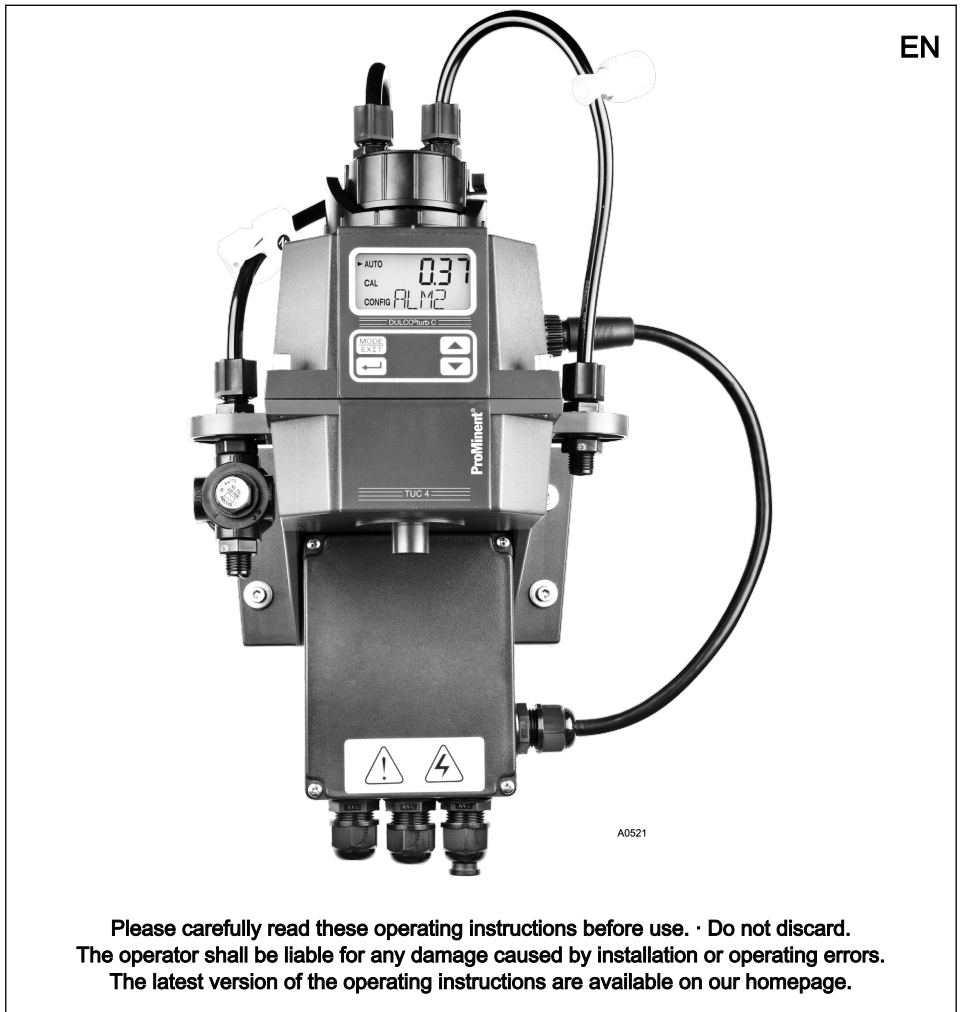


DULCO® turb C Measuring Device for Turbidity

Types: TUC 1, TUC 2, TUC 3, TUC 4



Please carefully read these operating instructions before use. · Do not discard.  
The operator shall be liable for any damage caused by installation or operating errors.  
The latest version of the operating instructions are available on our homepage.

### General non-discriminatory approach

In order to make it easier to read, this document uses the male form in grammatical structures but with an implied neutral sense. It is aimed equally at both men and women. We kindly ask female readers for their understanding in this simplification of the text.

### Supplementary information


 Please read the supplementary information in its entirety.

### Information







*This provides important information relating to the correct operation of the unit or is intended to make your work easier.*

### Warning information

Warning information includes detailed descriptions of the hazardous situation, see  *Chapter 1.1 'Labelling of Warning Information' on page 6.*

The following symbols are used to highlight instructions, links, lists, results and other elements in this document:

### More symbols

Symbol	Description
<b>1.</b> 	Action, step by step.
	Outcome of an action.
	Links to elements or sections of these instructions or other applicable documents.
	List without set order.
<i>[Button]</i>	Display element (e.g. indicators). Operating element (e.g. button, switch).

<b>Symbol</b>	<b>Description</b>
<i>'Display /GUI'</i>	Screen elements (e.g. buttons, assignment of function keys).
CODE	Presentation of software elements and/or texts.

# Table of contents

<b>1</b>	<b>Introduction</b> .....	<b>6</b>
	1.1 Labelling of Warning Information.....	6
	1.2 Users' qualifications.....	8
<b>2</b>	<b>Safety and responsibility</b> .....	<b>10</b>
	2.1 General safety information .....	10
	2.2 Correct and proper use.....	11
<b>3</b>	<b>Functional description / product identification</b> .....	<b>12</b>
	3.1 Scope of delivery.....	15
<b>4</b>	<b>Assembly and Installation</b> .....	<b>16</b>
	4.1 Wall-mounting.....	17
	4.2 Installation (hydraulic).....	20
	4.3 Installation (electrical).....	22
<b>5</b>	<b>Operating diagram</b> .....	<b>27</b>
	5.1 Overview of device /Control elements.....	27
	5.2 Overview of operating structure.....	28
<b>6</b>	<b>Commissioning</b> .....	<b>31</b>
	6.1 Inserting the drying agent.....	32
	6.2 Routine measurement.....	35
	6.3 Access code.....	36
	6.4 Device configuration.....	37
	6.4.1 Selecting the output.....	37
	6.4.2 Configuration of fault current (ERLV).....	39
	6.4.3 Configure alarm .....	40
	6.4.4 OFFSET configuration.....	42
	6.4.5 Extended settings.....	44
<b>7</b>	<b>Operation</b> .....	<b>55</b>
	7.1 Calibrating DULCO® turb C.....	55
	7.1.1 Standard solutions for calibration.....	55
	7.1.2 Perform calibration.....	61
<b>8</b>	<b>Maintenance, troubleshooting and repair</b> .....	<b>68</b>
	8.1 Information about troubleshooting.....	68
	8.1.1 System error messages.....	69

8.1.2	Faults in the process.....	69
<b>9</b>	<b>Spare parts and accessories.....</b>	<b>71</b>
<b>10</b>	<b>Disposal of Used Parts.....</b>	<b>72</b>
<b>11</b>	<b>Declaration of Conformity.....</b>	<b>73</b>
<b>12</b>	<b>Index.....</b>	<b>74</b>

# 1 Introduction

## Data and functions

These operating instructions describe the technical data and functions of the DULCO® turb C Measuring Device for Turbidity.

### 1.1 Labelling of Warning Information

#### Introduction

These operating instructions provide information on the technical data and functions of the product. These operating instructions provide detailed warning information and are provided as clear step-by-step instructions.

The warning information and notes are categorised according to the following scheme. A number of different symbols are used to denote different situations. The symbols shown here serve only as examples.

 **DANGER!****Nature and source of the danger**

Consequence: Fatal or very serious injuries.

Measure to be taken to avoid this danger.

**Description of hazard**

- Denotes an immediate threatening danger. If the situation is disregarded, it will result in fatal or very serious injuries.

 **WARNING!****Nature and source of the danger**

Possible consequence: Fatal or very serious injuries.

Measure to be taken to avoid this danger.

- Denotes a possibly hazardous situation. If the situation is disregarded, it could result in fatal or very serious injuries.

 **CAUTION!****Nature and source of the danger**

Possible consequence: Slight or minor injuries. Material damage.

Measure to be taken to avoid this danger.

- Denotes a possibly hazardous situation. If the situation is disregarded, it could result in slight or minor injuries. May also be used as a warning about material damage.

**!** NOTICE!

**Nature and source of the danger**

Damage to the product or its surroundings.

Measure to be taken to avoid this danger.

- Denotes a possibly damaging situation. If the situation is disregarded, the product or an object in its vicinity could be damaged.

**i** *Type of information*

*Hints on use and additional information.*

*Source of the information. Additional measures.*

- *Denotes hints on use and other useful information. It does not indicate a hazardous or damaging situation.*

### 1.2 Users' qualifications

 **WARNING!**

**Danger of injury with inadequately qualified personnel!**

**The operator of the plant / device is responsible for ensuring that the qualifications are fulfilled.**

If inadequately qualified personnel work on the unit or loiter in the hazard zone of the unit, this could result in dangers that could cause serious injuries and material damage.

- All work on the unit should therefore only be conducted by qualified personnel.
- Unqualified personnel should be kept away from the hazard zone

Training	Definition
Instructed personnel	An instructed person is deemed to be a person who has been instructed and, if required, trained in the tasks assigned to him/her and possible dangers that could result from improper behaviour, as well as having been instructed in the required protective equipment and protective measures.
Trained user	A trained user is a person who fulfils the requirements made of an instructed person and who has also received additional training specific to the system from ProMinent or another authorised distribution partner.
Trained qualified personnel	A qualified employee is deemed to be a person who is able to assess the tasks assigned to him and recognize possible hazards based on his/her training, knowledge and experience, as well as knowledge of pertinent regulations. The assessment of a person's technical training can also be based on several years of work in the relevant field.



<b>Training</b>	<b>Definition</b>
Electrician	<p>Electricians are deemed to be people, who are able to complete work on electrical systems and recognize and avoid possible hazards independently based on his/her technical training and experience, as well as knowledge of pertinent standards and regulations.</p> <p>Electricians should be specifically trained for the working environment in which they are employed and know the relevant standards and regulations.</p> <p>Electricians must comply with the provisions of the applicable statutory directives on accident prevention.</p>
Customer Service department	Customer Service department refers to service technicians, who have received proven training and have been authorised by ProMinent to work on the system.

***Note for the system operator***

*The pertinent accident prevention regulations, as well as all other generally acknowledged safety regulations, must be adhered to!*

## 2 Safety and responsibility

### 2.1 General safety information



#### **WARNING!**

##### **Live parts!**

Possible consequence: Fatal or very serious injuries

- Measure: Disconnect the mains power supply prior to opening the housing
- Disconnect damaged, defective or manipulated devices from the power supply



#### **WARNING!**

##### **Unauthorised access!**

Possible consequence: Fatal or very serious injuries.

- Measure: Ensure that there can be no unauthorised access to the unit



#### **WARNING!**

##### **Operating errors!**

Possible consequence: Fatal or very serious injuries.

- The unit should only be operated by adequately qualified and technically expert personnel
- Please also observe the operating instructions for controllers and fittings and any other component groups, such as sensors, sample water pumps ...
- The operator is responsible for ensuring that personnel are qualified



#### **CAUTION!**

##### **Electronic malfunctions**

Possible consequence: Material damage right through to destruction of the unit

- The mains connection cable and data cable should not be laid together with cables that are prone to interference
- Measure: Take appropriate interference suppression measures

**!** NOTICE!

**Correct and proper use**

Damage to the product or its surroundings

- The unit is not intended to measure or regulate gaseous or solid media
- The unit may only be used in accordance with the technical details and specifications provided in these operating instructions and in the operating instructions for the individual components

**!** NOTICE!

**Correct sensor operation**

Damage to the product or its surroundings

- Correct measuring and control is only possible if the sensor is working perfectly
- Check and calibrate the sensor regularly

## 2.2 Correct and proper use

**!** NOTICE!

**Correct and proper use**

The device is designed to measure the turbidity of water.

The unit may only be used in accordance with the technical details and specifications provided in this operating manual and in the operating manuals for the individual components (such as, for example, controllers, sensors, fittings, calibration devices, metering pumps, etc.).

Any other uses or modifications are prohibited.

### 3 Functional description / product identification

#### Brief description of the function

The DULCO® turb C has been developed for the online measurement of turbid matter in untreated water, process water and treated process water in drinking water abstraction.

The DULCO® turb C product line consists of four types of device:

Types TUC 1 and TUC 3 work with infrared light and fulfil the requirements of the international standards ISO 7027 and DIN EN 27027.

Types TUC 2 and TUC 4 work with achromatic light and fulfil USA standard US EPA 180.1.

All device types can be equipped with ultrasonic cleaning (TUC 3 / TUC 4) or without ultrasonic cleaning (TUC 1 / TUC 2). The sample cell ultrasonic cleaning system extends the calibration and maintenance intervals in media where coating formation is common.

DULCO® turb C	Part number	ISO 7027 DIN EN 27027	US EPA 180.1	Ultrasonic cleaning
TUC 1	1037696	Infrared light		No
TUC 2	1037695		Achromatic light	No
TUC 3	1037698	Infrared light		Yes
TUC 4	1037697		Achromatic light	Yes

An inlet side pressure regulating valve is standard. The DULCO turb C pressure regulating valve reduces the pressure from up to 13.8 bar (200 PSI) to 1.0 bar (15 PSI).

**Specifications**

Measuring range	0 – 1000.0 NTU
Accuracy limit	± 2% of the displayed value or ± 0.02 NTU under 40 NTU, depending on which value is the greater. ± 5% of the displayed value above 40 NTU
Resolution	0.0001 NTU below 10 NTU
Response time	Configurable
Display	Multiple row LCD display with backlighting
Alarm	Two programmable alarms, 120 - 240 VAC, 2 A Form C relay
Analogue output	4 ... 20 mA, 600 Ω
Interface	Bi-directional RS-485, Modbus
Max. water pressure	Integrated pressure regulating valve regulates 1380 kPa (200 PSI). In relation to the flow rate
Flow rate	6 l/h ... 60 l/h
Operating temperature	1 °C ... 50 °C
Materials that come into contact with the media	Polyamide (PA), silicone, polypropylene (PP), stainless steel, borosilicate glass
Power supply	100 – 240 VAC, 47 – 63 Hz, 80VA
Galvanic isolation	Dual insulation, degree of interference overvoltage category II
Ambient conditions	Not suitable for operation outdoors. Operating altitude maximum 2000 m (m above sea level). Maximum 95 % relative humidity (non-condensing).
Degree of protection	IP 66
Complies with the following standards	ISO 7027 and DIN EN 27027 for versions TUC 1 and TUC 3 (infrared light); US EPA 180.1 for versions TUC 2 and TUC 4 (achromatic light)

---

## Functional description / product identification

---

Dimensions:	Space requirements: 35 cm x 30 cm x 30 cm (height/width/depth)
Shipping weight	approx. 2.5 kg

### Optional: ultrasonic cleaning (TUC 3 / TUC 4)

The '*ultrasonic cleaning*' option is used for continuous cleaning of the cuvette. It serves neither to clean previously soiled sample chambers, nor can it replace manual cleaning. However, the cleaning intervals for manual cleaning can be significantly extended by the use of this system. A cuvette with an '*ultrasonic transducer*' is required for operation. The system emits an ultrasonic frequency via a spring to a piezoelectric transducer, which is connected to the base of the flow-through cuvette. The cuvette recognition system only functions in *[AUTO]* operating mode.

