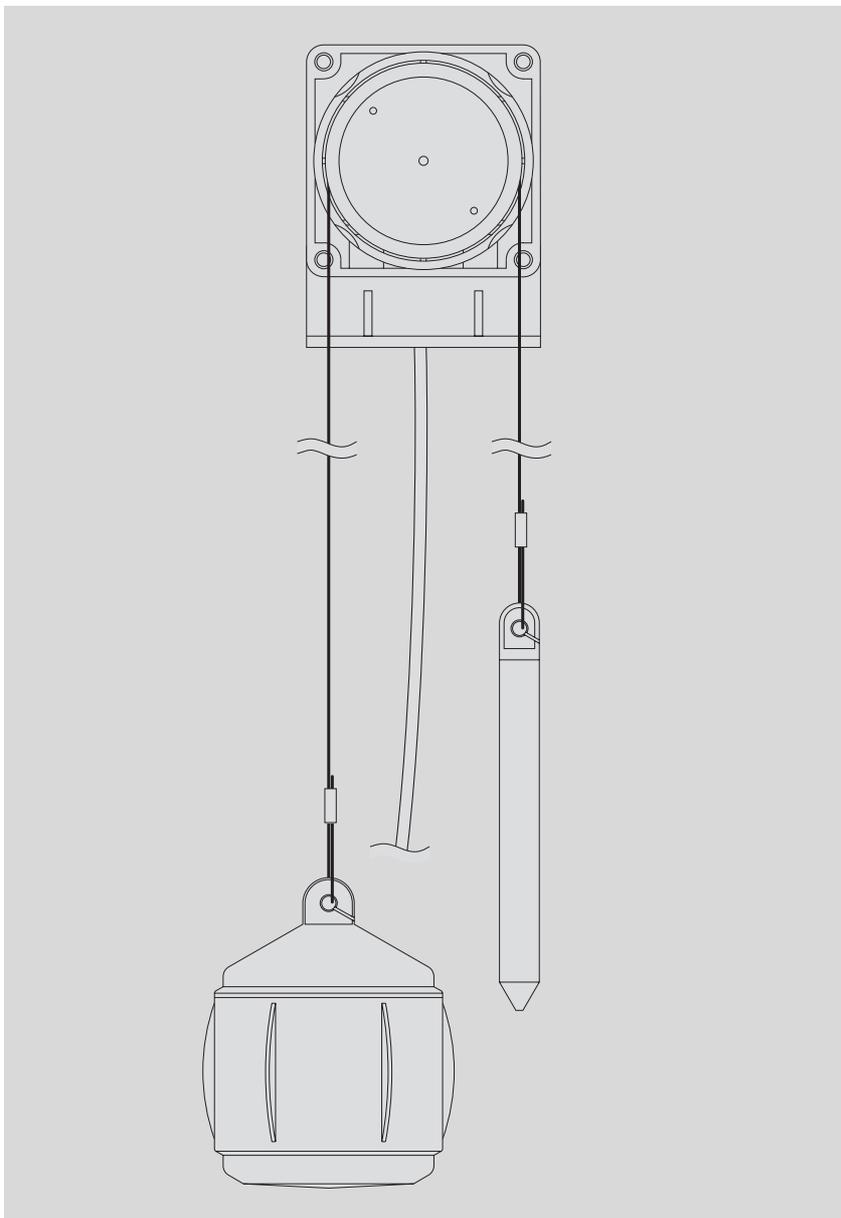


Operating instructions  
**Shaft Encoder**  
**OTT SE 200**



English

We reserve the right to make technical changes and improvements without notice.

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## 1 Scope of supply

- ▶ **OTT SE 200**
  - 1 Shaft encoder with permanently attached connecting cable (10 m, 15 m or 30 m); SDI-12 or SDI-12/4 ... 20 mA interface; float pulley for float cable with 1 mm diameter or for the bead chain
  - 1 set of installation accessories
  - 1 operating instructions
  - 1 Factory acceptance test certificate (FAT)

## 2 Order numbers

- ▶ **OTT SE 200**
  - Shaft encoder** 63.060.001.9.2
    - depending on desired design:
    - SDI-12 or SDI-12/4 ... 20 mA interface
    - rotational direction to the left or to the right
    - measuring range for designs with 4 ... 20 mA interface
      - 1 m, 10 m or 30 m / 3 ft, 30 ft or 90 ft
    - float pulley for float cable or bead chain
    - length of connecting cable 10 m, 15 m or 30 m
- ▶ **Accessories**
  - Float** 27.001.071.3.5
    - 80 mm Ø
  - Counterweight** 27.050.013.4.2
    - 0.100 kg
  - Float cable**
    - 1 mm Ø; Nirosta
    - Crimp sleeves
    - Length:
      - 10 m 27.150.040.9.2
      - 30 m 27.150.041.9.2
      - 50 m 27.150.042.9.2
      - 100 m 27.150.043.9.2
  - Bead chain with installation accessories**
    - Length:
      - 10 m 27.152.010.9.2
      - 30 m 27.152.030.9.2
      - 50 m 27.152.050.9.2
      - 100 m 27.152.100.9.2
  - Observation well installation set for 4"; 4,5"; 5" + 6"** 55.430.050.3.2

### 3 Introduction

The float-operated OTT SE 200 Shaft Encoder provides continuous water level measurement of groundwater and surface waters.

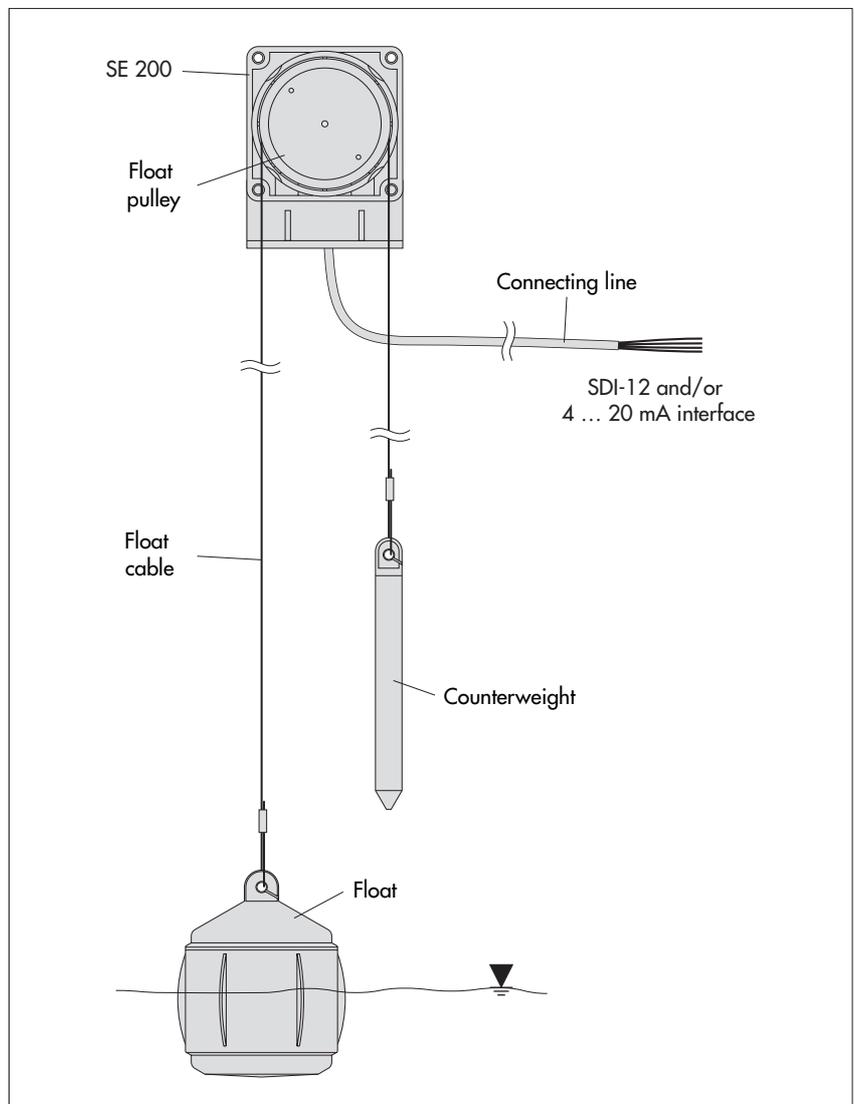
Changes in water level are transferred via a float-cable counterweight system to the float pulley of the SE 200. The rotation caused by this action is converted to an electrical signal that is available at the connecting line.

The SE 200 is available with a 4 ... 20 mA interface or with a combined 4 ... 20 mA/SDI-12 interface and is intended for use for connection to an external datalogger, a programmable logic controller (PLC), or to displays, for example.

Included in the scope of delivery is a set of installation accessories that enables one to install the unit as a stand-alone device or in combination with any OTT level recorder or that of a competitor. It is possible to install this unit in 4" to 6" observation wells as well using an observation well installation set (accessory).

A special design of the SE 200 is available with a float pulley for a bead chain instead of a float cable. This design operates without slippage even when the water level changes rapidly.

