EXcell 231 / 241

OPERATING INSTRUCTIONS

NIR - Absorption Sensor

EXNER
Process Equipment

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1 General information

The operating instructions enable the safe and efficient handling of the sensors EXcell 231 and EXcell 241.

The operating instructions belong to the product and must be stored in its direct vicinity and easily accessible to the staff at all times. Before starting any work, the staff must read these operating instructions carefully and understand them.

If these operating instructions incorporate documentation from suppliers (as an attachment), Exner Process Equipment assumes no guarantee for its contents, individual statements, technical data, etc.

1.1 Manufacturer

Exner Process Equipment GmbH
Carl-Metz-Str. 26
D-76275 Ettlingen

1.2 Depiction of information

For simplified and safe work with these operating instructions, uniform safety instructions and symbols are used.

Safety instructions

Safety instructions protect against injury to persons and damage to property. The measures described for averting danger must be adhered to.

The safety instructions are structured as follows:

SIGNAL WORD	
	Type and source of the danger Consequences in case of non-observation Prevention measures / Prohibitive rules

The components have the following meaning:

- Signal word: marks the seriousness of the danger
- Warning sign: draws attention to the danger
- Type and source of the danger: names the causes of the danger
- Consequences: describes the consequences in case of non-observation
- Measures: provides measures to avert the danger

DANGER

This warning message marks a danger with a high risk which results in death or severe injury if not avoided.

WARNING

This warning message marks a danger with a moderate risk which can result in death or severe injury if not avoided.

ATTENTION

This warning message marks a danger with a low risk which can result in minor or moderate injury if not avoided.

NOTE

This note contains information regarding possible material or environmental damages which do not result in injury to persons.

Symbols

Marks	Meaning
»	Instruction with no specified sequence
1.	Instruction with a specified sequence
•	List
→	Reference to Chapter
" "	Operating element, Push button, Button
✓	Result

2 Safety and protection measures

2.1 General safety instructions

The EXcell sensor is designed in such a way that no risks can arise from using the product if the operating instructions are observed.

- Read the operating instructions first.
- Only install or operate the sensor after having read and understood all notes on its safe and proper use.
- Keep the operating instructions in a safe place in order to be able consult them at all times if required.
- Only use the sensor and its accessories if they are in good order and condition.
- Ensure proper use of the sensor. Do not use it for applications for which it is not intended (e.g. as a step).
- Observe the laws, ordinances, regulations and standards applicable in the country of use and at the place of use.

2.2 Intended use

The EXcell sensor is attached to tanks or pipes. The optical part of the sensor is immersed into the process liquid in order to measure its physical properties through absorption of irradiated light.

- Prepare a maintenance schedule for the respective process.
- Only perform maintenance work described in these operating instructions!
- Changes to the sensor may only be carried out after consulting with the manufacturer.

NOTE

The manufacturer is not liable for damages arising from improper or unintended use.

2.3 Danger zones and residual dangers

Sensors are connected to tanks and pipes which can be pressurised. Process liquid can only escape in case of negligent action or improper use. The system or part thereof should therefore be depressurised and emptied completely before the sensor is removed.

- Before commissioning and after each maintenance, ensure that all seals and connections are complete and functional.
- Take appropriate safety precautions before touching the sensor as parts of it can adopt the process temperature.

2.4 Equipment and accessories

Only use tested and approved equipment and accessories.

Seals

The EXcell 231 / 241 sensor requires an elastomer seal. If you connect the sensor to your process using an adapter, then

Choose material properties of the process and O-ring seals depending on the process medium and cleaning liquid.

Take the swelling capacity and acid or base resistance of the sealing material into account.

2.5 Requirements of the staff

Qualification

Only trained professionals may install and service the sensor!

Protective clothing

When commissioning or servicing, the operating staff must wear goggles and appropriate protective clothing.

Accident prevention regulations (UVV)

Please observe the valid rules and regulations concerning occupational safety in the country and place of use!

2.6 Pictograms

For better orientation, pictograms and symbols are used in the operating instructions.

Pictogram	Meaning
	General warning sign

3 Technical data

3.1 Standards

The following standards were applied when manufacturing the sensor:

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

3.2 Specification

Sensor specifications	
Measurement range	0...6 AU; 0...6600 EBC; 0...12 OD
Resolution	0.01 AU
Accuracy	± 1 %
Reproducibility	≤ 1 % of the final value
Wave length	850 nm
Light source	LED
Material	Stainless steel 1.4435 (316L)
Surface finish	Ra <0.37 µm
Measuring window	Sapphire
Process connection	Thread PG 13.5; union nut (G 1 ¼")
Process temperature	0...90 °C, autoclavable
Process pressure	Max. 16 bar (232 psi)
Electrical connection	Fischer Core series
Connector cable length	2 m / 5 m
Interfaces	RS485 Modbus, USB (with ECI-01), 0/4...20 mA with switching output (with ECI-03), 0/4...20 mA with zeroing function (configuration "DA")

Max. measuring range:

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

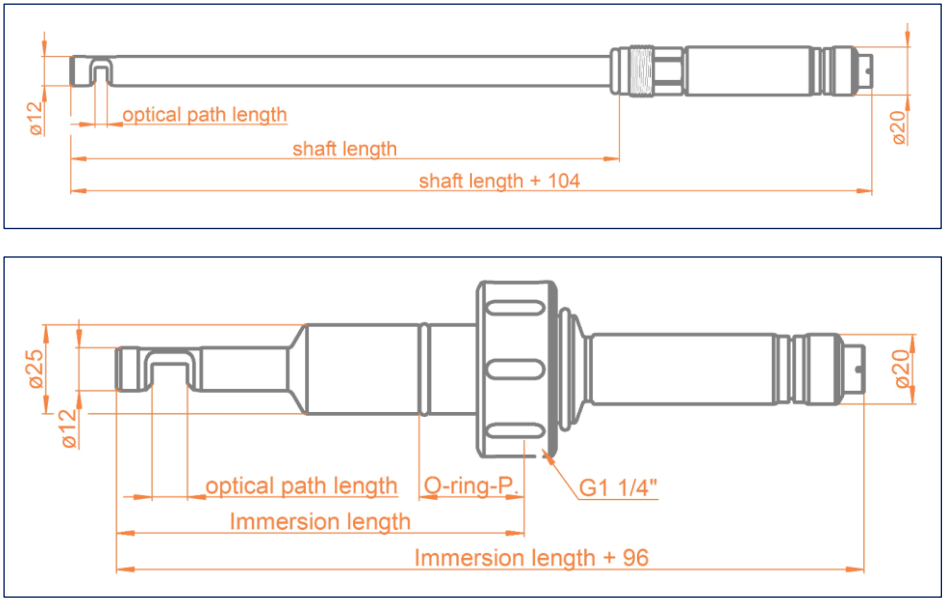


Fig. 1: EXcell 231 / 241 dimensions

3.4 Environmental conditions

Ambient temperature -10...70 °C

Transport and storage temperature -20...80 °C

3.5 EXcell process conditions

Max. permissible pressure PS:	16 bar	
Max. permissible temperature TS:	90 °C	
Max. permissible sterilisation temperature	135 °C	max. 1 hour

