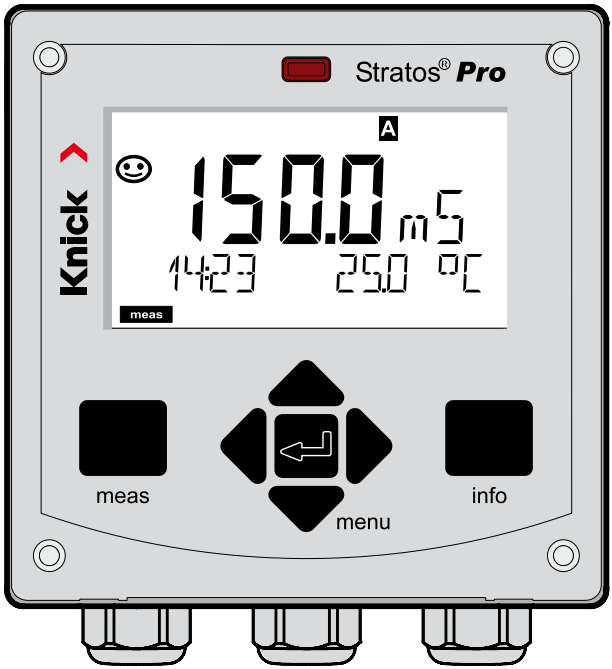
Stratos® Pro A401B CONDI

User Manual



Latest Product Information:

www.knick.de

094711

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Basics

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Return of products under warranty

Please contact our Service Team before returning a defective device.
Ship the cleaned device to the address you have been given.
If the device has been in contact with process fluids, it must be de-contaminated/disinfected before shipment. In that case, please attach a corresponding certificate, for the health and safety of our service personnel.

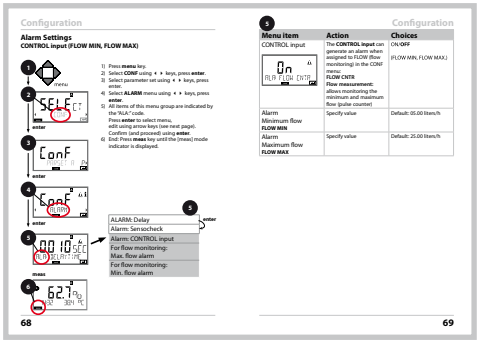
Disposal

Please observe the applicable local or national regulations concerning the disposal of "waste electrical and electronic equipment".

About this manual:

This manual is intended as a reference guide to your device –
You don't have to read the book from front to back.
Take a look at the ***Table of Contents*** or the ***Index*** to find the function you are interested in. Each topic is explained on a double-page spread with step-by-step instructions on how to configure the desired function. Clearly legible page numbers and headlines help you to quickly find the information:

Left page:
How do I get to the function



Right page:
Which settings are provided for this function

Safety Instructions

Quickstart Guides

Installation and first steps:

- Operation
- Menu structure
- Calibration
- Error messages and recommended actions

Specific Test Report

Control Drawings

Up-to date documentation available on our website:

www.knick.de

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Intended Use

Stratos Pro A401B CONDI is a 4-wire device for measurement of electrical conductivity and temperature in liquids using electrodeless (toroidal) sensors. Fields of application are: biotechnology, chemical industry, environment, food processing, water/wastewater treatment.

Enclosure and mounting possibilities

- The sturdy molded enclosure is rated IP 67/NEMA 4X for outdoor use. It is made of glass-reinforced PBT / PC and measures 148 mm x 148 mm x 117 mm (H x W x D).
  It is provided with knockouts to allow:
- wall mounting (with sealing plugs to seal the enclosure), see page 16
- post/pipe mounting (Ø 40 … 60 mm, ☐ 30 … 45 mm) see page 17
- panel mounting (138 mm x 138 mm cutout to DIN 43700), see page 18

Weather protector (accessory)

The weather protector, which is available as accessory, provides additional protection against direct weather exposure and mechanical damage, see page 17.

Connection of sensors, cable glands

For connecting the cables, the enclosure provides

- 3 knockouts for cable glands M20x1.5
- 2 knockouts for NPT 1/2" or rigid metallic conduit

For quasi-stationary installations with Memosens sensors, we recommend using the M12 device socket (accessory ZU 0822) instead of a cable gland – it allows simple replacement of the sensor cable without opening the device.

Sensors

The device has been designed for application with toroidal (electrodeless) sensors, in particular for Models SE 655/656, SE 660 and SE 670 (Knick).

Display
Plain-text messages in a large, backlit LC display allow intuitive operation. You can specify which values are to be displayed in standard measuring mode (“Main Display”, see page 36).

Color-coded user interface
The colored display backlighting signals different operating states (e.g. alarm: red, HOLD mode: orange, see page 37).