Fig. 1: Setup of a level measurement station using the OTT Shaft Encoder SE 200.



## 4 Installing the SE 200

There are three different possible types of SE 200 installations:

- ▶ as a stand-alone device
- ▶ as an attachment to any mechanical level recorder:
  - Variant 1: Existing float cable is fed through the SE 200 float pulley
  - Variant 2: SE 200 float pulley is coupled to the float pulley of the level recorder via a carrier unit.
- ▶ in a 4"; 4,5"; 5" or 6" observation well

An installation set with all required parts is provided along with the SE 200 to install it as a stand-alone device and as an attachment (see Fig. 2).

Additional accessories required:

- ▶ for the stand-alone device: Float, float cable, counterweight
- ▶ for attachment device: –
- ▶ for observation well installation: Observation well installation set, float, float cable, counterweight

### Note

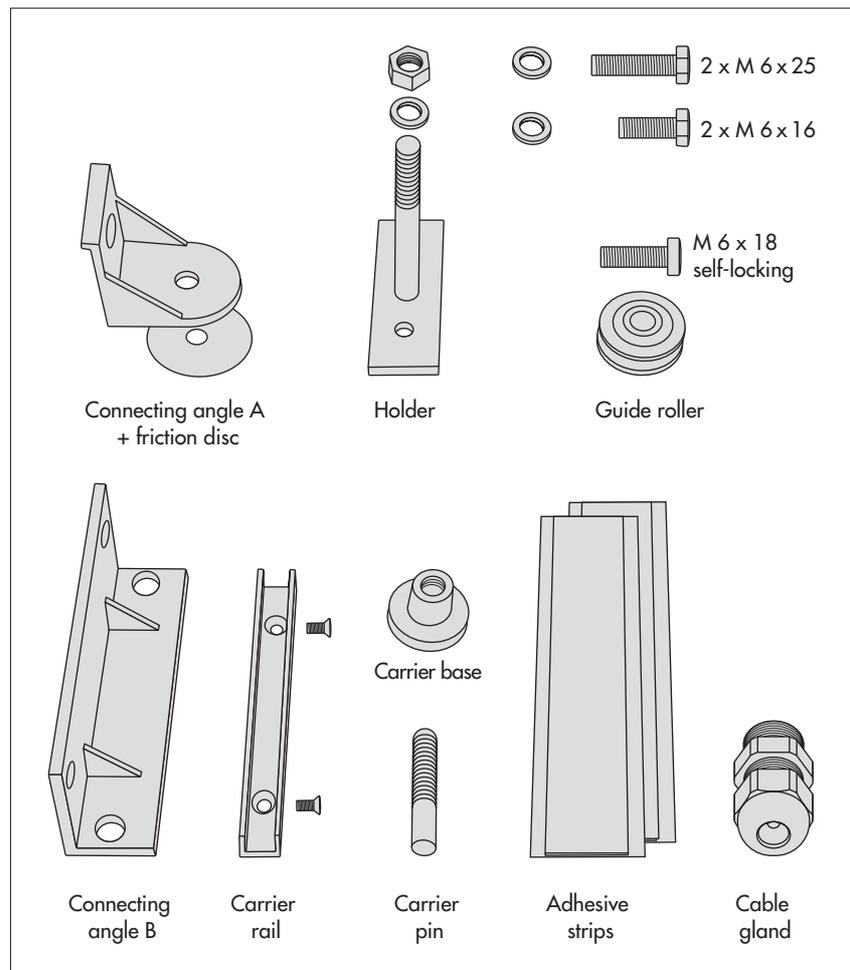
- ▶ SE 200 with float pulley for bead chain: Please refer to *Installation drawing for Thalimedes with bead chain (55.430.025.4.7)* which accompanies the bead chain.

Fig. 2: SE 200 Installation Accessories.

Cut the adhesive strips to length with scissors as required.

The holder and the cable gland are not necessary for the installation of the SE 200.

The dimensions of connecting angle B can be found in Appendix C.



#### 4.1 Installing the SE 200 as a stand-alone device

Please refer to Figures 2 + 3 and proceed as follows:

##### Fastening the SE 200

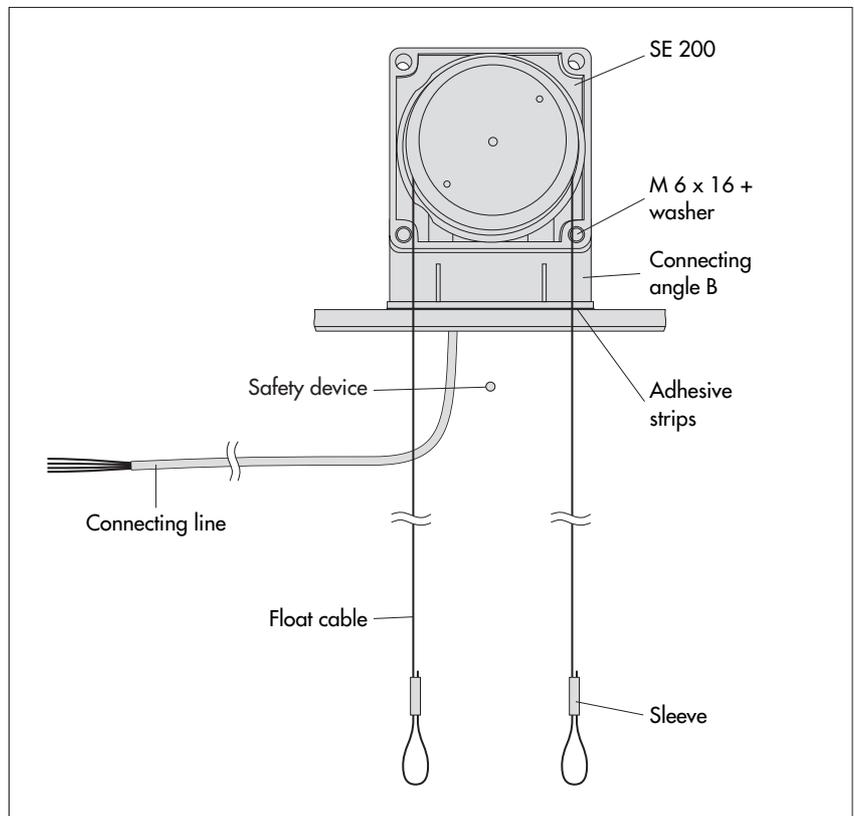
- Attach SE 200 to connection angle B (M 6 x 16 + washers); attach connection angle B to a flat base with double-sided adhesive strips (if necessary: use screws in addition). Alternatively: Attach the SE 200 directly to a suitable vertical mounting wall using M 6 x 25 screws and washers.

##### Installing the float, float cable and counterweight

- Determine the distance from minimum (lowest) water level to the upper edge of the SE 200; add approximately 50 cm to this value = length of the float cable; cut float cable to length.
- Form loops at either end of the float cable; slip the sleeves over the loops and pinch with a flat nose pliers; suspend float and counterweight inside the loops.
- Place the float cable over the float pulley; allow the float unit to stabilise. **Tip:** Use a safety device (such as a hook or a screw) to prevent possible loss of the float and counterweight while installing them!

Now turn to Chapter 5.

Fig. 3: Installing the SE 200 as a stand-alone device.  
Install connecting angle B so that it points forward!



#### 4.2 Installing the SE 200 as an attachment

see Appendix A

#### 4.3 Installing the SE 200 in an observation well

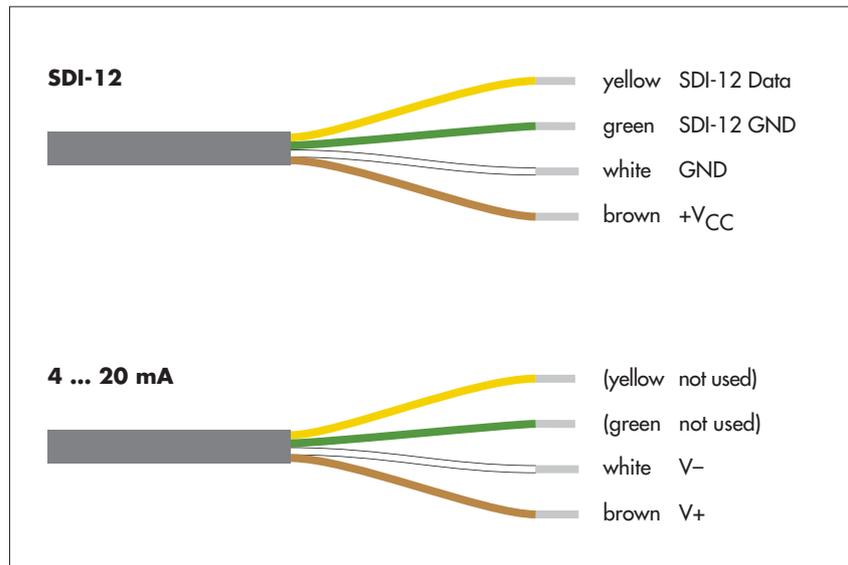
see Appendix B

## 5 Connecting the SE 200

The SE 200 contains an SDI-12 interface or a combination SDI-12/4 ... 20 mA interface depending on the conditions of delivery. These interfaces allow one to connect the SE 200 both to the OTT datalogger and to any datalogger by another manufacturer that has the correct interfaces. The SDI-12 interface must meet SDI-12 Standard 1.2 (SDI-12 = Serial-Digital Interface with 1200 baud). The interfaces of the SE 200 are available on a 4-wire connecting cable.