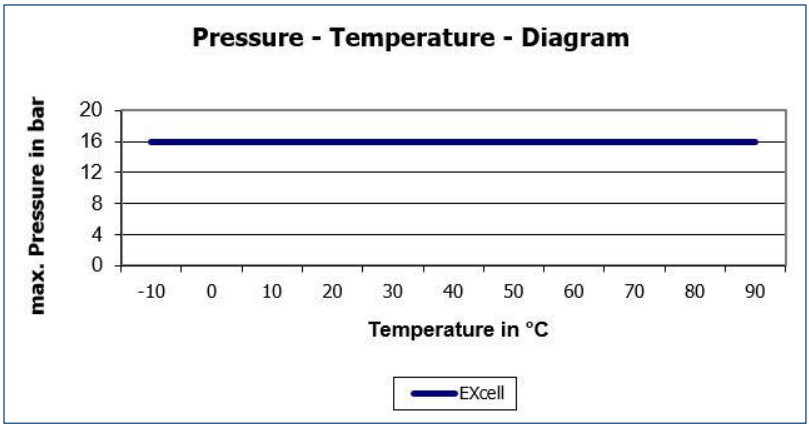


Figure 2: Pressure - temperature diagram EXcell

3.6 Identification plate

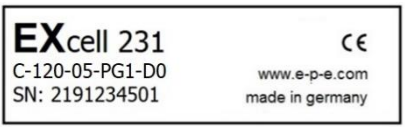


Fig. 3: Identification plate (based on EXcell 231)

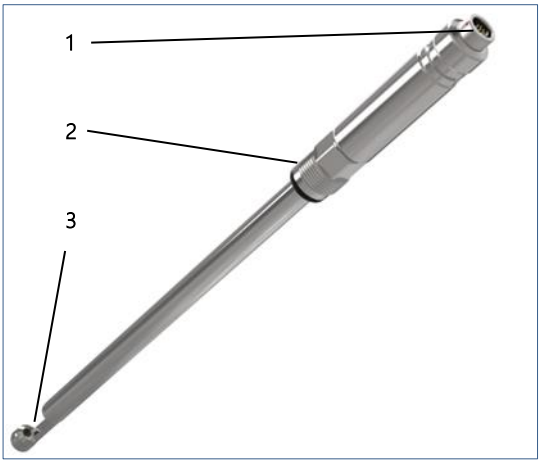
4 Product description

NOTE

The sensors of the EXcell series have an integrated temperature sensor. This is only used to monitor the condition of the sensor and is not suitable for precise control of the process temperature.

4.1 NIR – EXcell absorption sensor

4.1.1 Components



1	Fischer Core series connector plug
2	PG 13.5 thread
3	Measuring window

Fig. 4: EXcell 231 sensor

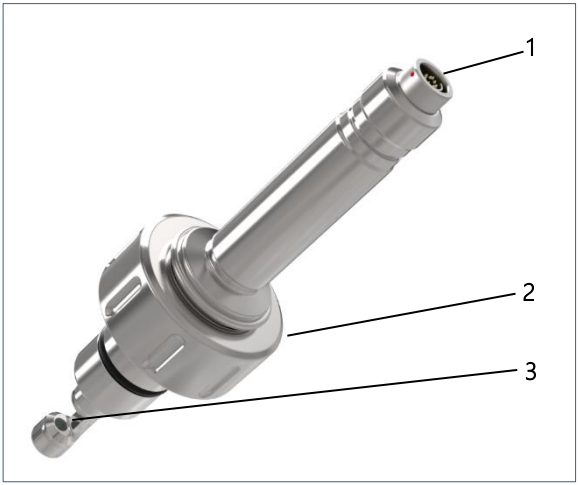
4.1.2 EXcell 231

The NIR absorption sensor EXcell 231 is a high-precision digital NIR rod sensor for monitoring production processes in the biotech, food and pharmaceuticals industries.

Its 12mm stainless steel design and non-wearing sapphire windows make the EXcell 231 a reliable absorption sensor with an integrated digital measurement amplifier. Turbidity values such as EBC / FAU / TEF /mg/l / AU / OD or customer-specific units can be output. The latter can be freely set using the EXpert configuration software.

The sensor can be comfortably parameterised at the PC using the matching EXpert 2.x software and the measuring values can be logged and displayed graphically. Also, a RS485 Modbus interface and an interface for 0...20mA output with an integrated measurement value display are available.

The sensor can be mounted like a standard pH-sensor by its PG13,5 thread connection. The assembly dimensions on the process side are equivalent to those of a standardised sensor. Therefore, this sensor can also be used in combination with retractable process probe housing and fully automatic cleaning systems.



1	Fischer Core series connector plug
2	DN25 (Ingold) connector
3	Measuring window

Fig. 5: Sensor EXcell 241

EXcell 241

The NIR absorption sensor EXcell 241 is a high-precision digital NIR rod sensor for monitoring production processes in the biotech, food and pharmaceuticals industries.

Its use on common DN25 welding plugs and the non-wearing sapphire windows make the EXcell 241 a reliable, intelligent absorption sensor with an integrated digital measurement amplifier which is very easy to install on typical industrial fermenters. Turbidity values such as EBC / FAU / TEF / mg/l / AU / OD or customer-specific units can be output. The latter can be freely set using the EXpert configuration software.

The sensor can be comfortably parameterised at the PC using the matching EXpert 2.x software and the measuring values can be logged and displayed graphically. Also, a

RS485 Modbus interface and an interface for 0...20mA output with an integrated measurement value display are available.

The sensor is attached to the welding socket using a G1 1/4" thread. In order to enable the best possible sterile installation, the O-ring-position can be chosen according to the existing plug.

4.1.3 Checking and adjustment

For checking and adjusting reference filters (EXcap 110) with various absorption values, the sensors EXcell 231 and EXcell 241 are available. If necessary, they can be attached to the sensor. To guarantee that inspection/adjustment is carried out without any errors, ensure that the reference filter is placed precisely on the sensor, and that the filter plate is at the lower measuring window of the sensor. The optical sensor unit must be dry and clean for this.

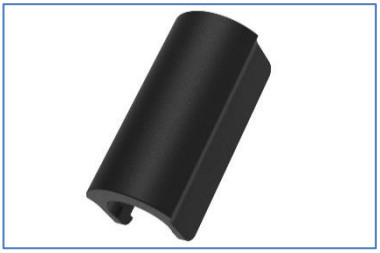


Fig. 6: Reference filter

In order to be able to carry out an inspection or adjustment of the sensor with the reference filter, the unit "AU" must first be selected for the sensor.

NOTE

If the measured value is outside the tolerances of the reference filter and the sensor, recalibration at the manufacturer's side is recommended.

5 Delivery

5.1 Scope of delivery

The sensor is checked at the factory and is shipped ready for installation in packaging which offers the sensor optimal protection.

The delivery includes:

- EXcell sensor
- Certificate for surfaces (optional)
- Certificate for elastomer compound (optional)
- Operating instructions

NOTE

Store the sensor in its packaging. It is best protected there until it is installed.

5.2 Checking the delivery

Before you approve the sensor for assembly, please ensure the following:

- Packaging and device are in good order and condition
- The sensor's identification plate corresponds with the information in the purchase order (→ Chapter 3.6 "Identification plate")

In case of queries, please contact your dealer directly.

6 Assembly

6.1 Assembly

Requirements:

- Sufficient working space is available to operate the sensor.
- The process is deactivated.
- The tanks and pipes are depressurised, empty and clean.
- The connecting piece and the process connector fit together.
- The earthing contact / shield for the connector cable is connected.

6.2 Mechanical connection

ATTENTION

Risk of injury due to escaping process liquid!

Depending on the process liquid's properties, you may incur scalding or chemical skin burns.

» Check that the tanks or pipes to which the sensor is being connected is depressurised, empty and clean!

NOTE

Ensure that

» sufficient working space is available to operate the sensor.

