

# EXNER PROCESS EQUIPMENT



## EXSPECT 231

NIR - Absorption Sensor  
Technical Information

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# 1 Product description

## 1.1 NIR - Absorption Sensor EXspect 231

### Components



Fig. 1: NIR - Absorption Sensor

### EXspect 231

The EXspect 231 NIR Absorption Sensor is a 180° transmitted light sensor in the near-infrared range (wavelength of 850 nm) that measures the light-absorption of fluids. The sensor is designed to monitor continuous process results or to display changes securely. It is particularly suitable for phase separation, controlling separators, filter monitoring and measuring concentrations.

- safe phase separation
- quicker product changeovers
- reduced sewage costs
- filter monitoring
- colour-independent concentration measurement
- compact design with integrated booster and display
- durable sapphire window
- hygienic Design, suitable for CIP
- LED light source, guaranteed stable and long-lasting signal
- integrated contact and analogue output
- simple to define parameters

**Measuring range** The measuring range of EXspect 231 sensors is related to the various units of measure and sensor designs as follows:

**EXspect 231 Design "A"**

0...100% Absorption

**EXspect 231 Design "B"**

0...3.5 AU Absorption Units (this corresponds to an optical density of 0...7 OD)

0...3,850 EBC European Brewery Convention

0...15,400 FAU Formazin Absorption Unit

0...15,400 FTU Formazin Turbidity Unit

0...31,570 mg/l Milligrams per litre of a dry substance

The maximum measuring range is dependent on the selected optical path length.

**EXspect 231 Design "C"**

0...6 AU Absorption Units (this corresponds to an optical density of 0...12 OD)

0...6,600 EBC European Brewery Convention

0...26,400 FAU Formazin Absorption Unit

0...26,400 FTU Formazin Turbidity Unit

0...54,120 mg/l Milligrams per litre of a dry substance

The maximum measuring range is dependent on the selected optical path length.

**Display** The current measurement value is shown on the display. The sensor can be configured using the touch display.

**Calibration input** The current measurement value can be set to 0 by briefly connecting a 24 V DC signal to the calibration input. That way, the transmitter can be adjusted to a known measuring medium (zeroed). The same happens if you use the "Offset Val" menu function.

## 1.2 Functions

<b>Measuring principle</b>	Defines the sensor's fundamental measuring principle.
<b>Unit of measurement</b>	<p>Defines the unit of measurement to be displayed. Various units can be selected depending on the sensor design. For absorption measurements, you can choose between AU (<b>A</b>bsorption <b>U</b>nit) and a self-defined free unit of measurement, a CDU (<b>C</b>ustomer <b>D</b>efined <b>U</b>nit). Other units available are:</p> <p>EBC           <b>E</b>uropean <b>B</b>rewery <b>C</b>onvention  FAU           <b>F</b>ormazin <b>A</b>bsorption <b>U</b>nit  FTU           <b>F</b>ormazin <b>T</b>urbidity <b>U</b>nit  mg/l           <b>M</b>illigrams per litre</p> <p>and a self-defined free unit of measurement, a CDU (<b>C</b>ustomer <b>D</b>efined <b>U</b>nit)</p> <p>The conversion rule is: 1 FAU = 1 FTU = 0.25 EBC = 2.05 mg/l</p>
<b>Zeroing</b>	<p>Set the current measurement value to 0 by using Offset.</p> <p>Same function as the calibrate input function with external contact.</p>
<b>Display options</b>	<p>Defines which measurement value should be displayed:</p> <ul style="list-style-type: none"> <li>• Absorption</li> <li>• Customer Defined Unit (CDU)</li> </ul> <p>The factory preset CDU value can only be changed or adjusted for sensors with the 8-pin M12 connector and with the ECI-01 communication interface, as well as the software EXpert 2.x.</p> <p>Regardless of the display options selected, the analogue output always provides an output dependent on the absorption.</p>
<b>Lower measuring range</b>	Defines the 4 mA point for the output current. You can choose from a range of 0 - 100 % of the possible measuring range.
<b>Upper measuring range</b>	Defines the 20 mA point for the output current. You can choose from a range of 0 - 100 % of the possible measuring range.
<b>Damping</b>	Dampens the measurement value through a flowing averaging process.
<b>Digital output off</b>	Defines the point at which the digital output is switched off for the contact switch. You can choose from a range of 0 - 100 % of the possible measuring range.