Fig. 4: Wire assignment of the SE 200 connecting cable.

top: Using the SDI-12 bottom interface  
bottom: Using the 4 ... 20 mA interface



### Note

- ▶ Referencing SE 200 measured values to a level zero: Input the contact gauge / staff gauge measured value, for example using a scaling function of the datalogger connected to the SE 200. Alternatively: Lift the float cable slightly and rotate the float pulley until the SE 200 outputs the desired value.

### 5.1 Connecting the SE 200 to any datalogger using the SDI-12 interface

- Connect the SE 200 to an SDI-12 input of the external datalogger. Follow the datalogger handbook as you do this. The wire assignments for the SE 200 connecting cable can be seen in Figure 4 (above).

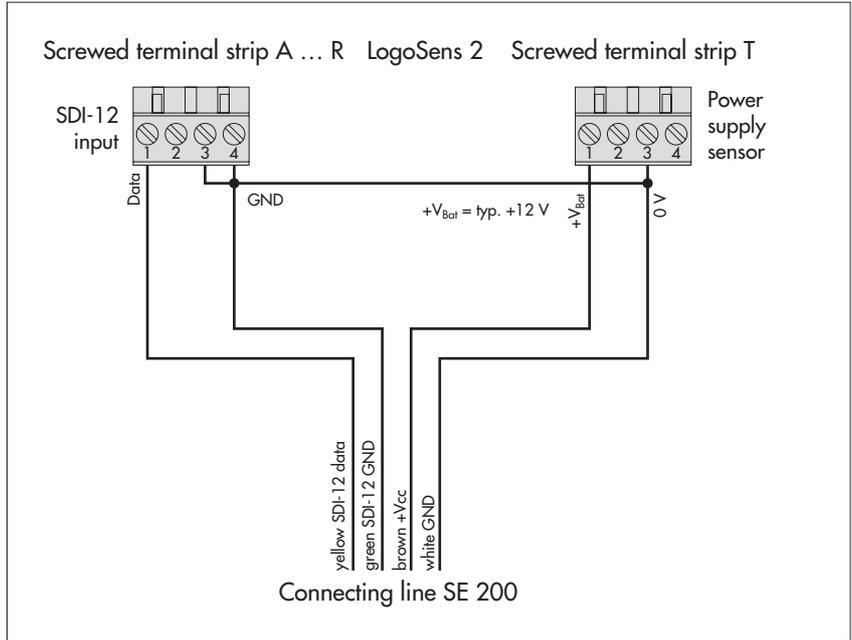
### 5.2 Connecting the SE 200 to any datalogger using 4 ... 20 mA

- Connect the SE 200 to a 4 ... 20 mA input of the external datalogger. Follow the handbook of the datalogger when you do this, as well as Chapter 7 of these instructions, *determine the maximum load resistance (4 ... 20 mA interface)*! The wire assignments for the SE 200 connecting cable can be seen in Figure 4 (below).

### 5.3 Connecting the SE 200 to the LogoSens 2 using an SDI-12 interface

- Connect the SE 200 as shown in Figure 5 to the LogoSens 2 Station Manager using the connecting cable.

Fig. 5: Connecting the SE 200 to the LogoSens 2 Station Manager using an SDI-12 interface.

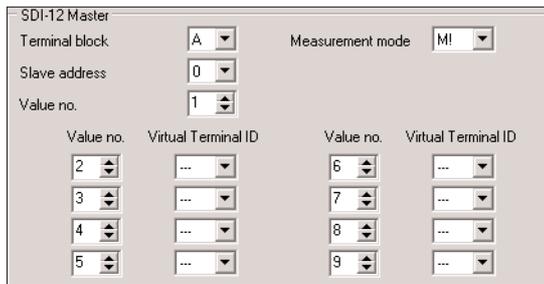


Please follow the LogoSens 2 Station Manager operating instructions as well.

#### Configuring the LogoSens 2 for SE 200 with the SDI-12 interface

- Create a LogoSens 2 channel using the *SDI-12 Master* function block (*Serial sensors* tab).
- Apply the following settings:

Fig. 6: Adjusting the LogoSens 2 *SDI-12 Master* function block operating parameters.



- ▶ Terminal block A ... R connection terminal of the SE 200
- ▶ Slave address typically 0 (only one SE 200 is connected to the terminal block)
- ▶ Value no. 1 (the SE 200 only determines one parameter; the water level)
- ▶ Measurement mode M!
- ▶ Value no./Virtual Terminal ID Not necessary in connection with the SE 200

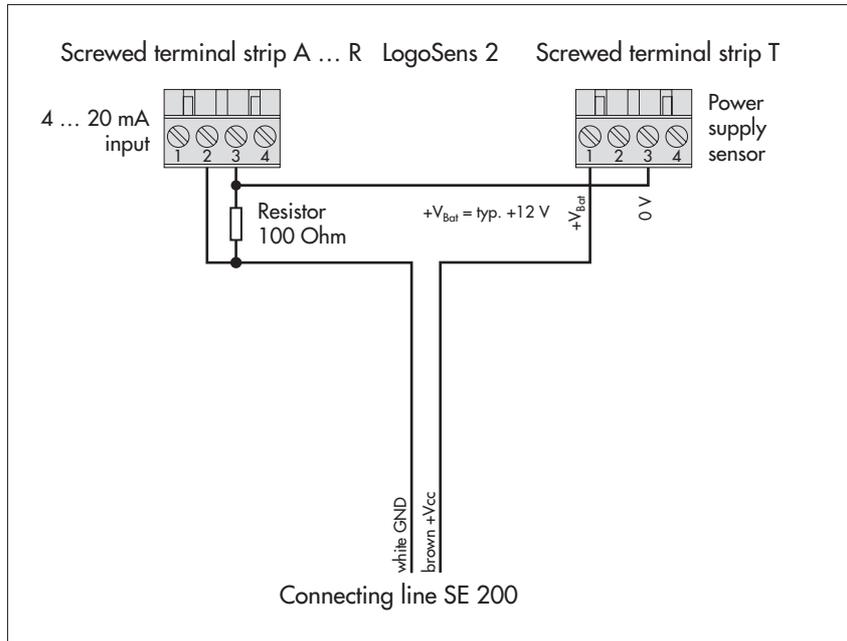
- In accordance with the conditions of delivery of the SE 200, adjust to the required units and number of digits after the decimal point in the *Channel* function block (m: 3; cm: 0; ft: 3).

## 5.4 Connect the SE 200 to the LogoSens 2 via the 4 ... 20 mA interface

- Connect the SE 200 as shown in Figure 7 to the LogoSens 2 Station Manager using the connecting cable.

Fig. 7: Connecting the SE 200 to the LogoSens 2 Station Manager using a 4 ... 20 mA Interface.

Use the 100 Ohm OTT resistor (order number: 55.550.126.4.2)!

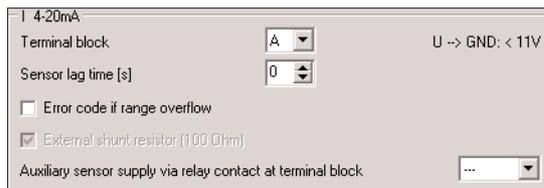


Please follow the LogoSens 2 Station Manager operating instructions as well.

### Configuring the LogoSens 2 for SE 200 with the 4 ... 20 mA interface

- Create a LogoSens 2 channel using the *I 4-20 mA* function block (*Analog Sensors* tab).
- Apply the following settings:

Fig. 8: Adjusting the LogoSens 2 *I 4-20mA* function block operating parameters.



- ▶ Terminal block A ... R  
Connection terminal of the SE 200
  - ▶ Sensor lag time (s) 0  
no lag time necessary
  - ▶ Error code if range overflow If necessary: Recording error codes when measuring ranges are exceeded
  - ▶ Auxiliary sensor supply via relay contact at terminal block Not necessary in connection
- Insert a *2-point scale* function block and make the appropriate settings (e.g. for an SE 200 with a 10 m measuring range and level measurement: Point 1: 4 → 0 ; Point 2: 20 → 10).
  - In the *Channel* function block, adjust to the required units and number of digits after the decimal point.

## 5.5 Setting the rotational direction for depth or level measurement

### Rotational direction definition

Example: The float pulley rotates clockwise

SE 200 with rotational direction to the "left" → decreasing measured values

SE 200 with rotational direction to the "right" → increasing measured values

### Adjusting the rotational direction for an SDI-12 interface

You can alternate between level and depth measurement using the SDI-12 command "Change Rotational Direction". This command changes the effect of the float pulley rotational direction on the measured value (whether it counts upward/downward). This depends on the end of the float cable at which the float hangs and the end at which the counterweight hangs.