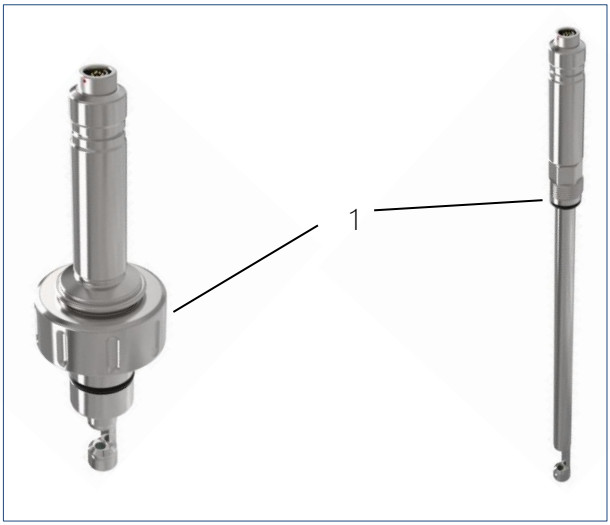
» the process is switched off.

» the tanks or pipes are depressurised, empty and clean.

» the connecting piece and the sensor's process connector fit together.

» Insert the sensor into the matching process connector.

» Tighten the pressure screw (1) or union nut (1) to a max. of 10-20 Nm. In case of application of the union nut in combination with strong vibrations in the system, the additional use of the safety bracket is recommended (see accessories).



1	Union nut / Pressure screw

Fig. 7: Union nut / pressure screw at the sensor

NOTE

The red dot on the connector of the sensor can be used as an alignment aid, since it is aligned with the measuring gap.

6.3 Electrical connection ECI-01

NOTE

Ensure that an original cable with the correct connectors is used.

The ECI-01 Exner Communication Interface transfers the measured values of the optical EXcell sensors to a standardised USB 2.0 interface and supplies the required voltage to the sensor.

NOTE

ECI-01 and the EXpert software are required to parameterise the sensor.

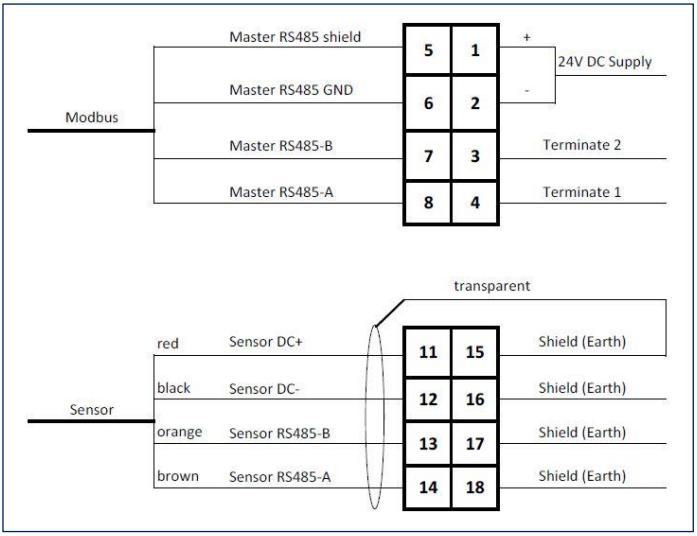
Cabinet:	Stainless steel
Voltage supply:	5 V DC via USB interface
Connection:	Fischer Core series / USB connector

6.4 Electrical connection ECI-02

The Exner Communication Interface ECI-02 is used for galvanic isolation of the power supply and the sensor signals. This interface is preferably used when several sensors are used at the same time. The ECI-02 ensures the safe transfer of the Modbus signal to a standardised RS485 interface and an optimal power supply for the connected sensor.

Cabinet	23 mm top-hat rail cabinet
Voltage supply	24 V DC, 12...36 V
Output	Modbus RS485
Input	EXcell sensor

ECI-02 terminal diagram



» To terminate RS485, place a jumper between "Terminate 1" and "Terminate 2".

6.5 Electrical connection ECI-03

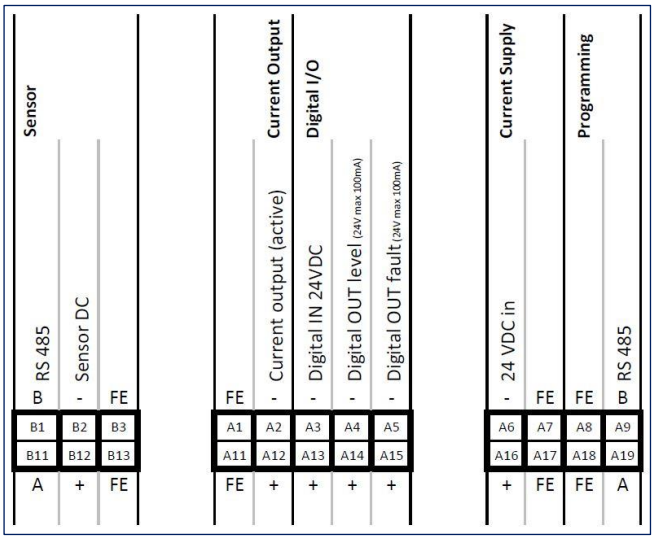
The ECI-03 Exner Communication Interface transfers the measured values of the optical EXcell sensors to a standardised 0/4...20 mA interface and supplies the required voltage to the sensor.

In addition, a limit value contact and an alarm contact can be used and the colour touch display shows current measured values and parameterisations.

A corresponding connection cable for software updates is provided as an accessory.

Cabinet:	Panel mounting 48x96 mm	
Voltage supply:	24 V DC	12...36 V
Output:	0/4...20 mA	max. 24 mA
	Limit contact	24V, 100 mA PNP
	Alarm contact	24 V, 100 mA PNP
Input:	EXcell sensor	Terminals
Display:	Graphics	25x29 mm touch function colour

ECI-03 terminal connection diagram



6.6 Electrical connection EXcell connection cable

The connection cable has an open cable end via which the sensors of the EXcell series can be connected to various communication interfaces and systems.

NOTE

Make sure you are using an original cable with the correct connector.

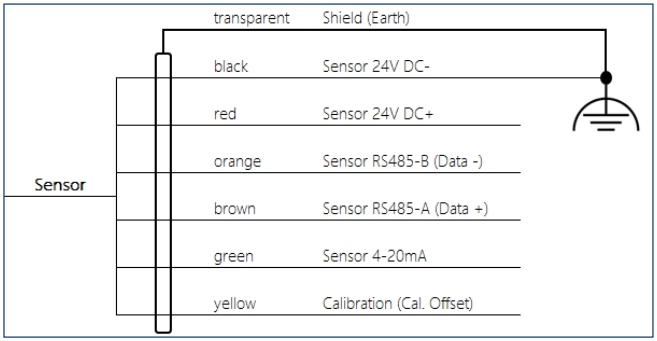
ATTENTION

Risk of injury from electric shock!

» Pay attention to the correct insulation of exposed contact points.

» Do not touch any live components or switch them of beforehand.

The EXcell sensor can be operated with a voltage of 9...24 V DC. It must be ensured that both, the shield of the connection cable and the negative pole of the power supply unit, which is required for the power supply, are connected to the functional earth. In addition to the standard version (...D0) of the sensor, another version (...DA) with an additional analogue output (4-20 mA) and an adjustment input is available.



When using the optionally available analogue output, the sensor can be adjusted to detect recurring product states. The switching input required for this (adjustment input) can be connected via the yellow strand of the connection cable (see above wiring diagram) can be connected.

