UMPIOXRV1-4EN

User's Manual

Process Refractometer PIOX® R

Remark: PIOX® is a protected trademark of FLEXIM Flexible Industriemesstechnik GmbH.

FLEXIM Flexible Industriemesstechnik GmbH
Wolfener Straße 36
D-12681 Berlin

Tel.: +49 (0)30 936 67 660
Fax: +49 (0)30 936 67 680

flexim@flexim.de
www.flexim.de

User's manual of the refractometer PIOX R300

Table of Contents

1 Introduction

1.1 Regarding this Manual

This manual has been written for the personnel operating the PIOX R300 refractometer. It contains very important information about the instrument, how to handle it correctly, how to avoid damaging it and how to avoid injury. Always keep this manual at hand. Get acquainted with the safety rules and the handling precautions. Make sure you have read and understood this manual before using the instrument.

All reasonable effort has been made to ensure the correctness of the content of this manual. Should you however find some erroneous information, please inform us.

Please note that we shall be grateful for any suggestions and comments regarding the PIOX R300 concept and your experience working with the instrument. This will ensure that we can further develop our products for the benefit of our customers and in the interest of technological progress.

Furthermore, should you have any suggestions about improving the documentation and particularly this User's Manual, please let us know so that we can consider your comments for future reprints.

We also provide special customer solutions and will be pleased to advise you in using PIOX R300 for specific applications and finding the most appropriate solution for your measurement problem.

The technical specifications of the instrument as well as the content of this manual are subject to change without prior notice. All rights reserved. No part of this manual may be reproduced in any form without FLEXIM's written permission.

1.2 Safety Precautions / Handling

You will find in this manual the following safety information:

Note:	*The notes contain important information which help you use your instrument in an optimal way.*

	*This text gives you important instructions which should be respected in order to ensure the correct function of the instrument and avoid measurement errors. Read this text cautiously and respect the given instructions.*

	*This text gives you important instructions which should be respected in order to avoid injuries of the personnel or damages to the instrument. Proceed cautiously!*

Respect these safety precautions!

1.3 Suitability and Warranty

You have bought a high quality measuring instrument. We thank you for trusting us.

We take no responsibility whatsoever concerning the suitability of the PIOX R300 for a particular measuring tasks. It is the duty of the user to ensure that the refractometer is used only for the purpose for which it has been designed ("correct use"). The correct use of the instrument includes the respect of the mounting, commissioning and maintenance instructions.

	*The user's manual and any complementary instructions you may have received with the instrument must be read before mounting, commissioning, operating or servicing the instrument.*

	*Improper installation and operation of the instrument can lead to the revocation of the guarantee.*

The PIOX R300 refractometer is guaranteed for the term and to the conditions specified in the sales contract provided it has been used for the purpose for which it has been designed and operated according to the instructions given in the present User's Manual. Misuse of the PIOX R300 will immediately revoke any warranty given or implied. This includes:

- the replacement of a component by a component that was not authorized by FLEXIM,
- unsuitable or insufficient maintenance,
- repair of the PIOX R300 by unauthorized personnel.

The manufacturer assumes no responsibility for damages resulting from incorrect use of the instrument.

FLEXIM assumes no responsibility for injury to the customer or third persons proximately caused by the material owing to defects in the product which were not predictable or for any indirect damages.

PIOX R300 is a very reliable instrument. It is manufactured under strict quality control, using modern production techniques. If installed correctly, in an appropriate location and as recommended, used cautiously and taken care of conscientiously, no troubles should appear. If any problem appears which cannot be solved with the help of this manual, please contact our sales office, giving a precise description of the problem. Don't forget to specify the model, serial number and firmware version of your instrument.

2 Description

2.1 Components of the Measuring System

The refractometer PIOX R300 is composed of an inline unit and an electronic unit which are connected together by a cable for power supply and signal transmission.

Fig. 2.1: Inline unit PIOX R300 with electronic unit TR374

The inline unit contains the emitter (LED), the receiver (CCD) and the optical components: measuring prism (NP20 or DP20, fused quartz or sapphire), aperture and projection lens. It is also equipped with a Pt1000 temperature probe for the measurement of the process temperature. The inline unit can be mounted on the pipe with the usual standard connection systems.

The electronic unit is composed of the signal processing system, the power supply, the operator interface and various interfaces for the communication with external devices. Its operator interface consists of a keyboard and a two-line display (16 digits per line). The keyboard features three function keys and 12 keys for numerical data input. A display of the refractive index, of the temperature-corrected refractive index, of the computed concentration and of the temperature is possible.

2.2 Measuring Principle

The refractometer PIOX R300 measures the absolute value of the refractive index of liquids. The refractive index is a characteristic property of every material. It is defined as the ratio of the speed of light in vacuum to that in the material.

The determination of the refractive index bases on the measurement of the deflection of a bundle of light rays having crossed the medium. The law of refraction, or Snell's law, describes the deflection of a light ray when crossing the interface between two different media:

$$n_i \cdot \sin \theta_i = n_t \cdot \sin \theta_t$$

with θ_i the angle of incidence, θ_t the angle of the transmitted light beam, n_i the refractive index of the media in which the incident beam propagates, and n_t the refractive index of the media in which the transmitted beam propagates.

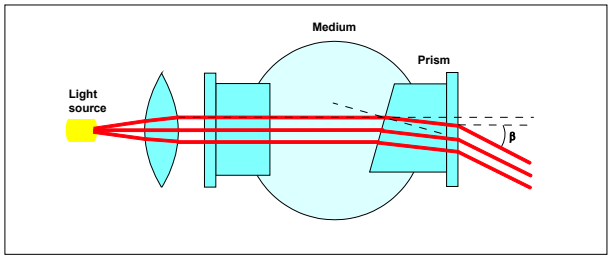


Fig. 2.2: Path of the light rays in the refractometer PIOX R

Fig. 2.2 gives a schematic overview of the measurement as it takes place in the inline unit. The light emitting diode of the emitter unit generates a bundle of parallel monochromatic light rays. This bundle crosses the liquid to be measured and is deflected at the surface of a prism situated in the receiver unit. This deflection is amplified as the bundle is deflected a second time while leaving the prism.

The deflected light rays create an optical image on a CCD cell situated in the receiver. The intensity maximum of this image is directly proportional to the deflection angle β. The CCD cell consists of a row of 2048 photo-detectors integrated in an electronic chip. It transforms the optical image into an electrical signal. With the help of a complex algorithm, this data is analyzed and the exact position of the maximum and thus the deflection angle is determined. The refraction index is then calculated basing on the law of refraction.

The electronic unit receives from the CCD cell the signal giving the refraction index and the temperature of the medium. The results are displayed as configured by the user and the measured values and sensor values are transmitted to the outputs.

2.2.1 Concentration Measurement

The refractive index is a characteristic property of every material. It the case of a solution, the index will vary with the concentration and the temperature. Fig. 2.3 gives an example of this interdependence between refractive index, concentration and temperature for a saccharoses solution.

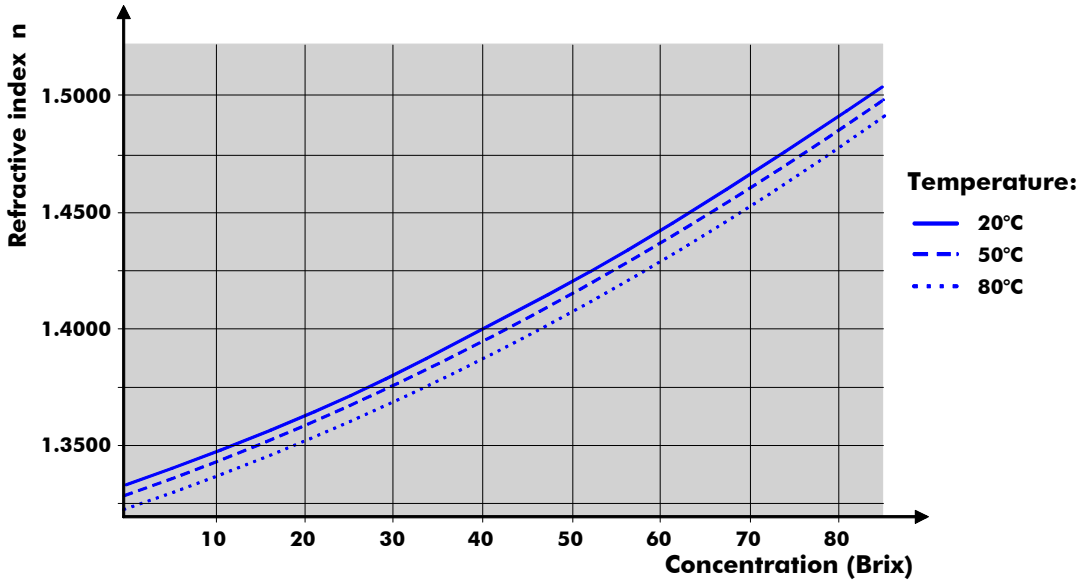


Fig. 2.3: Sound velocity in a saccharose solution as a function of the concentration

If this specific curve is known and single valued in the working range, and if other influences on the refraction index can be excluded, it is possible to use the measured refractive index to determine the concentration or the density of the liquid. This is only possible in liquid two components system.

This "calibration" procedure can be made at the Flexim laboratories or directly in the process. The dependence between the refractive index and the concentration is measured as a function of the temperature. It is then approximated as a polynomial of the 4th grade. The coefficients of this polynomial are recorded in the memory of the instrument and will be used to calculate the concentration on the basis of the measured refractive index.

The standard calibration curve of sugar (ICUMSA) is already recorded in the memory of the instrument .

2.2.2 Temperature Compensation

For industrial applications, a temperature compensated refractive index or concentration value is often needed. The refractive index or concentration measured at the process temperature is corrected to an equivalent value at a reference temperature. The correction of the refractive index takes place automatically if temperature coefficients are stored for the medium. The reference temperature has been chosen when calculating the temperature coefficients of the medium and is an integral part of the coefficient record for the medium.

2.3 Serial Number

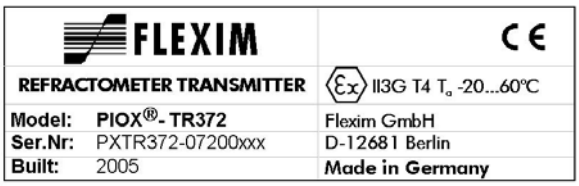


Fig. 2.4: Data plate of the transmitter

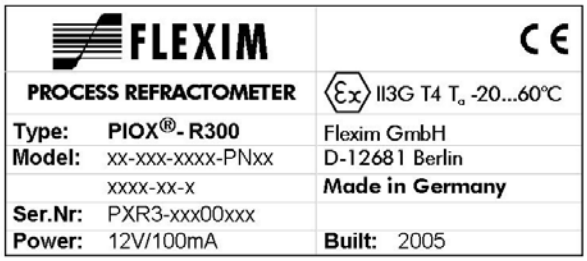
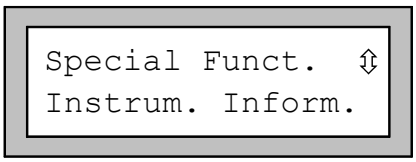


Fig. 2.5: Data plate of the inline unit

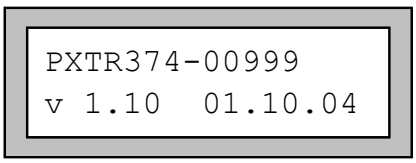
The serial number of the electronic unit is indicated on the data plate on the side of the transmitter housing.

The serial number of the inline unit is indicated on the data plate situated on the cable free arm of the unit.

2.4 Firmware Version



Select `SPECIAL FUNCTION \ INSTRUM. INFORM.` to obtain information about the refractometer. Confirm with **ENTER**.



The type designation and the serial number of your instrument are given on the first line. The firmware version and its date are given on the second line.

Press **ENTER** to return to the `SPECIAL FUNCTION` program branch.

3 Getting Started

3.1 First Control

Upon delivery, control if every article you have ordered has been delivered. Please make sure that the specifications of the inline unit and of the electronic unit that were delivered correspond to the specifications given on the purchase order. Model designation and serial number are given on the data plate of the units.

This instrument has already been tested thoroughly at the factory. When the instrument is delivered, please proceed to a visual control to make sure that no damage has occurred during transportation.

3.2 Manipulation

Always manipulate the inline unit with care, it contains fragile optical elements.

Never use the receiver and emitter arms of the inline unit for carrying!

PIOX is a precision measuring instrument and must be handled with care. To obtain good measurement results and in order not to damage the instrument, it is important that great attention is paid to the instructions given in this User's Manual, and particularly to the following points:

- Protect the instrument from excessive shock.
- Manipulate the cables cautiously (avoid excessive cable bend).
- Do not open the housing without authorization. The protective degree IP65 of the electronic unit PIOX TR374 is given only if the front plate is screwed on the housing.
- Connect the flowmeter correctly to the power supply (voltage, frequency, connection to ground).
- Make sure to work under correct ambient conditions (see specifications). Take the degree of protection into account.

3.3 Maintenance

The refractometer PIOX R300 normally does not need regular servicing or maintenance work. Always respect the handling precautions and the instructions given in this manual. If PIOX is installed correctly, in an appropriate location and as recommended, used cautiously and taken care of conscientiously, no troubles should appear.

Attention! *Never replace a component of the instrument by parts other than those supplied by Flexim.*

3.4 Cleaning

Generally, the regular process cleaning and rinsing cycles are sufficient to keep the optical surfaces (prism and window) clean. However, depending on the nature of the liquid to be measured, it might be necessary to clean the measuring prism regularly to prevent the formation of deposits.

When cleaning with a caustic soda lye or any other aggressive chemical, first make sure that all the joints and parts in contact with the medium are resistant.

If a manual cleaning of the prism or of the window is necessary, this can be made with a small pipe cleaner or with a soft cloth.

Only clean the prism with non-abrasive material!

3.5 Calibration of the refractometer

The refractometer PIOX R300 measures the absolute value of the refractive index. Normally, a calibration is not necessary. If necessary, proceed to calibration as described in section 6.2.

4 Installation

4.1 Selection of the Measuring Point

The PIOX R300 inline unit is designed to be installed directly in the process line (mean stream). It should be installed at a measuring point which is representative for the process and relevant to the application. If the measurement is to be integrated in the process control system, make sure to measure at a location where a fast reaction to the measurement is possible.

