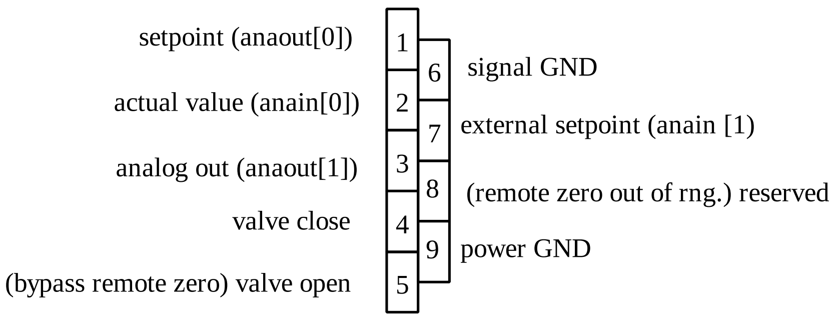
9.3. 20 mA connector (optional)



Different shunts can be set by altering the jumper positions inside the device:

- None
- 100 ohms
- 200 ohms
- 500 ohms

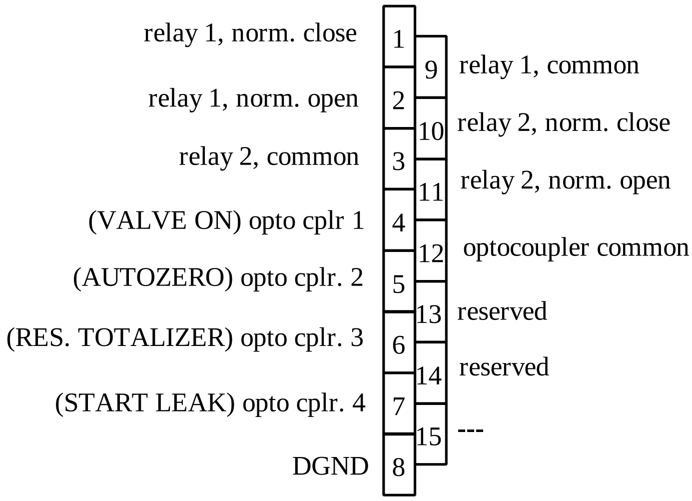
9.4. EXTERNAL connector



The signal specification depends on the sensor which has been configured (aval).

9.5. Relay connector

SUB-D, 15-pole female



Relay data:

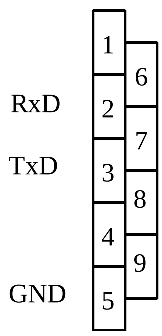
Max. activation current	2 A, 1 A
Max. activation voltage	30 VDC, 230 VAC
Max. activation power	20 W
Relay type	SPDT
Protected against L-loads	

Optocoupler data:

Max. reverse voltage	5 V
Max. forward current	20 mA

9.6. RS232 connector

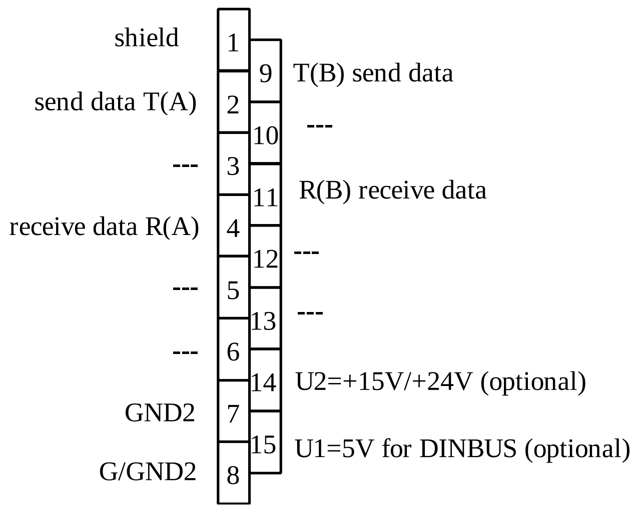
SUB-D, 15-pole female



All signals to RS232 standard.

9.7. RS485 connector

SUB-D, 15-pole female



- Connector compatible with DIN 66349 Part 2
- Terminators can be configured with jumpers

9.8. IEEE connector

The IEEE connector is fully compatible with the IEC 488 Standard.