Proceed:

1. Fasten the sensor in such a way that at least the complete optical assembly is in the desired reference medium. Make sure that there are as few air bubbles in the medium as possible, which could interfere with the measurement results.

2. As soon as the measured value has stabilized, the measured value can be set to "0" by applying a 24 V DC switching signal to the adjustment input. In order to activate this offset and to set the value of the reference liquid as "zero value" at the same time, the switching input must be subjected to the specified voltage for approx. 5 seconds.

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

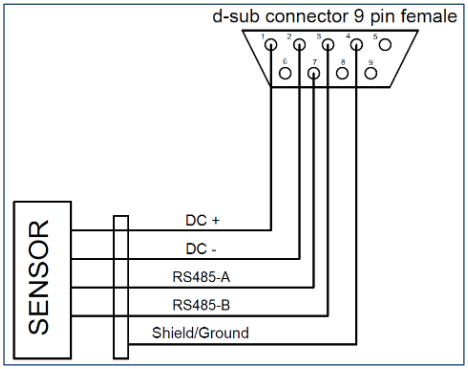
NOTE

An electrical voltage must not be applied permanently to the adjustment input (yellow wire) or when the cable is connected. The adjustment input must be kept voltage-free. It is only short-term for the described switching processes with a voltage (24 V DC) to apply

6.7 Electrical connection Lucullus

For the NIR absorption sensors EXcell 231 and EXcell 241 a suitable adapter cable is available especially for connection to a Lucullus system. This optionally can be ordered as an accessory.

Fig. 8: Lucullus system EXcell 231/241 connection cable


d-sub connector 9 pin female
SENSOR
DC +
DC -
RS485-A
RS485-B
Shield/Ground

7 Parameterisation

WARNING

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

NOTE

Ensure that only authorised and trained staff make changes to the parameterisation.

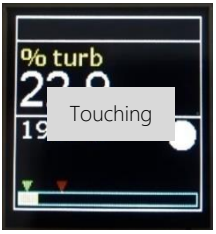
Use the EXpert 2.x software to parameterise the EXcell sensor. To do this, you must install the Expert 2.x software first on a Microsoft Windows PC with Windows 7 or higher and after that connect the sensor with the ECI 01 communication interface to the USB interface of the PC.

NOTE

Ensure that you

- First install the EXpert 2.x software on the PC and only after successful installation connect the sensor to the computer via the USB interface.
- Are using the latest EXpert 2.x software and the corresponding firmware has been installed on the sensor
- Follow the EXpert 2.x software operating instructions (display by pressing the "F1" key when the software has already started)

7.1 User menu ECI-03



1. You can access the menu by touching the display.

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

3. Then select the appropriate setting using the arrow keys and confirm by pressing the enter symbol.

4. The desired value is also selected using the arrow keys. If a numerical value is set, it can be increased/decreased by one digit by briefly touching the respective arrow key. Keeping the arrow key pressed longer changes the numerical value by increments of 10.

5. Press the enter symbol to confirm the value entered and exit this setting level. If no value has been changed and you wish to leave the setting menu level, press the ESC symbol.

6. You can return to the readout display by touching the speedo symbol or automatically if no entries have been made or if the display is not touched within a period of 30 seconds.

User menu

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

Parameter	Name	Value range	Description
Offset	Offset activation	**OFF**, ON	Activates/deactivates the setting "Offset"
Offset Val	Offset	-6.0 ... **0.0** (for unit AU)	Defines the offset value. A reliable offset value can only be set if the current measured value does not change or only minimally changes over a period of approx. 5 seconds.
Unit	Display toggling	**AU**, FAU, TEF, EBC, mg/l, CDU	Determines which measurement value should be displayed: **CDU**: customer-defined unit To adjust the CDU value settings, use the EXpert software.
AO min	Lower output limit (analogue output min)	**0.0** ... 6.0 (for unit AU)	Defines the absorption value at which the minimum output current is emitted.
AO max	Upper output limit (analogue output max)	**0.0** ... 6.0 (for unit AU)	Defines the absorption value at which the maximum output current is emitted.

Damping	Damping (Damping)	**0**... 100	Dampens the absorption measurement values by outputting a moving average across a set number of measurement values.
DO ON	Switch-on point (digital output on)	**0.0** ... 6.0 (for unit AU)	Defines the point at which the digital output is switched on
DO OFF	Disconnection point (digital output off)	**0.0** ... 6.0 (for unit AU)	Defines the point at which the digital output is switched off.
DO funct	Switch function (digital output type)	**NO**, NC	NO = Closer NC = Opener
DO Delay	Switching delay Digital Output delay	**0** ... 200 s	Delays the digital output switch by up to 200 seconds.
Language	Language settings	**German,** English, French, Dutch	Defines the display language.

8 Modbus Register

Modbus communication

Implementation class	
parameter	options
addressing	1 to 247 (default 1)
broadcast support	No
baud rate	1200
	2400
	4800
	9600
	19200 (default)
	38400
	57600
	115200
transmission mode	RTU (fixed)
data bits	8 (fixed)
parity	none, odd, even, mark, space
stop bits	1 (fixed)
electrical interface	RS485 2 Wire cabling

Supported Modbus functions
Read Holding Registers (03)
Write Single Register (06)

Supported Modbus exeptions
Illegal funktion (01)
Illegal data address (02)

Modbus registers

Parameter name	Default (decimal)	Unit	Variable type	Range (decimal)	Access	Modbus Address	Description
40001...40070 Readings							
Calibrated AU value		AU x 1000	SWord	-32768...32767	Read	40001	
OD value		OD x 1000	SWord	-32768...32767	Read	40002	
Temperature of process		°C x 10	SWord	-32768...32767	Read	40003	
Value of Current output		uA	Word	0...65535	Read	40004	
Current digital output state		#	Word	0/1	Read	40005	
EBC value		EBC	SWord	-32768...32767	Read	40006	
CDU value		CDU	SWord	-32768...32767	Read	40007	Name is determined by register 254..258, The CDU UnitFactor is determined by register 253
Current acces level		#	Word	0...65535	Read	40008	
FAU value		FAU x 0.1	SWord	-32768...32767	Read	40009	
TEF value		TEF x 0.1	SWord	-32768...32767	Read	40010	
mg/l		mg/l x 0.1	SWord	-32768...32767	Read	40011	

perc (%)		perc x 100	SWord	-32768...32767	Read	40012	contains 100 x percentage of max AU
Sensor Standard deviation		curre nt Unit	SWord	-32768...32767	Read	40014	Standard Deviation of the current unit the unit and factor is that of the current unit
Raw AU value		AU x 1000	SWord	-32768...32767	Read	40016	
Error Word		#	Word	0...65535	Read	40022	bit 0 EEPROM Communic ation error (1 = active)
							bit 1 AU Calibration error (1 = active)
							bit 2 EBC Calibration error (1 = active)
							bit 3 CDU Calibration error (1 = active)
							bit 4 Overtemp Sensor (1 = active)

							bit 5 Led Current out of limits (1 = active)
							bit 6 Led voltage out of limits (1 = active)
							bit 7 reserved
							bit 8 Ref 2.0V Error (1 = active)
							bit 9 Ref 4.1V Error (1 = active)
							bit 10 SupplyVolt age 5.0 Error (1 = active)
							bit 11 PCB OVertemp (1 = active)
							bit 12 (S)Word overflow (1 = active)
							bit 13 Invalid Zeropoint/I nvalid pathlength (1 = active)
							bit 14 reserved
							bit 15 reserved