<b>Digital output on</b>	Defines the point at which the digital output is switched on for the contact switch. You can choose from a range of 0 - 100 % of the possible measuring range.
<b>Digital output function</b>	Defines the digital output function for the contact switch. You can choose between making contact and breaking contact.
<b>Digital output delay</b>	Defines the digital output delay for the contact switch. You can choose from a range of 0 - 200 seconds.
<b>Language</b>	Defines the display language.

### 1.3 Process integration

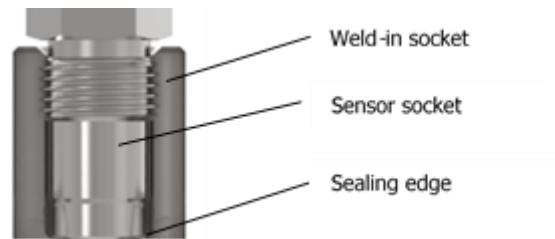
**Sensor** The EXspect 231 sensor can be integrated directly into a pipe or container by using its 1/2" connector, or by using an adapter with the available connector.



Fig. 2: Process integration

**Welding sockets** Installation using welding sockets guarantees hygienic process adaptation, which can be used without dead space and free of elastomers. As this is a purely metal-sealed system, no other sealing materials, e.g. elastomers, may be used.



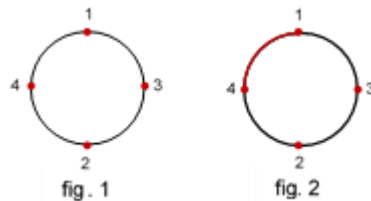
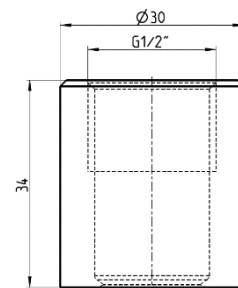


Please always use the weld-in plugs supplied so that the heat resulting from the welding process can be dissipated safely, and to effectively prevent the drill hole becoming distorted.



### Welding in tanks / pipes

- 1.) Drill a hole with the same outside diameter as the weld-in plug (maximum tolerance is +0.2 mm)
- 2.) Attach plugs at 4 evenly-spaced points (Abb. 1 below, following page)
- 3.) Screw in weld-in plugs
- 4.) Weld the parts between the 4 points (Abb. 2)



**Transmitter** The transmitter is powered by a 24 V DC supply, has a freely programmable contact switch, and a 4 - 20 mA output for outputting measurement values. The measuring value can be set to 0% via 24V input.

**Pressure / Temperature** The EXspect sensor can be used at a pressure up to 10 bar and at a maximum process temperature of 90 °C.

To protect the LED which is used, it is switched off at a temperature of 90 °C. Measurement is then no longer possible.

The display shows the error message "LED Current". After lowering the medium temperature below 90 ° C, the LED is reactivated and error message disappears.



Please note the pressure and temperature diagrams in Section 8!

**Installation location**

In principle, the sensors can be used in any location. However, you need to make sure that the pipe is completely filled, and that the sensor is not set up in a place where bubbles form due to agitation of the medium. You should also consider how easy it is to read the display, and how easy it is to access and operate the sensor at a location.

The following diagram shows the favoured locations for installing the sensor. As you can see, it is preferable for the sensor to be installed on the side of the pipe.

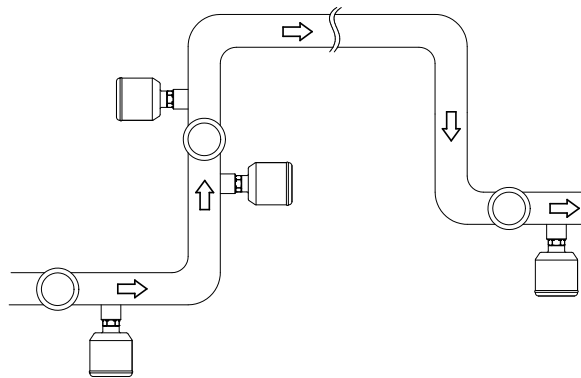


Fig. 3: Installation locations

When installing the sensor, you should make sure that the opening with the measurement aperture is facing in the direction of flow or parallel to it. If the sensor is set up against the direction of flow, this can lead to the medium being agitated in an unwanted way and/or the formation of bubbles, which can lead to distorted measurement values.