The system can detect the following fault states:

- Incorrect cuvette installed
- Error occurred in transducer
- Transducer has no contact to the spring

If an error occurs, the message *[CLN]* appears in the lower part of the LCD display. An alarm is triggered and 2 mA is applied to the current output.

The alarm relay is activated if the alarm function in *[ALM1/ALM2]* is set to *[ERROR]*

The 4 ... 20 mA output is set to 0, 2, 4, mA if the *[error level]* *[ERLV]* has been set to the appropriate mA level (0, 2, 4 mA).

### Interface RS-485

The DULCO® turb C is able to offer basic communication functions using simple programs such as e.g.

*[Hilgraeve HyperTerminal]* (included in most *[Microsoft Windows software]* packages). *[Visual Basic]* or other programs can also be used.

### 3.1 Scope of delivery



#### **Drying agent package**

*A drying agent package is included in the DULCO® turb C delivery. Do not mistake this for packaging material. Do not throw the drying agent away.*



#### **Packaging material**

*Dispose of packaging material in an environmentally responsible way. All packaging components carry the corresponding recycling code ♻️.*

The following parts are delivered as standard with the DULCO® turb C:

Description	Quantity
DULCO® turb C with terminal box and integrated flow assembly	1
Operating Instructions	1
Drying agent package	1
Cuvette	1
Hose kit:	1
■ Shut-off clamp (1 piece)	
■ Back pressure valve (1 piece)	
■ Connection hoses with connection pieces for pressure regulating valves (2 pieces)	
■ Vent screw (used in pressurised systems) (1 piece)	


Remove the DULCO® turb C from the packaging box. Carefully check the components. Ensure that no visible damage has been caused during shipping. If the components supplied fail to comply with the order, please contact your local distributor or the ProMinent customer services department immediately.

### 4 Assembly and Installation

#### **!** NOTICE!

##### **Drying agent**

Possible malfunctioning of DULCO® turb C due to moisture in the device.

Install the drying agent bag before initial commissioning, see  *Chapter 6.1 'Inserting the drying agent' on page 32*

#### **!** NOTICE!

##### **Installation site and conditions**

- The installation (electrical) may only take place after mounting (mechanical)
- Ensure that there is unimpeded access for operation
- Ensure for secure and vibration-free fastening.
- Avoid direct sunlight
- Permissible ambient temperature of the DULCO® turb C at installation site: 1 ... 50 °C at max. 95% relative air humidity (non-condensing)
- Consider the permissible ambient temperature and the connected components


#### **i** **Read-off and operating position**

- *Install the device in a position where it can be read and operated easily (at eye level if possible)*

#### **i** **Mounting position**

- *Leave sufficient free space for the cables and necessary work*

#### **i** **Packaging material**

*Dispose of packaging material in an environmentally responsible way. All packaging components carry the corresponding recycling code .*



## 4.1 Wall-mounting

### Installation (mechanical)

**!** NOTICE!

**Distance to the sampling site**

Install the DULCO® turb C no further than 3 metres away from the sampling site. This is the only way to ensure a quick response time from the system.



***Free space above the sensor***

*Leave at least 200 mm clearance above the DULCO® turb C for carrying out any work required on the DULCO® turb C.*

*Fasten the DULCO® turb C using four M6 screws and the terminal box using two M4 screws.*

## Assembly and Installation

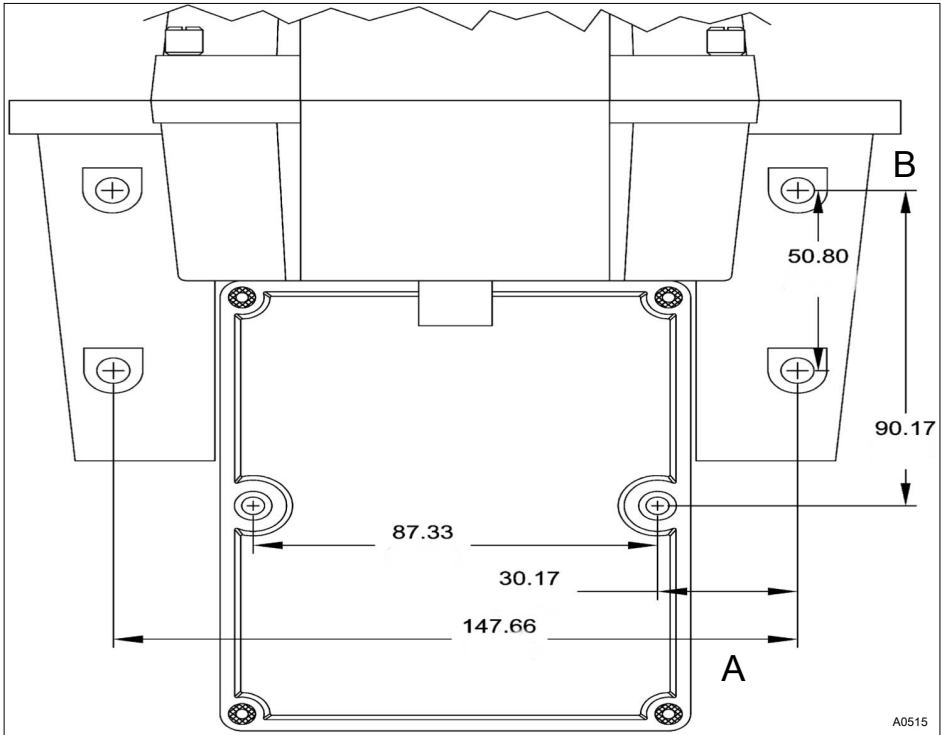


Fig. 1: The diagram is not to scale. It is for information only. All values given in millimetres.

A Terminal box

B DULCO® turb C housing

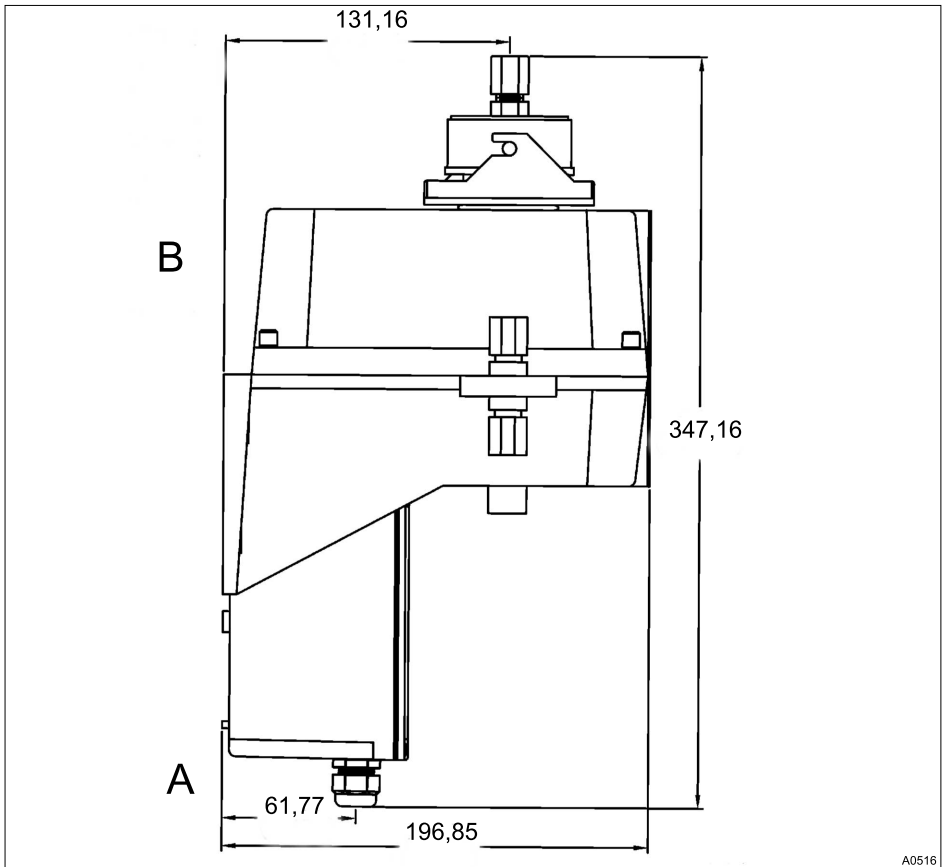


Fig. 2: The diagram is not to scale. It is for information only. All values given in millimetres.

A Terminal box

B DULCO® turb C housing

1. ➤ Fasten the terminal box (A) to the wall with two M4 screws
2. ➤ Fasten the DULCO® turb C housing (B) to the wall above the terminal box using four M6 screws

### 4.2 Installation (hydraulic)

#### CAUTION!

##### Free flow at outlet

Direct any sample water that has flowed through the DULCO® turb C into a free outlet. The sampled water may not be fed back into the process.

#### CAUTION!

##### Algae growth under the influence of light

Possible algae growth if unsuitable hoses are used.

Do not use transparent hoses if the installation is subjected to powerful sources of light. This prevents the formation of algae in the installation.

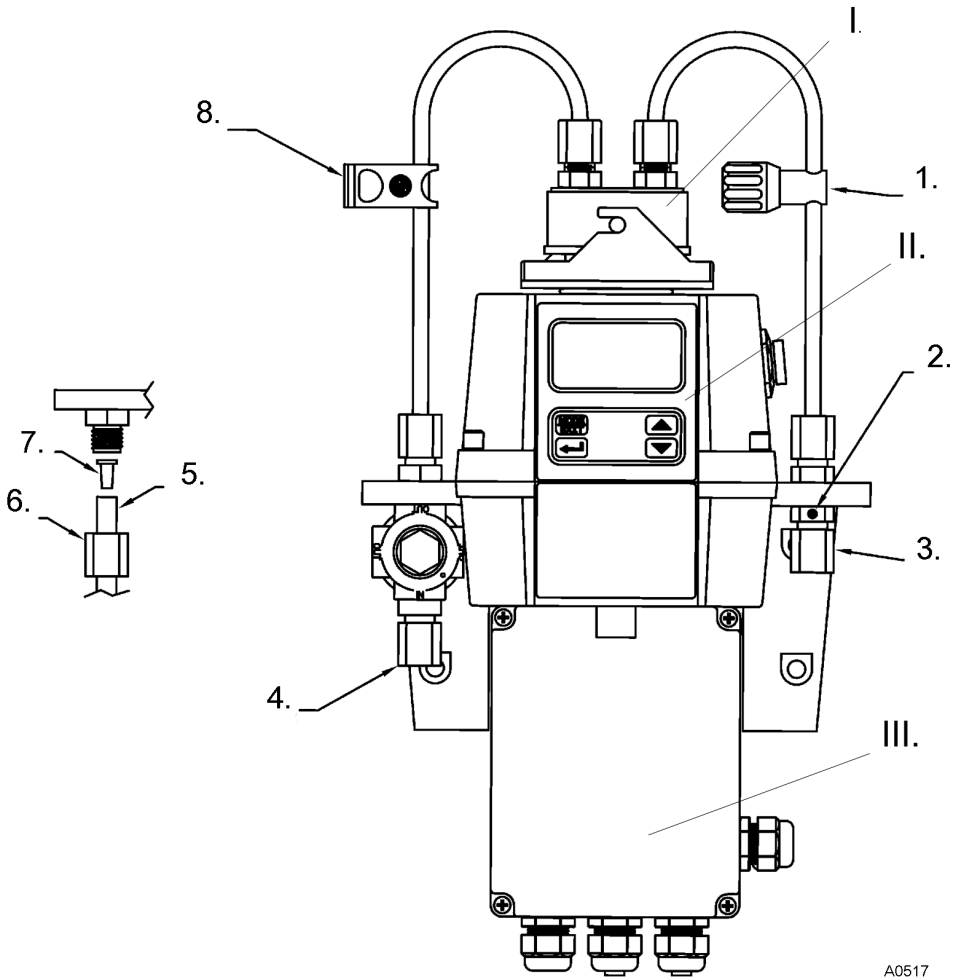
#### **Leakage on the vent screw**

*Slight leakage may occur at the bore hole for the vent screw during the installation process. This will cease as soon as normal flow is established.*

*In the event that the installation continues to leak permanently at this point due to the high pressure in this area, we recommend sealing off the bore hole with the sealing plug supplied. In order to ensure free drainage, a bleed option must be installed at another area of the outlet in order to avoid overpressure or underpressure in the system.*

#### **Permissible operating parameters**

- Maximum liquid temperature 50 °C
- Maximum pressure 13.8 bar
- Flow rate 6 ... 60 l/h



A0517

Fig. 3: Recommended cabling for the DULCO® turb C

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>I. Flow unit</li> <li>II. Sensor unit with operating unit</li> <li>III. Terminal box</li> </ul> | <ul style="list-style-type: none"> <li>1. Back pressure valve. To regulate the flow and in order to remove small air bubbles</li> <li>2. Vent screw. For use on pressurised systems. Not used for pressureless systems</li> <li>3. Hose connector. 4.75 mm interior diameter, 8 mm external diameter. Hose connection for free sample water outlet</li> </ul> |
|--|---|

4. Hose connector. 4.75 mm interior diameter, 8 mm external diameter.  
Hose connection to the sampling site

5. Detail: Hose

### 4.3 Installation (electrical)

6. Detail: Union nut hose connection  
7. Detail: Replacement hose connection  
8. Shut-off clamp. To shut-off the inlet in an emergency or for necessary work



#### **WARNING!**

##### **Live parts!**

Possible consequence: Fatal or very serious injuries

- Measure: Disconnect the power supply before opening the housing
- Disconnect damaged, defective or manipulated devices from the power supply
- The provision of a suitable isolating device (emergency-off switch, etc.) is the responsibility of the plant operator



#### **NOTICE!**

Do not route any RS-485 cables in the same cable duct as the power supply cable. This may result in major anomalies.