Warning Word		#	Word	0...65535	Read	40023	bit 0 Low signal
							bit 1 reserved
							bit 2 reserved
							bit 3 reserved
							bit 4 reserved
							bit 5 reserved
							bit 6 reserved
							bit 7 reserved
							bit 8 reserved
							bit 9 reserved
							bit 10 reserved
							bit 11 reserved
							bit 12 reserved
							bit 13 reserved
							bit 14 reserved

							bit 15 reserved
AUOffset	0	AU x 1000	SWord	-32768...32767	Read	40025	contains 1000 x AU Offset value
EBCOffset	0	EBC	Sword	-32768...32767	Read	40026	contains the through calibration tables calculated EBC offset value
CDUOffset	0	CDU	SWord	-32768...32767	Read	40027	contains the through calibration tables calculated CDU offset value
ODOffset	0	OD x 1000	SWord	-32768...32767	Read	40028	contains the through calibration tables calculated OD offset value
FAUOffset	0	FAU x 0.1	SWord	-32768...32767	Read	40029	contains the through calibration tables calculated FAU offset value
TEFOffset	0	TEF x 0.1	SWord	-32768...32767	Read	40030	contains the through calibration tables calculated TEF offset value

mg_lOffset	0	mg/l x 0.1	SWord	-32768...32767	Read	40031	contains the through calibration tables calculated mg_l offset value
percOffset	0	perc x 100	SWord	-32768...32767	Read	40032	contains the through calibration tables calculated perc offset value
Parameter name	Default (decimal)	Unit	Variable type	Range (decimal)	Access	Modbus Address	Description
40071...40300 Settings							
Modbus slave adres	1	#	Word	1...247	Read/ Service	40071	
Modbus baudrate	1920	#	Word	120/240/480/ 960/1920/384 0/ 5760	Read/ Service	40072	Value = baudrate/1 0
Modbus Parity	0		Word	0, 1, 2, 3, 4	Read/ Service	40073	Parity 0 = none, 1 = odd, 2 = even, 3 = mark, 4 = space
Averaging number	5	#	Word	0...2000	Read/ Service	40076	Smoothing factor for averaging (Running average) (0 -> AVG = RAW)

SensorFilterAVGnr	5		Word	5,,,100	Read/ Service	40077	Window size of filtering and avaraging calculation (Noice reduction)
Temp averaging nr	5	#	Word	0...20	Read/ Service	40078	Smoothing factor for averaging Temperature value (0 -> AVG = RAW)
Active unit	1	#	Word	0/1/2/3/4/5/6	Read/ Service	40079	0 = AU, 1 = EBC, 2 =CDU, 3 = OD, 4 = TEF, 5 = FAU, 6 = mg/l, 7 = perc
Digital output ON Level	1	Active Unit	Sword	-32768...32767	Read/ Service	40080	Value should be given in current Active Unit (determined in register 40079)
Digital output OFF Level	2	Active Unit	Sword	-32768...32767	Read/ Service	40081	Value should be given in current Active Unit (determined in register 40079)
Digital output function	0	#	Word	0/1	Read/ Service	40082	0 = Closer 1 = Opener

Digital output delay	0	seconds	Word	0...200	Read/ Service	40083	
Digital output inverted	0	#	Word	0/1	Read/ Service	40084	0 = normal operation, 1 = inverted operation
Current loop mode	1	#	Word	0/1	Read/ Service	40085	0 = 0-20mA, 1 = 4-20mA
Current loop min value	0	Active Unit	Sword	-32768...32767	Read/ Service	40086	Currentloop value belonging to 0 or 4 mA, Value should be given in current Active Unit (determined in register 40079)
Current loop max value	8	Active Unit	Sword	-32768...32767	Read/ Service	40087	Currentloop value belonging to 20mA, Value should be given in current Active Unit (determined in register 40079)
Current loop failure value	0	uA	Sword	-32768...32767	Read/ Service	40088	Closed Loop output current when sensor in error

Max Active Unit Value		Active Unit	Sword	-32768...32767	Read	40089	Contains the Value of the Active Unit @ "MaxAUAlarm" Or if that's impossible, the maximum value (32767)
Min Active Unit Value		Active Unit	Sword	-32768...32767	Read	40090	Contains the Value of the Active Unit @ "AU = 0" Or if that's impossible, the minimum value (-32768)
OffsetStatus	0	#	word	0/1	FREE	40091	Setting this value To zero = 'offset off', Setting this value to any other value = 'offset on'
Viewsettings		#	Word	0...65535	Read/ Service	40092	bit 0 if true, Present 1 digit more in LCD and PC Software

							bit 1 if true noise reduction via STDev and averaging is on, else no noise reduction (This is different from the running averaging!)
							bit 2 reserved
							bit 3 reserved
							bit 4 reserved
							bit 5 reserved
							bit 6 reserved
							bit 7 reserved
							bit 8 reserved
							bit 9 reserved
							bit 10 reserved
							bit 11 reserved

							bit 12 reserved
							bit 13 reserved
							bit 14 reserved
							bit 15 reserved
Temp Access Code	0	#	word	0...65535	FREE	40098	Setting this address to the value in address 299 to get servicelevel access for one operation
OffsetZero	0	#	word	0/1	FREE	40099	Setting this register To other than zero triggers a recalculation of the offsetvalues with the current calibrated offsetless AU value This register is Reset To 0 after executing a command

Recalcalculate	0	#	word	0...65535	Read	40100	If this register is Set (<>0) Then calibration slopes are recalculate d And the register is Reset
Path length	5000	µm		1000 - 65535	Read	40125	Pathlength between LED and Sensor (um)
LED switch OFF temperature	900	10 x °C	Word	500 - 2500	Read	40126	Is also overtemp trigger value
CDU UnitFactor	0		SWord	-3...3	Read/ Service	40254	example 1: -1 = CDU x 0,1 example 2: 3 = CDU x 1000
CDU unit name	CDU		String 10 Chars		Read/ Service	40255	low-byte; Char 1 (most left position)
							high-byte; Char 2
						40256	low-byte; Char 3
							high-byte; Char 4
						40257	low-byte; Char 5
							high-byte; Char 6
						40258	low-byte; Char 7
							high-byte; Char 8

						40259	low-byte; Char 9
							high-byte; Char 10 (most right position)
Service Level Access Code	12345	#	word	0…65535	Read/Service	40300	Code to enter in 97 to get Sevicelevel access for one operation
Parameter name	Default (decimal)	Unit	Variable type	Range (decimal)	Access	Modbus Address	Description
40301…40400 Sensor Software/Hardware data							
Manu-facturer ID			String (10 Chars)	ASCII	Read	40306	low-byte; Char 1 (most left position)
							high-byte, Char 2
						40307	low-byte, Char 3
							high-byte, Char4
						40308	low-byte; Char 5
							high-byte; Char 6
						40309	low-byte; Chart 7
							high-byte; Char 8
						40310	low-byte; Chart 9
							high-byte; Char 10 (most right position)