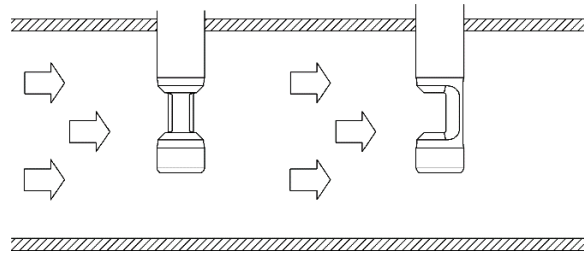


Fig. 4: Sensor positioning

## 1.4 Inspection and calibration

Reference filters (EXcap 110) with various absorption values are available for inspecting and calibrating the sensor EXspect 231. These can be attached to the sensor as and when required. To guarantee the inspection/calibration is carried out without any errors, you should make sure that the reference filter is touching right up against the sensor, and that the filter plate is on the same side of the sensor as the detector.



Fig. 5: Reference filter

In order to be able to carry out an inspection or calibration of the sensor by means of the reference filter, the unit "AU" must be selected in advance for the sensor versions "B" and "C". For a comparison of version "A" the following table can be used.

AU	0,35	1	2	3
%-Trübung	55,35	90	99	99,9



## 2 Setting parameters

### 2.1 User menu

#### CAUTION!

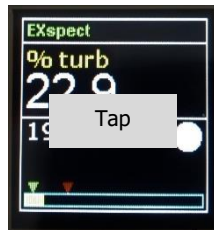


Setting parameters incorrectly can result in incorrect measurement values and digital output switching points being displayed. This can have an unwanted impact on your processes.

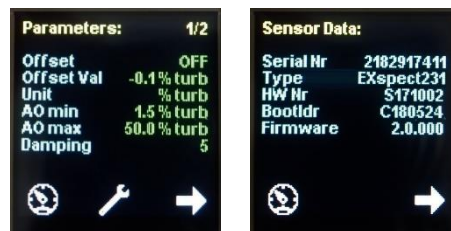


Make sure that only authorised and trained personnel make changes to the parameters.

**Sensor parameters can either be defined by using the touch display or by using an M12 (8-pin) connector in combination with the communication interface ECI-01 and the software EXpert 2.x.**



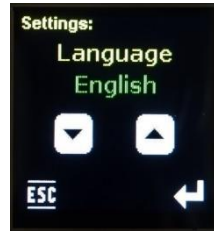
You can get to the menu by tapping on the display.



You can get to the individual parameters, as well as the sensor and display data, by pressing the arrow symbol. If you want to configure a parameter, tap on the tool symbol.



You then select the appropriate setting using the arrow keys and confirm by pressing the enter symbol.



You also select the desired value using the arrow keys. If you're setting a numerical value, this can be increased/decreased by 1 digit by briefly tapping on the respective arrow button. Holding down the arrow button for longer changes the numerical value by increments of 10.

Pressing the enter symbol confirms the value given and exits that setting menu level. If no value has been changed and you want to leave the setting menu level, press the ESC symbol.



You get back to the readout display by tapping the speedo symbol. The readout display is returned to automatically if no entries have been made or if the screen is not touched within a period of 30 seconds.

### User menu

The values **underlined and in bold** are **standard user parameters**.

Parameter	Designation	Value range	Description
Offset	Activating "offset" setting	<b>OFF</b> , ON	Activates/deactivates the setting "offset"
Offset Val	Offset	Version A: -100.0 ... <b><u>0.0</u></b> (for unit %)  Version C: -6.0 ... <b><u>0.0</u></b> (for unit AU)	Defines the offset value.
Unit	Display options	<u>Version A:</u> <b><u>%</u></b> , CDU  <u>Version B/C:</u> <b><u>AU</u></b> , FAU, FTU, EBC, mg/l, CDU	Determines which measurement value should be displayed:  Description of units as per section 2