- Select the value (0 or 1) for the "Change Rotational Direction" command so that the following conditions are met:

Table 1:

	<b>Water level</b>	<b>Measured value</b>
Depth	rises ↑	decreasing ↓
Measurement	falls ↓	increasing ↑
Level	rises ↑	increasing ↑
Measurement	falls ↓	decreasing ↓

### Adjusting the rotational direction for a 4 ... 20 mA interface

For the SE 200 with a 4 ... 20 mA output, the level or depth measurement must be done using the float and counterweight arrangement at the float cable. The SE 200 is available from the factory in "left" or "right" rotational settings.

- Select the position of the float and counterweight so that the conditions shown in Table 1 are met.

## 6 SDI-12 Commands and Answers

### 6.1 Standard commands

The following SDI-12 standard commands are implemented in the SE 200:

Command	Answer	Description
a!	a<CR><LF>	Acknowledgment active
aI!	allccccccmmmmmm... ...vvvxxxx<CR><LF>	Send identification SE 200 Answer = ...OTTHYDRO0000820.03
aAb!	b<CR><LF>	Change address
?!	a<CR><LF>	Query address
aM!	atttn<CR><LF>	Start measurement
aD0!	a<values><CR><LF>	Send data
aC!	atttnn<CR><LF>	Start simultaneous measurement

More information on the SDI-12 standard commands can be found in the document *SDI-12; A Serial-Digital Interface Standard for Microprocessor-Based Sensors; Version 1.2* (see Internet page [www.sdi-12.org](http://www.sdi-12.org)).

### 6.2 Extended SDI-12 Commands

All extended SDI-12 commands begin with an O for OTT. With these commands, it is possible to configure the SE 200 through the transparent mode of a datalogger.

Command	Answer	Description
- Adjust/read units aOU<value>! aOU!	aOU<value><cr> aOU<value><cr>	Adjust units Read out unit a – Sensor address <value> – Unit 0 = m 1 = cm 2 = ft
- Set measured value to 0 aOZ!	aOZOK<cr>	Set measured value to 0 at the current float pulley position a – Sensor address
- Adjust/read rotational direction aOR<value>! aOR!	aR<value><cr> aR<value><cr>	Adjust rotational direction Read out rotational direction a – Sensor address <value> – Rotational direction 0 = to the right 1 = to the left
- Adjust/read float pulley circumference aOC<value>! aOC!	aC<value><cr> aC<value><cr>	Adjust float pulley circumference Read out float pulley circumference a – Sensor address <value> – b.a b – Digit prior to the decimal point b – Digit after the decimal point Number of spaces: 5 (4 digits + decimal point) Note the following settings for the units m → <b>bbb.a</b> Input in mm (001.0 ... 999.9) cm → <b>bbb.a</b> Input in mm (001.0 ... 999.9) ft → <b>b.aaa</b> Input in feet (0.001 ... 9.999)

- Adjusting/reading the 4 ... 20 mA interface – lower limit

aOPA<value>!                      aOPA<value<cr>  
aOPA!                                  aOPA<value<cr>

Adjust lower limit  
Read out lower limit  
a – Sensor address  
<value> – p**b**.a  
p – Sign (+,-)  
b – Digits prior to the decimal point  
b – Digits after the decimal point  
Number of spaces: 6 (5 digits + decimal point)  
Note the following settings for the units  
m → p**bb**.aaa Input in m (-30.000 ... +30.000)  
cm → p**bb**.aaa Input in m (-30.000 ... +30.000)  
ft → p**bb**.aaa Input in feet (-98.424 ... +98.424)  
Note: When switching between m and ft, rounding errors of ±0.001 are possible.

- Adjusting/reading the 4 ... 20 mA interface – upper limit

aOPB<value>!                      aOPB<value<cr>  
aOPB!                                  aOPB<value<cr>

Adjust upper limit  
Read out upper limit  
a – Sensor address  
<value> – p**b**.a  
p – Sign (+,-)  
b – Digits prior to the decimal point  
b – Digits after the decimal point  
Number of spaces: 6 (5 digits + decimal point)  
Note the following settings for the units  
m → p**bb**.aaa Input in m (-30.000 ... +30.000)  
cm → p**bb**.aaa Input in m (-30.000 ... +30.000)  
ft → p**bb**.aaa Input in feet (-98.424 ... +98.424)  
Note: When switching between m and ft, rounding errors of ±0.001 are possible.

- Adjusting/reading the 4 ... 20 mA interface – mode

aOPC<value>!                      aOPC<value<cr>  
aOPC!                                  aOPC<value<cr>

Adjust mode  
Read out mode  
a – Sensor address  
<value> – Mode  
0 = 4 ... 20 mA interface deactivated  
    (only the SDI-12 interface is active)  
1 = 4 ... 20mA and SDI-12 interface are active  
2 = 4 mA output (constant value)  
3 = 20 mA output (constant value)  
4 = 12 mA output (constant value)

## 7 Determine the maximum load resistance (4 ... 20 mA interface)

The load resistance connected to the SE must not exceed a specific maximum value. This value depends on the level of the supply voltage to the SE 200. If the load resistance is greater, the output current can no longer be evaluated. Smaller load resistances are allowed.

- Read off the maximum load resistance for your supply voltage from the following diagram.

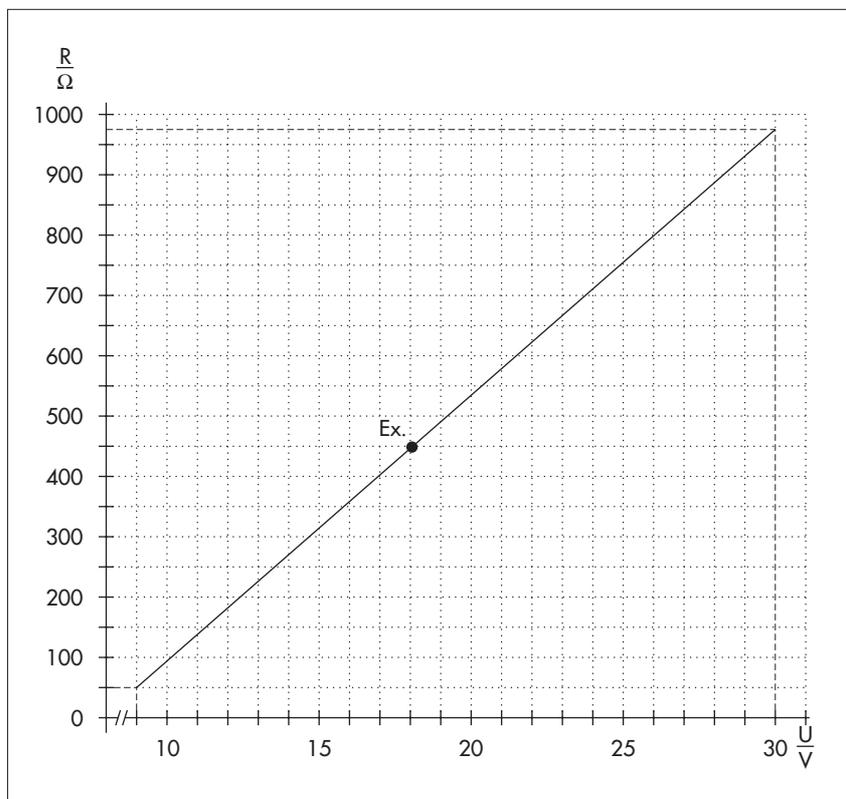
**Example:** Supply voltage 18 Volts → max. load resistance 450 Ohm.

The SE 200 delivers an output current corresponding to the measured value for a load resistance of up to 450 Ohms.

- Dimension the connected electrical circuit accordingly. Check the input resistance of the connected peripheral device for this purpose.

Fig. 9: Diagram to determine the maximum load resistance as a function of supply voltage.

Minimum supply voltage: 9 V  
Maximum supply voltage: 30 V  
Resistor tolerance: 0.1 %/15 ppm!



## 8 Maintenance

The SE 200 does not require any special maintenance work. However, make sure the float and counterweight hang freely.

To buffer the loss of operating voltage, the SE contains a lithium battery. This lithium battery has a lifespan of at least 10 years<sup>1)</sup>. The SE 200 is also functional after 10 years provided that the operating voltage is applied uninterrupted. In order to maintain buffer operation when the operating voltage fails, we recommend replacement of the lithium battery after 10 years. This replacement must be done at the factory!



Never open the casing of the SE 200! There are no adjustment or control elements inside the casing! The lithium battery is only replaceable at the factory!

In case of device defects or to exchange the battery, contact the repair center of OTT:

OTT MESSTECHNIK GmbH & Co. KG  
Repair Center  
Ludwigstrasse 16  
87437 Kempten · Germany  
Tel. +49 (0)831/5617-433  
Fax +49 (0)831/5617-439  
repair@ott-hydrometry.de

<sup>1)</sup> If the unit is to be stored without operating voltage being applied, its lifespan is at least 5 years.