Reseller ID			String (10 Chars)	ASCII	Read	40311	low-byte; Char 1 (most left position)
							high-byte, Char 2
						40312	low-byte, Char 3
							high-byte, Char4
						40313	low-byte; Char 5
							high-byte; Char 6
						40314	low-byte; Chart 7
							high-byte; Char 8
						40315	low-byte; Chart 9
							high-byte; Char 10 (most right position)
Sensor ID			String (10 Chars)	ASCII	Read	40316	low-byte; Char 1 (most left position)
							high-byte, Char 2
						40317	low-byte, Char 3
							high-byte, Char4
						40318	low-byte; Char 5
							high-byte; Char 6
						40319	low-byte; Chart 7
							high-byte; Char 8
						40320	low-byte; Chart 9

							high-byte; Char 10 (most right position)
Firmware version			String (10 Chars)	ASCII	Read	40321	low-byte; Char 1 (most left position)
							high-byte, Char 2
						40322	low-byte, Char 3
							high-byte, Char4
						40323	low-byte; Char 5
							high-byte; Char 6
						40324	low-byte; Chart 7
							high-byte; Char 8
						40325	low-byte; Chart 9
							high-byte; Char 10 (most right position)
Sensor serial number			String (30 Chars)	ASCII	Read	40336	low-byte; Char 1 (most left position)
							high-byte, Char 2
						40337	low-byte, Char 3
							high-byte, Char4
						40338	low-byte; Char 5
							high-byte; Char 6
						40339	low-byte; Chart 7

							high-byte; Char 8
						40340	low-byte; Chart 9
							high-byte; Char 10
						40341	low-byte; Char 11
							high-byte; Char 12
						40342	low-byte; Char 13
							high-byte; Char 14
						40343	low-byte; Char 15
							high-byte; Char 16
						40344	low-byte; Chart 17
							high-byte; Char 18
						40345	low-byte; Char 19
							high-byte; Char 20
						40346	low-byte; Char 21
							high-byte; Char 22
						40347	low-byte; Char 23
							high-byte; Char 24
						40348	low-byte; Char 25
							high-byte; Char 26
						40349	low-byte; Char 27
							high-byte; Char 28
						40350	low-byte; Char 29

							high-byte; Char 30 (most right position)
Sensor type number			String (30 Chars)	ASCII	Read	40351	low-byte; Char 1 (most left position)
							high-byte, Char 2
						40352	low-byte, Char 3
							high-byte, Char4
						40353	low-byte; Char 5
							high-byte; Char 6
						40354	low-byte; Chart 7
							high-byte; Char 8
						40355	low-byte; Chart 9
							high-byte; Char 10
						40356	low-byte; Char 11
							high-byte; Char 12
						40357	low-byte; Char 13
							high-byte; Char 14
						40358	low-byte; Char 15
							high-byte; Char 16
						40359	low-byte; Chart 17
							high-byte; Char 18
						40360	low-byte; Char 19

							high-byte; Char 20
						40361	low-byte; Char 21
							high-byte; Char 22
						40362	low-byte; Char 23
							high-byte; Char 24
						40363	low-byte; Char 25
							high-byte; Char 26
						40364	low-byte; Char 27
							high-byte; Char 28
						40365	low-byte; Char 29
							high-byte; Char 30 (most right position)
Sensor tag number			String (30 Chars)	ASCII	Read/Service	40366	low-byte; Char 1 (most left position)
							high-byte, Char 2
						40367	low-byte, Char 3
							high-byte, Char4
						40368	low-byte; Char 5
							high-byte; Char 6
						40369	low-byte; Chart 7
							high-byte; Char 8
						40370	low-byte; Chart 9

							high-byte; Char 10
						40371	low-byte; Char 11
							high-byte; Char 12
						40372	low-byte; Char 13
							high-byte; Char 14
						40373	low-byte; Char 15
							high-byte; Char 16
						40374	low-byte; Chart 17
							high-byte; Char 18
						40375	low-byte; Char 19
							high-byte; Char 20
						40376	low-byte; Char 21
							high-byte; Char 22
						40377	low-byte; Char 23
							high-byte; Char 24
						40378	low-byte; Char 25
							high-byte; Char 26
						40379	low-byte; Char 27
							high-byte; Char 28
						40380	low-byte; Char 29
							high-byte; Char 30 (most right position)

Parameter name	Default (decimal)	Unit	Variable type	Range (decimal)	Access	Modbus Address	Description
40401...40512 Status							
Up time		seconds	DWord	0...4294967295	Read	40401...40402	40401 = low-word 40402 = high-word
Startups		#	DWord	0...4294967295	Read	40403...40404	40403 = low-word 40404 = high-word
Highest proces temperature		°C x 10	SWord	-32767...32767	Read	40421	
# Proces overtemps		#	Word	0...65535	Read	40423	Level determined by register 125
Extended Modbus Start Register	2048	#	Word	0...65535	Read	40511	Contains Start register adress of Extended Modbus array
Extended Modbus Unit Length	16	#	Word	0...65535	Read	50512	Contains Length of 1 unit in Extended modbus Array

Extended Modbus registers							
Parameter name	Default (decimal)	Unit	Variable type	Range (decimal)	Access	Modbus Address	Description
42049...42176 Readings							
Unit 0 Value pointer	0		Word	0...65535	Read	42049	Pointer to AU value (Register)
Unit 0 factor	3		SWord	-32767 ...32767	Read	42050	Factor (3 = AU x 1000)
Unit 0 Offset	0		Word	-32767 ...32767	Read	42051	AU offset value
Unit 0 reserved			Word	0...65536	Read	42052	
Unit 0 reserved			Word	0...65537	Read	42053	
Unit 0 reserved			Word	0...65538	Read	42054	
Unit 0 reserved			Word	0...65539	Read	42055	
Unit 0 reserved			Word	0...65540	Read	42056	
Unit 0 reserved			Word	0...65541	Read	42057	
Unit 0 reserved			Word	0...65542	Read	42058	
Unit 0 reserved			Word	0...65543	Read	42059	
Unit 0 name	UA		ASCII	0...65544	Read	42060	Unitname (Little Endian!)
Unit 0 name			ASCII	0...65545	Read	42061	Unitname (Little Endian!)
Unit 0 name			ASCII	0...65546	Read	42062	Unitname (Little Endian!)
Unit 0 name			ASCII	0...65547	Read	42063	Unitname (Little Endian!)
Unit 0 name			ASCII	0...65548	Read	42064	Unitname (Little Endian!)
Unit 1 Value pointer	5		Word	0...65535	Read	42065	Pointer to EBC value (Register)

Unit 1 factor	0		SWord	-32767 ...32767	Read	42066	Factor (0 = EBC x 1)
Unit 1 Offset	0		Word	-32767 ...32767	Read	42067	EBC offset value
Unit 1 reserved			Word	0...65536	Read	42068	
Unit 1 reserved			Word	0...65537	Read	42069	
Unit 1 reserved			Word	0...65538	Read	42070	
Unit 1 reserved			Word	0...65539	Read	42071	
Unit 1 reserved			Word	0...65540	Read	42072	
Unit 1 reserved			Word	0...65541	Read	42073	
Unit 1 reserved			Word	0...65542	Read	42074	
Unit 1 reserved			Word	0...65543	Read	42075	
Unit 1 name	BE		ASCII	0...65544	Read	42076	Unitname (Little Endian!)
Unit 1 name	C		ASCII	0...65545	Read	42077	Unitname (Little Endian!)
Unit 1 name			ASCII	0...65546	Read	42078	Unitname (Little Endian!)
Unit 1 name			ASCII	0...65547	Read	42079	Unitname (Little Endian!)
Unit 1 name			ASCII	0...65548	Read	42080	Unitname (Little Endian!)
Unit 2 Value pointer	6		Word	0...65535	Read	42081	Pointer to CDU value (Register)
Unit 2 factor	3		SWord	-32767 ...32767	Read	42082	Factor (3 = CDU x 1000)
Unit 2 Offset	0		Word	-32767 ...32767	Read	42083	CDU offset value
Unit 2 reserved			Word	0...65536	Read	42084	
Unit 2 reserved			Word	0...65537	Read	42085	
Unit 2 reserved			Word	0...65538	Read	42086	