Parameter	Designation	Value range	Description
			Adjust the CDU value settings using the software EXPert.  Regardless of the display options selected, the analogue output always provides an output dependent on the absorption.
AO min	Analog Output min	Version A: <b>0.0</b> ... 100.0 (for unit %)  Version C: <b>0.0</b> ... 6.0 (for unit AU)	Defines the absorption value at which the minimum output current is emitted.
AO max	Analog Output max	Version A: 0.0 ... <b>100.0</b> (for unit %)  Version C: 0.0 ... <b>6.0</b> (for unit AU)	Defines the absorption value at which the maximum output current is emitted.
Damping	Damping	<b>0</b> ... 100	Dampens the absorption measurement values by displaying a sliding average across a set number of measurement values.
DO on	Digital Output on	Version A: <b>0.0</b> ... 100.0 (for unit %)  Version C: <b>0.0</b> ... 6.0 (for unit AU)	Defines the point at which the digital output is switched on.
DO off	Digital Output off	Version A: <b>0.0</b> ... 100.0 (for unit %)  Version C: <b>0.0</b> ... 6.0 (for unit AU)	Defines the point at which the digital output is switched off.
DO funct	Digital output switching function	<b>NO</b> , NC	NO = normally open NC = normally closed
DO Delay	Digital output switching delay	<b>0</b> ... 200 s	Delays the digital output switch by up to 200 seconds.
Language	Language settings	<b>Deutsch</b> , English, Français, Nederlands	Defines the display language.

## 2.2 Calibrate the sensor to the medium (zeroing)

**To recognise recurring product conditions, the sensor can be calibrated to these product conditions.**

Select the parameter "Offset ON". Dip the sensor tip into the reference liquid and, as soon as the measured value has

stabilized, select the "SET" menu function under parameter "Offset Val" to set the offset. This way, the value is set to 0.

Alternatively, a 24 V DC switching signal can be applied at the calibration input. In order to activate the offset and to set the value of the reference liquid as "zero value" at the same time, the adjustment input must be supplied with a voltage of 24 V DC for a short time (approx. 5 sec.).

Briefly applying 24 V DC to the calibration input has the same function as the two following settings in the display:

- Activation Offset (Offset ON)
- Setting the Offset value (SET OffsValue)

If the voltage (24 V DC) is only applied to the calibration input for approx. 1 sec., the offset can be activated or deactivated. A "reset to zero" does not take place.



At the calibration input (Pin 5, see chapter 4.3), an electrical voltage must be applied permanently or when connecting the cable. The adjustment input must be kept de-energized. It is only for a short time to apply a voltage (24V DC) to the described switching operations.

### 2.3 Output current

**The EXspect sensor is equipped with a 4 - 20 mA output for displaying the absorption measurement value. The output current is configured by using the following parameters:**

"AO min" defines the lower measuring range and the 4 mA point.

"AO max" defines the upper measuring range and the 20 mA point.



"Damping" defines the damping affecting the display and the output current.

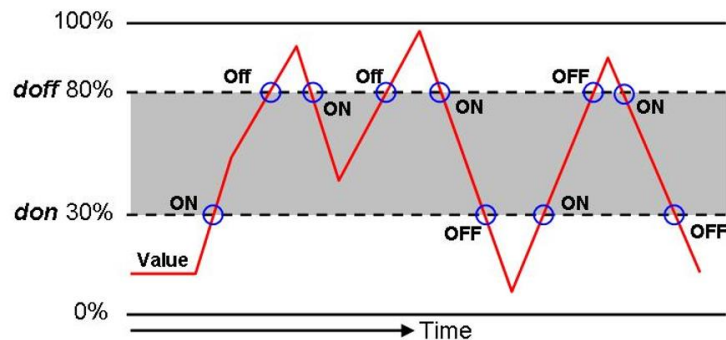
## 2.4 Digital output switching points

The EXspect sensor has a PNP digital output which is configured using four parameters.