The following conditions must be fulfilled:

- The inline unit should be mounted on a vertical pipe, with the **medium flowing upward (rising pipe)** to ensure that the prism is always flooded and rinsed.
- **The pipe must always be full**.
- The medium's pressure and temperature at the selected measuring point must lie within the specification of the inline unit.
- Make sure that the ambient conditions are appropriate for the degree of protection of the inline unit and of the electronic unit. Do not isolate the units! If there is a risk that the temperature exceeds the specified temperature range, the units must be cooled.
- The inline unit should not be exposed to direct sunlight or to rain or to vibrations (pumps!).
- Select a measuring point where the medium temperature is as high as possible, but still respecting the temperature specification of the inline unit. The **prism will keep clean better at high temperatures** since the solubility is higher and the viscosity is lower.
- Furthermore, there must be a **minimum flow** to ensure that the prism is rinsed. It is therefore recommended to select a **location where the pipe diameter is relatively small and where the pressure is relatively high**. This is particularly important if the mediums tends to form deposits or is transporting solid particles.
- A certain amount of air bubbles in the medium does not influence the measurement but the prism must be flooded at any time. **There will be less gas bubbles at a higher pressure** since the solubility is then higher.
- If the mediums is transporting solid particles, is highly viscous or abrasive, it is recommended to measure in a bypass which can easily be cleaned or to plan a possibility to discontinue the stream to clean the prism manually. It is also strongly recommended to integrate the refractometer in the cleaning process or to plan a rinsing circuit.
- The selected measuring point should be easily accessible for service work.

Select afterward the location of the electronic unit within cable reach of the measuring point. Make sure that the temperature at the selected location is within the operating temperature range of the electronic unit (see technical data in appendix A).

4.2 Connection of the Inline Unit

Mount the inline unit on the pipe at the selected measuring point.

If the inline unit is to be welded to the pipe, always make sure that that no welding beads or welding residues are left in the pipe before flooding the pipe and commissioning the refractometer. The beads and residues could damage the optical surfaces.

Note: *When mounting the sensor, make sure that the emitter and receiver units are aligned on another. A correct alignment is extremely important!*

Note: *It is recommended to lay the cables from the measuring point to the instrument before proceeding to connection in order to avoid mechanical strain on the connectors.*

4.3 Mounting the Electronic Unit

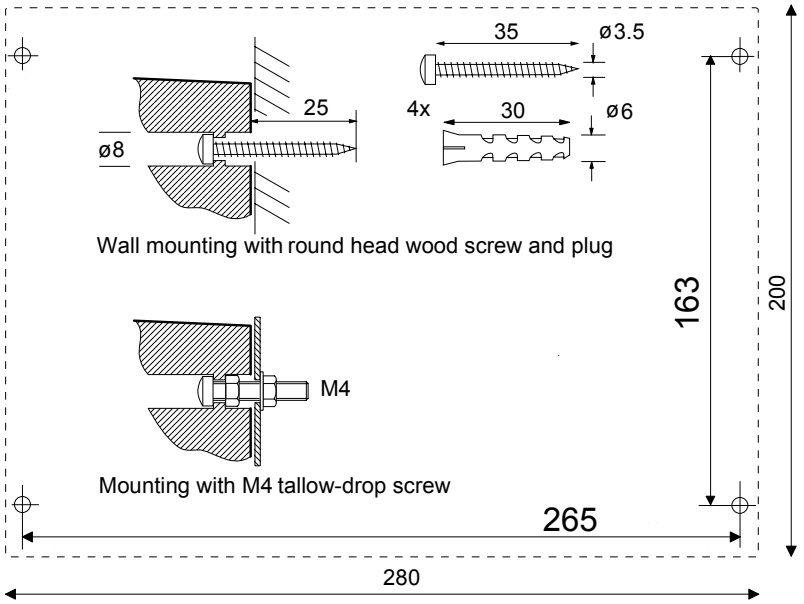


Fig. 4.1: Mounting of PIOX TR374

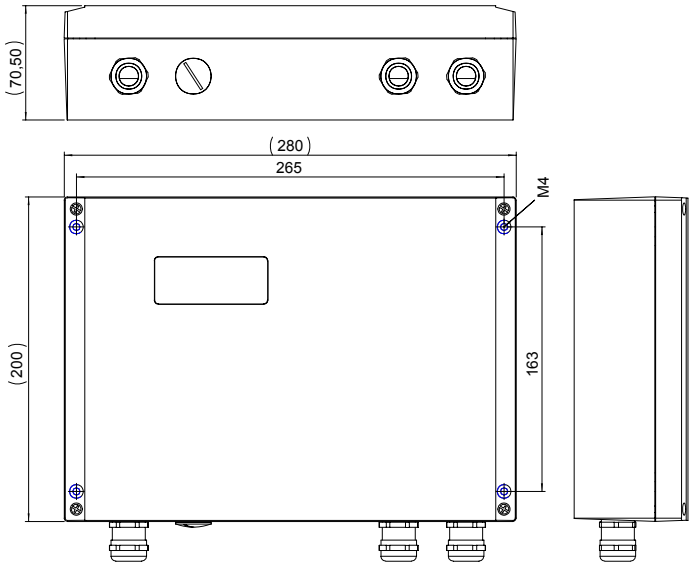


Fig. 4.2: Dimensions of the electronic unit PIOX TR207 (in mm)

- Unscrew the front panel of the housing.
- At the selected location, drill 4 holes in the wall according to Fig. 4.1.
- Insert 4 plugs in the holes. Screw the housing on the wall.

4.3.1 Pipe Mounting Kit

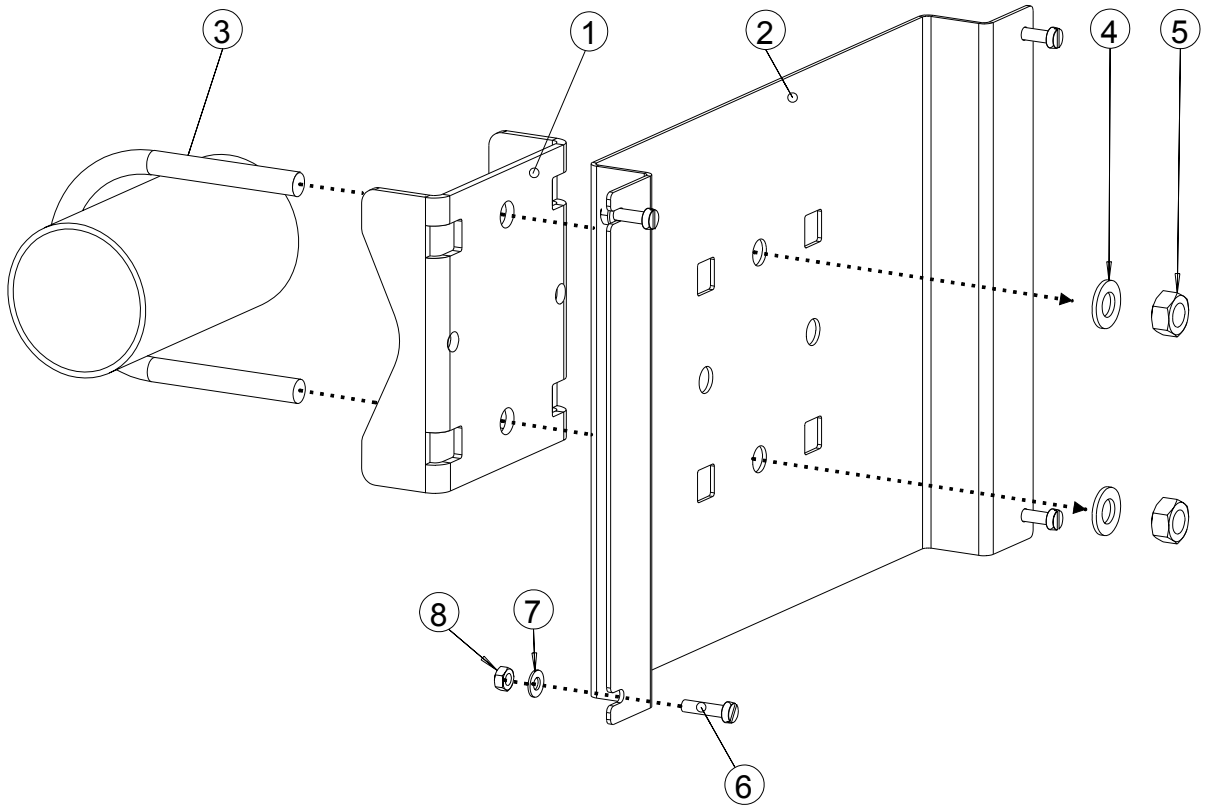


Fig. 4.3: Pipe mounting kit for the electronic unit
(1 = pipe plate, 2 = instrument plate, 3 = shackle)

For pipes of approx. 2 inches in diameter:

- Fasten the pipe plate on the pipe as illustrated in Fig. 4.3, then screw the flowmeter on the instrument plate with the supplied screw, washers and nuts.

For bigger pipes:

- For bigger pipes, it is possible to secure the pipe mounting kit to the pipe with tension straps threaded through the square holes of both plates instead of using the shackle.

4.4 Connection of the Inline Unit

Attention!	*The protective degree of the refractometer is only guaranteed if all cables fit firmly and tightly in the cable glands, the cable glands are tightly screwed on the enclosures and the cover is tightly screwed on the housing.*

The connection of the inline unit to the junction box has already been made at the factory. The cable glands for the connection to the junction box and to the electronic unit were supplied with the refractometer.

Prepare the connection cable and connect the leads of the connection cable to the terminals of the transmitter as specified in Table 4.1 and Table 4.2.

Attention!	*It is important for a correct high frequency shielding that the cable shield has a good contact to the cable gland (and thus to the housing).*

Table 4.1: Connection to the transmitter PIOX TR374

Terminal	Lead
AV	yellow
AVS	green
ARS	brown
AR	white

Table 4.2: Connection to the junction box

Terminal	Lead
+	yellow
–	green
A+	brown
B-	white

4.5 Connection of the Power Supply

An external safety switch must be installed in order to be able to interrupt the power supply of the refractometer rapidly at any time. The switch must be located near the refractometer. Use a switch with appropriate disconnection effect.

Attention! *The type of power supply needed for the instrument is indicated on the data plate situated under the power connection terminals.*

- Prepare the connection cable and connect the leads to the terminals of the electronic unit as indicated in Table 4.3.
- Connect the other end of the power cable to the power supply.

Table 4.3: Connection of the power supply

AC

Terminal	Connection
PE	Earth
N	Neutral
L1	Phase 100...230 VAC, 50/60 Hz
Fuse: 1.25 A, delayed action	

DC

Terminal	Connection
PE	Earth
L-	- DC
L+	+ DC
Fuse: 1.25 A, delayed action	

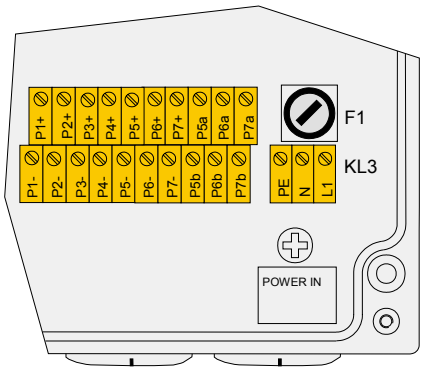


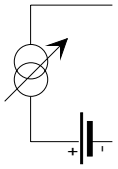
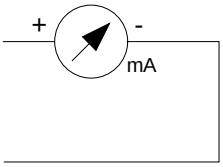
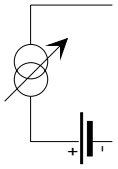
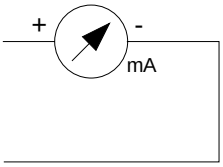
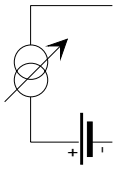
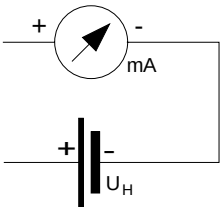
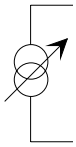
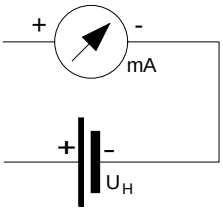
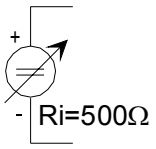
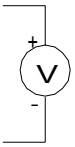
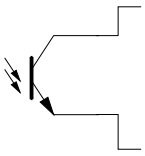
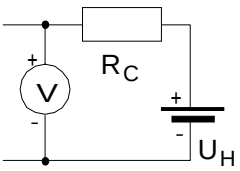
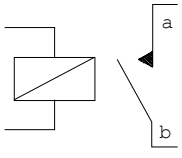
Fig. 4.4: Terminals of the electronic unit TR374 for the connection of the outputs and of the power supply

4.6 Connection of the Outputs

The terminals to be used for the connection of the process outputs will be known only after the configuration of the outputs (chapter 7). The leads can be left unconnected for later connection if you don't configure the outputs now.

- Prepare the output cable with a M20 cable gland.
- **TR374**: Lead the output cable into the transmitter housing through the second filler plug on the right. The terminals **P1** to **P7** are intended for the connection of the outputs.

Table 4.4: Circuits of the process outputs

OUTPUT	PIOX	TERMINAL	CIRCUIT	
Current loop active		Px+ (red) (black) Px-		$R_{LOAD} < 500\ \Omega$
Current loop semi-active used as active current loop		Px+ (red) (black) Px-		$R_{LOAD} < 50\ \Omega$
Current loop semi-active used as passive current loop		Px+ (red) (black) Px-		U_H = 0 to 24 V $U_H > 0.021A * R_{LOAD}[\Omega]$ (* R_{LOAD} is the sum of all ohmic resistances in the circuit (resistance of the conductors, inner resistance of the auxiliary power supply, resistance of the ampere meter/voltmeter, etc.).)
Current loop passive		Px+ (red) (black) Px-		U_H = 5 to 25 V $U_H > 0.021A * R_{LOAD}[\Omega] + 4V$ *Example: If U_H = 12V, then R_{LOAD} must be between 0 Ω and 380 Ω!*
Voltage output		Px+ (red) (black) Px-		$R_{LOAD} > 2\ M\Omega$ (Note: With a smaller R_{LOAD}, the precision will not be as high as specified.)
Binary output Open-Collector		Px+ (red) (black) Px-		U_H = 5 to 24 V $R_C[k\Omega] = U_H / Ic\ [mA]$ Ic = 1 to 4 mA
Binary output Relays (Reed-Contact)		Px+ Pxa Pxb Px-		U_{MAX} = 24 V I_{MAX} = 150 mA

4.6.1 Serial Interface RS232

TR374: The RS232 interface is located on the front panel of the instrument.