## 9 Note about the disposal of old devices



In accordance with the European Union guideline 2002/96/EC, OTT takes back old devices within the member countries of the European Union and disposes of them in an appropriate way. The devices concerned by this are marked with the symbol shown aside. For further information about the return procedure, please contact your local sales contact. You will find the addresses of all sales partners in the internet on "[www.ott-hydrometry.com](http://www.ott-hydrometry.com)". Please take into consideration also the national implementation of the EU guideline 2002/96/EC of your country.

## 10 Technical Data

Measuring range	
SDI-12	±30 m; ±98.424 ft
4 ... 20 mA	0 ... 1 m; 0 ... 10 m; 0 ... 30 m 0 ... 3 ft; 0 ... 30 ft; 0 ... 90 ft
Resolution	
SDI-12	0.001 m; 1 cm; 0.001 ft
4 ... 20 mA	0.1 % of the measuring range
Precision <sup>1)</sup>	
SDI-12	± 0.003 % of the measuring range ± 1 digit
4 ... 20 mA	0.1 % of the measuring range
Units	
SDI-12	m; cm; ft
Interfaces	SDI-12 or SDI-12/4 ... 20 mA
Supply voltage	9 to 30 V DC
Current drawn	
SDI-12 Sleep mode	< 400 µA
SDI-12 Active mode	< 2.0 mA
Dimensions L x W x H	82 mm x 82 mm x 34 mm
Weight	0.250 kg
Casing material	Fiberglass reinforced plastic
Type of protection	IP 54
Temperature range	
Operational	-20 ... +70 °C
Storage	-40 ... +85 °C
Relative humidity	10 ... 95 % (non-condensing)
Float pulley circumference	200.0 mm
Standard float cable	1 mm Ø other diameters are scalable; e.g. 0.6 mm float cable -Ø, adjust float pulley circumference to 198.7 mm
Connecting cable	
Length	10 m, 15 m or 30 m
Wire assignment	
- green	SDI-12 GND
- brown	+V <sub>CC</sub> (typ. 12 V DC) or V+ (4 ... 20 mA)
- white	GND or V- (4 ... 20 mA)
- yellow	SDI-12 data
EMC limits	
- Resistance to electrostatic discharge (ESD)	complies with EN 61000-4-2 degree of severity 2 (4 kV contact discharge)
- Resistance to electromagnetic fields	complies with EN 61000-4-3 degree of severity 3 (10 V/m)
- Resistance to transient fields (burst)	complies with EN 61000-4-4 special degree of severity (4 kV)
- Resistance to surge (1 kV)	complies with EN 61000-4-5 degree of severity 2
- Line-borne and radiated interference	complies with EN 55022 Class B

<sup>1)</sup> Base precision SE 200 (without float/float cable/counterweight)

## Appendix A: Installing the SE 200 as an attachment

Figures 10 through 15 indicate examples of attachment options to mechanical level recorders. Each illustration indicates the parts of the installation accessories used.

Select the illustration that applies to you and proceed as follows:

### Fastening the SE 200

- When using a carrier unit (Figure 14 + 15): Fasten the carrier rail to the float pulley of the SE 200 using two recessed-head bolts; attach the carrier base to the opposite float pulley (mechanical level recorder) using double-sided adhesive strips; insert carrier pin into carrier base.
- Depending on the design of the level recorder, fasten the SE 200 using either
  - connecting angle A with a friction disc fitted underneath or
  - screw it onto connecting angle B (M 6 x 25 + washers); attach connecting angle B to a flat base using double-sided adhesive strips (use screws if necessary).
- Place float cable over both float pulleys or couple the float pulleys via the carrier pin and carrier rail.

Then turn to Chapter 5.

Fig. 10: Attachment example to an OTT horizontal Type X level recorder.

Additional float cable guide via SE 200 float pulley.

Tighten the guide roller screw only slightly!

Required parts:  
Connecting angle A  
+ friction disc  
Guide roller

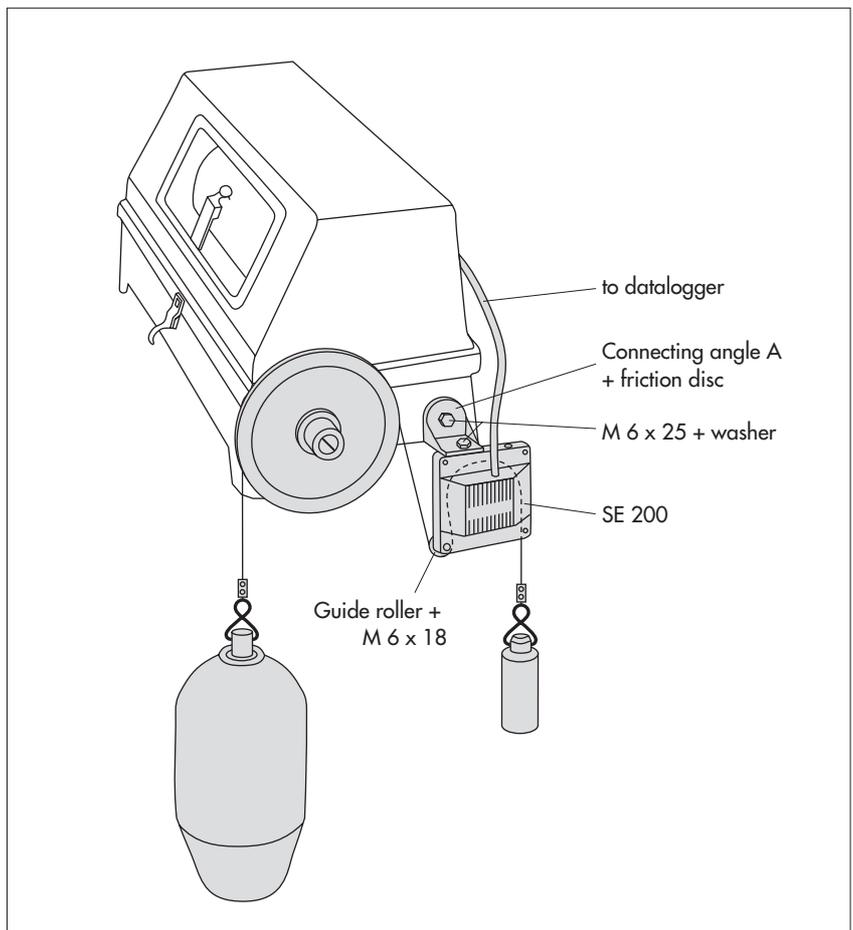


Fig. 11: Attachment example to  
OTT strip chart recorder R20.

Additional float cable guide  
via SE 200 float pulley.

Use the short guide lever for a standard  
R 20 and the long guide lever for an  
R 20 with bracket (dashed lines).

Tighten the guide roller screw only slightly!

Required parts:  
Connecting angle A  
+ friction disc  
Guide roller

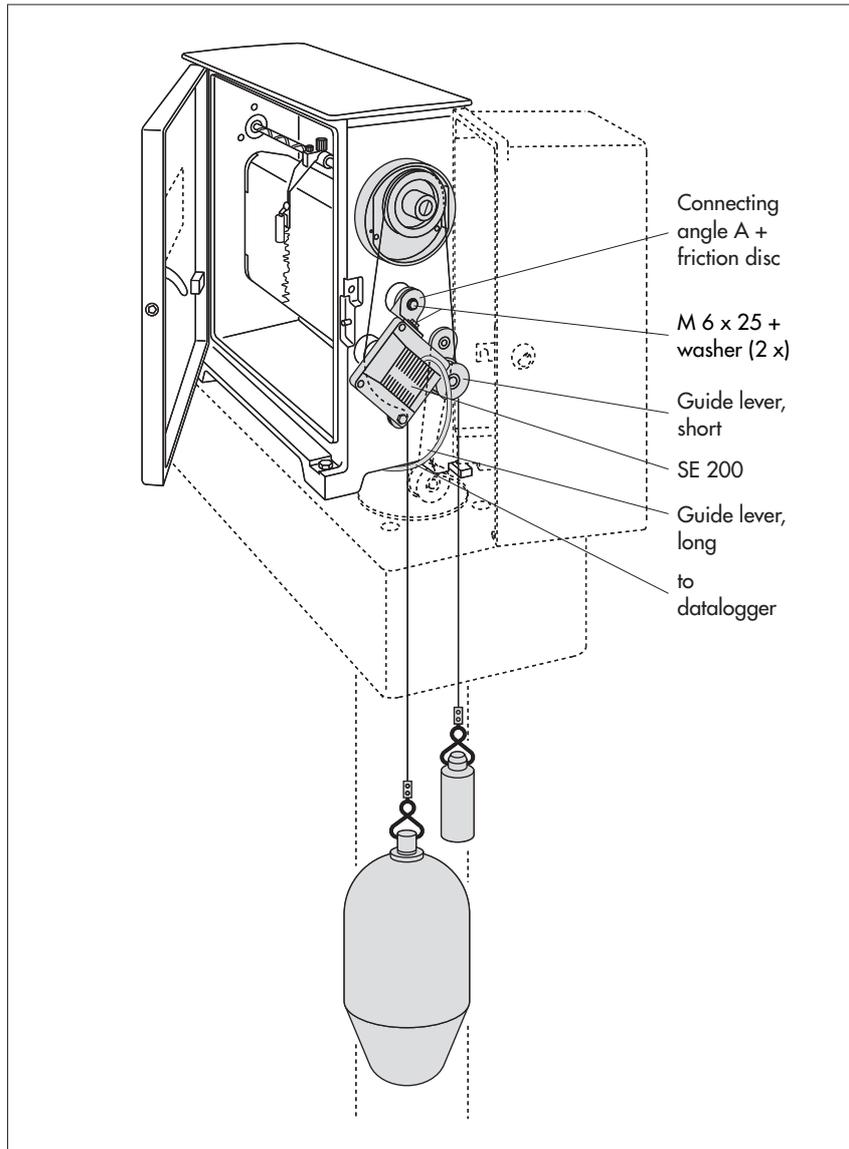


Fig. 12: Attachment example to an OTT vertical level recorder R16.