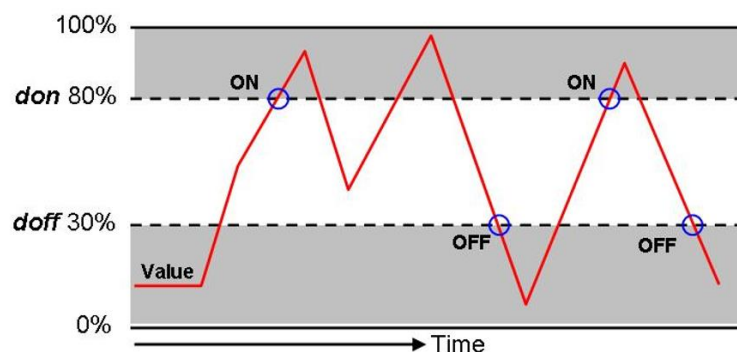
"DO ON" defines the point at which the digital output is switched on, and "DO OFF" defines the point at which it is switched off.

Together, the two parameters define the function of the digital output switching points:

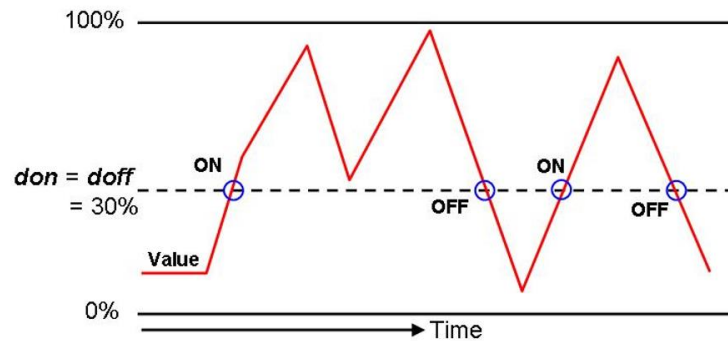
If the "DO ON" value is smaller than the "DO OFF" value, the digital output turns on if the measurement value is between the two points (window function).



If the "DO ON" value is larger than the "DO OFF" value, the output switches on if the measurement value exceeds the "DO ON" value. It only switches off again if the measurement value falls below the "DO OFF" value (hysteresis function).



If the "DO ON" and "DO OFF" values are the same, the output switches on when the measurement value exceeds the switching point values, and switches off when it falls below them again.



Both parameters can be defined as being between 0 and 100% of the possible measuring range, and independently of each other.

"DO funct" inverts the functions of the switching points. If the value = NO, the digital output switcher works as a normally open contact, if the value = NC, it works as a normally closed contact.

"DO delay" delays the reaction of the digital output switcher by up to 200 s. This value applies to switching the output on and off in equal measure.

## 2.5 Display

**The EXspect sensor is equipped with a removable display. It is not possible to operate the sensor without them.**

**Parameters can be set by using the display or by using the communication interface ECI-01 (for EXspect 231).**



If sensor parameters are set using the display, it should be noted that when removing the cover plate, the pressure screw is fastened using an appropriate tool so that it can't move. After setting parameters, the cover is to be put back properly and in the correct place.

Setting parameters using the ECI-01 communication interface and the EXpert 2.x software is only possible with an 8-pin connector.



Before connecting the sensor to a PC via the ECI-01 communication interface for the first time, you must first install the EXpert 2.x software on it.



## 3 Technical data

### 3.1 Standards

EN 61326-1: 2013-7  
EN 61326-2-3: 2013-7  
DIN/EN 27027 (ISO 7027)

### 3.2 Specifications

Sensor specifications	
Measurement range	Version A: 0 - 100 % turbidity Version B: 0 - 3.5 AU / 0 - 3850 EBC / 0 - 7 OD Version C: 0 - 6 AU / 0 - 6600 EBC / 0 - 12 OD
Resolution	0,1% or 0,01 AU
Accuracy	± 1 %
Reproducibility	≤ 1 % from final value
Wave length	850 nm
Light source	LED
Material	Stainless steel 1.4435 (316L)
Surface finish	Electropolished Ra <0.37 µm
Measurement aperture	Sapphire
Supply voltage	24 V DC
Output current	4...20 mA
Digital output switching	Can be set to NO or NC
Input contact	+24 V DC for calibrating (zeroing)
Cable connection	5 or 8-pin M12 plug
Cable length	2 m or 5 m
Connecting piece	G ½" for welding sockets with 15° cone

**Maximum measurement range for Version B:**

Unit	Optical path length		
	5 mm	10 mm	20 mm
AU	0... 3.5	0...3.5	0...3.5
OD	0...7	0...3.5	0...1.75
EBC	0...3850	0...1920	0...960