Diagnostic functions
“Sensocheck“ automatically monitors sensor and cables; and the “Sensoface“ function clearly indicates the sensor condition, see page 114.

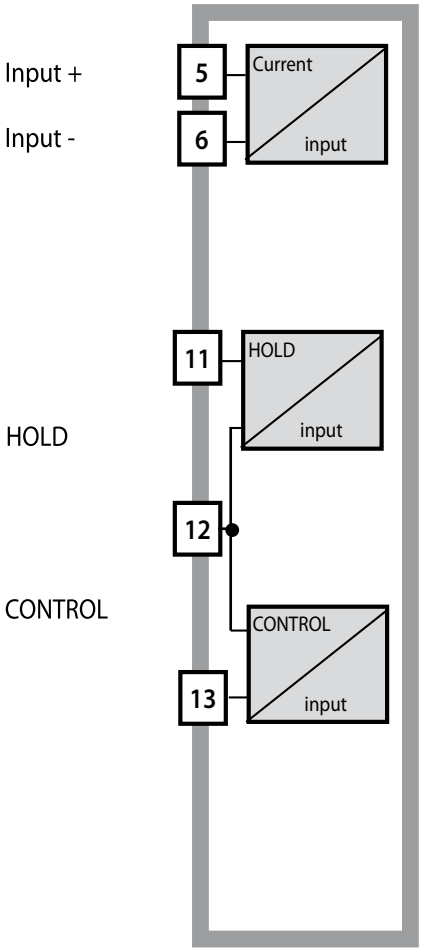
Data logger
The internal logbook (TAN SW-A002) can handle up to 100 entries – up to 200 with AuditTrail (TAN SW-A003), see page 117.

2 parameter sets A, B
The device provides two parameter sets which can be switched manually or via a control input for different process adaptations or different process conditions.
For overview of parameter sets (table for copy), see page 52.

Password protection
Password protection (passcodes) for granting access rights during operation can be configured, see page 122.

TC process medium: Selecting the compensation method
The following temperature compensation methods are provided: linear (by entering a temperature coefficient), natural waters (nLF), NaCl, see page 74.

Control inputs



I input
The analog (0) 4 ... 20 mA current input can be used for external temperature compensation (TAN required).
See page 76.

HOLD
(floating digital control input)
The HOLD input can be used for external activation of the HOLD mode, see page 41.

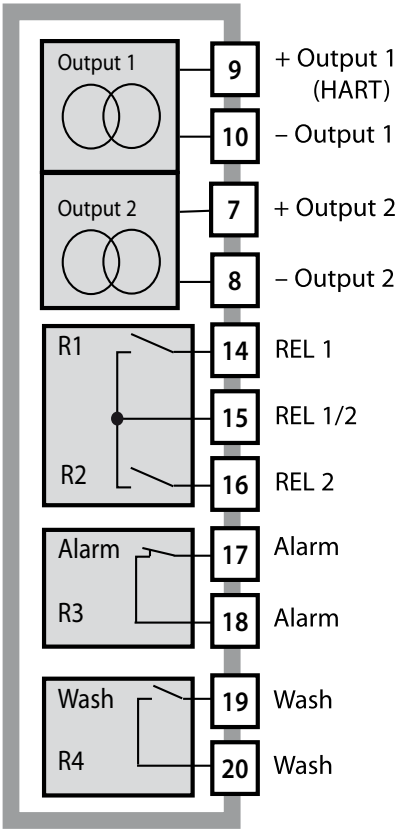
CONTROL
(floating digital control input)
The CONTROL input can be used either for parameter set selection (A/B) or for flow monitoring, see page 78.
The "Wash" contact can be used for indicating the active parameter set (see next page).

Power supply
Current is provided through a universal power supply 24 ... 230 V AC/DC, AC: 45 ... 65 Hz.

Options
Additional functions can be activated by entering a TAN (page 122).

Signal outputs
The device provides two current outputs (for transmission of measured value and temperature, for example). The output curve is adjustable (linear, bilinear or logarithmic), see page 62 onwards.

Relay contacts
Four floating relay contacts are available.



Current outputs
The floating current outputs (0) 4 ... 20 mA are used for transmitting measured values. The output curve can be linear, bilinear or logarithmic. An output filter can be programmed, the fault current value can be specified. See page 62 onwards.