*The signal leads of the DULCO® turb C may not be routed alongside faulty cabling. Faults could lead to malfunctions in the DULCO® turb C.*



### **RS-485**

*The RS-485 digital interface (2 leads / half duplex) is characterised by a very high tolerance to electromagnetic interference due to the symmetrical signal transmission. This means that cable lengths of up to 900m can be used. The final device on a bus must be equipped with a 120 ohm resistor, in order to avoid signal overlapping.*

*In order to avoid damage, only separate and connect the RS-485 cable if the DULCO® turb C is switched off.*

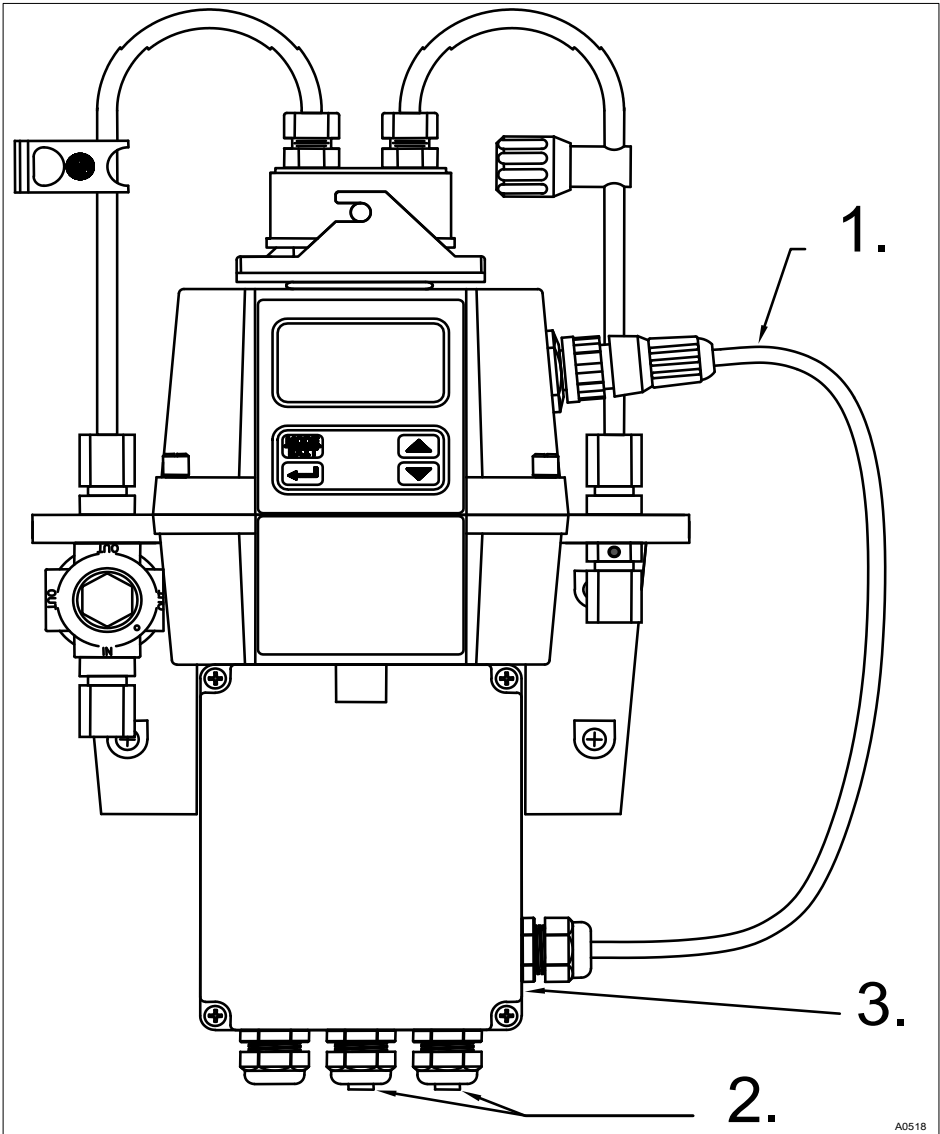


Fig. 4: Cable assignment for DULCO® turb C

- 1. Sensor cable
- 2. Liquid-tight threaded connection
- 3. Terminal box



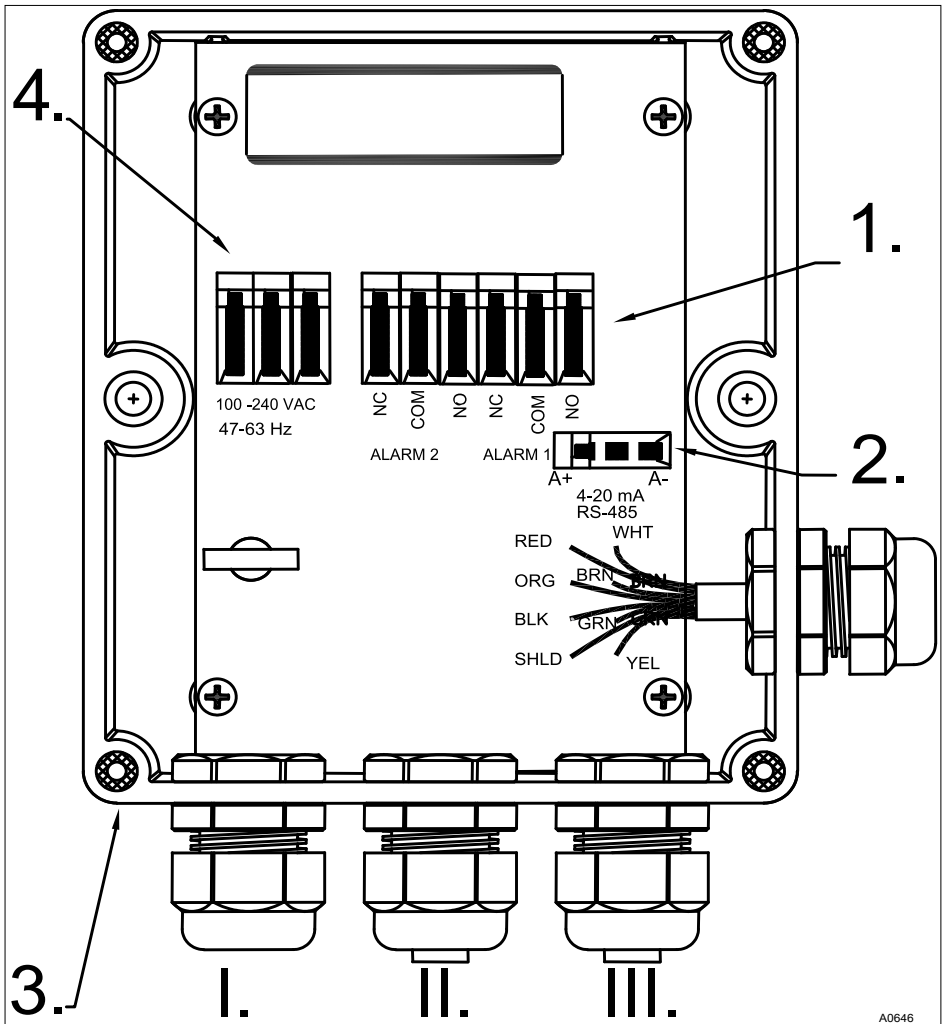


Fig. 5: Cable assignment at DULCO® turb C terminal box

- |   |  |
|---|--|
| I. Power cable threaded connection (supplied without power cable)   | 2. Terminal 4-20 mA / RS 485 (0.25 - 1.5 mm <sup>2</sup> ) |
| II. Alarm cable threaded connection                                 | 3. Terminal box  |
| III. Sensor cable threaded connection                               | 4. Terminal power cable (0.25 - 1.5 mm <sup>2</sup> )      |
| 1. Terminal Alarm 1 and 2 (0.25 - 1.5 mm <sup>2</sup> ) maximum 2 A |  |



*All terminals in the terminal box are labelled and are self-explanatory.*

*All cable bushings are equipped with blanks on shipping. These must be removed as required.*

*Strip the Insulation on all cables to a length of 6 mm.*

*Equip all cables with strain relief.*

*Supply voltage: 100 - 240 VAC at 47 - 63 Hz*

1. ➤ Release the four housing screws from the corners of the terminal box.
2. ➤ Lift off the terminal box cover.
3. ➤ Remove the blanks from the required bore holes
4. ➤ Guide the cables into the threaded connectors
5. ➤ Connect the cables with the designated terminals.
6. ➤ Tighten the clamping nuts of the threaded connections so that they are properly sealed
7. ➤ Place the terminal box cover back onto the terminal box
8. ➤ Manually tighten the housing screws
9. ➤ Once again check the seating of the seals and threaded connections. Protection class IP 66 is only achieved if the control panel mounting is correct

## 5 Operating diagram

### 5.1 Overview of device /Control elements

- **Users' qualification:** Instructed person, see ↗ Chapter 1.2 'Users' qualifications' on page 8

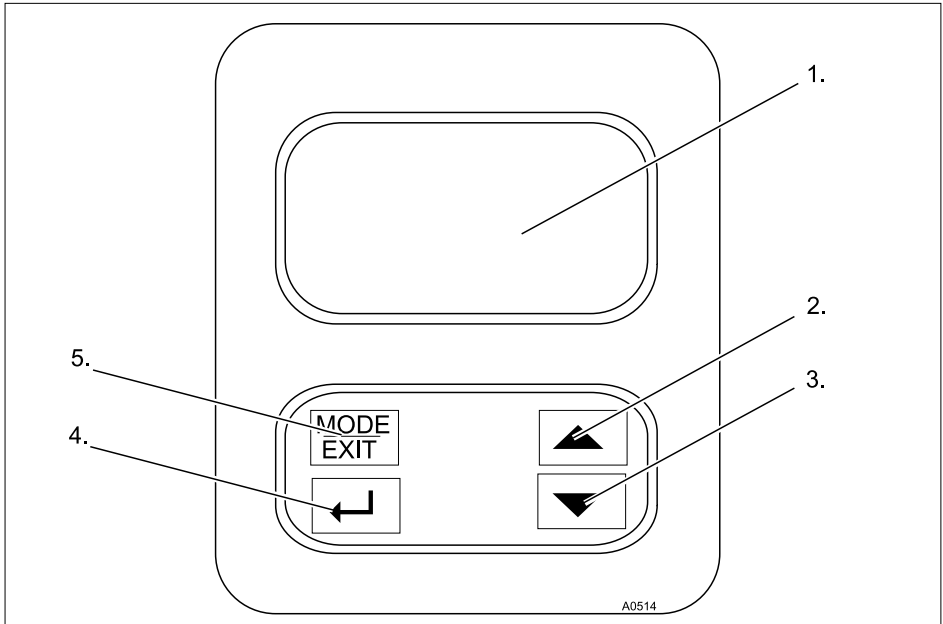


Fig. 6: Overview of device /Control elements

1. LCD display
2. UP key
3. DOWN key
4. ENTER button
5. MODE/EXIT button

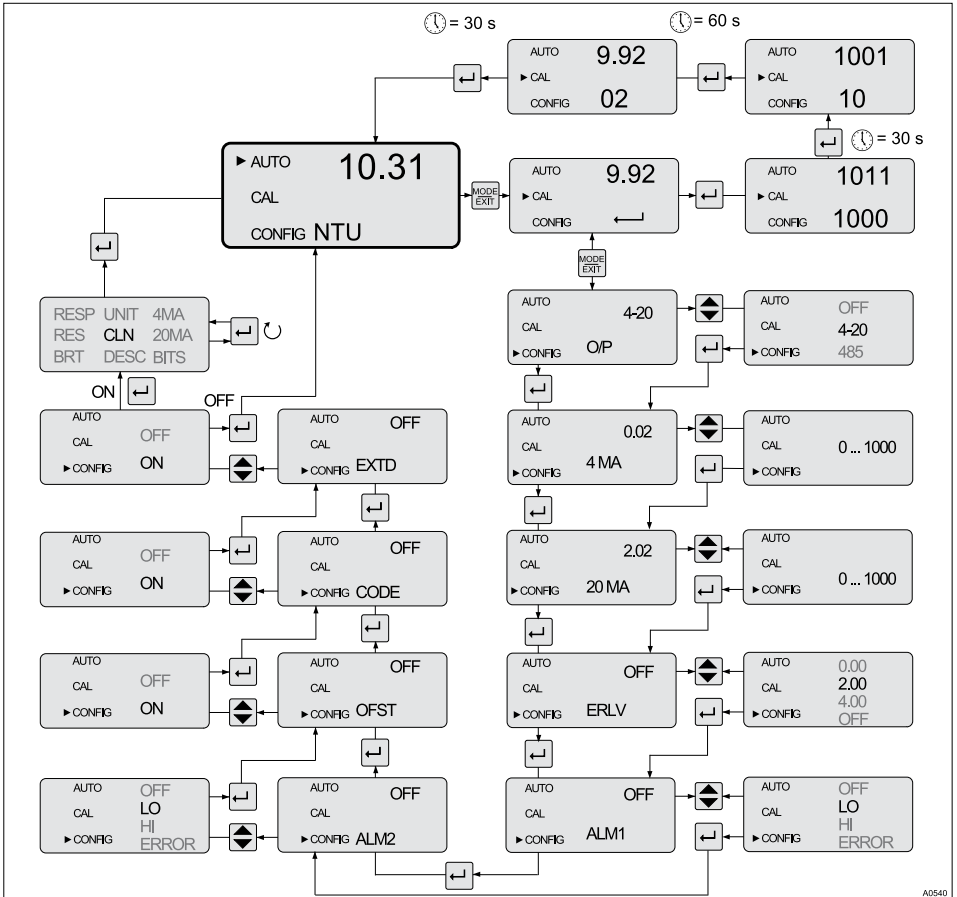
Function	Description
LCD display	The parameters of the respective mode are shown on the LCD display.
UP key	To increase a displayed number

Function	Description
DOWN key	To decrease a displayed number
ENTER button	To apply, confirm or save a displayed value or status or
MODE/EXIT button	In order to call-up and select the three optional modes <i>[CAL]</i> , <i>[CONFIG]</i> and <i>[AUTO]</i> (measurement)

## 5.2 Overview of operating structure

The sensor is equipped with three modes, which can be selected by means of the MODE/EXIT button:

- *[AUTO mode]*: Standard mode, display of the current measured values
- *[CAL]*: Calibration mode for executing the calibration process
- *[CONFIG]*: Configuration mode for configuring customer-specific settings. Automatic switchover into the mode *[AUTO mode]* if no entry undertaken within 15 minutes



A0540

Fig. 7: Overview of operating structure

### Configuration menu

The configuration menu is subdivided into several submenus, in order to facilitate configuration.