Additional float cable guide via SE 200 float pulley.

Float pulley circumference: adjust to 198.7 mm (0.6 mm float cable).

Tighten the guide roller screw only slightly!

- Required parts:  
 Connecting angle A + friction disc  
 Guide roller

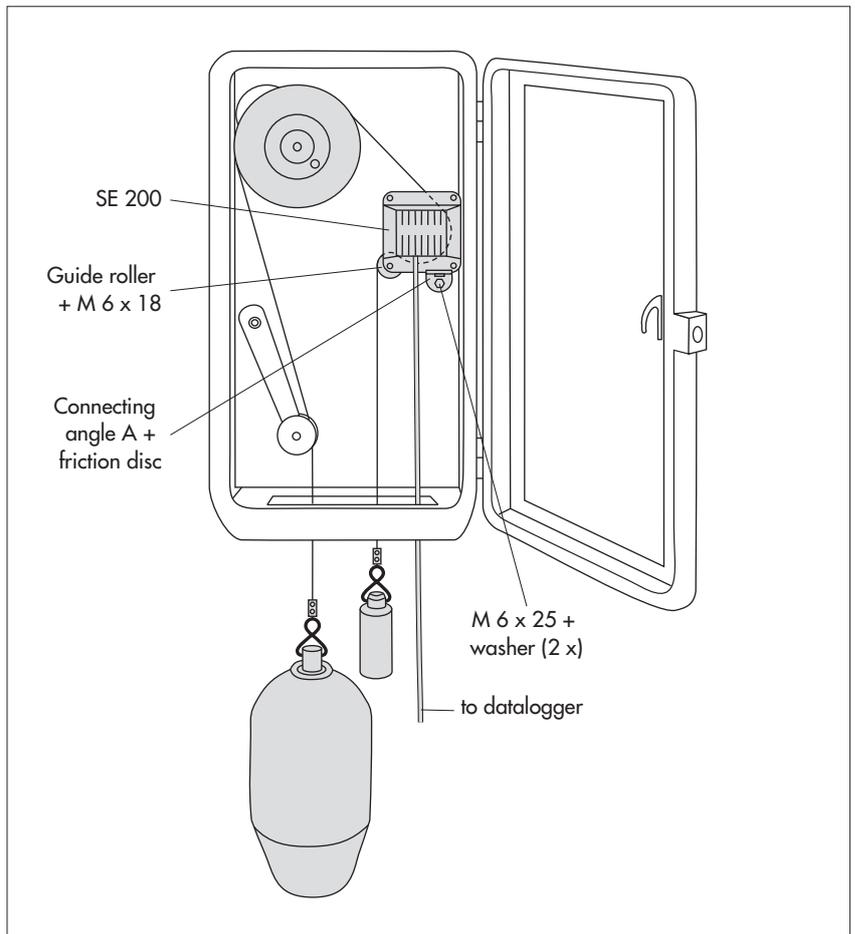


Fig. 13: Example of attachment to strip chart recorder from another manufacturer.

Additional float cable guide via SE 200 float pulley.

Tighten the guide roller screw only slightly!

- Required parts:  
 Connecting angle A + friction disc  
 Guide roller

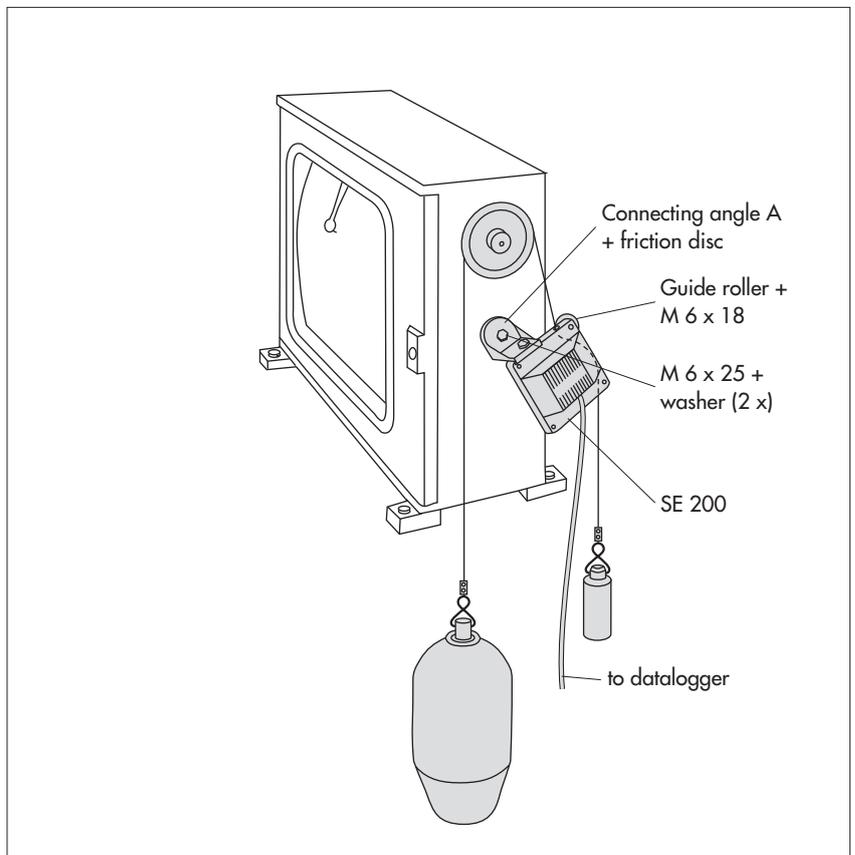


Fig. 14: Attachment example to the vertical drum recorder of a different manufacturer.

Coupling the SE 200 using the carrier unit, consisting of a carrier rail, carrier base and carrier pin.

Attach the carrier base to the float pulley so that it can rotate without blockage.

- Required parts:  
Connecting angle B  
Carrier rail  
Carrier base  
Carrier pin  
Adhesive strips