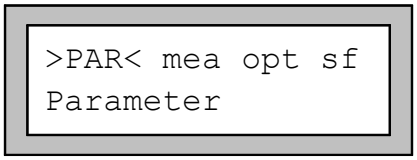
4.6.2 Serial Interface RS485

The electronic unit is also equipped with a RS485 interface. Connect the RS485 cable to the terminals A+ and B-, and the shield of the cable to the terminal 101.

5 Operation of the Refractometer

This chapter describes the user interface of PIOX R300. If you are already acquainted with these features, you can skip it and proceed to chapter 6 to configure the measurement.

5.1 Instrument Start-Up

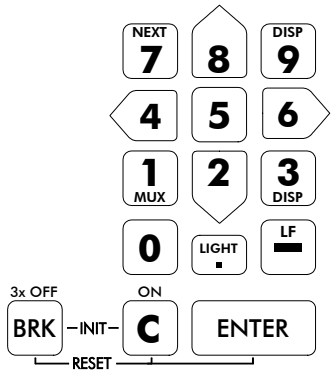


PIOX starts up as soon as it is connected to the power supply. The main menu is displayed after the initialization.

Note!	*No data can be entered while the serial number is displayed.*

5.2 The Keyboard

The operator interface of PIOX consists of a keyboard and a two-line display (16 digits per line). The keyboard features three function keys and 12 keys for numerical data input.



Several keys have double functions. They can be used for INPUT as well as for SELECTION.

In SELECTION mode, for example, the arrow-shaped numerical keys operate as cursor keys.

In INPUT mode, they can be used for the input of numbers and characters.

Fig. 5.5: The keyboard

Table 5.1: General functions of the keyboard

LIGHT ■	Switches the background lighting ON/OFF.
BRK –INIT– C ENTER RESET	RESET Press these keys simultaneously to recover from an error. This has the same effect as restarting the unit. Data will not be affected.
BRK –INIT– C ON	INIT (cold start) Pressing these keys simultaneously and holding them down until the main menu appears will initialize PIOX. Some parameters and settings might be reset to the factory default values.

Attention!	*After initialization, always check all parameters for correctness and control the configuration of the outputs.*

Be careful not to interrupt an ongoing measurement by inadvertently pressing BRK!

Table 5.2: Selection

BRK	Press on BRK to call the main menu.
4 6	Selecting the menu entry at the left or at the right of the currently highlighted one.
8 2	Scrolling upwards or downwards through the menus.
ENTER	Confirmation of the selected entry.

Table 5.3: Input of numerical values

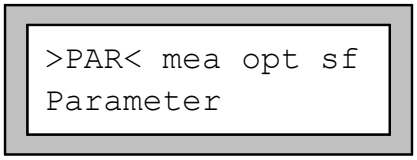
0 DISP 9	Input of the numerical value shown on the key
LF –	Sign for the input of negative data
LIGHT .	Decimal point
C	Deletion of data. After the deletion of data, the previous value will be displayed.
ENTER	Confirmation of input.

Table 5.4: Input of text

4 6	Selection of the position of the character to be input.
DISP 9	Changes the currently selected character to an 'A'.
3 DISP	Changes the currently selected character to a 'Z'.
5	Changes between small and capital letters.
2 8	Moving to the next/previous ASCII character.
0	Deleting the character currently shown and inserts a blank space.
NEXT 7 1 MUX	To automatically scroll upwards/downwards through the selected restricted ASCII character set. The character changes every second. The scrolling can be interrupted by pressing any other key.
ENTER	Finishes editing.

5.3 The Firmware

5.3.1 The Main Menu



After switching on and initialization, the main menu appears on the first line of the display. The main menu has following entries: PAR (parameter), MEA (measuring), OPT (output options) and SF (special functions), corresponding to the four main program branches. The actually selected program branch is displayed in capital letters between arrows. The full name of the program branch is displayed on the second line.

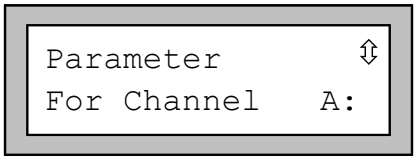
Use keys 4 and 6 to select a program branch. Confirm your selection by pressing **ENTER**.

5.3.2 The Program Branches

Table 5.5: Main functions of the different program branches

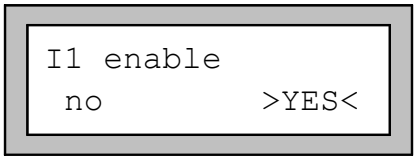
PARAMETER:	Selection of the measuring channel
	Selection of the measured medium, of the physical quantity to be measured and of the units
	Configuration of eventual correction parameters
MEASURING:	Starting the measurement
	Selection of the measuring point if many are defined
OUTPUT OPTIONS:	Setting of the damping of the measured values
	Activation of the process inputs and outputs
	Activation of the serial output
	Settings of the alarms
SPECIAL FUNCTION:	Settings of the process inputs and outputs
	Settings of the serial output (format, output rate and data to be output)
	Measurement settings
	Settings of the day and time
	Settings for the firmware dialogs
	Display of the serial number and of the firmware version

5.4 Navigation in the Firmware



If a vertical arrow (⇳) is displayed beside a menu option, this menu option contains a selection list. This list is displayed on the second line.

Use the arrow keys 8 and 2 to scroll through the list, then confirm your selection by pressing **ENTER**.



PIOX sometimes requests a selection on the second line. The actually selected option is displayed in capital letters and between arrows.

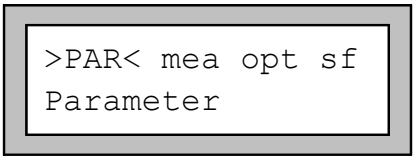
Use keys 4 and 6 to select one of the options, then confirm your selection by pressing **ENTER**.

Note:	*You can return to the main menu at any time by pressing key **BRK**.*

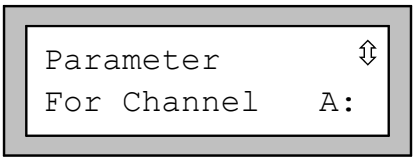
Note:	*In this manual, all program entries and keys will appear in capital letters. Program entries are in typewriter characters* ("PARAMETER"). *Submenus are separated from the main menu entry by a backslash.*

6 Configuration of the Measurement

The measurement must now be configured, i.e. the quantity to be measured, the units and the correction values must be defined. The configuration must be made separately for every available measuring channel. It can be modified at any time later by calling the program branch PARAMETER again.

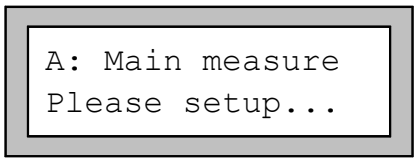


In the main menu, select the program branch PARAMETER and press **ENTER**.

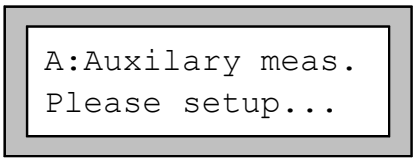


Select the channel for which you want to configure the measurement and press **ENTER**.

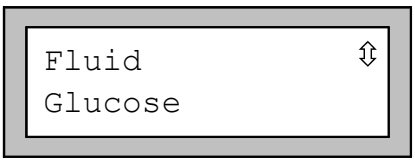
Note: This display does not appear if your instrument has only one measuring channel.



This display will be shown only if the instrument was configured for the measurement of a three components solution. In this case, two physical values must be configured for the same channel. The configuration procedure must be gone through twice, once for the main physical value, once for the auxiliary value. Press **ENTER** to start the configuration of the main measurement. Proceed as described below. When you are through with the configuration, the following display will appear:



Press **ENTER** to start the configuration of the auxiliary measurement. The same configuration procedure is started for the auxiliary channel.



Select in the fluid selection list the fluid to be measured. The fluid selection list contains standard fluid such as glucose, saccharose, etc., all fluids you have defined yourself and all fluids of the internal data base.

If you want to measure a fluid which is not in the fluid selection list, select OTHER MEDIUM. Only scales will be available as physical quantities, since no coefficients are available for the medium.

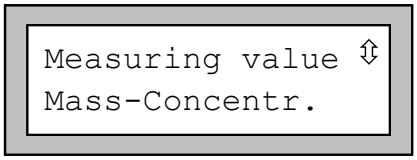
Confirm your selection by pressing **ENTER**.

6.1 Selection of the Physical Quantity and of the Units

PIOX can measure the following quantities:

- refractive index and normalized refractive index
- concentration in mass percent
- concentration in volume percent
- Brix value

The selected quantity will be displayed by PIOX during the measurement The normalized refractive index can always be displayed simultaneously. The normalized refractive index is a correction of the refractive index measured at the process temperature to the value of the refractive index at a given reference temperature. The correction of the refractive index takes place automatically if temperature coefficients are stored for the selected fluid.



The physical quantities and scales available for the selected fluid are displayed.

Physical quantities are for example the volume concentration and the mass concentration. The measurement of these quantities is possible only if the respective coefficients are available. A typical scale is for example the Brix value for the concentration of a sugar solution.

Select the physical quantity to be measured. Confirm your selection by pressing **ENTER**.

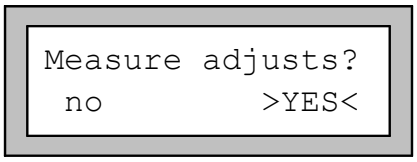
If many units are available for the selected physical quantity, they are now displayed. This display does not appear when you have selected a scale. Confirm the units to be used. Confirm your selection by pressing **ENTER**.

6.2 Correction Values

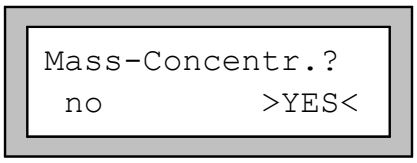
The measured values can be corrected in two different ways. It is possible to correct the primary physical quantities measured by PIOX, which are the refractive index and the temperature of the fluid. **These sensor values are corrected directly before they are used by the transmitter** for the calculation of the selected physical quantities. **It is also possible to correct the values calculated by the transmitter**, i.e. the physical quantity you have selected and the normalized refractive index by adding a constant value.

The corrections can be defined in the following displays. If you do not wish to define a correction, select NO in the two following displays and go to section 6.3.

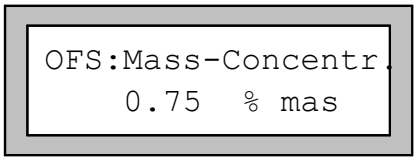
6.2.1 Correction of the Physical Quantity and of the Normalized Refractive Index



If you do not wish to define an offset for the selected physical quantity or for the normalized refractive index, select NO, confirm by pressing **ENTER** and go to section 6.2.2. Otherwise, select YES and confirm by pressing **ENTER**.



The selected physical quantity is displayed on the first line. Select YES to define an offset for this quantity. Confirm by pressing **ENTER**.

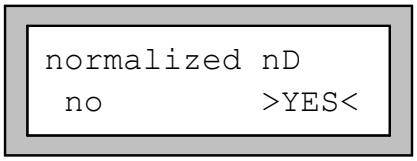


Enter the offset. The unit displayed is the unit previously selected. The maximum possible value for the offset is 10% of the valid value range of the selected physical quantity.

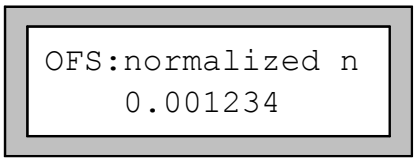
Example:

You are measuring the glucose concentration and have selected the Brix scale as quantity to be measured. The Brix scale ranges from 0° to 100°. The maximum offset is thus 10°.

Confirm by pressing **ENTER**.

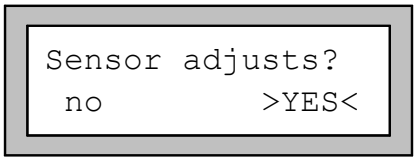


If you do not wish to define an offset for the normalized refractive index, select NO, confirm by pressing **ENTER** and go to section 6.2.2. Otherwise, select YES and confirm by pressing **ENTER**.

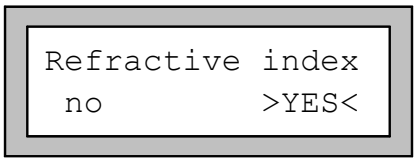


Enter the offset for the normalized refractive index. The offset value must be comprised in the range ± 0,100000. Confirm by pressing **ENTER**.

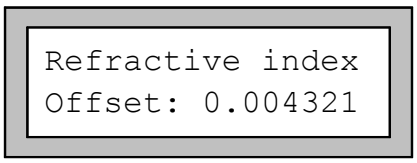
6.2.2 Correction of the Sensor Values



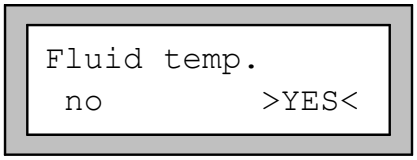
If you do not wish to define a correction of the sensor values, select NO, confirm by pressing **ENTER** and go to section 6.3. Otherwise, select YES and confirm by pressing **ENTER**.



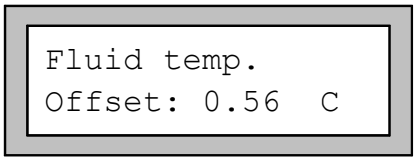
Select YES if you wish to define a correction for the measured refractive index. Confirm by pressing **ENTER**.



The offset will be added to the refractive index measured by the sensor before its value is used for the calculation of any further quantities. The offset value must be comprised in the range ± 0,0500. Enter the offset and confirm by pressing **ENTER**.



Select YES if you wish to define a correction for the measured fluid temperature. Confirm by pressing **ENTER**.



The offset will be added to the fluid temperature measured by the sensor before its value is used for the calculation of any further quantities. The offset value must be comprised in the range ± 10,00°C. Enter the offset and confirm by pressing **ENTER**.

6.3 Other Values

If no supplementary values are needed for the measurement and if no auxiliary physical quantity needs to be defined, the configuration of the measurement is now finished. Proceed to the configuration of the process outputs (chapter 7).

Supplementary values are quantities that are measured by another instrument and transmitted to PIOX via the process inputs. Approximated values for these quantities must be entered now. These approximated values are only needed as substitute values for the case that no input values are available during the measurement (failure of the corresponding instrument, defect cable, etc...) .

Supplementary values can only be taken into account when the respective coefficients for the selected fluid are available.