The following submenus are available:

- Select the output *[O/P]*
- Configuration of 4 ... 20 mA interface *[ERLV]*
- Configuration of the alarm *[ALM1 / ALM2]*
- Configuration of the offset *[OFST]*
- Configuration of access protection *[CODE]*
- Extended settings *[EXTD]*

The procedure for configuring the menu settings is described here ↪ *Chapter 6.4 'Device configuration' on page 37*.

The extended settings are grouped together in order to prevent accidental alteration.

- Speed of response *[RESP]*
- Screen resolution *[RES]*
- LCD illumination brightness *[BRT]*
- Displayed units *[UNIT]*
- Ultrasonic cleaning *[CLN]*
- RS-485 parameters *[BITS]*
- Drying agent alarm *[DESC]*

The procedure for configuring the extended settings is described here ↪ *Chapter 6.4.5 'Extended settings' on page 44*.

## 6 Commissioning

### Unit NTU (optionally FNU)

The NTU (**N**ephelometric **T**urbidity **U**nit) is a unit used for measuring turbidity in liquids. Alternatively, the measured value may be displayed in FNU (**F**ormazine **N**ephelometric **U**nit), see [↗ 'Units' on page 48](#). The calculation is undertaken 1:1.

Measured values above 1000 NTU fall outside the measuring range of this DULCO® turb C. Measured values above 1100 NTU cause the display to flash and issue a message indicating that the measured value is too high.

During normal operation of the DULCO® turb C an arrow is positioned next to *[AUTO]*. In this state, the lower row indicates the unit of measurement and the upper row shows the current measured value.

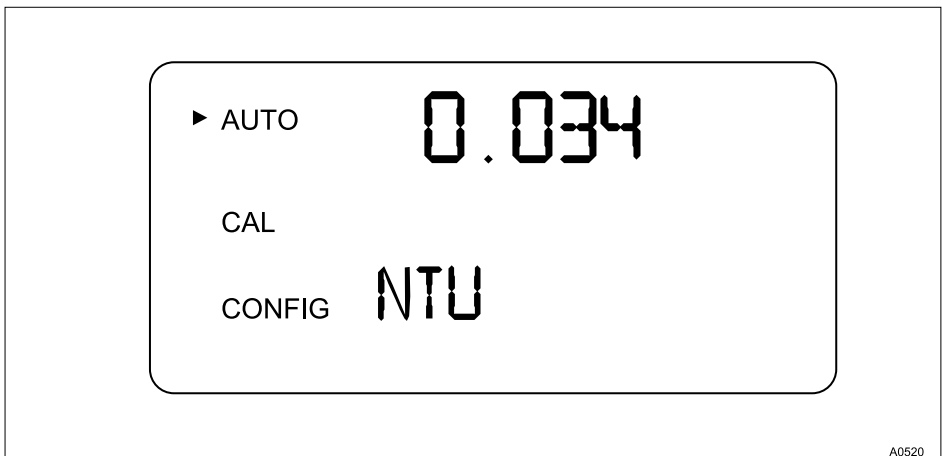


Fig. 8: Display in automatic mode

### 6.1 Inserting the drying agent



#### **Remove transport mounting**

*The transport mounting must be removed before initial insertion of the drying agent bag. This pipe can be subsequently disposed of.*

The DULCO® turb C is equipped with a dehumidifying device. A drying agent bag in the DULCO® turb C dries the air. The thermal discharge from the sensor is used to heat the air. A fan mounted in the inner part of the DULCO® turb C circulates the warm air around the optical sleeve and cuvette. DULCO® turb C continuously monitors the state of the drying agent bag. As soon as the drying agent needs to be exchanged, this is indicated in the lower row of the LCD display; Warning [DESC] (for [Desiccant] = drying agent). Replacement drying agent bags can be obtained from Prominent or from your local representative.

Saturated drying agent can cause an alarm to be triggered, in order to indicate the requirement for exchange. Refer to 'Drying agent alarm' on page 51



#### **NOTICE!**

##### **Seal sensor housing**

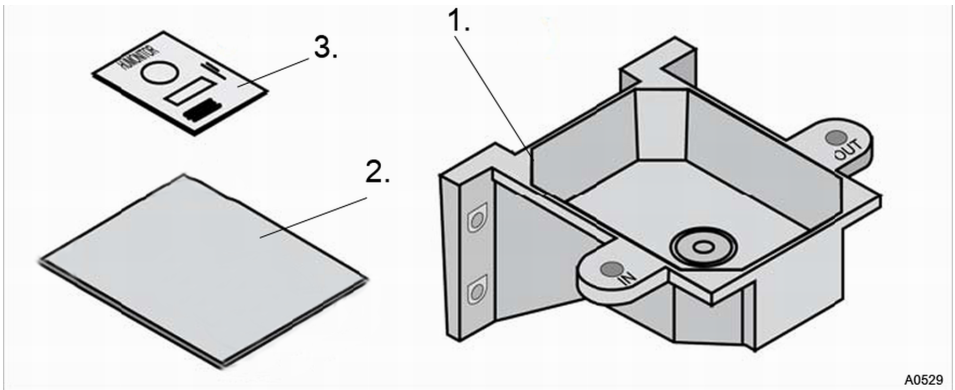
Possibility of premature drying agent saturation.

A damaged seal can lead to premature saturation of the drying agent.

Check the seal every time the drying agent is exchanged. Correct the seal seating or exchange the seal if necessary.

1. Release the screws from the corners of the housing and remove the upper part of the DULCO® turb C





A0529

Fig. 9: Inserting the drying agent

2. ➤ Insert the drying agent immediately after opening the packaging, in order to avoid premature saturation.  
Remove the new drying agent bag (2) from the packaging and place it together with the humidity indicator card (3) in the lower part of the DULCO® turb C (1). In doing so, place the humidity indicator card (3) on the new drying agent bag (2).
3. ➤ Place the upper part on the lower part and tighten the four screws hand-tight.

- ⇒ The DULCO® turb C must be reset in order to enable detection of the new drying agent. To do this, remove the sensor connection cable for 2 seconds from the DULCO® turb C and then reconnect it. Otherwise, the warning [DESC] may appear on the LCD display.

# IMPORTANT DESICCANT USE

Proper use of the factory supplied desiccant is essential to maintain optimal performance of this instrument and maximize maintenance intervals.

If a non-factory supplied desiccant is selected, use a 4-6 oz. pouch of molecular sieve desiccant. **Do not** use silica gel, it is not sufficiently effective

A0648

*Fig. 10: Insert sheet in drying agent bag packaging*

Always use the original packaging. If you do not have any of the original drying agent, use 113 ... 170 grammes zeolite-based drying agent (molecular sieve) of similar quality (3 Å pore width). Silica gel and other chemical drying agents may not be used.

## **6.2 Routine measurement**

Routine measurement: The turbidity can be correctly measured approx. 45 - 60 minutes after beginning measurement / commissioning (warm-up phase).

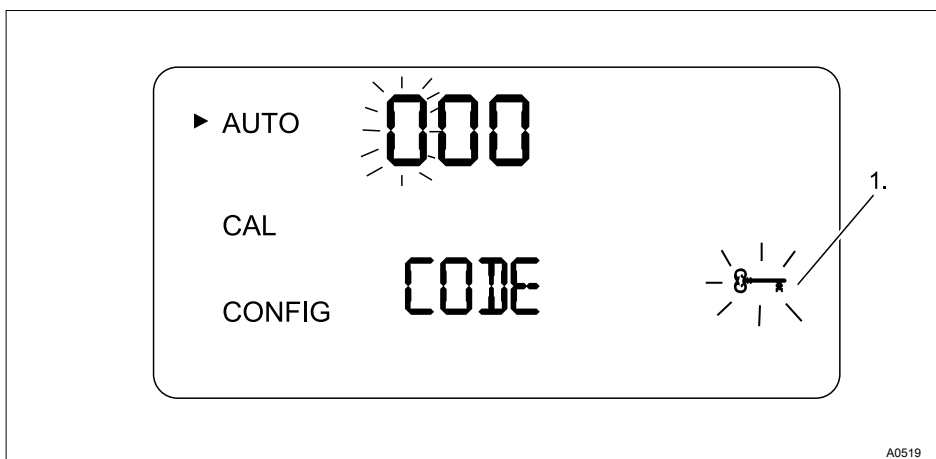
When a continuous process water flow is passing through the DULCO® turb C, the DULCO® turb C indicates the measured turbidity level of the sample on the LCD display. In addition, a 4-20 mA signal or a digital signal is given, depending on the selected option.

### 6.3 Access code



*The access code cannot be changed.*

You can activate the access code for the DULCO® turb C in the configuration menu. If the access code has been activated, a 'Key' symbol (1) is shown in the lower right-hand section of the LCD display, when the **[MODE/EXIT]** button is operated.



*Fig. 11: Access code*

When one of the access code numbers is flashing, you can change the number with the UP or DOWN button and confirm with the ENTER button.

#### Entering the access code

The access code (333) must be entered in order to access the 'CAL' or 'CONFIG' menus.

1. ➤ The first number of the access code flashes. Select the correct number with the UP or DOWN button and then press ENTER  
⇒ The second number of the access code flashes.
2. ➤ Select the correct number with the UP or DOWN button and then press ENTER  
⇒ The third number of the access code flashes.
3. ➤ Select the correct number with the UP or DOWN button and then press ENTER

- ⇒ If you have selected the valid access code, you will now have access to the DULCO® turb C's calibration mode. If the access code is incorrect, the DULCO® turb C returns to AUTO mode.

## 6.4 Device configuration

### 6.4.1 Selecting the output

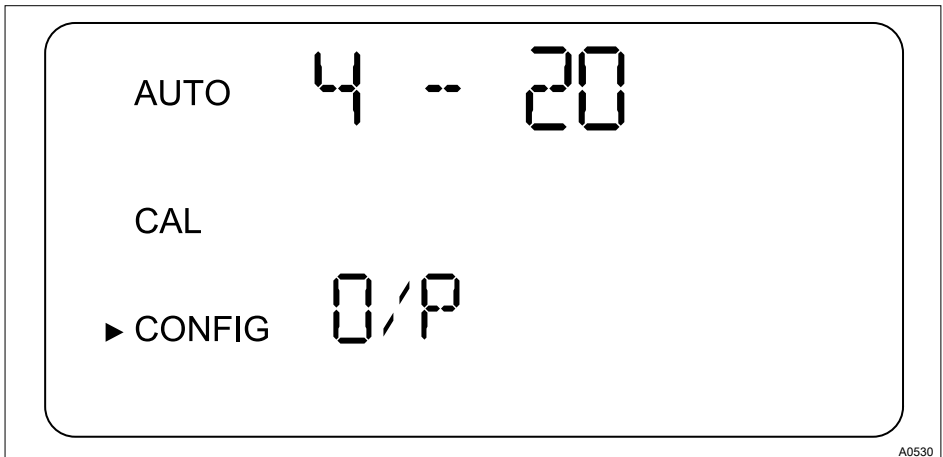


Fig. 12: Selecting the output

Function	Options	Info
Output (O/P)	<ul style="list-style-type: none"> <li>■ 4 - 20 mA</li> <li>■ 485</li> <li>■ off</li> </ul>	
4 - 20 mA		
Value 4 mA	0 ... 1000 NTU	Selection of the lower turbidity limit value (LOLM)*, which corresponds to the output value 4 mA.

## Commissioning

Function	Options	Info
Value 20 mA	0 ... 1000 NTU	Selection of the upper turbidity limit value (UPLM)**, which corresponds to the output value 20 mA.
<p>* = a higher NTU value can be entered than for 'value 20 mA', in order to reverse the sign of the output current</p> <p>** = a lower NTU value can be entered than for 'value 4 mA', in order to reverse the sign of the output current</p>		
485		
Baud	Value baud <ul style="list-style-type: none"><li>■ 1200</li><li>■ 2400</li><li>■ 4800</li><li>■ 9600</li><li>■ 19200</li></ul>	Selection of the baud rate for the I/O interface
Addr	1 ... 255	Selection of the device address
MBUS	ASCII RTU	Selection ASCII or RTU

### 6.4.2 Configuration of fault current (ERLV)

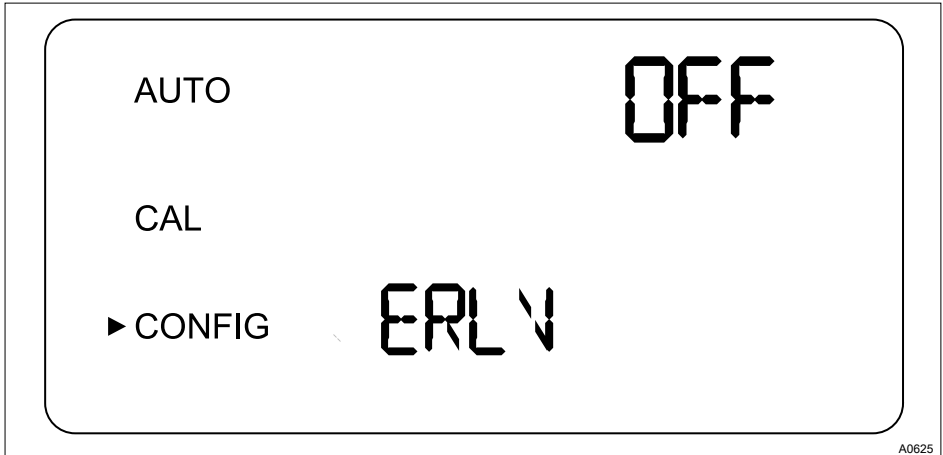


Fig. 13: Configuration of fault current (ERLV)

The 4-20 mA signal output can be utilized in the event of a system error on the DULCO® turb C in order to indicate the problem by activating the *[ERLV ON]* function. In doing so, fault currents of 4.00 mA, 2.00 mA or 0 mA can be selected. In the event of an error, the configured current value is output to the controller, regardless of which measured value is pending. If the function is switched off by setting *[OFF]* then the 4-20 mA signal output remains unaffected by fault conditions.