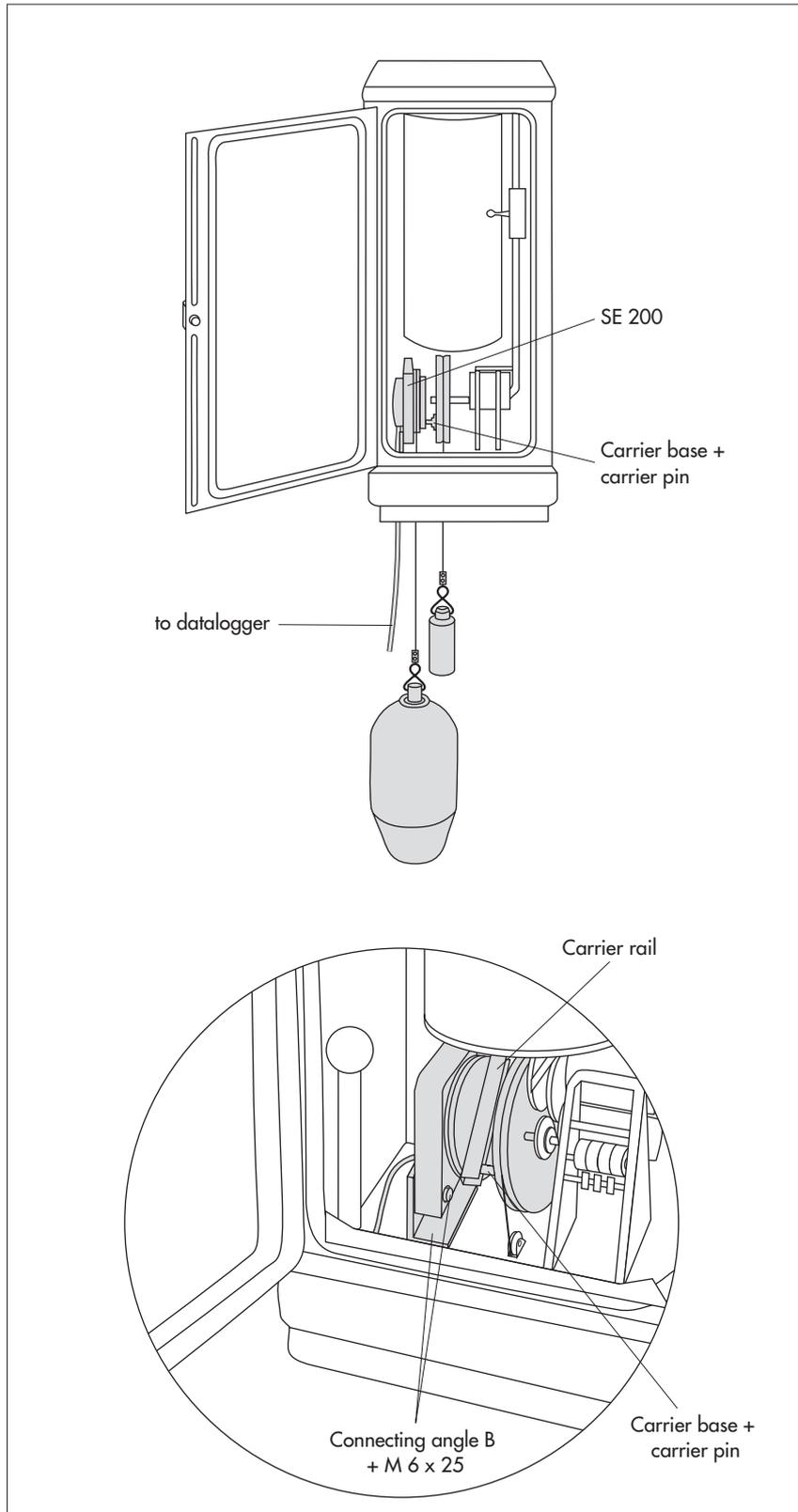
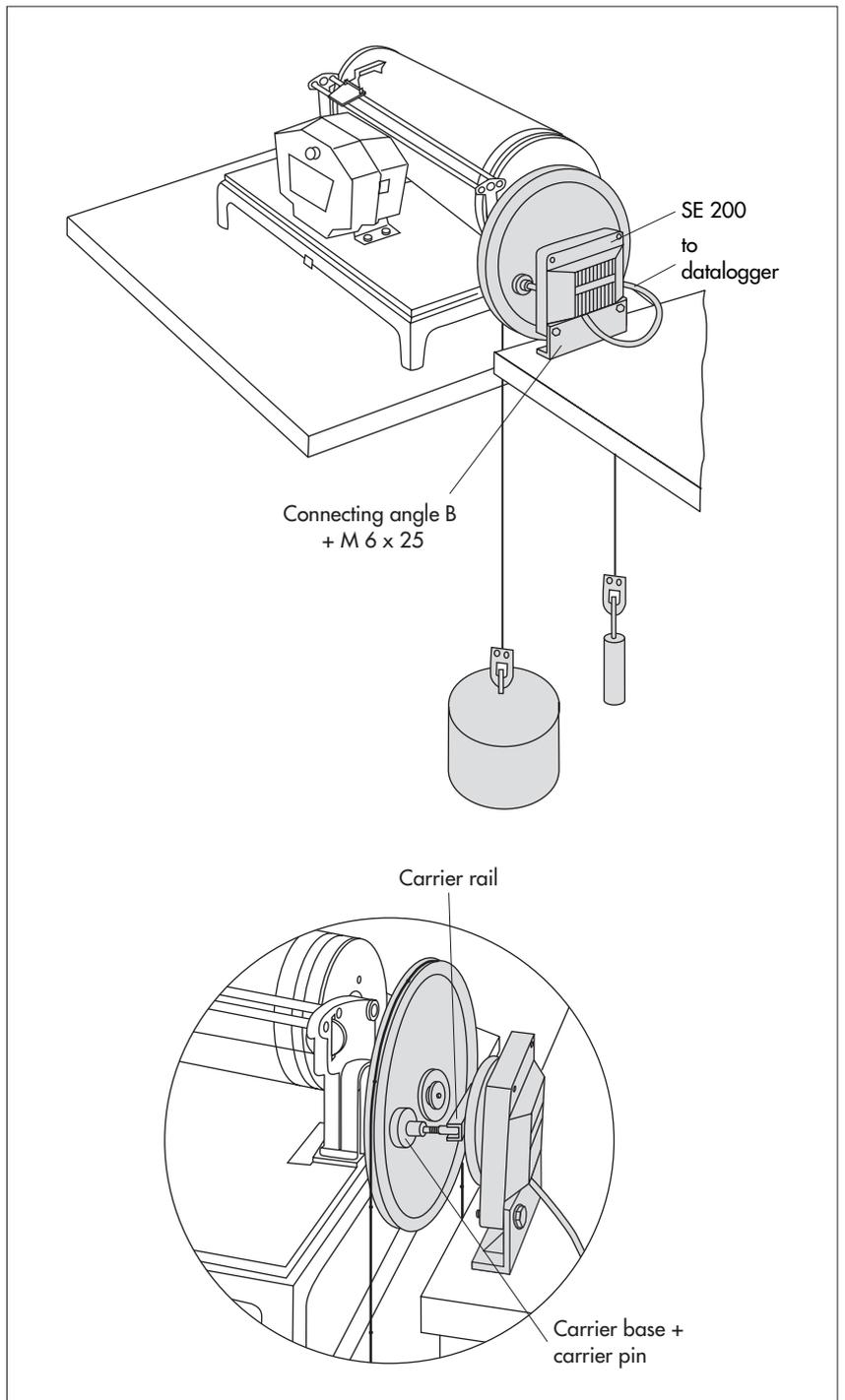


Fig. 15: Attachment example to the horizontal drum recorder of a different manufacturer.

Coupling the SE 200 using the carrier, consisting of a carrier rail, carrier base and carrier pin.

- Required parts:  
Connecting angle B  
Carrier rail  
Carrier base  
Carrier pin  
Adhesive strips



## Appendix B: Installing the SE 200 in an observation well

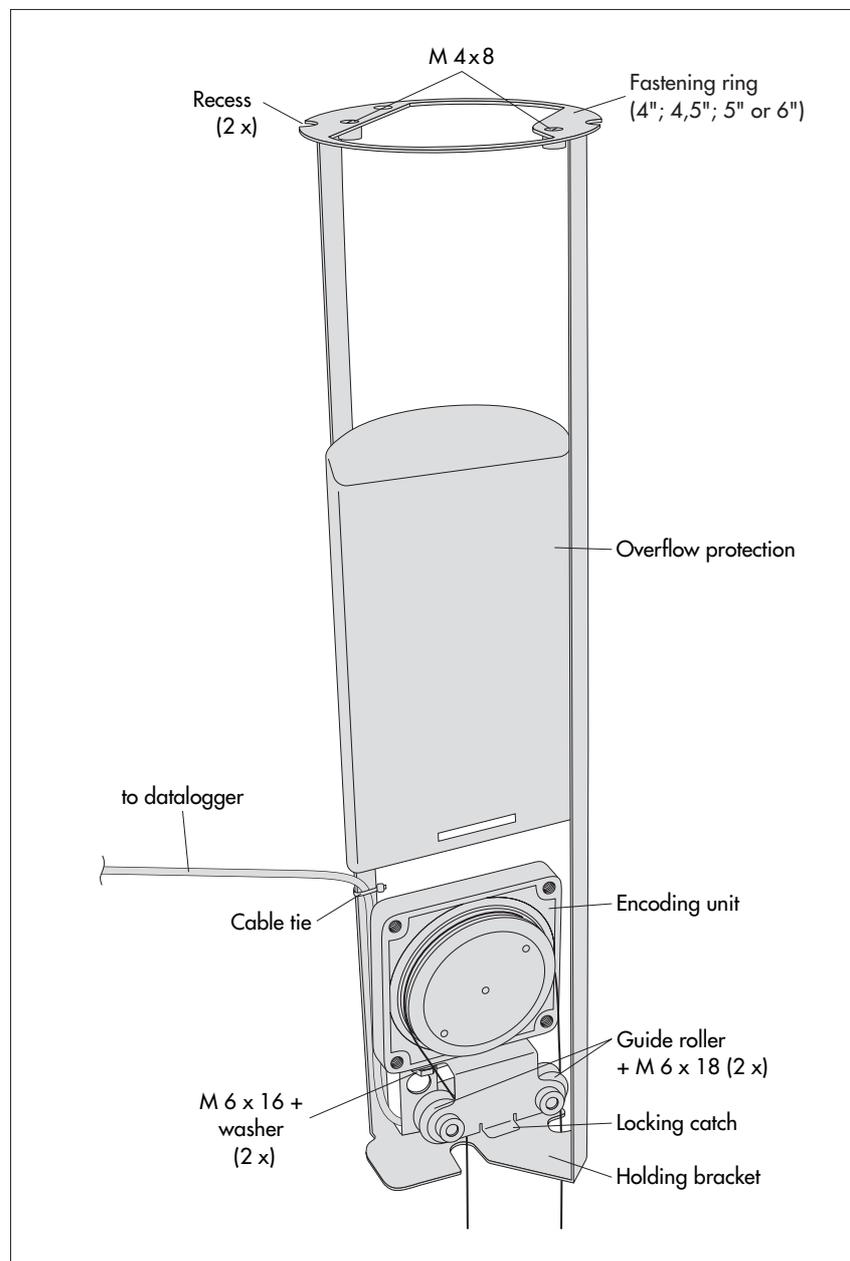
The SE 200 can also be installed in 4"; 4,5"; 5" or 6" observation wells using the observation well installation set (accessories).