The following supplementary values are possible:

- fluid temperature
- fluid pressure
- fluid density
- fluid cinematic viscosity
- fluid dynamic viscosity
- fluid conductance
- fluid pH value
- sound speed in the fluid
- volume flow of the fluid

7 Process Outputs

If the measured values should be transmitted to another instrument via the process outputs, these outputs must be configured now. If you do not need process outputs, skip this chapter and proceed to chapter 8.

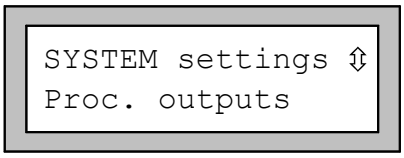
The process outputs must first be **configured** in the SPECIAL FUNCTION program branch, and then **activated** in the program branch OUTPUT OPTIONS. The latter is described in chapter 9.

The configuration of an output consists of three steps:

- Assigning a measuring channel (source channel) to the output.
- Defining the measured value the assigned channel should transmit to the output (source item) and the properties of the signal.
- Defining the behavior of the output in case no valid measured values are available.

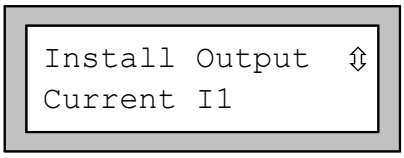
Note:	*PIOX stores the configuration of an output at the end of the installation dialogue. If you leave the installation dialogue by pressing **BRK**, changes won't be saved.*

7.1 Enabling an Output

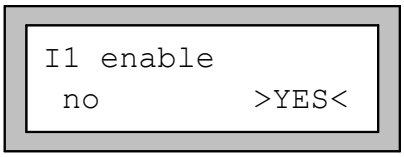


In the program branch SPECIAL FUNCTION\SYSTEM SETTINGS, select the PROCESS OUTPUTS option.

Confirm by pressing **ENTER**.

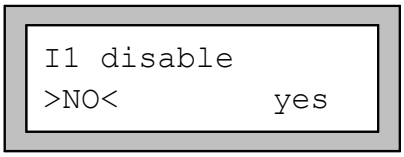


Select the output you want to install. The selection list contains all the actually available process outputs. A tick (✓) after an item of the list means that this output has already been installed. Confirm by pressing **ENTER**.

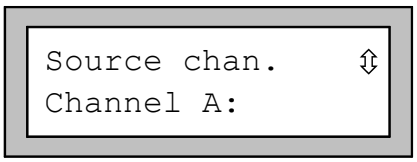


This display will appear if the selected output was not already enabled.

Select YES and confirm by pressing **ENTER**.

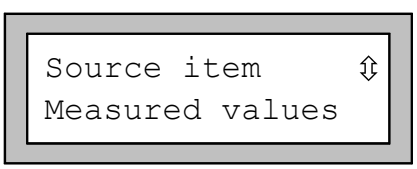


If the selected output was already enabled, select NO to change its configuration, or YES to go back to the previous menu and select another output. Confirm by pressing **ENTER**.



Select in the selection list the channel which you want to assign as source channel to the previously selected output. Confirm by pressing **ENTER**.

Note: This display does not appear if your instrument has only one measuring channel.

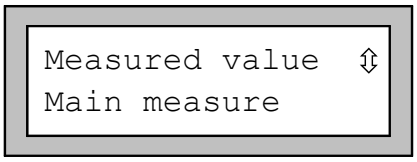


Select the source item type, i.e. the type of quantity which should be transmitted to the output. The different source item types are given in Table 7.1. Confirm by pressing **ENTER**.

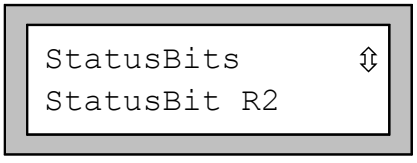
If you want to define a status output or an alarm output, select the item type STATUSBITS. Each measuring channel of PIOX has 4 status bits (R1 ... R4) which can be used to define a status output (alarm output).

Table 7.1: Available source item types for the process outputs

Source item type	Possible source items	
Measured values	Mean measure	Mean quantity of measurement as selected in the PARAMETER program branch
	Auxilary value	Auxiliary quantity of measurement
	Normalized nD	Normalized refractive index
Sensor values	Refractive index	Measured refractive index (not normalized)
	Fluid temperature	Temperature of the fluid as measured by the sensor
	Sensor temperature	Average temperature of the sensor
	Humidity L	Humidity in the first part of the sensor
	Humidity C	Humidity in the second part of the sensor
	Max. humidity	Humidity in the most humid part of the sensor
	Signal amplitude	Relative amplitude of the signal
	Signal quality	Relative quality of the signal
	Pixel position	Absolute pixel position
	Ground zero	Absolute zero point of the pixels
Linked inputs	Fluid temperature	
	Fluid pressure	
	Density	
	Cinematic viscosity	
	Dynamic viscosity	
	Conductance	
	pH value	
	Sound speed	
	Voume flow	
	CommonInp. x	With x=1...4 any output of a type not specified here
StatusBits	StatusBit R1	First status bit of the channel
	StatusBit R2	Second status bit of the channel
	StatusBit R3	Third status bit of the channel
	StatusBit R4	Fourth status bit of the channel

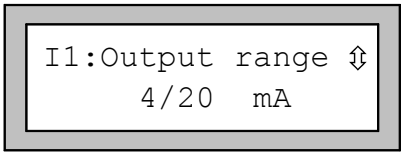


Select the source item and confirm by pressing **ENTER**.

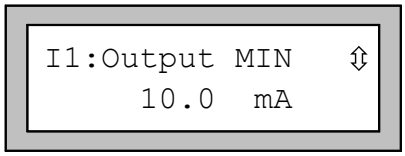


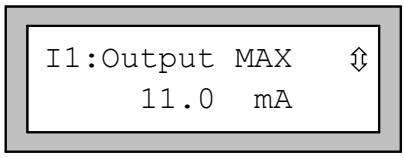
If you have selected STATUSBITS as source item type, select one of the status bits of the channel. The further configuration of the status output takes place in the OUTPUT OPTIONS program branch (chapter 9).

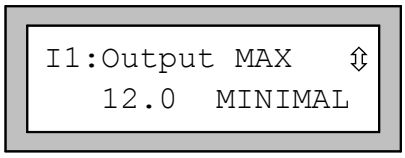
7.2 Output Range



If you are configuring an analogue output, PIOX now asks you for the output range. Select one of the ranges offered in the selection list or OTHER RANGE to enter manually the output range.







If you have selected OTHER RANGE, enter the minimal output value (OUTPUT MIN) and the maximal output value (OUTPUT MAX).

Confirm each value with **ENTER**.

The entered output range should cover at least 10% of the full physical output range (I_{MAX} - I_{MIN} ≥ 2mA for a 20 mA current loop for example). If this is not the case, PIOX will display the smallest maximal output value (OUTPUT MAX) possible for the entered minimal output value (OUTPUT MIN).

7.3 Output Value in Case of Error

In the further dialogue, you can select that value which PIOX shall output in case the assigned source item cannot be measured or located. For example, PIOX might not be capable to measure the refractive index during a certain period of time because of the presence of gas bubbles in the medium. It will then output the defined "error value".

Table 7.2: Error value options

Error value option	Result
Minimum	Output of the lowest possible value (lower limit of the output range)
Hold last value	Output of the last measured value
Maximum	Output of the highest possible value (upper limit of the output range)
Other value	Output of a value to be defined within the physical limits of the output.

Example:

The normalized refractive index was selected as source item for the current loop, the current loop range was set to 4/20 mA, the error value delay t_d to a value greater as zero.

The measurement of the refractive index is impossible during the time interval t_0...t_1.

What signal should be output during this time interval?

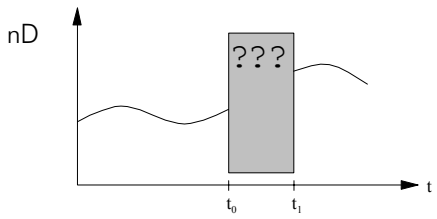
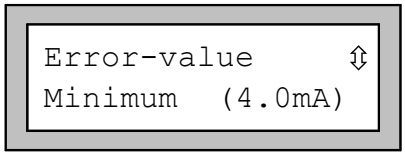
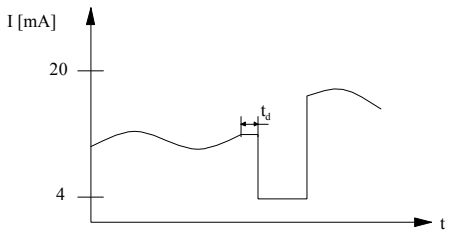
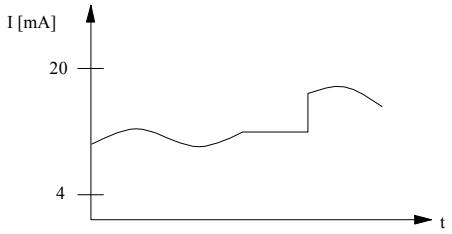
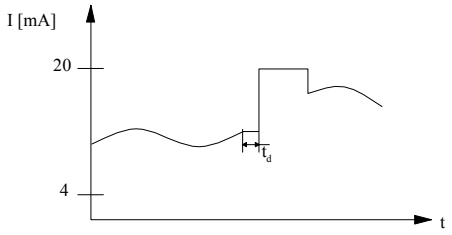
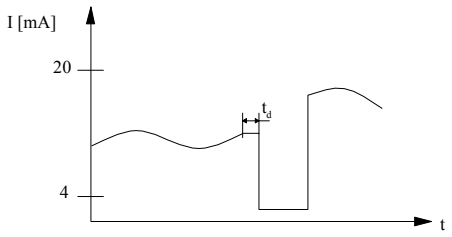


Fig. 7.1: Error value delay

Table 7.3: Error value options

Selected error value option	Output signal
	

Error-value ⇳ Hold last value	
Error-value ⇳ Maximum (20.0mA)	
Error-value ⇳ Maximum (20.0mA) Error-value ⇳ Other value ...	

Error-value ⇳
Minimum (4.0mA)

Select an error value in the selection list.

Confirm by pressing **ENTER**.

Error-value:
2.00 mA

If you have selected OTHER VALUE, enter an error value now. The value must be within the physical limits of the process output. Confirm by pressing **ENTER**.

I1 active loop
Terminal:P1+,P1-

The terminals to be used for the connection of the output are now displayed (here: P1+ and P1- for the active current loop). Confirm by pressing **ENTER**.

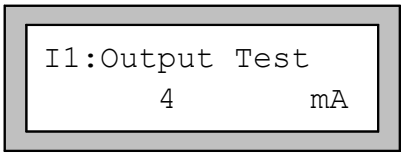
Connect the leads of the output cable to the terminals displayed here.

7.3.1 Function Check

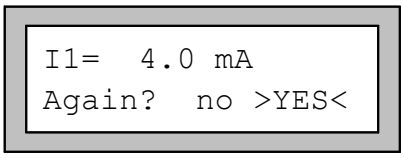
Finally, you can test the function of the installed output.

- Connect the leads of the output cable to a multimeter.

Test of an analogue output



Enter a test value (in our example, the current output is tested). The test value should be in the selected output range. Confirm by pressing **ENTER**.

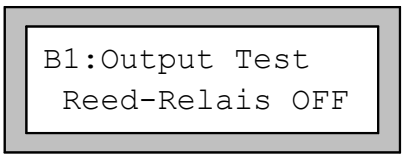


The input functions correctly if the measuring instrument displays the entered value.

Select YES to repeat the test, NO to return to the SYSTEM SETTINGS.

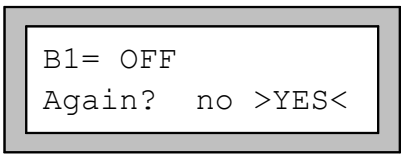
Confirm by pressing **ENTER**.

Test of a binary output



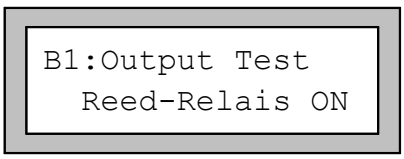
In the OUTPUT TEST selection list, select OFF to test the de-energized state of the output. Confirm by pressing **ENTER**.

No current should be flowing at the output now.



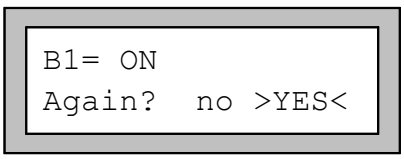
Select YES.

Confirm by pressing **ENTER**.



In the OUTPUT TEST selection list, select ON to test the energized state of the output. Confirm by pressing **ENTER**.

A current should be flowing now.



Select YES to repeat the test, NO to return to the SYSTEM SETTINGS. Confirm by pressing **ENTER**.

The outputs are now configured and ready to be activated. Proceed to chapter 8 if you wish to use the serial output or to chapter 9 for the definition of the output options.

8 Serial Output

PIOX TR300 can output up to 15 different values for each channel in regular intervals via the serial interface.

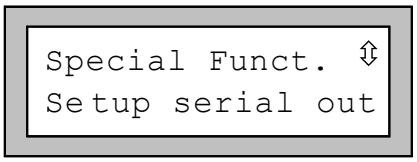
To enable the serial output, you must:

- define the output rate in SPECIAL FUNCTION/SETUP SERIAL OUT,
- define the quantities to be output in SPECIAL FUNCTION/SETUP SERIAL OUT,
- and activate the serial output in OUTPUT OPTIONS

before the measurement is started.

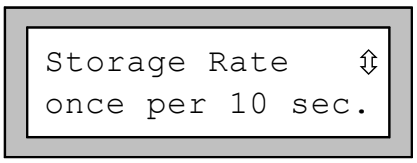
If you do not need to output the measured data via the serial interface, skip this chapter and proceed to chapter 9.

8.1 Definition of the Output Rate and of the Quantities to be Output

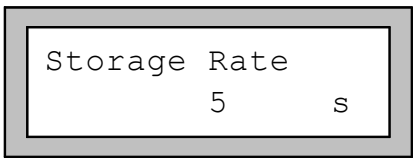


Select the program branch SPECIAL FUNCTION /SETUP SERIAL OUT.

Confirm by pressing **ENTER**.

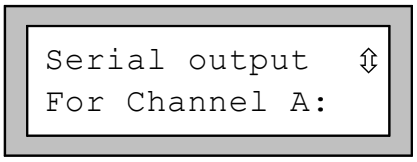


In the first display of the branch, you can set the output rate. The output rate is the frequency of the output of a data line. The rate selected here will be used for all measuring channels. Select one of the predefined rate of the selection list or EXTRA to enter another storage rate. Confirm by pressing **ENTER**.