Select the desired fault current by pressing the buttons ▲ and ▼ and then press the ↵, in order to store the selected setting.

Function	Options	Info
Error Level (ERLV)	OFF 0 mA 2 mA 4 mA	

### 6.4.3 Configure alarm

The DULCO® turb C is equipped with two independently programmable alarm relays. Three items of information have to be entered in order to fully configure the alarms:

- Alarm function: HI, LO, OFF or ERROR
- Alarm limit value (limit value at which the alarm becomes active)
- Alarm delay time (how long the limit value must be exceeded before the alarm is activated and the period of time before the alarm is reset)

#### Alarm function



#### ***Alarm triggering in the event of an internal system error***

*The relay produces an alarm in the event of an internal system error, regardless of the configured turbidity values.*

You can either deactivate the alarm (OFF) or program it so that it works in accordance with one of the following modes:

- Alarm HI: The relay triggers the alarm in the event that the turbidity value exceeds the programmed alarm value for at least the specified period of time
- Alarm LO: The relay triggers the alarm in the event that the turbidity value drops below the programmed alarm value for at least the specified period of time
- Alarm ERROR: The relay triggers the alarm when an internal system error occurs

#### Limit value alarm

The turbidity threshold at which the alarm is triggered is referred to as the '*Limit value alarm*'. You can configure the limit value across the entire display range of the device in steps of 0.01 NTU.

#### Delay period alarm

The alarm delay times prevent the alarm from being triggered in the event that the turbidity briefly exceeds or drops below the threshold value. The delay function works as follows:

- Delay time '*Alarm on*': The turbidity must exceed the '*Limit value alarm*' for at least the number of seconds set here before the alarm is activated. If the time of the '*Delay alarm on*' is set to 5 seconds and the turbidity exceeds the '*Limit value alarm*' for only 4 seconds, the alarm will not be activated. However, if the turbidity exceeds the '*Limit value*' for 5 seconds or longer, the sensor triggers an alarm.
- Delay time '*Alarm off*': The turbidity must remain under the '*Limit value alarm*' for at least the number of seconds set here before the alarm is deactivated. If the time of the '*Delay alarm off*' has been set to 5 seconds and the turbidity remains under the '*Limit value alarm*' for only 4 seconds, the alarm will not be deactivated. As soon as the turbidity remains below the '*Limit value alarm*' for at least 5 seconds, the sensor deactivates the alarm.



Menu Alarm

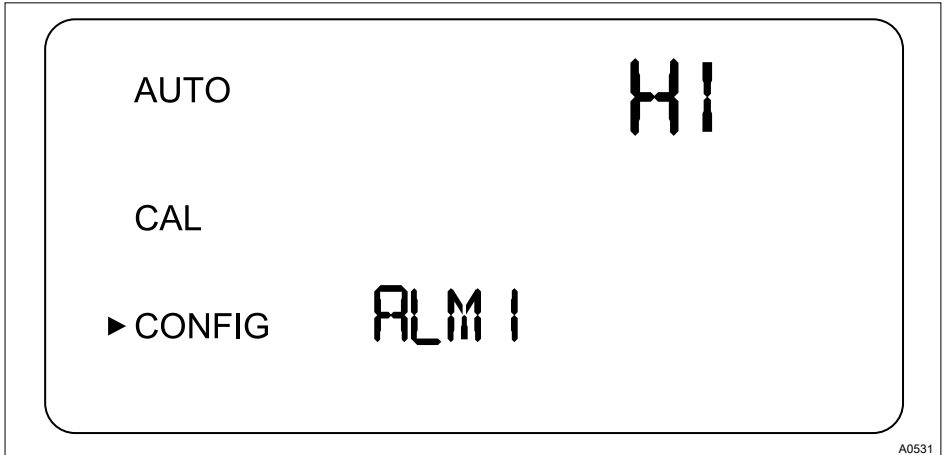


Fig. 14: Menu Alarm

Operation	Options	Info
Alarm 1 (ALM1) or Alarm 2 (ALM2)	<ul style="list-style-type: none"> <li>■ HI</li> <li>■ LO</li> <li>■ OFF</li> <li>■ ERROR</li> </ul>	Select the alarm function
Limit value (S/P)	0 ... 1000 NTU	Set the 'Limit value alarm'
Delay time alarm on (DLY▲)	1 ... 30 s	Set the number of seconds for the 'Delay alarm on' function.
Delay time alarm off (DLY▼)	1 ... 30 s	Set the number of seconds for the 'Delay alarm off' function.

### 6.4.4 OFFSET configuration



The **OFFSET** symbol is shown as soon as an offset is being used. The maximum offset amounts to 1.00 NTU. If the device deviation is greater than 1 NTU, then it is recommended to carry out a complete calibration.

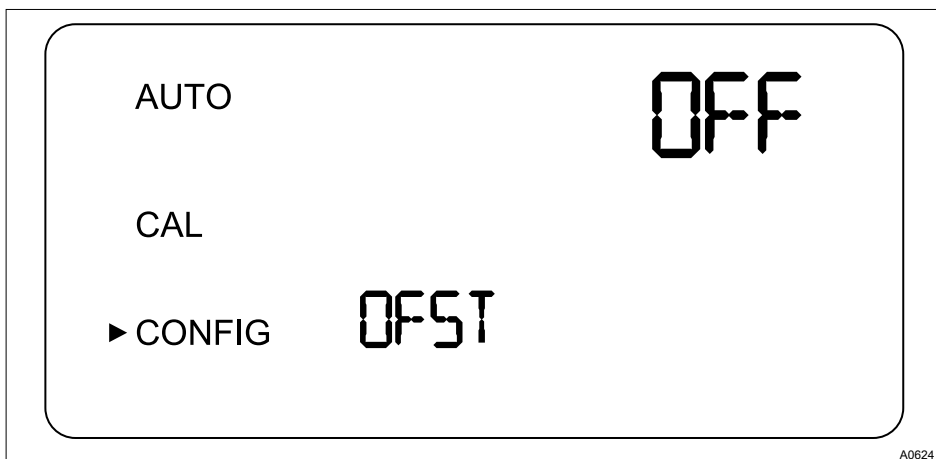









Fig. 15: OFFSET configuration

In certain circumstances it may be desirable to use an offset function in order to balance the device, instead of performing a complete calibration (as described under [Chapter 7.1 'Calibrating DULCO® turb C' on page 55](#)). This procedure is not recommended as a replacement for regular calibration, however, it can be used in order to compensate for known minor deviations where measuring operations cannot be interrupted. This balancing method means that the device only displays precise turbidity values in the immediate vicinity of the sample value and not across the entire measured range.

**Proceed as follows in order to configure the offset:**

1.  Take a sample of the process water being monitored by the device and make a note of the turbidity as indicated by the device.
2.  Measure the turbidity value of the sample with the help of a calibrated manual laboratory measuring device (reference device)
3.  Compare the turbidity value indicated by the device with the value measured by the reference device. If the values are extremely close to each other (depending on the accuracy of the reference device), then no offset configuration or calibration is required and the procedure can be aborted at this point.
  - ⇒ However, if the values differ significantly (however, less than 1 NTU), then proceed as follows in order to improve the turbidity value for the device, so that the device matches the laboratory value.
4.  Select the offset function by pressing *[MODE/EXIT button]* until the arrow is positioned next to *[CONFIG]*
5.  Press the key *↵*, until *[OFST]* is shown in the lower row
  - ⇒ At this point, the upper row of the display indicates the operating condition of the offset function.
6.  If the function is switched off, then switch it *[ON]*, by pressing *▼* or *▲*.
7.  Select the desired offset value with *▼* or *▲*
  - ⇒ Press the key *↵*, to accept the value.



*The difference between the value measured by the DULCO® turb C NTU-value and the value measured by the reference device is the offset value.*

*For example, if the DULCO® turb C measures a value of 0.016 NTU for the process water, and the reference device measures a value of 0.012 NTU for the sample, then entering an offset value of -0.04 will cause the DULCO® turb C to display the value 0.012 NTU*

8. → At this point, the offset configuration is completed. At this stage, the device remains in configuration mode [CONFIG]. Press the key [MODE/EXIT button] in order to return to [AUTO]

### 6.4.5 Extended settings

#### Extended settings

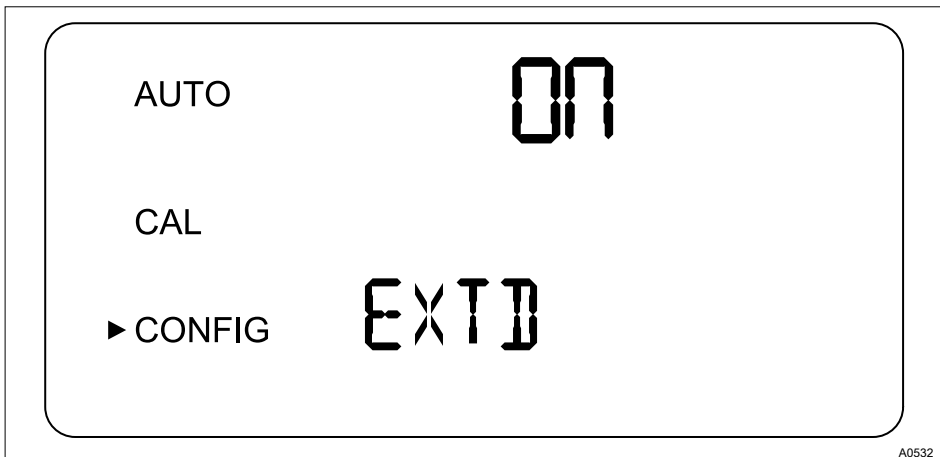
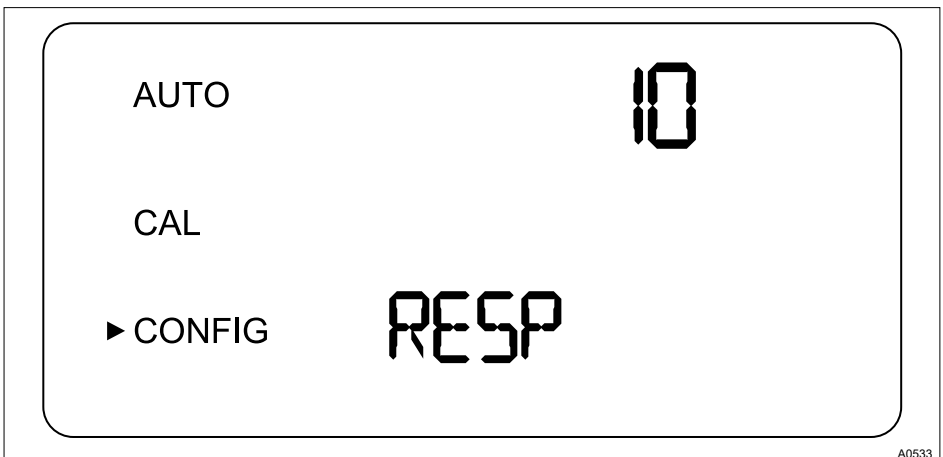


Fig. 16: Extended settings

Function	Options	Info
Extended settings	[ON] (On) [OFF] (Off)	Select the function "Extended settings" in order to access configuration for the following options: <ul style="list-style-type: none"> <li>■ Speed of response</li> <li>■ Screen resolution</li> <li>■ LCD illumination brightness</li> <li>■ Units</li> <li>■ Ultrasonic cleaning</li> <li>■ RS-485 parameters</li> <li>■ Alarm drying agent</li> </ul>

Response time



A0533

Fig. 17: Response time

Function	Options	Info
Reaction time (RESP)	1 ... 100 % Factory setting: 10 %	<p>Select a reaction time for the displayed and output NTU values.</p> <p>Select the highest reaction time (i.e. the highest number) in order to avoid anomalies caused by air or other influences.</p> <p>Select the lowest reaction time (i.e. the lowest number) if rapid changes are to be expected, which are to be monitored.</p> <p>The displayed number is a relative reaction time. The approximate reaction time (in seconds) can be calculated by the displayed number multiplied by 5.</p>

### Screen resolution

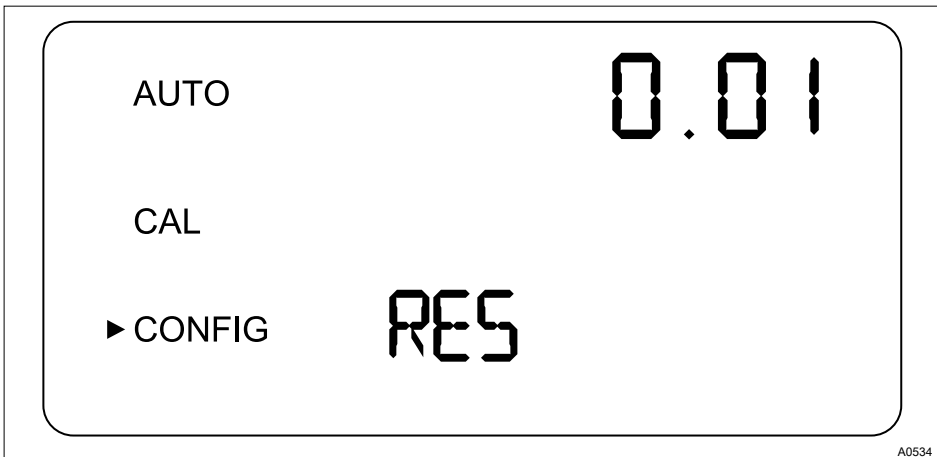


Fig. 18: Screen resolution

Function	Options	Info
Screen resolution (RES)	1 ... 0.001 Factory setting: 0,01	For displayed values under 10 NTU the DULCO® turb C is able to display a value with up to four digits after the decimal point