OTT or HT top caps are to be used to seal the pipes (others on request). You can also use a contact gauge with the installed observation well installation set. In the process, the measuring tape is then passed in front of the holding bracket. Proceed as follows to install:

- Select the right fastening ring to fit the existing observation well.
- Assemble the observation well installation set and the SE 200 as shown in Figure 10; install the fastening ring only as shown! Hex head cap screws are provided for the guide rollers; tighten these screws only slightly (self-locking).
- Fix the transducer cable to the holding bracket using a cable tie.

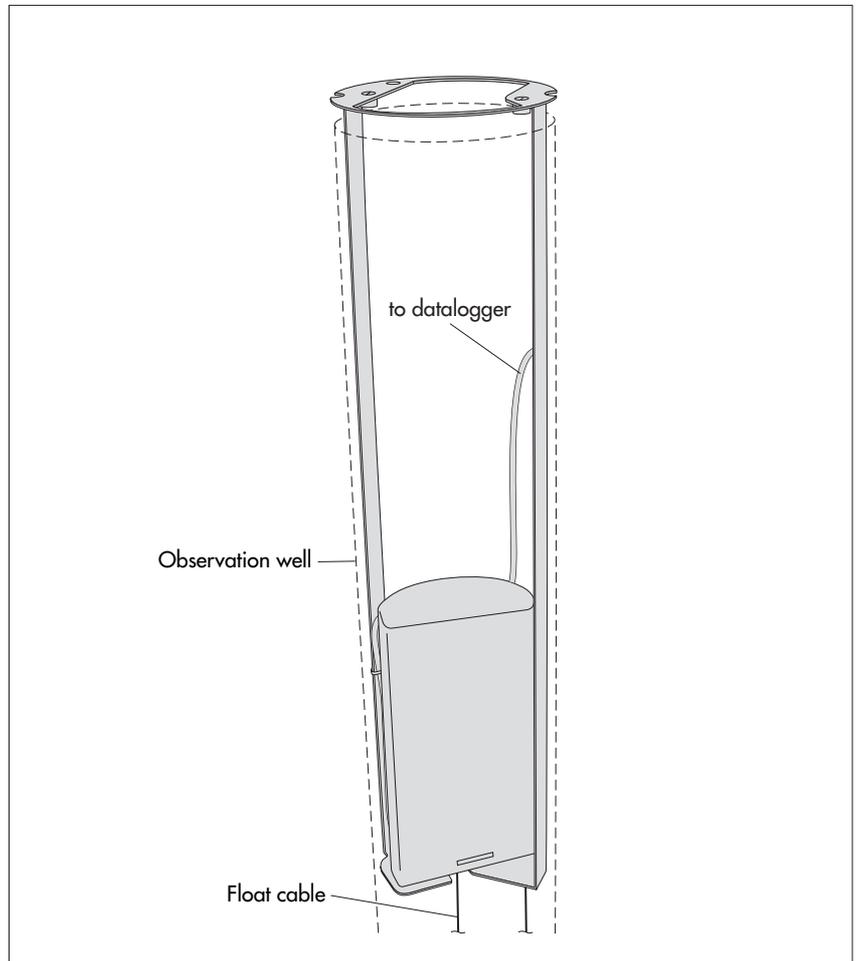
Then turn to Chapter 5.

Fig. 16: Assemble SE 200 observation well installation set.



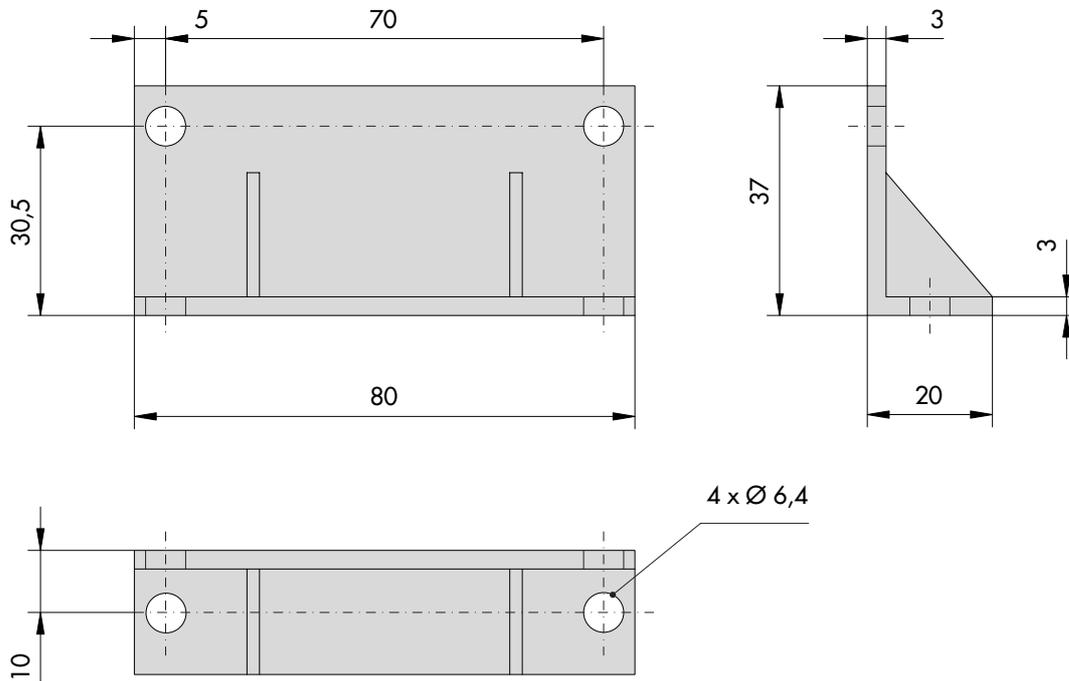
- Place the float cable over the float pulley.
- Place overflow protection (diving bell principle) over the SE 200 until it engages with both locking catches.
- First, carefully lower the float, then the entire observation well installation set and counterweight into the observation well; the fastening ring will come to rest on the bottom of the top cap when this is done (for OTT top caps: rotate the fastening ring until there is a recess at the suspension bracket of the top cap).
- Close the top cap.

Fig. 17: Installation set fitted with SE 200 in a well pipe.  
Top cap not shown for purposes of clarity.

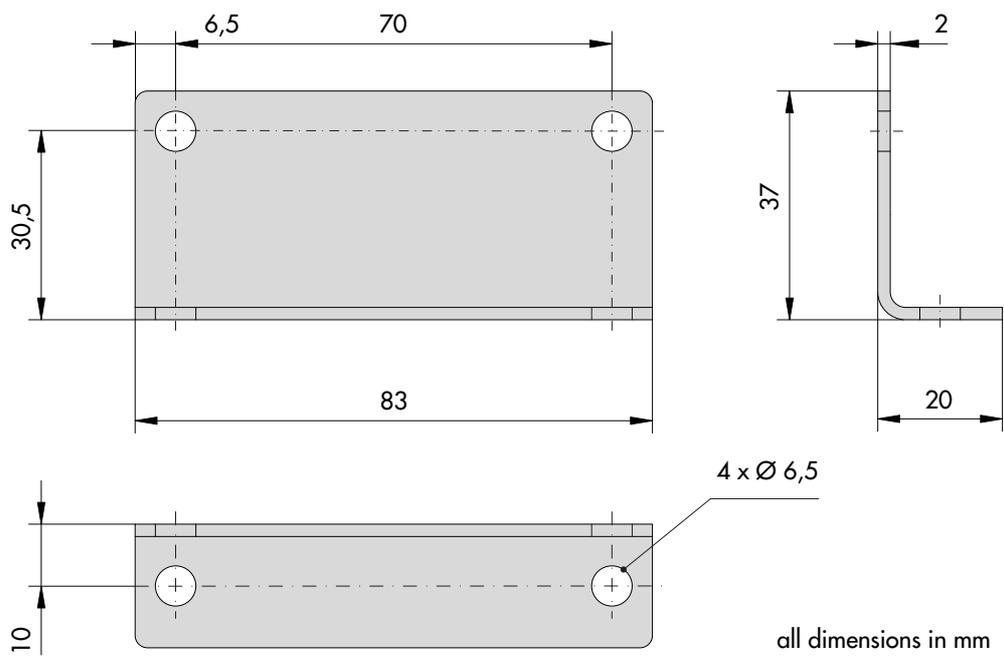


## Appendix C: Dimensions of connecting angle B

### Connecting angle B (plastic)



### Connecting angle B (metal)









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**OTT MESSTECHNIK GmbH & Co. KG**

Ludwigstrasse 16  
87437 Kempten · Germany  
Tel. +49 (0)831 5617-0  
Fax +49 (0)831 5617-209

[info@ott-hydrometry.de](mailto:info@ott-hydrometry.de)  
[www.ott-hydrometry.de](http://www.ott-hydrometry.de)