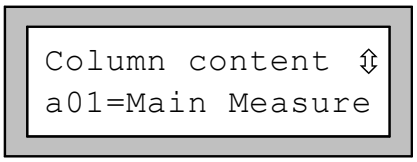
If you have selected EXTRA in the previous display, enter the storage rate now.

Confirm by pressing **ENTER**.



Select the channel for which you want to configure the serial output. Confirm by pressing **ENTER**.

Note: This display does not appear if your instrument has only one measuring channel



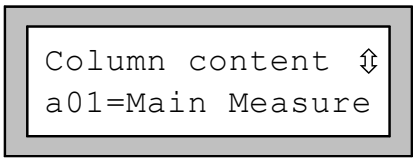
The COLUMN CONTENT selection list is displayed. It contains the actual configuration of the serial output for the previously selected channel. Each entry of the list defines a column of the output.

- The first character of each entry of the list is the designation the column. The 15 possible columns of the output are designated by the letters a to o.
- The designation of the column is followed by the number of the column in the serial output. PIOX does not always output all the 15 possible columns, it will rather output only the columns to which a source item has been assigned.
- Afterward, the type of source item contained in the column is given. The different source item types are given in Table 8.1. If no source item has been assigned to a column, the designation of the column is followed by "-- = >off<".

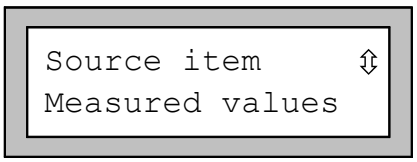
Example:

The selection list contains the following entries: a01=Main Measure, b02=Limit R1, all other columns are off.

PIOX will transmit two columns to the output at the previously selected rate. The first output contains the main measure, the second one the status bit R1.



To change the content of a column, select this column in the selection list and confirm by pressing **ENTER**.



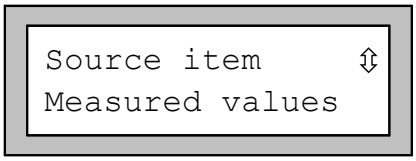
Select the source item type, i.e. the type of quantity which should be transmitted to the serial output. The different source item types are given in Table 8.1.

If you want to define a status output or an alarm output, select the item type `STATUSBITS`. Each measuring channel of PIOX has 4 status bits (R1 ... R4) which can be used to define a status output (alarm output).

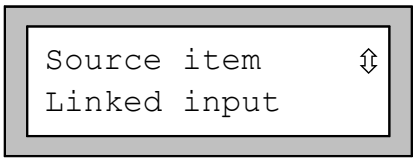
Confirm by pressing **ENTER**.

Table 8.1: Available source item types for the serial output

Source item type	Possible source items	
Measured value	Mean measure	Mean quantity of measurement as selected in the `PARAMETER` program branch
	Auxilary value	Auxiliary quantity of measurement
	Normalized nD	Normalized refractive index
Sensor value	Refractive index	Measured refractive index (not normalized)
	Fluid temperature	Temperature of the fluid as measured by the sensor
	Sensor temperature	Average temperature of the sensor
	Humidity L	Humidity in the first part of the sensor
	Humidity C	Humidity in the second part of the sensor
	Max. humidity	Humidity in the most humid part of the sensor
	Signal amplitude	Relative amplitude of the signal
	Signal quality	Relative quality of the signal
	Pixel position	Absolute pixel position
	Ground zero	Absolute zero point of the pixels
Linked inputs	Fluid temperature	
	Fluid pressure	
	Density	
	Cinematic viscosity	
	Dynamic viscosity	
	Conductance	
	pH value	
	Sound speed	
	Volume flow	
	CommonInp. x	With x=1...4 any output of a type not specified here
StatusBits	StatusBit R1	First status bit of the channel
	StatusBit R2	Second status bit of the channel
	StatusBit R3	Third status bit of the channel
	StatusBit R4	Fourth status bit of the channel

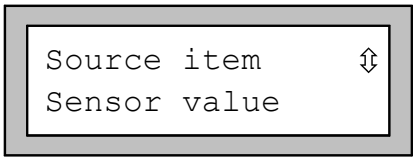


If you have selected MEASURED VALUES as source item type, select now the source item in the MEASURED VALUES selection list. Confirm by pressing **ENTER**.

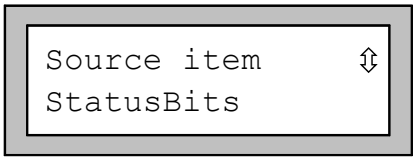


If you have selected LINKED INPUTS as source item type, select now the source item in the LINKED INPUTS selection list. Confirm by pressing **ENTER**.

When the input value is preceded by a question mark in the selection list, this means that there is actually no input configured for the measurement of this value. If you select one of the input values preceded by a question mark, a warning will be displayed.

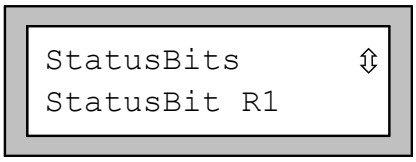


If you have selected SENSOR VALUES as source item type, select now the source item in the SENSOR VALUES selection list. Confirm by pressing **ENTER**.



If you have selected STATUSBITS as source item type, select now the status bit which should be used as source item. Confirm by pressing **ENTER**.

The further configuration of the status output takes place in the OUTPUT OPTIONS program branch (chapter 9).



When the status bit is in default state, the message NOT will be sent to the serial output. When the trigger condition is fulfilled, the message TRIG will be sent to the serial output, independently of the settings that have been made in the program branch OUTPUT OPTIONS.

8.2 The Serial Output Table

At the beginning of the measurement, a header describing the format of the output table is sent. The measuring values are transmitted afterward. In the standard output format, the columns are separated from another by a semi-column and each line ends with a line feed.

The three first line of the header contains general information about the instrument and the measurement.

\DEVICE	Serial number of the instrument and firmware version
\STORAGE DATE	Date and time of the measurement
\STORAGE RATE	Output rate (time between two data lines belonging to the same channel)

Afterward, the following data is sent in a block for each channel.

\A:-;CHANNEL_INFORMATION	Information about the channel (designation of the measuring point, name of the fluid, selected measurement quantity). Each line begins with the name of the channel (\A:, \B:, \C: or \D:)
\A:=;COLUMN DESCRIPTIONS	The content of each column sent for this channel is specified on one line:
	- Column number (COL_01, COL_02, ...)
	- Source item
	- Measuring unit
	- Column title
	- Information

The header ends with the message \DATA.

Example:

```
\DEVICE             ;PXTR372-07200101(V1.92)
\STORAGE_DATE;12.08.2004 14:51:46
\STORAGE_RATE;3 sec
\A:-;CHANNEL_INFORMATION
\A:-;Measuring_point=;123-00-33
\A:-;Bank[0].Main.Fluid=;MyOwnSubstance;Scale:Brix
\A:-;COLUMN DESCRIPTION
\A:-;COL_01=;Mass-Concentr.      ;[% mas];(MME);
\A:-;COL_02=;StatusBit R1        [bit];(R1S);Measured values/Main values
\A:-;COL_03=;Fluid temperat.;    [C];(SFT);
\A:-;COL_04=;Fluid pressure      [?];(LPR);UNLINKED!
\A:-;COL_05=;StatusBit R3        [bit];(R3S);Sensor values/Refr.index
\A:-;  (MME)[% mas];  (R1S)[bit];  (SFT)[C];  (LPR)[?];  (R3S)[bit];
\DATA
A:;    10.26;  NOT;  22.13;  ?E?;  NOT;
A:;    10.26;  NOT;  22.12;  ?E?;  NOT;
A:;    10.26;  NOT;  22.12;  ?E?;  NOT;
A:;    10.27; TRIG;  22.11;  ?E?;  NOT;
```

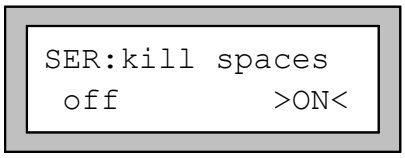
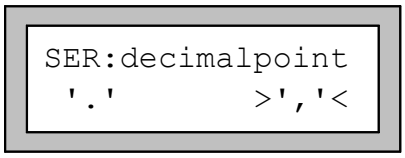
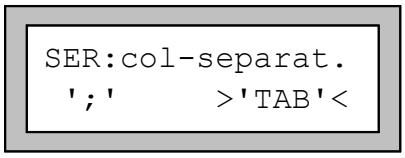
Table 8.2: Titles of the columns of the serial output

Column title	contains	Possible measuring units
SRI	Sensor - Refractive index	(none)
SFT	Sensor - Fluid temperature	[°C] [°F]
SDT	Sensor - Instrument temperature	[°C] [°F]
SHL	Sensor - Humidity 1	[%H]
SHR	Sensor - Humidity 2	[%H]
SAM	Sensor - Signal amplitude	[%]
SQU	Sensor - Signal quality	[%]
SPP	Sensor - Pixel position	(none)
SGZ	Sensor - Pixel zero point	(none)
MEA	Measured value - Main measure	(unit depends on the quantity)
NDT	Measured value - normalized refractive index	(none)
MAU	Measured value - Auxiliary value	(unit depends on the quantity)
R1S	StatusBit - R1	[bit]
R2S	StatusBit - R2	[bit]
R3S	StatusBit - R3	[bit]
R4S	StatusBit - R4	[bit]
LTF	Process input - Fluid temperature	[°C] [°F]
LPF	Process input - Fluid pressure	[bar]
LDE	Process input - Fluid density	[g/cm^3]
LVI	Process input - cinematic viscosity	[cSt=mm^2/s]
LVD	Process input - dynamic viscosity	[mPas]
LGS	Process input - conductance	[mS]
LPH	Process input - pH value	[pH]
LSS	Process input - Sound velocity	[m/s]
LVF	Process input - Volume flow	[m^3/h]
LC1	Process input - general input 1	(units are determined by the linked process input)
LC2	Process input - general input 2	
LC3	Process input - general input 3	
LC4	Process input - general input 4	

8.3 Format Settings of the Serial Output

If needed, the format settings of the serial output can be edited in the program branch `SPECIAL FUNCTION \ SYSTEM SETTINGS \ SERIAL TRANSMIS`.

Table 8.3: Settings of the serial output

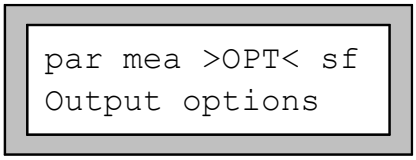
	TARGET: PC	TARGET: External printer
	When `ON` is selected, space characters will not be transmitted. In this way, the file size can be considerably reduced (i.e. shorter transmission time).	Select `OFF` in order to have all values of a column printed below another.
	Decimal separation to be used for floating point variables (point or comma. Country-specific setting.	
	Character to be used for separating columns (semicolon or tabulator). Setting depends on the requirements of the PC program.	`TAB` increases the total width of a line depending on how the tabulator is set on the printer.

9 Output Options

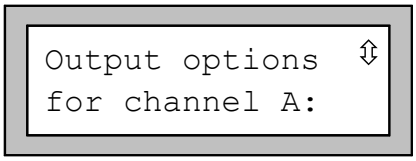
If you have configured process outputs or the serial output, they must now be activated in the OUTPUT OPTIONS program branch. The configuration of status outputs also takes place in this program branch. If you do not need outputs at all, you can skip this chapter and start the measurement as described in chapter 10.

In the OUTPUT OPTIONS program branch, you can:

- define the damping of the measured values,
- activate the configured process inputs and outputs,
- define and activate alarms
- and activate the serial output of the measured values.



Select the OUTPUT OPTIONS program branch. Confirm by pressing **ENTER**.



Select the channel for which you want to set the output options and confirm by pressing **ENTER**.

Note: This display does not appear if your instrument has only one measuring channel.

9.1 Setting of the Damping Time

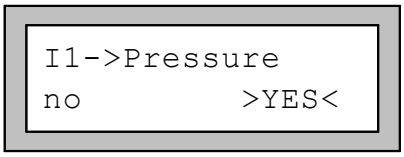
Each measured value displayed by the instrument is actually the average of the measured values of the last x seconds, where x is the **damping factor**. A damping factor of 1 s means that the measured values are not averaged, since the measuring rate is of approx 1 value per second. The default value is 10 s. This is appropriate for normal measuring conditions. Strongly fluctuating readings caused by high dynamics require a larger damping factor.

Enter the damping factor. Values between 1 s and 100 s are accepted.

Confirm by pressing **ENTER**.

9.2 Activation of the Process Inputs

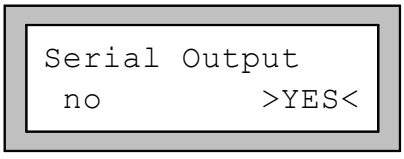
The input activation displays of all the configured process inputs will now be shown one after another.



The type and number of the input is displayed on the first line (here I1 for the first current input), followed by the type of value linked to this process input. Select YES to activate the specified input, NO to deactivate it.

Confirm by pressing **ENTER**.

9.3 Activation of the Serial Output



If the serial output has been configured in the SPECIAL FUNCTION program branch, the SERIAL OUTPUT display now appears. The configuration of the serial output is described in chapter 8.

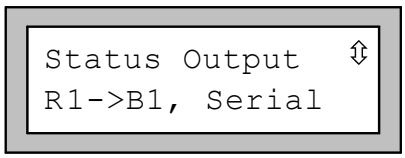
Select YES to activate the output of the measured values to the serial interface, NO to deactivate it. Confirm by pressing **ENTER**.

9.4 Status Output (Alarms)

Each measuring channel of PIOX has 4 status bits (R1 ... R4) which can be used to define a status output (alarm output). To do this, you must now first activate the status bit and then configure the status output.

In the following displays, only the status bits which have been linked to a process output or to the serial output will be shown. If the status bits you need are not displayed, you must first link them to an output. This procedure is described in chapter 7.

9.4.1 Selection of the Status Bit



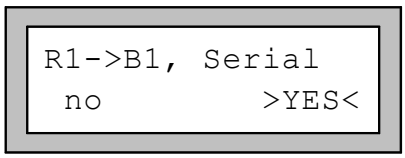
Select the status bit you want to use for a status output. The designation of the status bit is followed by the output to which it is actually linked.

If you do not wish to define any status output or if you don't want to modify the actual settings, select `SKIP SETUP` in the `STATUS OUTPUT` display. Selecting this option ends the `OUTPUT OPTIONS` program branch. You can then start the measurement as described in chapter 10.