**Maximum measurement range for Version C:**

Unit	Optical path length		
	5 mm	10 mm	20 mm
AU	0...6	0...6	0...6
OD	0...12	0...6	0...3
EBC	0...6600	0...3300	0...1650

**3.3 Dimensions**

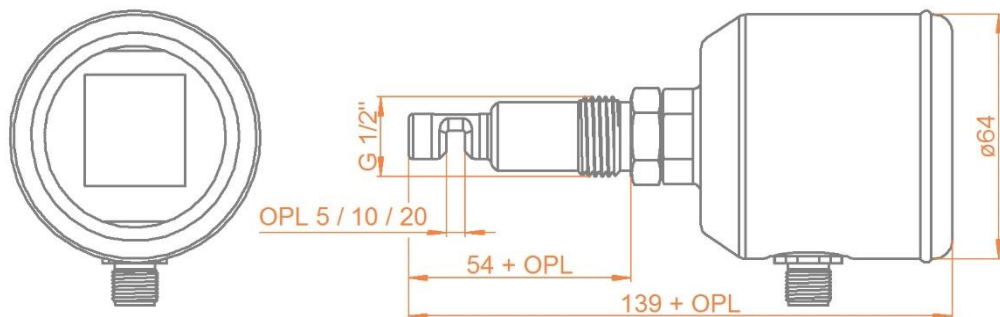


Fig. 11: Sensor dimensions

**3.4 Environmental conditions**

<b>Ambient temperature</b>	-10 - 70 °C
<b>Transport and storage temperature</b>	-20 - 80 °C

### 3.5 EXspect process conditions

Max. permissible pressure PS: 10 bar

Max. permissible temperature TS: 90 °C

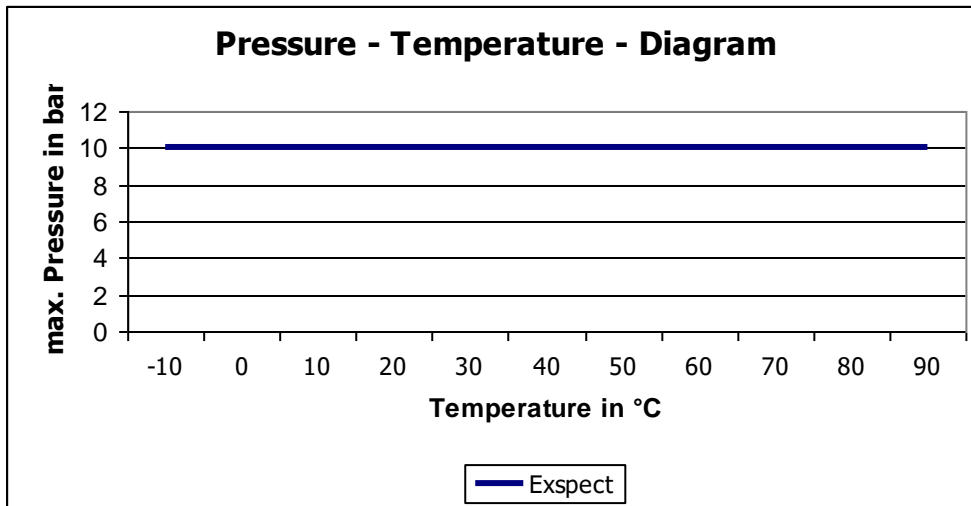


Fig. 12: EXspect pressure-temperature diagram

### 3.6 EXspect 231 ORDER STRUCTURE

EXspect 231 Sensor										
	<b>Des.</b>	<b>Measurement range</b>								
	A	0 - 100% absorption								
	B	0 - 3.5 AU / 0 - 3850 EBC / 0 - 7 OD								
	C	0 - 6 AU / 0 - 6600 EBC / 0...12 OD								
		<b>Des.</b>	<b>Optical path length</b>							
		05	5 mm							
		10	10 mm							
		20	20 mm							
			<b>Des.</b>	<b>Material (touching medium)</b>						
			4435	Stainless steel 1.4435 / 316 L						
			XXXX	Special design						
			<b>Des.</b>	<b>Seal material (touching medium)</b>						
			MET	Metal sealing						
			XXX	Special design						
			<b>Des.</b>	<b>Connecting piece</b>						
			G12	Thread G 1/2"						
			XXX	Special design						
			<b>Des.</b>	<b>Interface</b>						
			AS	analogue 4 - 20 mA / 5-pin M12						
			AD	analogue 4 - 20 mA / can be set digitally / 8-pin M12						
		XX	Special design							
			<b>Des.</b>	<b>Display</b>						
			1	with integrated display						
			X	Special design						
<b>EXspect 231</b>		-		-		-		-		<b>Order number</b>