### LCD illumination brightness

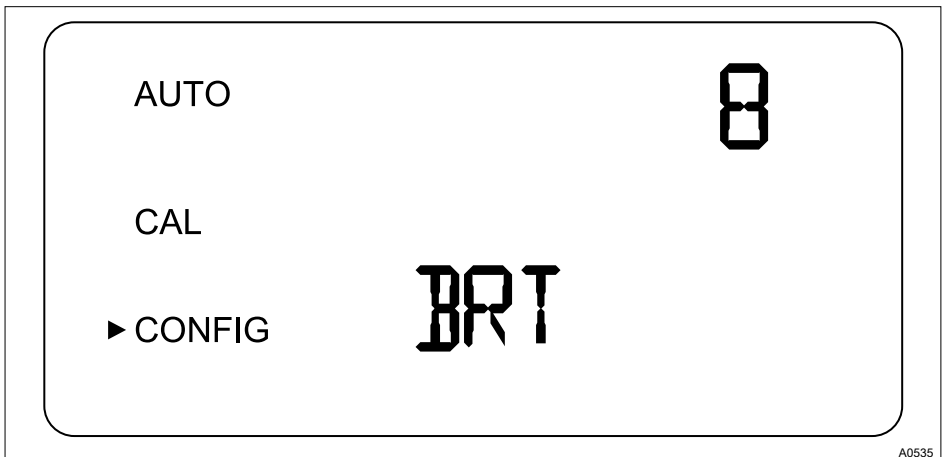


Fig. 19: LCD illumination brightness

Function	Options	Info
LCD illumination brightness (BRT)	1 ... 10 Factory setting: 8	Adjust the backlighting for the LCD display as required

Units

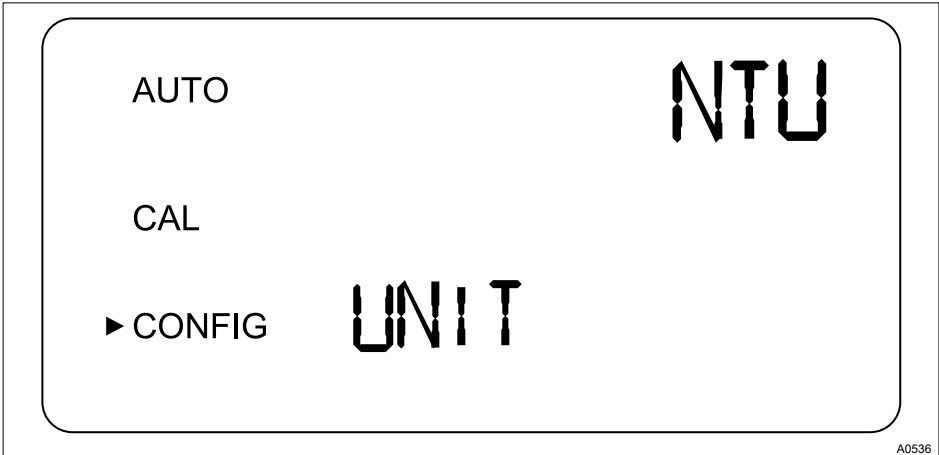


Fig. 20: Units

Function	Options	Info
Units (UNIT)	<ul style="list-style-type: none"><li>■ NTU</li><li>■ FNU</li></ul> Factory setting: NTU	Select a unit for displaying the turbidity measurement:  NTU <i>[Nephelometric Turbidity Units]</i>  or  FNU <i>[Formazin Nephelometric Units]</i>

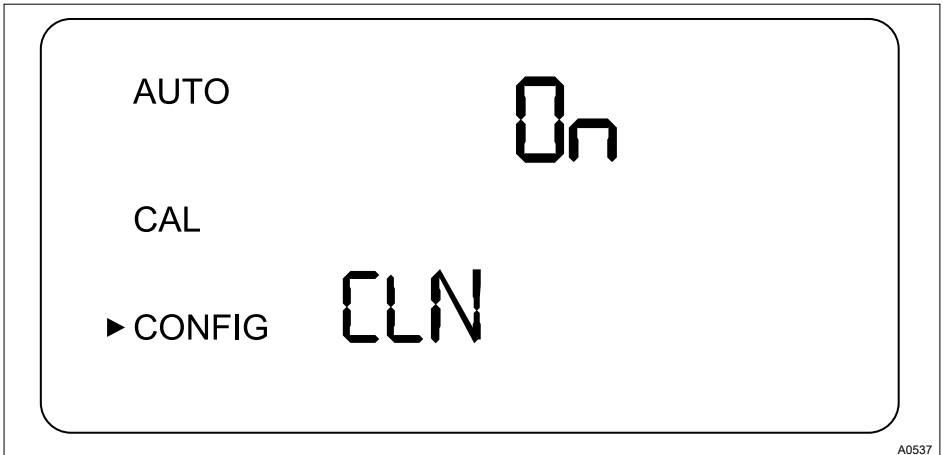


Ultrasonic cleaning (models TUC 3 and TUC 4)



**Error message in the event of incorrect cuvette**

Only active if a corresponding cuvette with ultrasound transducer is used. If you use a cuvette without an ultrasound transducer, then an error message will be shown on the LCD display.



A0537

Fig. 21: Ultrasonic cleaning

Function	Options	Info
Ultrasonic cleaning (CLN)	[ON] (On) [OFF] (Off) Factory setting: [ON]	Switching the ultrasonic cleaning function on and off

If the ultrasonic cleaning function is working normally 'AUTO' flashes in automatic measuring mode (AUTO)

### RS-485 parameters

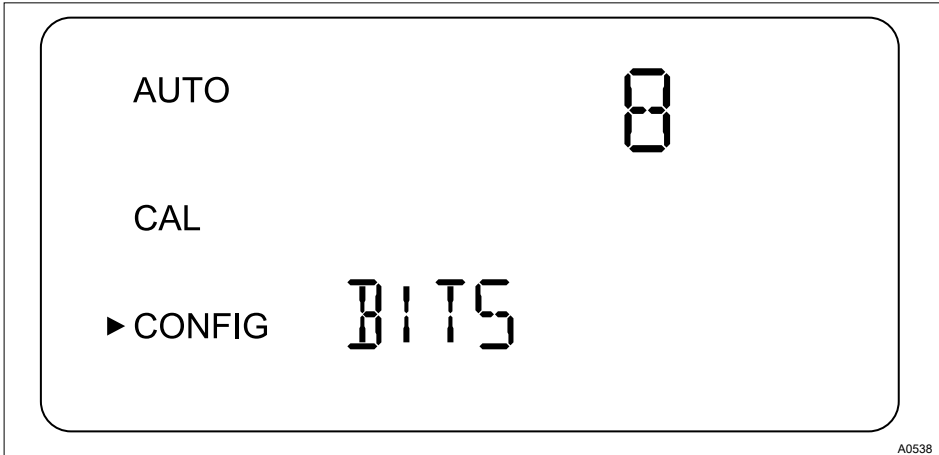


Fig. 22: RS-485 parameters

Function	Options	Info
Bits (BITS)	7 8 Factory setting: 8	The required number of data bits for the communications software deployed
Parity (PRTY)	nOnE ODD E Factory setting: nOnE	The parity bit required for the communications software.
Stop	1 2 Factory setting: 1	The stop bit required for the communications software.

Drying agent alarm

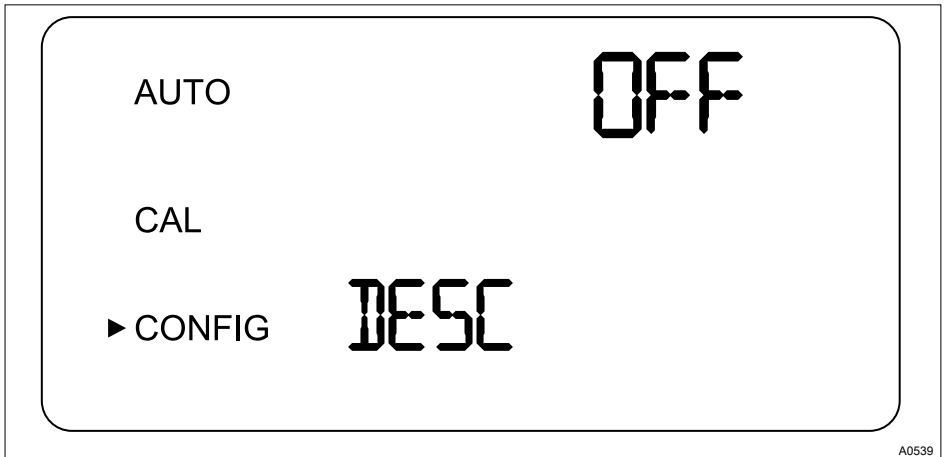


Fig. 23: Drying agent alarm

Function	Options	Info
Drying agent alarm (DESC)	[ON] (On) [OFF] (Off) Factory setting: [OFF]	Select [ON <sub>i</sub> ] in order to trigger an alarm when the drying agent is saturated

In order to activate one or both alarms, then you must configure 'ERROR', see [Chapter 6.4.3 'Configure alarm'](#) on page 40.

In order to indicate an error via the 4-20 mA signal, 'ERROR ALARM (ERLV)' must be selected in alarm current, see [Chapter 6.4.3 'Configure alarm'](#) on page 40.

**Configuration of 4 mA output**

Allow a constant output of 4 mA and will allow you to calibrate or adjust the 4 mA signal.

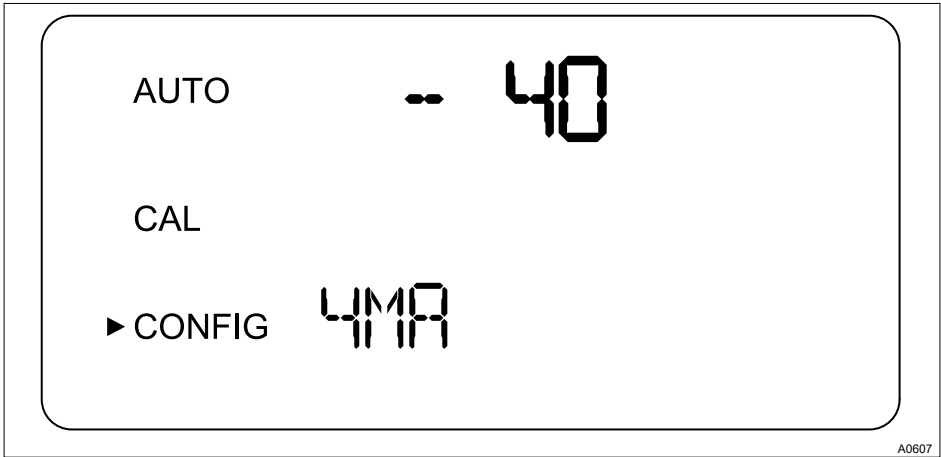
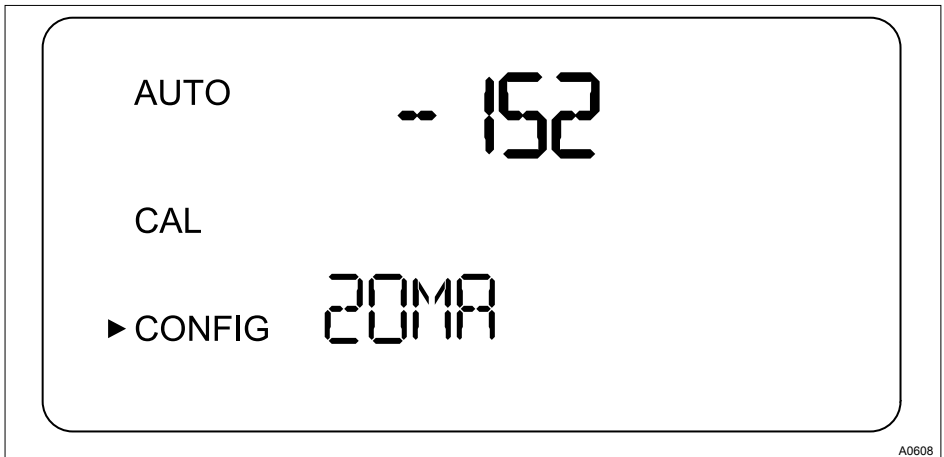


Fig. 24: Configuration of 4 mA output

Function	Options	Info
Configuration of 4 mA output	- 40 ... + 40	Configure the mA value in order to adapt to the super-ordinated control system (e.g. SPC or SCADA)  One count number corresponds to 0.01 mA

### Configuration of 20 mA output

Allow a constant output of 20 mA and will allow you to calibrate or adjust the 20 mA signal.



A0608

Fig. 25: Configuration of 20 mA output

Function	Options	Info
Configuration of 20 mA output	- 1000 ... + 1000	Configure the mA value in order to adapt to the super-ordinated control system (e.g. SPC or SCADA)  One count number corresponds to 0.01 mA

### Save configuration settings

If you have set the extended settings (EXTD) to 'OFF' then you can use the **[↵]** button to save the settings and return to the permanent display in 'AUTO' mode, see figure Fig. 7

If you have set the extended settings (EXTD) to 'ON' then you can use the **[↵]** button after the final menu in the extended settings to save your settings and return to the permanent display in 'AUTO' mode, see figure Fig. 7. All changes previously undertaken in the configuration menu can be stored in this manner.

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## Commissioning

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You can access the configuration menu at any time in order to reset or modify some or all of the parameters. You can exit the configuration menu at any time by pressing the *[MODE/EXIT button]*. In doing so, any changes to the parameters that you have modified will be stored.

### Flow controller

The flow controller (part number 1037880) limits high-pressure systems to a flow of less than 1 l/min.

## 7 Operation

### 7.1 Calibrating DULCO® turb C



*The DULCO® turb C is tested and calibrated before leaving the factory. For this reason, the DULCO® turb C may be used immediately. Under normal conditions, it is recommended to carry out calibration at least once every three months.*

*If the DULCO® turb C is in [CAL] or [CONFIG] mode, the alarm relay changes to alarm status. If no input is made in [CAL] mode within a period of 15 minutes, the DULCO® turb C automatically switches back to [AUTO] mode.*



#### **CAUTION!**

##### **Use of diluted formazine**

Possible consequences: Inaccurate calibration. Malfunctions in dependent processes.