Unit 2 reserved			Word	0...65539	Read	42087	
Unit 2 reserved			Word	0...65540	Read	42088	
Unit 2 reserved			Word	0...65541	Read	42089	
Unit 2 reserved			Word	0...65542	Read	42090	
Unit 2 reserved			Word	0...65543	Read	42091	
Unit 2 name	DC		ASCII	0...65544	Read	42092	Unitname (Little Endian!)
Unit 2 name	U		ASCII	0...65545	Read	42093	Unitname (Little Endian!)
Unit 2 name			ASCII	0...65546	Read	42094	Unitname (Little Endian!)
Unit 2 name			ASCII	0...65547	Read	42095	Unitname (Little Endian!)
Unit 2 name			ASCII	0...65548	Read	42096	Unitname (Little Endian!)
Unit 3 Value pointer	1		Word	0...65535	Read	42097	Pointer to OD value (Register)
Unit 3 factor	3		SWord	-32767 ...32767	Read	42098	Factor (3 = OD x 1000)
Unit 3 Offset	0		Word	-32767 ...32767	Read	42099	OD offset value
Unit 3 reserved			Word	0...65536	Read	42100	
Unit 3 reserved			Word	0...65537	Read	42101	
Unit 3 reserved			Word	0...65538	Read	42102	
Unit 3 reserved			Word	0...65539	Read	42103	
Unit 3 reserved			Word	0...65540	Read	42104	
Unit 3 reserved			Word	0...65541	Read	42105	
Unit 3 reserved			Word	0...65542	Read	42106	
Unit 3 reserved			Word	0...65543	Read	42107	

Unit 3 name	DO		ASCII	0...65544	Read	42108	Unitname (Little Endian!)
Unit 3 name			ASCII	0...65545	Read	42109	Unitname (Little Endian!)
Unit 3 name			ASCII	0...65546	Read	42110	Unitname (Little Endian!)
Unit 3 name			ASCII	0...65547	Read	42111	Unitname (Little Endian!)
Unit 3 name			ASCII	0...65548	Read	42112	Unitname (Little Endian!)
Unit 4 Value pointer	9		Word	0...65535	Read	42113	Pointer to TEF value (Register)
Unit 4 factor	-1		SWord	-32767 ...32767	Read	42114	Factor (-1 = TEF x 0,1)
Unit 4 Offset	0		Word	-32767 ...32767	Read	42115	TEF offset value
Unit 4 reserved			Word	0...65536	Read	42116	
Unit 4 reserved			Word	0...65537	Read	42117	
Unit 4 reserved			Word	0...65538	Read	42118	
Unit 4 reserved			Word	0...65539	Read	42119	
Unit 4 reserved			Word	0...65540	Read	42120	
Unit 4 reserved			Word	0...65541	Read	42121	
Unit 4 reserved			Word	0...65542	Read	42122	
Unit 4 reserved			Word	0...65543	Read	42123	
Unit 4 name	ET		ASCII	0...65544	Read	42124	Unitname (Little Endian!)
Unit 4 name	F		ASCII	0...65545	Read	42125	Unitname (Little Endian!)
Unit 4 name			ASCII	0...65546	Read	42126	Unitname (Little Endian!)
Unit 4 name			ASCII	0...65547	Read	42127	Unitname (Little Endian!)
Unit 4 name			ASCII	0...65548	Read	42128	Unitname (Little Endian!)

Unit 5 Value pointer	8		Word	0...65535	Read	42129	Pointer to FAU value (Register)
Unit 5 factor	-1		SWord	-32767 ...32767	Read	42130	Factor (-1 = FAU x 0,1)
Unit 5 Offset	0		Word	-32767 ...32767	Read	42131	FAU offset value
Unit 5 reserved			Word	0...65536	Read	42132	
Unit 5 reserved			Word	0...65537	Read	42133	
Unit 5 reserved			Word	0...65538	Read	42134	
Unit 5 reserved			Word	0...65539	Read	42135	
Unit 5 reserved			Word	0...65540	Read	42136	
Unit 5 reserved			Word	0...65541	Read	42137	
Unit 5 reserved			Word	0...65542	Read	42138	
Unit 5 reserved			Word	0...65543	Read	42139	
Unit 5 name	AF		ASCII	0...65544	Read	42140	Unitname (Little Endian!)
Unit 5 name	U		ASCII	0...65545	Read	42141	Unitname (Little Endian!)
Unit 5 name			ASCII	0...65546	Read	42142	Unitname (Little Endian!)
Unit 5 name			ASCII	0...65547	Read	42143	Unitname (Little Endian!)
Unit 5 name			ASCII	0...65548	Read	42144	Unitname (Little Endian!)
Unit 6 Value pointer	10		Word	0...65535	Read	42145	Pointer to mg/l value (Register)
Unit 6 factor	-1		SWord	-32767 ...32767	Read	42146	Factor (-1 = mg/l x 0,1)
Unit 6 Offset	0		Word	-32767 ...32767	Read	42147	mg/l offset value
Unit 6 reserved			Word	0...65536	Read	42148	
Unit 6 reserved			Word	0...65537	Read	42149	

Unit 6 reserved			Word	0...65538	Read	42150	
Unit 6 reserved			Word	0...65539	Read	42151	
Unit 6 reserved			Word	0...65540	Read	42152	
Unit 6 reserved			Word	0...65541	Read	42153	
Unit 6 reserved			Word	0...65542	Read	42154	
Unit 6 reserved			Word	0...65543	Read	42155	
Unit 6 name	gm		ASCII	0...65544	Read	42156	Unitname (Little Endian!)
Unit 6 name	l/		ASCII	0...65545	Read	42157	Unitname (Little Endian!)
Unit 6 name			ASCII	0...65546	Read	42158	Unitname (Little Endian!)
Unit 6 name			ASCII	0...65547	Read	42159	Unitname (Little Endian!)
Unit 6 name			ASCII	0...65548	Read	42160	Unitname (Little Endian!)
Unit 7 Value pointer	11		Word	0...65535	Read	42161	Pointer to % value
Unit 7 factor	2		SWord	-32767 ...32767	Read	42162	Factor (2 = % x 100)
Unit 7 Offset	0		Word	-32767 ...32767	Read	42163	% offset value
Unit 7 reserved			Word	0...65536	Read	42164	
Unit 7 reserved			Word	0...65537	Read	42165	
Unit 7 reserved			Word	0...65538	Read	42166	
Unit 7 reserved			Word	0...65539	Read	42167	
Unit 7 reserved			Word	0...65540	Read	42168	
Unit 7 reserved			Word	0...65541	Read	42169	
Unit 7 reserved			Word	0...65542	Read	42170	

Unit 7 reserved			Word	0...65543	Read	42171	
Unit 7 name	%		ASCII	0...65544	Read	42172	Unitname (Little Endian!)
Unit 7 name			ASCII	0...65545	Read	42173	Unitname (Little Endian!)
Unit 7 name			ASCII	0...65546	Read	42174	Unitname (Little Endian!)
Unit 7 name			ASCII	0...65547	Read	42175	Unitname (Little Endian!)
Unit 7 name			ASCII	0...65548	Read	42176	Unitname (Little Endian!)