You can disable all status outputs at once by selecting the option `DISABLE ALL`. Selecting this option also ends the `OUTPUT OPTIONS` program branch. You can then start the measurement as described in chapter 10.

Confirm by pressing **ENTER**.

9.4.2 Activation of the Status Bit



Select `YES` to activate the selected status bit. Select `NO` to deactivate the status bit and return to the last display.

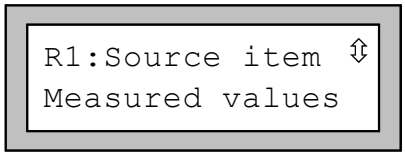
Confirm by pressing **ENTER**.

9.4.3 Selection of the Source Item

The **source item** is the quantity that will trigger the status bit, i.e the quantity about which you want information to be sent to the status output.

Example:

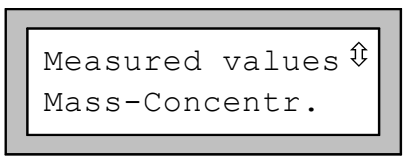
You are using PIOX to control the Brix value of a sugar solution. The latter should not be higher than 30°. Select the Brix value as source item for the status output. PIOX will control the Brix value and switch an alarm when the defined limit is not respected. This alarm can be transmitted to the process control system.



Select the source item type in the `SOURCE ITEM` selection list. The different source item types are given in Table 9.1.

Confirm by pressing **ENTER**.

Source item = measured values



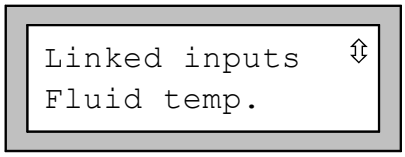
If you have selected `MEASURED VALUES` as source item type, select now the source item in the `MEASURED VALUES` selection list.

Confirm by pressing **ENTER**.

Table 9.1: Available source item types for the status outputs

Source item type	Possible source items	
Measured value	Mean measure	Mean quantity of measurement as selected in the PARAMETER program branch
	Auxilary value	Auxiliary quantity of measurement
	Normalized nD	Normalized refractive index
Sensor value	Refractive index	Measured refractive index (not normalized)
	Fluid temperature	Temperature of the fluid as measured by the sensor
	Sensor temperature	Average temperature of the sensor
	Humidity L	Humidity in the first part of the sensor
	Humidity C	Humidity in the second part of the sensor
	Max. humidity	Humidity in the most humid part of the sensor
	Signal amplitude	Relative amplitude of the signal
	Signal quality	Relative quality of the signal
	Pixel position	Absolute pixel position
	Ground zero	Absolute zero point of the pixels
Linked inputs	Fluid temperature	
	Fluid pressure	
	Density	
	Cinematic viscosity	
	Dynamic viscosity	
	Conductance	
	pH value	
	Sound speed	
	Volume flow	
	CommonInp. x	With x=1...4 any output of a type not specified here

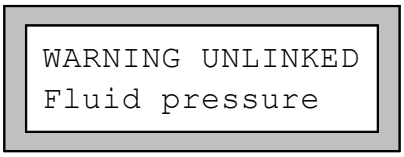
Source item = linked inputs



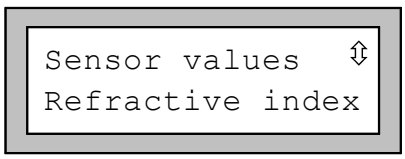
If you have selected LINKED INPUTS as source item type, select now the source item in the LINKED OUTPUTS selection list.

Confirm by pressing **ENTER**.

When the input value is preceded by a question mark in the selection list, this means that there is actually no input configured for the measurement of this value. If you select one of the input values preceded by a question mark, a warning will be displayed:



Source item = sensor values



If you have selected SENSOR VALUES as source item type, select now the source item in the SENSOR VALUES selection list. Confirm by pressing **ENTER**.

9.4.4 Definition of the Triggering Condition

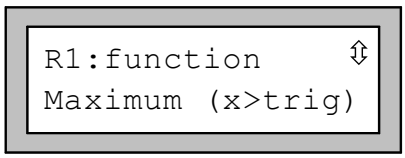
Once the source item has been selected, you can define the triggering condition of the status output, i.e. the condition that has to be fulfilled in order for the output to trigger. Three alarm functions are available. They are listed in Table 9.2.

Table 9.2: Alarm function

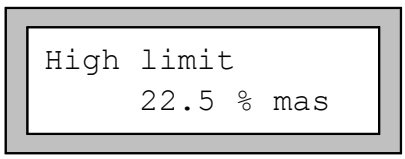
Alarm Function	Description
Maximum (x>trig)	The status output will trigger when the source item surpasses a certain maximum value.
Minimum (x<trig)	The status output will trigger when the source item falls below a certain minimum value.
Source error	The status output will trigger when the source item is not valid

Example:

In the example given above, the function needed can be reached by selecting the alarm type Maximum (x>trig) for the status output. The `HIGH LIMIT` of the output should be set to 30°.



Select the alarm function and confirm by pressing **ENTER**.



If you have selected `HIGH LIMIT` or `LOW LIMIT` as alarm function, enter now the maximum or minimum value for the source item. Note that PIOX always takes the signs of the source item and of the limit into account.

Confirm by pressing **ENTER**.

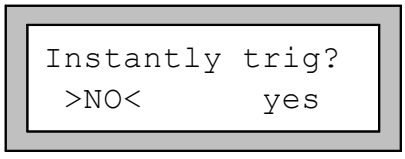
It is now possible to define an hysteresis for the status output. This function is useful to avoid a constant triggering of the output by measuring values fluctuating around the limit. The hysteresis is a symmetrical range around the limit in which fluctuation is permitted. The output will be triggered when the measuring values reach the upper limit of this range and when the measuring values fall below the lower limit.

Example:

If a variation of 0,5°Brix about the higher limit is allowed, set the hysteresis to 0,5°Brix for the 30°Brix limit. The alarm will trigger at 30.5°Brix and at 29.5°Brix. Small fluctuations around 30°Brix won't have any effect on the alarm.

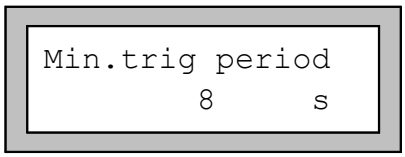
9.4.5 Setting of the Triggering Period

It is possible to have the status output triggered as soon as the defined condition is given. It is also possible to have the output trigger only when the condition has been fulfilled without interruption for a certain predefined lapse of time.



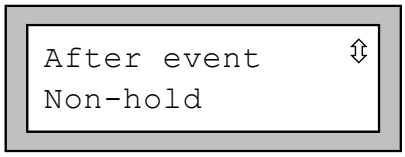
Select `YES` if the alarm should be activated instantly. Select `YES` if the alarm should be activated only after the switching condition has been fulfilled for a while.

Confirm by pressing **ENTER**.



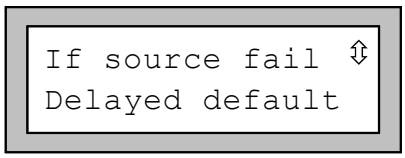
Enter now the lapse of time in which the switching condition must be fulfilled without interruption before the status output is activated. Confirm by pressing **ENTER**.

9.4.6 Behavior of the Status Output after Triggering



If the status bit should go back to its default state when the triggering condition is not fulfilled any more, select NON−HOLD. If not, select HOLD and confirm by pressing **ENTER**. The alarm will then stay in the activated state as long as it is not reset manually (see section 10.1).

Confirm your selection by pressing **ENTER**.



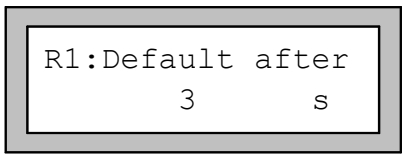
You can enter here what should happen when the measurement of the source item is not possible any more after the status output has been switched.

Select HOLD OUTPUT if the status output should stay activated.

Select DEFAULT OUTPUT if the status output should be deactivated instantly.

Select DELAYED DEFAULT if the status output should be deactivated after a certain lapse of time.

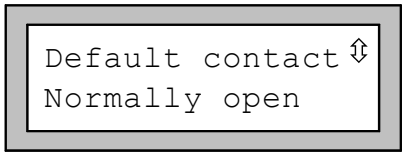
Confirm by pressing **ENTER**.



If you have selected DELAYED DEFAULT in the previous step, enter the delay for the deactivation now.

Confirm by pressing **ENTER**.

9.4.7 Default State of the Status Output



You must now define the default state of the status output.

If you select NORMALLY OPEN, the default state of the status output will be "logical zero" (StatusBit=0).

If you select NORMALLY CLOSED, the default state of the status output will be "logical one" (StatusBit=1).

Depending on the physical type of the output, the default state of the output will be as follows:

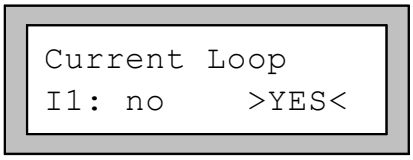
Table 9.3: Default state of the status output

Default state	State of a relay	State of an optocoupler	State of a current output
StatusBit=0	no current (contacts are open)	no current (auxiliary tension)	current has lowest possible value
StatusBit=1	current (contacts are closed)	current $I<U_{HV}/2$	current has highest possible value

Note: This settings are not active when the status bit is sent to the serial output. In this case, the message NOT will be sent to the serial output when the status bit is in default state. When the trigger condition is fulfilled, the message TRIG will be sent.

9.5 Activation of the Process Outputs

The activation displays of all the configured process outputs will now be shown one after another. The configuration of the process outputs is described in chapter 7.



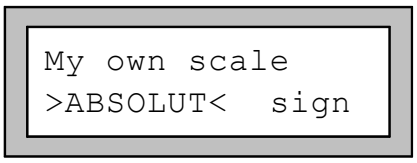
Select YES to activate the specified output, NO to deactivate it. Confirm by pressing **ENTER**.

You must now enter 3 different values which will define the mapping of the measured values on the output values (current, voltage or frequency values).

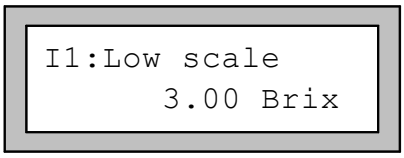
With the MEAS.VALUES option, you can specify if the measured values should be considered with or without their sign for the output.

The ZERO-SCALE VALUE and FULL-SCALE VALUE determine the range of measured values which will be mapped on the physical range of the output. For all values greater than the full-scale value, the output value will be clipped to the maximal output value ("OUTPUT MAX"). For all values smaller than the zero-scale value, the minimal value ("OUTPUT MIN") will be output. The zero-scale and full-scale values can be negative or positive. The range of measured values does not need to be symmetrical.

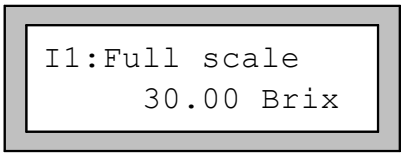
In most of the cases, the zero-scale value will be the lowest measured value expected, the full-scale value the highest value expected.



Select SIGN if the sign of the measured values should be considered for the output, ABSOLUTE if it should not be considered.



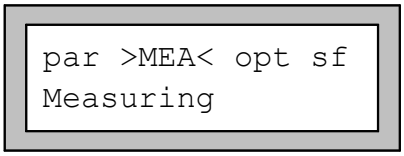
Enter as ZERO-SCALE VALUE the lowest measured value expected. The displayed measuring unit is the unit of the source item of the output. The ZERO-SCALE VALUE is the measured value corresponding to the lower limit of the physical range of the output.



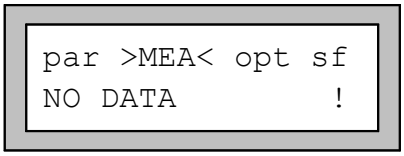
Enter as FULL-SCALE VALUE the highest measured value expected. The FULL-SCALE VALUE is the measured value corresponding to the upper limit of the physical range of the output.

The OUTPUT OPTIONS program branch is now completed and PIOX returns to the main menu. You can now start the measurement as described in chapter 10.

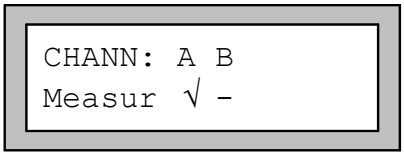
10 Starting the Measurement



In the main menu, select the program branch MEASURING, then press **ENTER**.



If an error message appears, the parameters of the channel were not defined. Return to the program branch PARAMETER and enter the missing parameters.



You must now activate the channels on which you want to measure and deactivate the others.

Note: This display does not appear if your instrument has only one measuring channel.

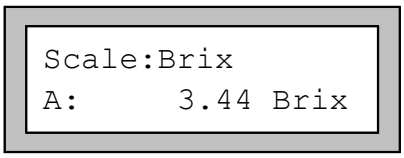
"√" means that the measuring channel is activated, "–" that the measuring channel is deactivated and "•" that the measuring channel cannot be activated (you did not enter parameters for that channel).

- Use the keys 4 and 6 to select a measuring channel.
- Press key 8 to activate or deactivate the selected channel.

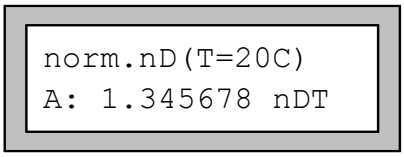
A deactivated channel will be ignored during the measurement. All parameters entered for this channel will remain unchanged.

Press **ENTER** when finished.

Note:	*A measuring channel cannot be activated if no parameter have been entered.*



The measurement is started. The designation of the measured quantity is displayed on the first line, its value on the second line.



Press key 3 DISP to have the normalized refractive index displayed.

During the measurement you can scroll on both display lines to obtain more information about the measurement.