Diluted formazine is instable. Ensure that freshly prepared formazine solution is used when performing calibration.

If possible, use a standard solution from Prominent for calibration. These standard solutions are more stable than formazine and have a minimum shelf-life of 12 months. In doing so, observe the use-by-date on the standard solution packaging.

Calibration set order number: 1037699

#### 7.1.1 Standard solutions for calibration



*If the DULCO® turb C is operated over its complete measuring range of 0.02 NTU ... 1000 NTU, you must perform calibration with all 3 standard solutions (0.02 NTU, 10.0 NTU and 1000 NTU). If the sensor is only operated in measurement ranges under 10 NTU, then you may perform a simplified calibration with standard solutions 0.02 NTU and 10.0 NTU.*

### Indexing the standard solution with your cuvette

#### CAUTION!

##### **Malfunction of the control circuit**

Possible consequence: Poor end-product quality

Ensure that your controller or other measuring equipment is configured so that the indexing process does not lead to unintentional control functions in the measuring and control system. The controller connected to the DULCO® turb C may not process the signals issued by the DULCO® turb C and use them for control purposes while the signals are being indexed.

#### NOTICE!

##### **Screen resolution**

For the purposes of indexing, we recommend that the DULCO® turb C should be set in the "Commissioning/solution display" menu so that the following resolutions are obtained

- 1000 NTU: No digits after the decimal point on the display
- 10 NTU: Two digits after the decimal point on the display
- 0.02 NTU: Four digits after the decimal point on the display

#### NOTICE!

##### **Freezing of standard solution**

The standard solutions must not freeze. Even for short periods of time.



C# 39957P L# 72633	<b>Calibration Kit</b>	<b>ProMinent®</b>
	<b>FOR TUC 1, 2, 3, 4; - 0.02, 10.0, 1000 NTU</b>	
	 <b>LOT: 01047</b> use before: <b>APR 2012</b>  <b>Part No. 1037699</b>	<b>WARNING:</b> Do not freeze. Standards are Invalid if freezing occurs.
	ProMinent GmbH Im Schuhmachergewann 5-11 69123 Heidelberg Phone: +49 6221 842-0      www.prominent.de	<small>A0647</small>

Fig. 26: Insert sheet for standard solutions



### **Handling the standard solution**

*The standard solution 1000 NTU must be lightly shaken before use for calibration.*

*Standard solution 10 NTU must be transferred to the cuvette from the storage bottle before it is used for the first time. The filling for the 10 NTU cuvette is then usable for 24 hours.*

*Do not use the standard solution once the use-by-date has expired.*

*The cuvettes for the 1000 NTU and 0.02 NTU standard solutions may not be opened.*

Transfer 10 NTU standard solution into the cuvette

**Primary Turbidity Standard**  
**125 ml**  
**10.0 NTU**

RINSE 5mL \_\_\_\_\_

FILL 20mL \_\_\_\_\_

RINSE 5mL \_\_\_\_\_

**Directions:**

1. Rinse a clean measuring cuvette with 5mL of this standard. Discard this material. FILL 20mL \_\_\_\_\_
2. Carefully pour 20mL of this standard into the rinsed cuvette RINSE 5mL \_\_\_\_\_
3. Clean the cuvettes prior to use. See operators manual for procedure.
4. This standard may deteriorate if stored in the glass cuvette for periods longer than 24 hours. FILL 20mL \_\_\_\_\_
5. Do not pour used standard back into container. RINSE 5mL \_\_\_\_\_

**ProMinent®** LOT# 01006 <sup>use</sup> before: APR 2012

ProMinent GmbH Im Schuhmachergewann 5-11 69123 Heidelberg  
Phone: +49 6221 842-0 www.prominent.de

FILL 20mL \_\_\_\_\_

L# 72635

A0649

Fig. 27: Labels on the storage bottle 10 NTU

1. ➤ Rinse a cuvette using 5 ml of 10 NTU standard solution.  
⇒ Dispose of the 5 ml rinsing solution afterwards.
2. ➤ Fill the rinsed cuvette with 20 ml 10 NTU standard solution.
3. ➤ Clean and dry the exterior of the cuvette, before inserting the cuvette into the DULCO® turb C.

4. ➤



*The 10 NTU cuvette may now be used for 24 hours. After 24 hours, the 10 NTU standard solution in the cuvette will become unusable.*

*Do not pour any standard solution into the storage bottle.*



### ***Purpose of indexing***

*The standard solution cuvettes have a minimal manufacturing tolerance. This manufacturing tolerance results from the manufacturing process and is unavoidable.*

*In order to minimise the effects of these manufacturing tolerances on the calibration process, you must index and mark the position on the cuvette with the lowest turbidity value (lowest NTU value).*

*You can mark the index points with the help of the marking rings supplied. These marking rings are included with the calibration set packaging. The marking ring must first be placed around the plastic cover of the respective cuvette.*

Prerequisite: The DULCO® turb C is ready for operation and is set to *[AUTO]* mode.

1. ➤ Open the flow unit by screwing it clockwise and remove the in-line flow fitting from the cuvette.
2. ➤ Insert the *[1000 NTU]* calibration cuvette into the DULCO® turb C.
3. ➤ Turn the *[1000 NTU]* calibration cuvette one full turn in 20° steps. At each step, wait until the displayed measured value has stabilised.
  - ⇒ Mark the point on the cuvette with the lowest NTU value with the help of the marking ring supplied, so that the marker points towards yourself.
4. ➤ Remove the *[1000 NTU]* calibration cuvette and insert the *[10 NTU]* calibration cuvette into the DULCO® turb C.
5. ➤ Turn the *[10 NTU]* calibration cuvette one full turn in 20° steps. At each step, wait until the displayed measured value has stabilised.
  - ⇒ Mark the point on the cuvette with the lowest NTU value with the help of the marking ring supplied, so that the marker points towards yourself.
6. ➤ Remove the *[10 NTU]* calibration cuvette and insert the *[0.02 NTU]* calibration cuvette into the DULCO® turb C.
7. ➤ Turn the *[0.02 NTU]* calibration cuvette one full turn in 20° steps. At each step, wait until the displayed measured value has stabilised.
  - ⇒ Mark the point on the cuvette with the lowest NTU value with the help of the marking ring supplied, so that the marker points towards yourself.
8. ➤ Insert the cuvette sample with the cuvette into the DULCO® turb C.
9. ➤ Close the in-line flow fitting by screwing it in an anticlockwise direction.
  - ⇒ The DULCO® turb C will be in *[AUTO]* mode.



*For subsequent calibration, insert the calibration cuvettes into the DULCO® turb C so that the marker on the marking ring faces towards you.*

## 7.1.2 Perform calibration



### CAUTION!

#### Malfunction of the control circuit

Possible consequence: Poor end-product quality

Ensure that your controller or other measuring equipment is configured so that the calibration process does not lead to unintentional control functions in the measurement and control system. The controller connected to the DULCO® turb C may not process the signals issued by the DULCO® turb C and use them for control purposes while the signals are being indexed.



### NOTICE!

#### Fan standstill

The DULCO® turb C fan is switched off during the calibration process, in order to extend the service life of the drying agent.

The fan is switched on:

- During the calibration countdown
- After returning to *[AUTO]* mode
- After 5 minutes without input from the operator
  - Whichever occurs first.

Keep the measurement chamber covered if no cuvette is inserted and only place a cuvette into the measurement chamber if it is completely dry, in order to avoid premature saturation of the drying agent.



### NOTICE!

#### Cleaning and drying the cuvette

Possibility measurement value distortion.

Before each cuvette is inserted, it must be thoroughly cleaned and dried with the cleaning cloth provided with the calibration set. Even minimal traces of foreign bodies and moisture on the surface of the cuvette can cause the measured result to be falsified.

Prerequisite: The DULCO® turb C is ready for operation and is set to *[AUTO]* mode.

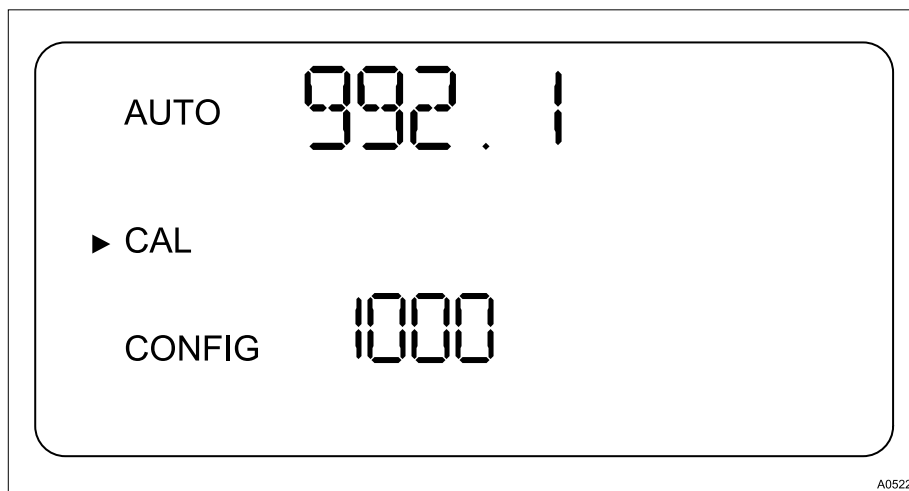
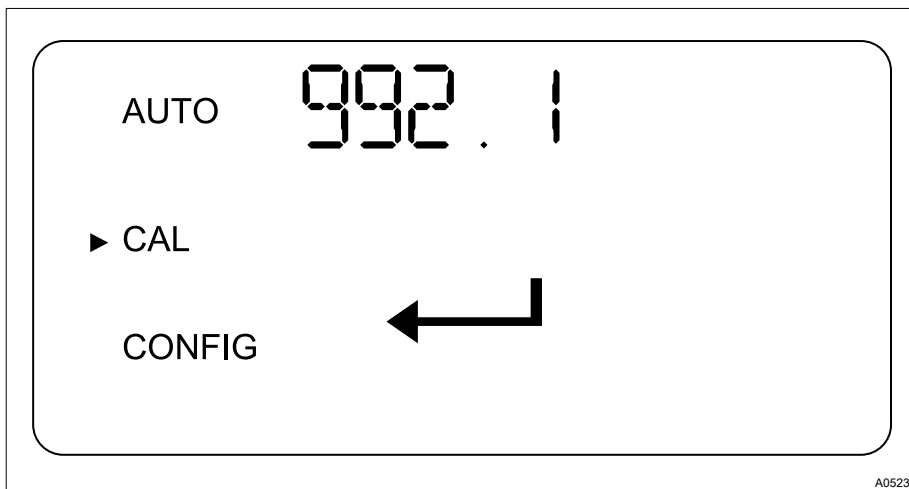



Fig. 28: Display [Calibration 1000 NTU]

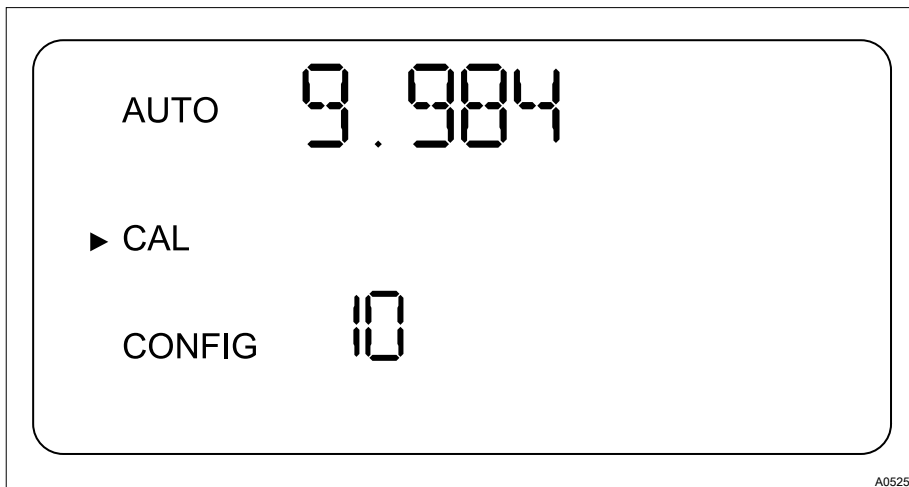
1. ➤ Select *[CAL]* mode by pressing the *[MODE/EXIT]* key once
  - ⇒ An arrow appears next to the *[CAL]* entry in the LCD display (see Fig. 28). The lower display value (1000) is the selected calibration point. The upper displayed value is the currently measured NTU value.
2. ➤ Open the flow unit by screwing it in a clockwise direction and remove the cuvette sample together with the cuvette
3. ➤ Insert the *[1000 NTU]* calibration cuvette into the DULCO® turb C so that the marker is facing towards you, see ↗ '*Indexing the standard solution with your cuvette*' on page 56
4. ➤ Slowly rotate the calibration cuvette 20° from the centre point to the left and then 20° from the centre point to the right
  - ⇒ Leave the calibration cuvette in the position with the lowest measured value.



A0523


Fig. 29: Display [Start calibration]

5.  Press the  $\leftarrow$  key to start calibrating at [1000 NTU]
- ⇒ A 30 second countdown begins, after which the DULCO® turb C is calibrated at [1000 NTU].



A0525

Fig. 30: Display [Calibration 10 NTU]

6.  Remove the [1000 NTU] calibration cuvette

7. ➔ Insert the [10 NTU] calibration cuvette into the DULCO® turb C so that the marker is facing towards you, see ↪ 'Indexing the standard solution with your cuvette' on page 56
8. ➔ Slowly rotate the calibration cuvette 20° from the centre point to the left and then 20° from the centre point to the right  
⇒ Leave the calibration cuvette in the position with the lowest measured value.