## 4 Spare parts and accessories

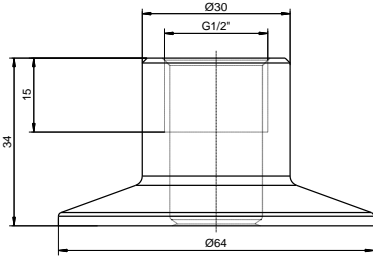
<b>EXspect 231 accessories</b>	
<b>Description</b>	<b>Order number</b>
2 m EXspect connector cable (M12 5-pin)	2-125-00-001
5 m EXspect connector cable (M12 5-pin)	2-125-00-002
2 m EXspect connector cable (M12 8-pin)	2-120-68-001
5 m EXspect connector cable (M12 8-pin)	2-120-68-002
PC software EXpert 2.x on a USB stick (for Windows)	2-120-69-003
ECI-01 EXspect 271/231 connection interface for connecting to a PC via USB (connector cable M12 8-pin)	2-120-66-001

<b>EXspect 231 certificates</b>	
<b>Description</b>	<b>Order number</b>
Certificate EN10204-2.2 for surface finish (Ra <0.37 µm)	2-121-01-001
Certificate EN10204-3.1 for materials	2-121-01-002

<b>EXspect 231 factory servicing</b>	
<b>Description</b>	<b>Order number</b>
Factory recalibration for NIR sensors incl. certificate (proof of return)	2-999-00-013

<b>EXspect 231 spare parts</b>	
<b>Description</b>	<b>Order number</b>
Operating and display unit	2-118-00-001

EXspect 271 installation adapters		
Description	Drawing	Order number
Welding socket G 1/2" cylindrical		2-087-33-003
Weld-in plug G1/2" made of brass		2-086-11-001
Varivent process adapter F DN 25-40		2-083-33-001
Varivent process adapter N DN 40-125		2-083-33-002
Process adapter Tri-clamp 1 1/2"		2-083-33-005

Process adapter Tri-clamp 2"		2-083-33-006
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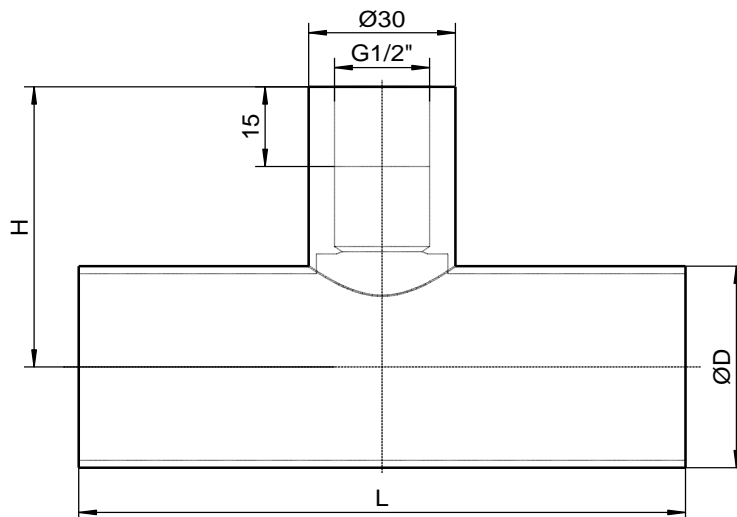
### Weld-in pipe with adapter G 1/2"

Material of pipe: 1.4435

Material of adapter: 1.4404

Pressure range: 0...10 bar

ØD	L	H	Order number
DN 25	100 mm	51,5 mm	2-083-33-007
DN 32	110 mm	54,0 mm	2-083-33-008
DN 40	120 mm	57,0 mm	2-083-33-009
DN 50	140 mm	63,5 mm	2-083-33-010
DN 65	160 mm	73,5 mm	2-083-33-011



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