Table 10.1: Display during measurement

Keys	Function
8 DISP 9	Scrolling on the upper line of the display (back/forward)
2 3 DISP	Scrolling on the lower line of the display (back/forward)

Table 10.2: Values that can be displayed on the upper line of the display

Display	Meaning	Hint
A:Sens=*****...	Status string of the sensor	Short status
A:Humid= 33/37%	Relative air humidity in both chambers of the sensor	Sensor humidity
A:Tdev= 25 C	Inner temperature of the sensor	Sensor temp.
A:Tflu= 22.34 C	Fluid temperature as measured by the sensor	Fluid temp.
A:nD = 1.345678	Refractive index of the fluid as measured by the sensor	Refractive index
A:nDv= 1.346051	Measured refractive index relative to the vacuum refractive index.	Refr.ind. vacuum
A:Amp= 82.34564%	Signal amplitude (Values >100% are possible)	Signal amplitude
A:Quality= 91.2%	Signal quality (Values >100% are possible)	Signal quality
A:Pixel= 745.34	Pixel position	Pixel position
A:Gnd-Z= 1045.12	Zero point of the pixels	Ground zero

Table 10.3: Values that can be displayed on the lower line of the display

Measured value	Meaning	Hint
A: 3.44 Brix	Measured value (here: Brix)	(Name der Messgrösse)
A: 1.345678 nDT	normalized refractive index	norm.nD(T=xxC) (the reference temperature defined in the temperature coefficients of the fluid and relative to which the normalization toot place is given in parenthesis)

10.1 Reset of the Status Outputs

During measurement, pressing key **C** three times will switch all alarms to their default state. However, all alarms which triggering condition is still met will switch back into their active state after 1 second. Use this function to reset an alarm of type HOLD when the triggering condition is not met anymore.

Pressing **BRK** stops measurement and brings you back to the main menu. All alarms are switched to their de-energized state, independently of their programmed default state.

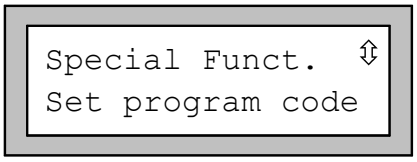
After a cold start, all alarm outputs will be re-initialized.

10.2 Protection against Interruption

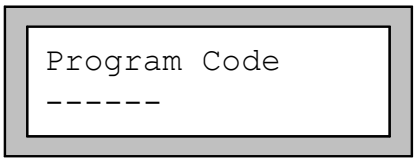
The special function SET PROGRAM CODE allows the user to input a 'secret number' that must be entered to interrupt an ongoing measurement, as a protection against unwanted interruption. When a program code has been entered, the full code (= BREAK code) must be entered to interrupt the measure. To execute commands during a running measure, you only need to enter the first 3 digits of the code (= ACCESS code).

When a program code has been set, the message "PROGRAM CODE IS ACTIVE" might be displayed when a key is pressed. The message will disappear after a few seconds.

Attention!	*Don't forget the program code!*

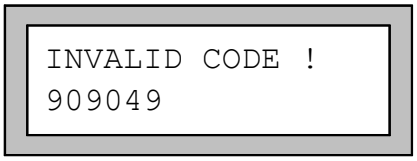


In the SPECIAL FUNCTION program branch, select the SET PROGRAM CODE option.



Enter a program code of up to 6 characters.

Confirm the entered code by pressing **ENTER**.

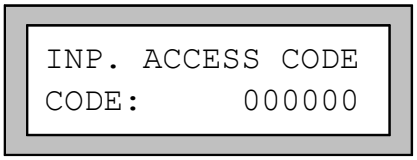


This error message warns you if you have entered a reserved number (a HotCode for language selection for example).

The previous program code, as far as existing, is valid until you enter another code correctly or deactivate the program code.

10.2.1 Interruption of Measurement

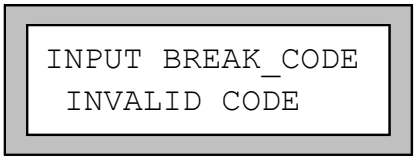
When a program code has been set, PIOX will ask for it when you select a command line or press key **BRK** during measurement.



Enter the program code (ACCESS or BREAK code depending on what you want to do). Confirm by pressing **ENTER**.

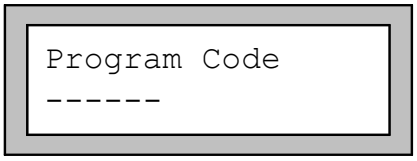
With key **C**, you can cancel the code input and return to the measure.

The program code "000000" is always displayed first in the program code input display. If you enter a program code beginning with "000", you will have a nearly immediate access to measure related commands.



If the entered code is **not** the current program code, an error message is displayed for a few seconds. If the entered code is valid, the command will be executed or the measurement will be interrupted.

10.2.2 Deactivating a Program Code



A program code can be canceled by entering "------" in the PROGRAM CODE display (SPECIAL FUNCTION \ SET PROGRAM CODE). Confirm with **ENTER**.

Attention!	*If you enter "-" less than six times, PIOX reads your entry as a new program code!*

A Technical Specifications

Measurement

Measuring principle:	transmitted light refractometer
Measuring range:	nD: 1,2 ... 1.8 °Bx: 0 ... 95
Sensitivity:	nD: 0,000 1 ... 0,000 01 (corresponds typically to 0,005 mass%)
Reaction time:	0,7 s
Process temperature:	standard: -18°C ... 120°C optional: -18°C ... 150°C
Process pressure:	10 bar to 40 bar depending on the process connection
Temperature measurement	
Probe:	Pt1000 class A
Temperature range:	-30°C... 200°C
Precision, Transmitter	0,05°C
Temperature compensation:	linear or not linear, can be parametrized

Sensor Enclosure

Material:	Stainless steel
Ambient temperature:	5°C to 55°C
Deg. of protection:	IP65 acc. to EN60529
Material:	Body: Stainless steel, Hastelloy, Titanium, others on inquiry Optics: quartz glass or sapphire Gaskets: EPDM, Viton or Kalrez
Dimensions:	see drawings on the next pages

Transmitter type PIOX® TR

Ambient temperature:	-10°C...60°C
Power supply:	(100...240) VAC (18...36) VDC
Display:	2 x 16 characters dot matrix, backlil
Power consumption:	< 15 W
Field housing TR374	
- Mass:	ca. 2,8 kg
- Deg. of protection:	IP65 acc. to EN60529
- Material:	Aluminum, powder coated
- Dimensions:	(280 x 200 x 70) mm (WxHxD)
- Channels:	1 or 2
Housing for 19" rack unit TR379	
- Mass:	approx. 1,7 kg
- Deg. of protection:	IP20 acc. to EN60529
- Material:	Aluminum
- Dimensions: (WxHxD)	(213x129x170) mm (42DUx3HU) (without backpanel)
- Channels:	2

Software

Operating systems:	all Windows™ versions
Functions:	Modulation and administration of the media's characteristic curves, upload and download to and from the transmitter

Process outputs (optional)

- The outputs are galvanically isolated from the main device.
- The number of outputs that can be installed depends on the output type. Consult Flexim for more information.

Current	
- Range:	(0/4...20) mA
- Precision:	0,1% of reading ± 15 µA
- Active ouptut:	$R_{ext} < 500\ \Omega$
Passive output:	$U_{ext} < 24$ V, $R_{ext} < 1k\Omega$
Voltage	
- Range:	(0...1) V or (0...10) V
- Precision:	0...1 V: 0,1% v. MW ± 1 mV 0...10 V: 0,1% v. MW ± 10 mV
- Internal resistance:	$R_i = 500\ \Omega$
Frequency:	
- Type:	Open collector, 24 V/4 mA
- Range:	0...1 kHz or 0...10 kHz
Binary	
- Open collector:	24 V/4 mA
- Reed relay:	48 V/0,1 A
Function:	Limit

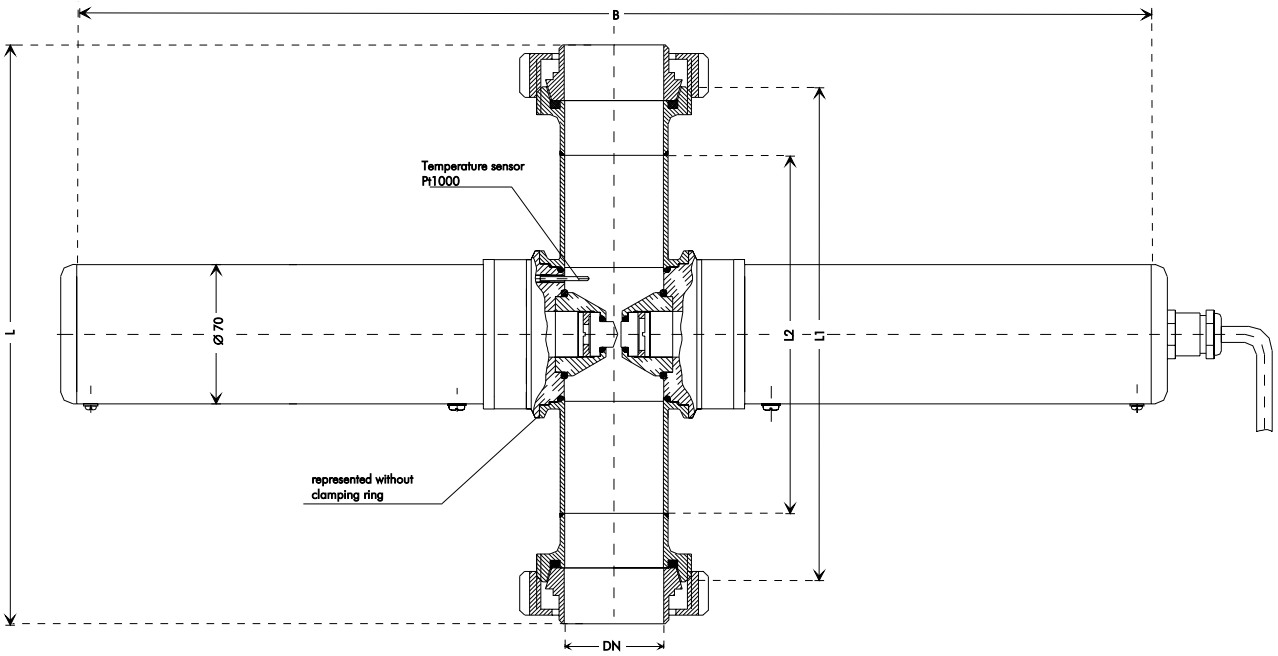
Process inputs (optional)

- The outputs are galvanically isolated from the main device.
- A maximum of 4 inputs can be installed.

Temperature	
- Type:	Pt100 four-wire circuit
- Range:	-50°C...400°C
- Resolution:	0,1 K
- Precision:	± (0,2 K + 0,1% of reading)
Current	
- Range:	active: (0...20) mA passive: (-20...20) mA
- Precision:	0,1% of reading ± 10 µA
- Internal resistance:	$R_i = 50\ \Omega$
Voltage	
- Range:	(0...1) V or (0...10) V
- Precision:	0...1 V: 0,1% v. MW ± 1 mV 0...10 V: 0,1% v. MW ± 10 mV
- Internal resistance:	$R_i = 1\ M\Omega$

Dimensions

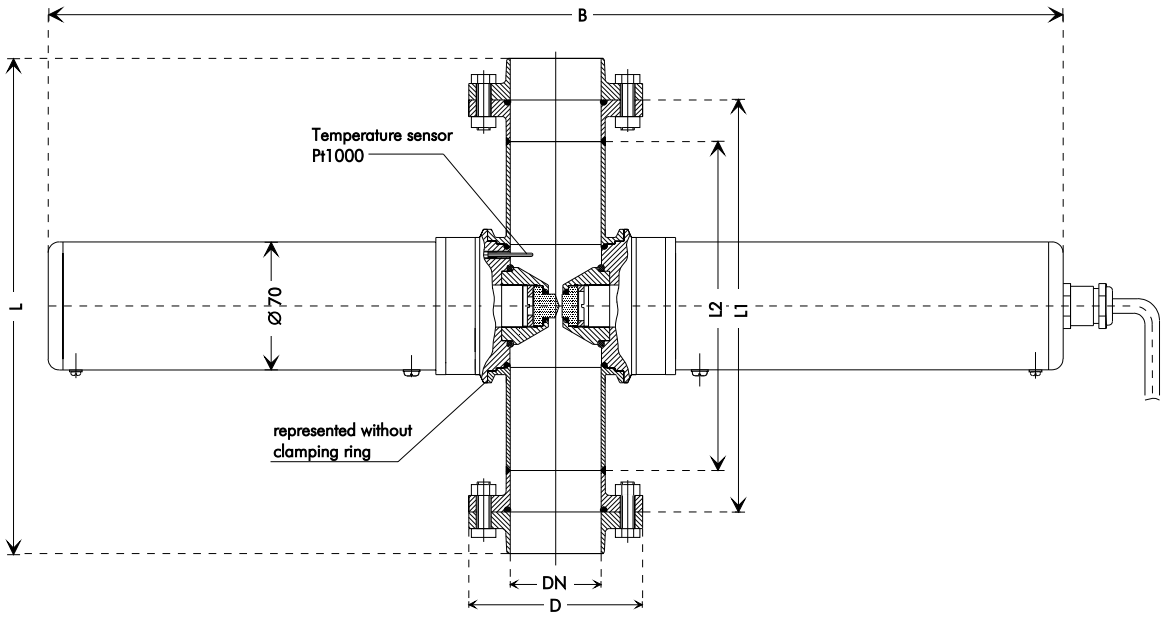
Varivent Threaded Connection ("Dairy" Connection)



Dimensions in mm

Nominal diameter (DN)	Width (B)	Overall length (L)	Fitting length (L1)	Fitting length weldings (L2)
40	534	284	246	180
50	546	292	250	180
65	562	378	330	250