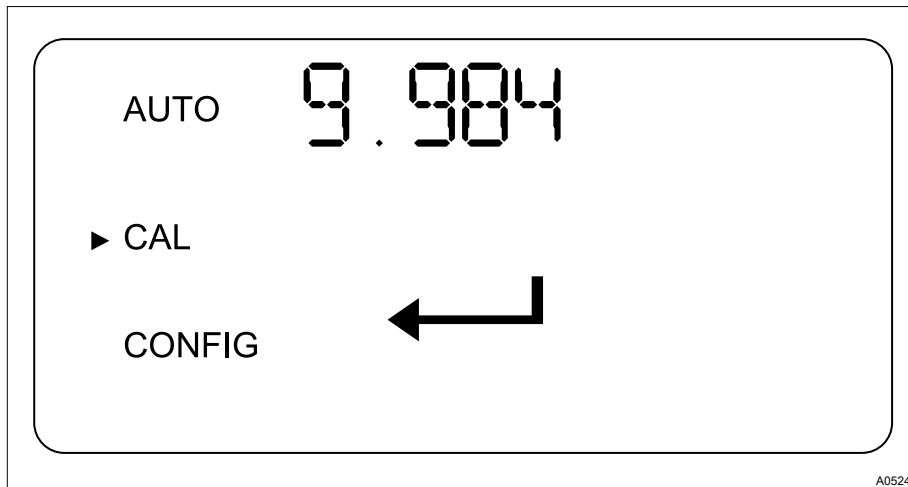
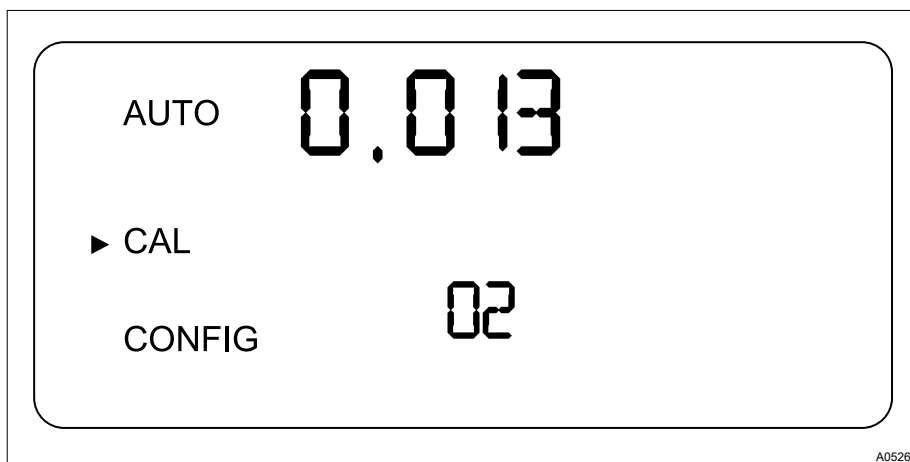


Fig. 31: Display [Start calibration]

9. ➔ Press the ↵ key to start calibrating at [10 NTU]  
⇒ A 60 second countdown begins, after which the DULCO® turb C is calibrated at [10 NTU].

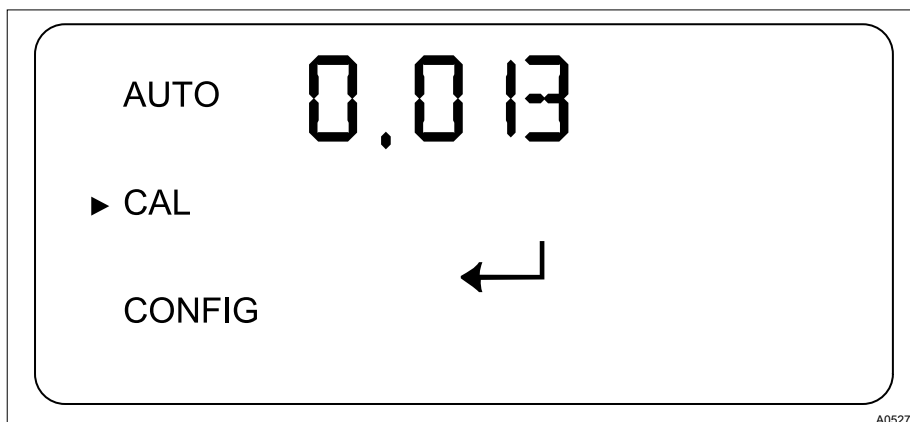




A0526

Fig. 32: Display [Calibration 0.02 NTU]

10. ▶ Remove the [10 NTU] calibration cuvette
11. ▶ Insert the [0.02 NTU] calibration cuvette into the DULCO® turb C so that the marker is facing towards, you ↺ 'Indexing the standard solution with your cuvette' on page 56
12. ▶ Slowly rotate the calibration cuvette 20° from the centre point to the left and then 20° from the centre point to the right
  - ⇒ Leave the calibration cuvette in the position with the lowest measured value.



A0527

Fig. 33: Display [Start calibration]

13. ▶ Press the  $\downarrow$  key to start calibrating at  $[0.02\text{ NTU}]$ 
  - ⇒ A 30 second countdown begins, after which the DULCO® turb C is calibrated at  $[0.02\text{ NTU}]$ .
14. ▶ Remove the  $[0.02\text{ NTU}]$  calibration cuvette from the DULCO® turb C
15. ▶ Insert the cuvette sample with the measuring cuvette into the DULCO® turb C.
16. ▶ Close the in-line flow fitting by screwing it in an anticlockwise direction
  - ⇒ The DULCO® turb C is now calibrated and is reset to  $[AUTO]$  mode

### Incorrect calibration

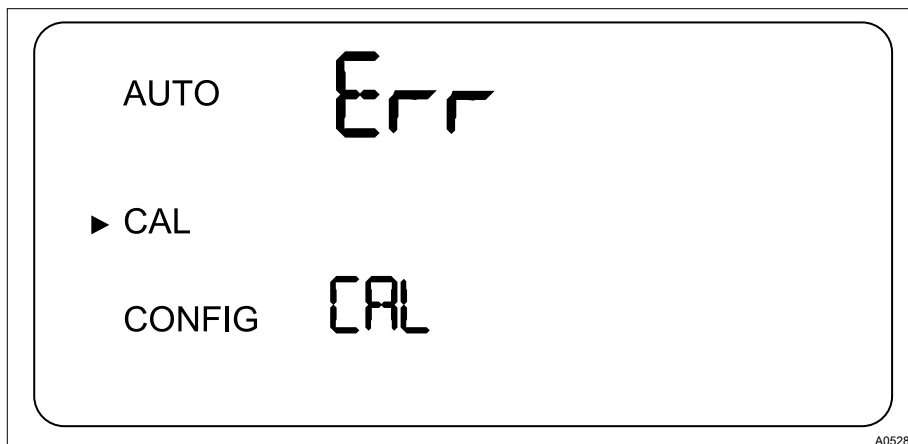





Fig. 34: Display  $[Incorrect\ calibration]$

If the  $[Err\ CAL]$  display appears, it indicates that the internal analysis carried out by the DULCO® turb C has revealed that the calibration was executed incorrectly.

To carry out the calibration procedure again, press the  $[MODE/EXIT]$  key and restart the calibration.

### Restoring the factory calibration settings

1.  In order to restore the factory calibration, press and hold the ▲ key
2.  Now press the ↵ key and release it again
3.  Now release the ▲ key
  - ⇒ The sensor will now work with the factory calibration values.



#### ***Display [Err CAL]***

*If an error occurs, the sensor continues to indicate values, however, the accuracy of these measured values is uncertain, meaning that you cannot rely on the values given. For this reason, the DULCO® turb C display also indicates [Err CAL], in order to bring your attention to incorrect calibration or operation according to factory calibration. In this operating status, pay attention to the possible effects on the process as a whole.*

## 8 Maintenance, troubleshooting and repair

### 8.1 Information about troubleshooting

The DULCO® turb C also carries out general self-diagnosis. Any errors are displayed in the bottom row of the display.

The DULCO® turb C operates three-stage fault detection:

- Warning, e.g. *[DESC]*
  - A warning is merely a message on the display which serves to indicate a pending problem. No alarms are issued. If, for example, the drying agent alarm is deactivated and the drying agent is saturated, the LCD display shows the warning *[DESC]*
- Error *[Err]*
  - An error *[Err]* indicates a malfunction or problem which can generally be rectified by the operator. This includes, for example, a lamp failure *[LAMP]* or incorrect calibration *[CAL]*. If an error occurs, the sensor continues to indicate values, however, the accuracy of these measured values is uncertain, meaning that you cannot rely on the values given.
- Fault *[FAIL]*
  - A fault *[FAIL]* is a system error. This problem cannot be rectified by the operator. The DULCO® turb C must be sent back to the factory for repair. These faults are faults in the *[CPU]*, *[AD]*, *[EEPROM]* or other units built into the DULCO® turb C. In the event of a malfunction, the DULCO® turb C

will not function correctly and the *[FAIL]* message will appear in the LCD display. Both alarm relays are activated and the current output is set to 2 mA.

### 8.1.1 System error messages

<b>Fault message</b>	<b>Possible cause</b>	<b>Measure</b>
[MA]	4 ... 20 mA circuit open	Check cabling
[DESC]	Drying agent saturated	Exchange drying agent. Refer to <a href="#">Chapter 6.1 'Inserting the drying agent'</a> on page 32
[LAMP]	Lamp failure	Exchange lamp. Contact customer service
[FLOW]	Flow interrupted	Establish flow
[CLN]	Cuvette ultrasound transducer has no contact	Rotate the cuvette slightly in order to improve contact. Exchange the cuvette if the problem persists.
	Cuvette removed	Insert cuvette
[FAIL]	Fatal system errors	Contact customer service


### 8.1.2 Faults in the process

<b>Fault</b>	<b>Possible cause</b>	<b>Process error</b>
Displayed values higher than expected	Air bubbles in the sample water	Ensure that the outlet bleed valve is open and not blocked  Create backpressure  Install air bubble trap, accessories, order number 1037790
	Condensate or cuvette not airtight	Check cuvette for condensate or leaks
	Cuvette soiled	Clean cuvette
	Incorrectly calibrated	Calibration, see <a href="#">Chapter 7.1.2 'Perform calibration'</a> on page 61
Displayed values incorrect	Air bubbles in the sample water	Ensure that the outlet bleed valve is open and not blocked  Create backpressure  Install air bubble trap, accessories, order number 1037790

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## Maintenance, troubleshooting and repair

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Fault	Possible cause	Process error
	Particles of dirt in the cuvette	Clean the cuvette of any particles of dirt.
Displayed values lower than expected	Incorrectly calibrated	Calibration, see  <i>Chapter 7.1.2 'Perform calibration' on page 61</i>
Upper row of display flashes	Sample has exceeded the permissible measurement range	Check sample. Sample turbidity may be too high to be read by the DULCO® turb C

## 9 Spare parts and accessories

### Spare parts

Spare part	Part number
Drying agent	1037701
Cuvette TUC1 / TUC2	1037877
Cuvette TUC3 / TUC4	1037878
Infrared lamp TUC1 / TUC3	1037702
White light lamp TUC2 / TUC4	1037703
Hose kit	1037879
Pressure regulating valve	1037885

### Accessories

Accessories	Part number
Calibration set	1037699
Flow controller	1037880
Air bubble trap	1037700

### 10 Disposal of Used Parts

- **User qualification:** instructed user, see ↪ *Chapter 1.2 'Users' qualifications' on page 8*

#### **! NOTICE!**

##### **Regulations governing the disposal of used parts**

- Note the national regulations and legal standards that currently apply in your country

The manufacturer will take back decontaminated used units providing they are covered by adequate postage.

Decontaminate the unit before returning it for repair. To do so, remove all traces of hazardous substances. Refer to the Material Safety Data Sheet for your feed chemical.

A current Declaration of Decontamination is available to download on the ProMinent website.



## 11 Declaration of Conformity

We,

- ProMinent GmbH
- Im Schuhmachergewann 5 - 11
- DE - 69123 Heidelberg,

hereby declare that the product specified in the following, complies with the relevant basic health and safety requirements of the EU Directive, on the basis of its functional concept and design and in the version distributed by us. Any modification to the product not approved by us will invalidate this declaration.

Designation of the product:	Turbidity Sensor DULCOturb C
Product type:	TUC1, TUC2, TUC3, TUC4
Serial number:	see nameplate on the device
Relevant EU directives:	Low Voltage Directive (2014/35/EU) EU-EMC Directive (2014/30/EU) RoHS Directive (2011/65/EU)
Harmonised standards applied, in particular:	EN 61010 - 1: 2010 EN 61326 - 1: 2013, Class A, industrial electromagnetic environment EN 50581: 2012
Place/Date:	20/04/2016

## 12 Index

<b>A</b>	
Accessibility . . . . .	16
Accessories . . . . .	71
Action, step by step . . . . .	2
Alarm delay period . . . . .	40
Alarm ERROR . . . . .	40
Alarm function . . . . .	40
Alarm HI . . . . .	40
Alarm limit value . . . . .	40
Alarm LO . . . . .	40
Alarm menu . . . . .	41
Ambient temperature . . . . .	16
Applied harmonised standards . . . . .	73
<b>C</b>	
Calibration erroneous . . . . .	66
<b>D</b>	
Data . . . . .	6
Degree of protection IP 66 . . . . .	26
Delay period alarm . . . . .	40
Designation of the product . . . . .	73
<b>F</b>	
Flow . . . . .	20
FNU . . . . .	31
Functions . . . . .	6
<b>G</b>	
General non-discriminatory approach . . . . .	2
<b>I</b>	
Incorrect calibration . . . . .	66
<b>L</b>	
Limit value alarm . . . . .	40
Links to elements or sections of these instructions or other applicable documents . . . . .	2
Liquid temperature . . . . .	20
<b>M</b>	
Menu Alarm . . . . .	41
More symbols . . . . .	2
Mounting position . . . . .	16
<b>N</b>	
Non-discriminatory approach . . . . .	2
NTU . . . . .	31
<b>O</b>	
Operating position . . . . .	16
<b>P</b>	
Pressure . . . . .	20
<b>R</b>	
Reading position . . . . .	16
Recycling . . . . .	15, 16
Relevant EU directives . . . . .	73
<b>S</b>	
Serial number . . . . .	73
Spare parts . . . . .	71
Strain relief . . . . .	23
Sunlight . . . . .	16
<b>T</b>	
Turbidity threshold . . . . .	40
<b>U</b>	
Unit NTU . . . . .	31
Users' qualifications . . . . .	8
<b>W</b>	
Warning information . . . . .	6

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