9 Maintenance

9.1 Important maintenance notes

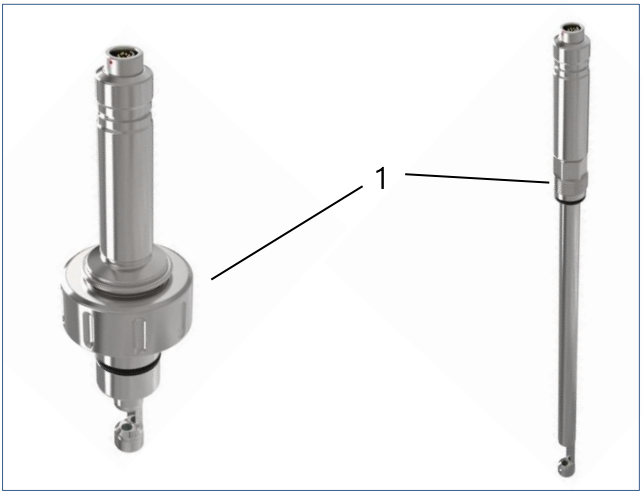
- Service the sensor regularly Prepare a maintenance schedule for the respective process.
- Only trained personnel is allowed to perform maintenance work.
- Always wear appropriate protective clothing when performing maintenance works.
- Only perform maintenance work or repairs described in the operating manual.
- Changes to the design may only be carried out after consulting with the manufacturer.
- Pipes or tanks must be depressurised, empty and clean before you remove the sensor from the process.

9.2 Checking the process connector

The sensor is held and sealed in the connector by the pressure screw (1).

NOTE

Check regularly whether the process connector is sealed. If necessary, tighten the pressure screw (1) or the union nut (1) to 10-20 Nm.



1	Union nut / Pressure screw

Fig. 9: Union nut / pressure screw at the sensor

9.3 Clean the measurement window

Absorption in the process is measured by two measurement windows (sapphire). The measurement value can be distorted by contaminants or deposits.

Clean deposits from the measurement window regularly.

1. Remove the sensor from the process connector.
2. Remove deposits from the windows.
3. Check the measuring window for possible damage.

ATTENTION

Risk of injury due to escaping process liquid!

» Wear safety goggles and protective clothing!

» Check that the tanks or pipe the sensor is being connected to is/are depressurised, empty and clean!

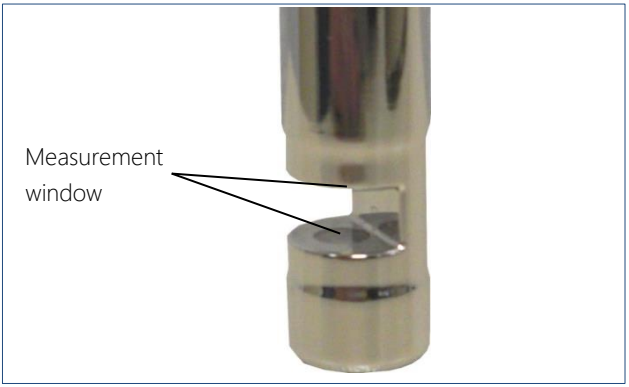


Fig. 10: Measurement window on the sensor

9.4 Autoclaving

- Observe the pressure temperature diagram (→Chapter 3.5)
- Disconnect the sensor from all electronic components
- Protect the LED against the influence of high temperatures and select the autoclaving times as short as possible
- Equip the connector plug with the protection cap.

NOTE

Temperatures above 90 ° C significantly reduce the life of the LED. Protect the LED by de-energising the sensor during sterilisation or autoclaving and keeping process times as short as possible.

9.5 Maintenance plan

Perform the maintenance work at recommended intervals!

Interval	Work
Every three months	Visually check the tightness of the process connector. Tighten the pressure screw to a maximum of 10-20 Nm.
Yearly	Remove the sensor and clean the measurement window.

Adjust the intervals for required maintenance to suit your process conditions.

10 Ordering structure

10.1 EXcell 231 sensor

	Code	Measurement range					
	C	0...6 AU / 0...6600 EBC / 0...12 OD					
	X	Special version					
		Code	Shaft length				
		120	120 mm				
		225	225 mm				
		325	325 mm				
		425	425 mm				
		XXX	Special version				
			Code	Optical path length			
			05	5 mm			
			10	10 mm			
			20	20 mm			
			XX	Special version			
				Code	Process connection		
				PG1	Gewinde PG 13,5		
				XXX	Special version		
					Code	Interface	
					D0	Modbus RTU (RS485)	
					DA	Modbus RTU (RS485) / 4...20 mA	
EXcell 231						Ordercode	

Example: EXcell 231-C-225-10-PG1-D0

10.2 Sensor EXcell 241

	Code	Measurement range					
	C	0...6 AU / 0...6600 EBC / 0...12 OD					
	X	Special version					
		Code	Immersion length				
		070	65 mm + optical path length				
		110	105 mm + optical path length				
		XXX	Special version				
			Code	Optical path length			
			05	5 mm			
			10	10 mm			
			20	20 mm			
			XX	Special version			
				Code	O-Ring position		
				25	25 mm		
				28	28 mm		
				29	29 mm		
				30	30 mm (for standard weld-in socket)		
				35	35 mm		
				50	50 mm		
				55	55 mm		
				XX	Special version		
					Code	Sealing material	
					EPD	EPDM (FDA/USP VI)	
					XXX	Special version	
						Code	Interface
						D0	Modbus RTU (RS485)
						DA	Modbus RTU (RS485) / 4...20 mA
EXcell 241							Ordercode

Example: EXcell 241-C-110-05-30-EPD-D0

11 Spare parts and accessories

EXcell 231 / 241 accessories	Order code
PC EXpert 2.x software on a USB stick (for Windows)	2-120-69-003
Communication interface ECI-01 for PC connection via USB	2-120-69-004
Communication interface ECI-02 Modbus RS485	2-120-58-003
Communication interface ECI-03 0...20mA with display	2-120-69-005
EXcell 231/241 2m connection cable (for ECI-02/03)	2-120-69-001
EXcell 231/241 5m connection cable (for ECI-02/03)	2-120-69-002
EXcell 231/241 2m connection cable (for Lucullus)	2-120-69-006
EXcell 231/241 5m connection cable (for Lucullus)	2-120-69-007
Connection cable ECI-01 to ECI-03	2-120-69-009

Accessories for EXcell 241	Order code
Safety weld-in socket DN25 straight, 40 mm, 1.4404 / 316L	2-087-33-001
Safety weld-in socket DN25 inclined, 40 mm, 1.4404 / 316L	2-087-33-002
Safety bracket SK25 for welding socket DN25 (Ingold)	2-140-33-002

EXcell 231 / 241 certificates	Order code
Certificate EN10204-2.2 for surface-finishing (Ra<0,37 µm)	2-121-01-019
Certificate EN10204-3.1 for materials (media wetted parts)	2-121-01-002
Certificate for elastomer-compound EPDM-FDA / USP VI according to DIN EN 10204-2.2	2-121-01-003
Certificate for factory calibration NIR sensors acc. DIN EN 10204-3.1	2-121-01-022

EXcell 231 / 241 factory inspection	Order code
Factory recalibration for NIR sensors incl. certificate (proof of return)	2-999-00-013

12 Disposal

Please observe the valid rules and regulations concerning disposal in the country and at the place of application.

Disposal

Ensure that the sensor is free from hazardous and toxic substances. Components must be disposed of separately in accordance with their respective materials.

Packaging

The packaging consists of cardboard and can be disposed of with scrap paper. The integrated foam inserts must be removed in advance.

13 Certificates and compliances

All freely available certificates and conformities can be found in their most current form in the "Downloads" section of our website.

To access the following address, enter it into your browser or scan the QR code below. Then select the relevant product and document from the list.

https://e-p-e.com/en/downloads

Depending on the product, additional certificates (e.g. material, surface, etc.) are available. If necessary, please send a corresponding request to Exner Process Equipment GmbH.

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