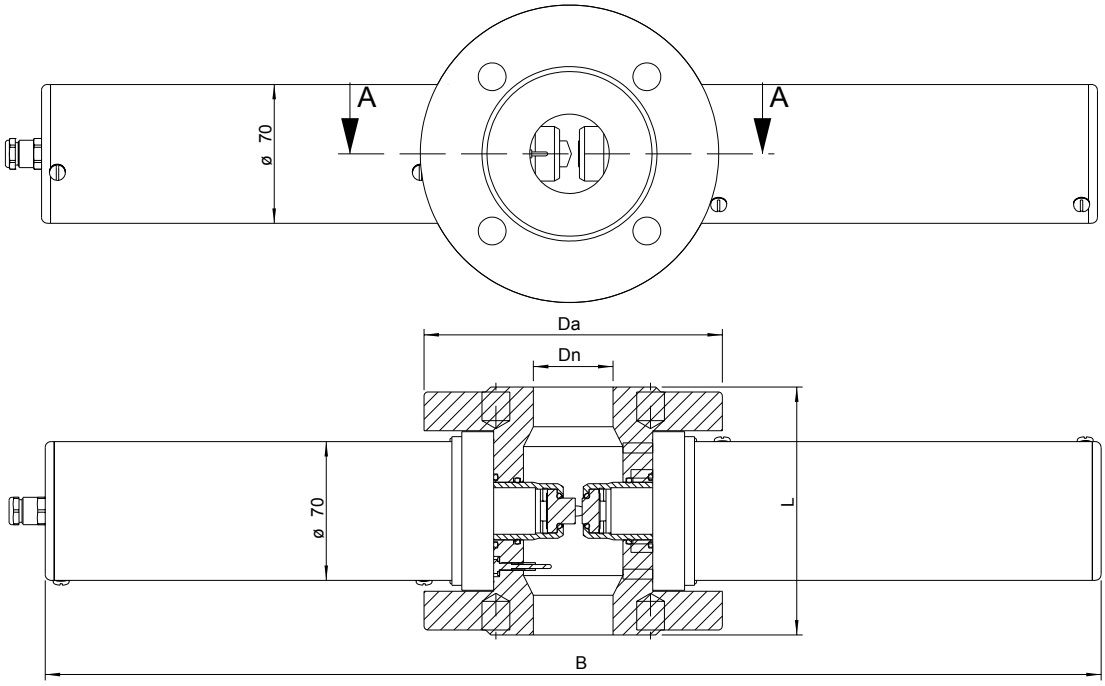
Varivent Flanged Connection



Dimensions in mm

Nominal diameter (DN)	Out. diam. flange (Da)	Width (B)	Overall length (L)	Fitting length (L1)	Fitting length weldings (L2)
40	82	534	280	230	180
50	94	546	280	230	180
65	113	562	350	300	250
80	128	577	350	300	250
100	159	596	350	300	250

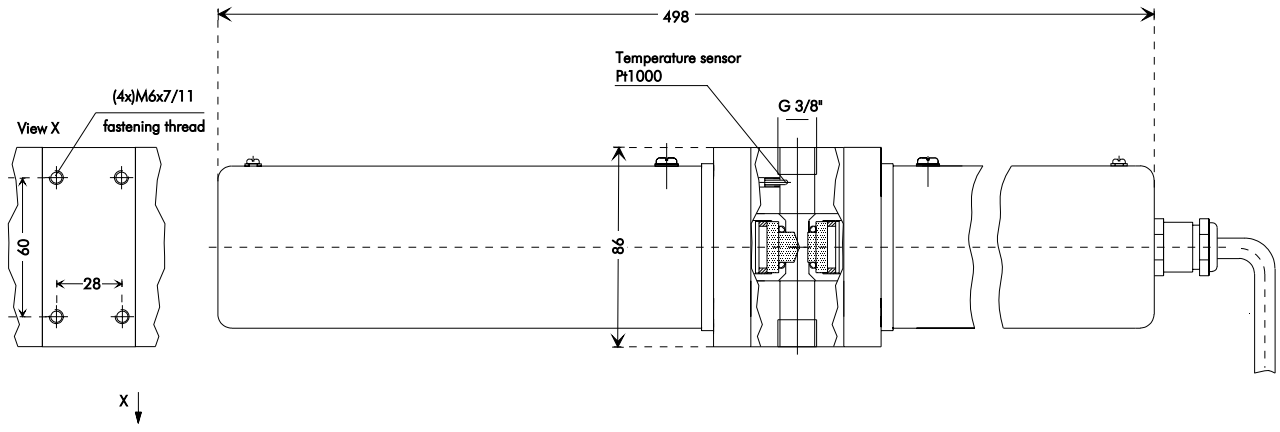
Sensor Enclosure with Flanged Connection acc. to DIN 2635



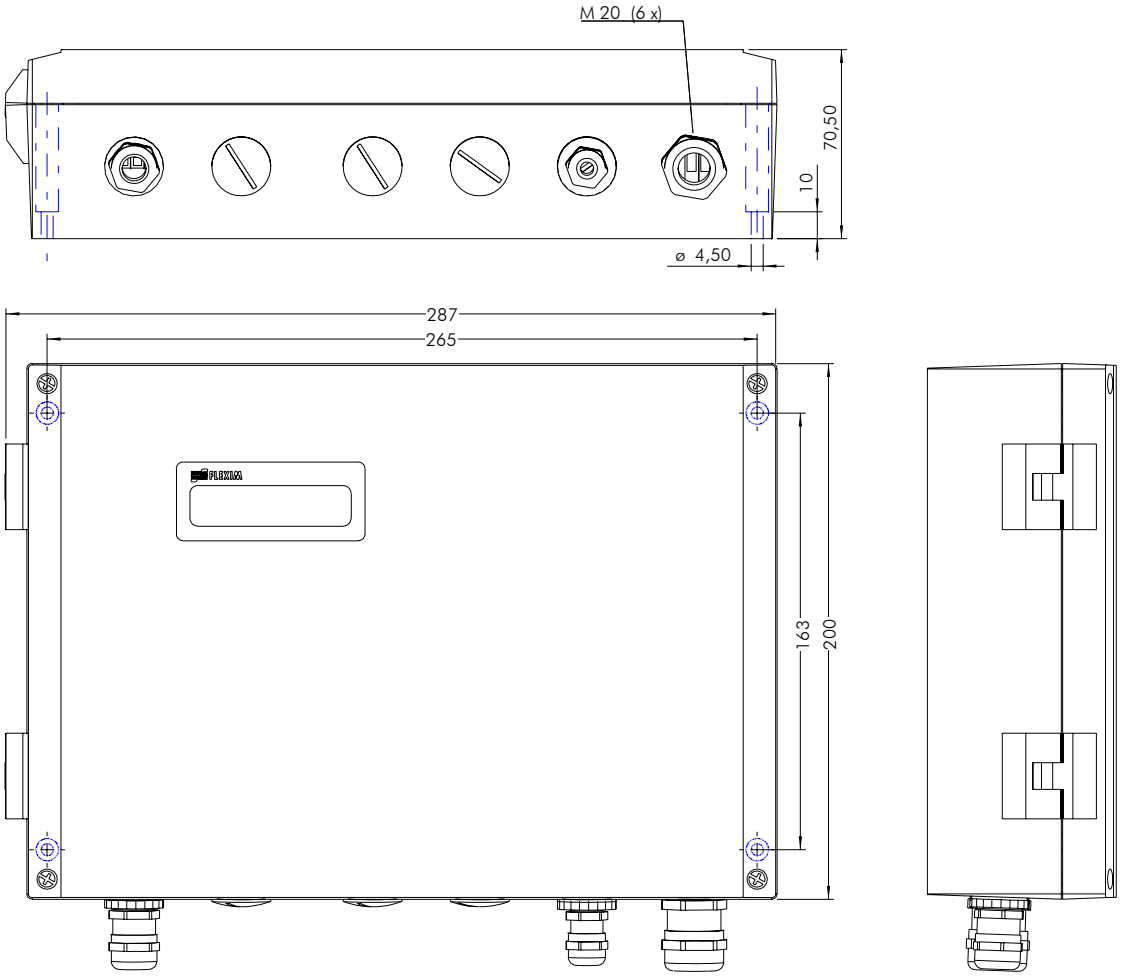
Dimensions in mm

Nominal diameter (DN)	Out. diam. flange (Da)	Width (B)	Overall length (L)
15	95	495	115
25	115	495	120
40	150	531	125
50	165	531	125
65	185	561	130
80	200	561	130

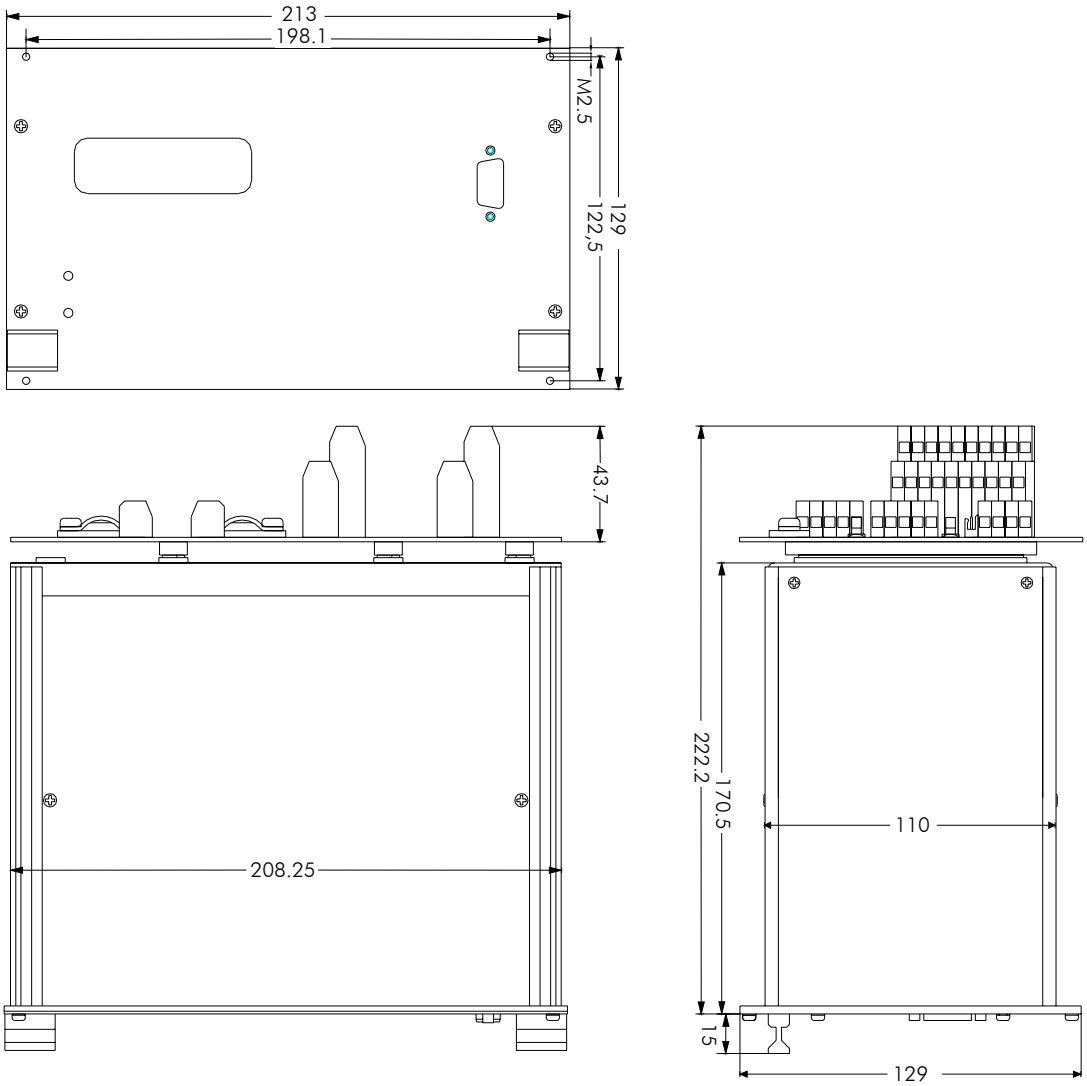
Inline Sensor for Bypass Operation (Ermeto)



Dimensions, Field Housing (TR374)



Dimensions, 19" Rack Unit (TR379)



B Certificates

Declaration concerning the Use in Hazard Zone 2

We,

Flexim Flexible Industrie Messtechnik GmbH
Wolfener Str. 36
D-12681 Berlin,

declare under our sole responsibility that the refractometer transmitter

PIOX TR372 and PIOX TR374

to which this declaration relates are in conformity with the EEC directive:

Directive 94/9/EEC - Safety Requirements for Control Systems and Equipment for Use in Explosive Atmospheres.

Flexim GmbH has, as demanded in this directive, established a quality control system which has been acknowledged in the declaration IBExU02ATEX Q00.

The conditions defined in the standard

DIN EN 60079-14 / VDE 0165:2004-07-00
Electrical Apparatus for Use in explosive Atmosphere,
Part 14: Electrical Apparatus for explosive Gas Atmosphere

for electrical equipment for use in hazard zone 2 are fulfilled.

Berlin, 12/01/2005

Dipl.-Ing. Jens Hilpert
Geschäftsführer

Declaration concerning the Use in Hazard Zone 2

We,

Flexim Flexible Industrie Messtechnik GmbH
Wolfener Str. 36
D-12681 Berlin,

declare under our sole responsibility that the sensor unit

PIOX R300

to which this declaration relates is in conformity with the EEC directive:

Directive 94/9/EEC - Safety Requirements for Control Systems and Equipment for Use in Explosive Atmospheres

when used with the refractometer transmitters

PIOX TR372, PIOX TR374.

Flexim GmbH has, as demanded in this directive, established a quality control system which has been acknowledged in the declaration IBExU02ATEX Q00.

The conditions defined in the standard

DIN EN 60079-14 / VDE 0165:2004-07-00
Electrical Apparatus for Use in explosive Atmosphere,
Part 14: Electrical Apparatus for explosive Gas Atmosphere

for electrical equipment for use in hazard zone 2 are fulfilled.

Berlin, 12/01/2005

Dipl.-Ing. Jens Hilpert
Managing Director

Declaration of conformity

We,

Flexim Flexible Industrie Messtechnik GmbH

Wolfener Str. 36

12681 Berlin

Germany,

declare under our sole responsibility that the

refractometer transmitters PIOX TR372 and PIOX TR374

and the sensor unit PIOX R300

to which this declaration relates are in conformity with the EEC directives

EMC Directive 89/336/EEC for Electromagnetic Compatibility,

Low Voltage Directive 73/23/EEC for Electrical Safety

when used together.

The transmitters and the sensor unit are in conformity with the following European Standards:

Class	Standard	Description
EMC Directive	EN61326-1 EN61326/A1	Electrical equipment for measurement, control and laboratory use - EMC requirements
- Immunity	EN61326-1	Electrical equipment for continuous, unattended operation
	EN 61000-4-2	Electrostatic Discharge Immunity
	EN 61000-4-3	RF Field Immunity
	EN 61000-4-4	Electrical Fast Transient / Burst Immunity
	EN 61000-4-5	Surge Immunity Test
	EN 61000-4-6	RF Conducted Immunity
	EN 61000-4-11	AC Mains Voltage Dips and Interruption Immunity
- Emission	EN61326-1	Electrical equipment Class B
	EN 55011	Disturbance Voltage Class A
	EN 55011	Disturbance Field Strength Class A
Low Voltage Directive	EN 61010-1 EN 61010-1/A2	Safety requirements for electrical equipment for measurement, control and laboratory use
- Isolation		Pollution degree 2
		Overvoltage category 2
		Safety class 1

Berlin, 13/01/2005

Dipl.-Ing. Jens Hilpert

Managing Director