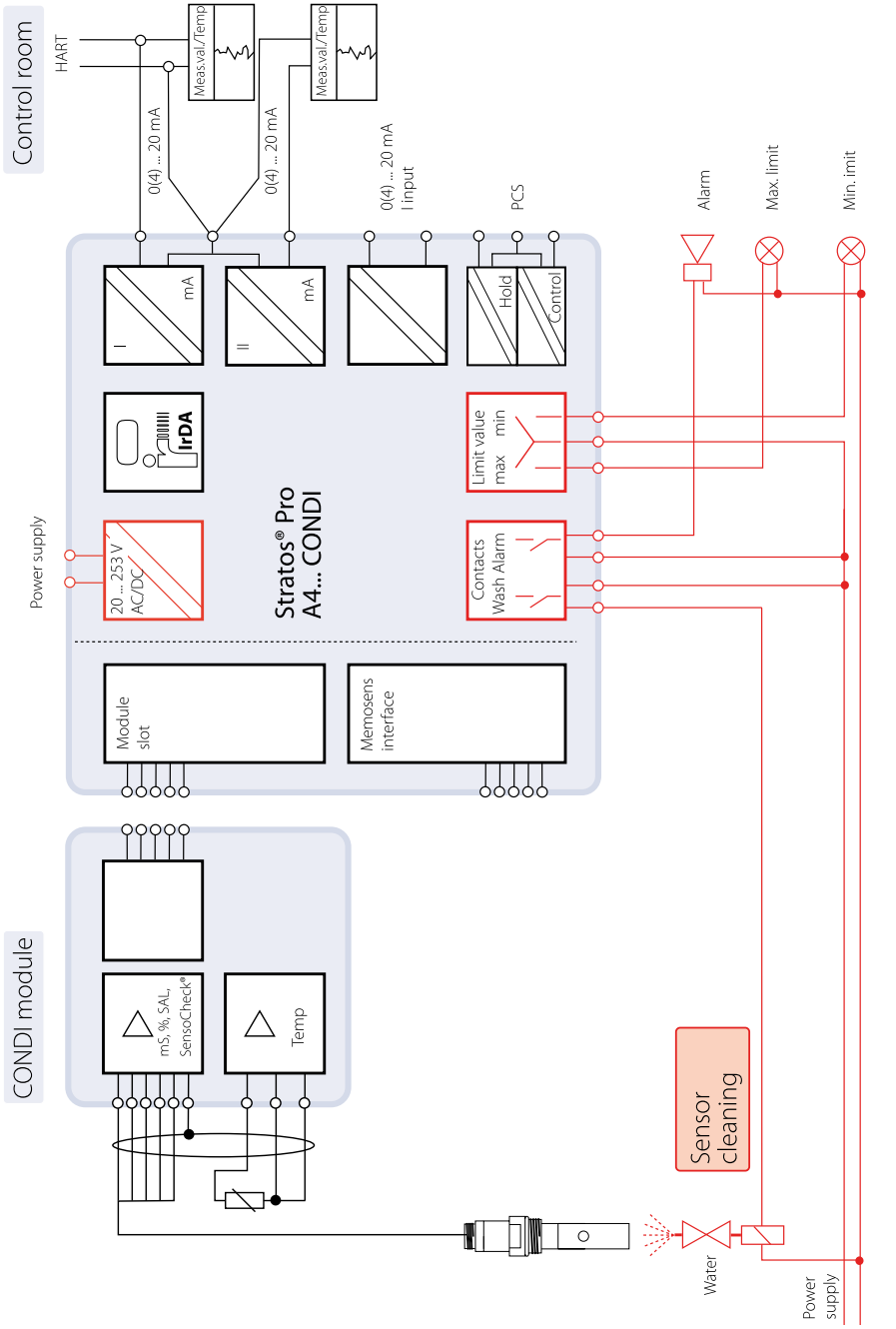
Relay contacts
2 relay contacts for limit values. Adjustable for the selected process variable: hysteresis, switching behavior (MIN/MAX limit), contact type (N/O, N/C) and delay (page 84).

Alarm
An alarm can be generated by Sensocheck, flow monitoring or current failure (page 80).

Wash (cleaning function)
This contact can be used for controlling a rinsing probe or for indicating the active parameter set (page 98).

PID controller
Configurable as pulse length or pulse frequency controller (page 94).

Typical Application of Stratos Pro A401B CONDI



Safety Information

Be sure to read and observe the following safety instructions!
The device has been manufactured using state of the art technology and it complies with applicable safety regulations.
When operating the device, certain conditions may nevertheless lead to danger for the operator or damage to the device.

See also separate "Safety Instructions" document.

⚠ CAUTION!

Commissioning must only be performed by trained personnel authorized by the operating company! Whenever it is likely that protection has been impaired, the device shall be made inoperative and secured against unintended operation.
The protection is likely to be impaired if, for example:

- the device shows visible damage
- the device fails to perform the intended measurements
- after prolonged storage at temperatures below –30 °C or above 70 °C
- after severe transport stresses

Before recommissioning the device, a professional routine test must be performed. This test must be carried out at the manufacturer's factory.

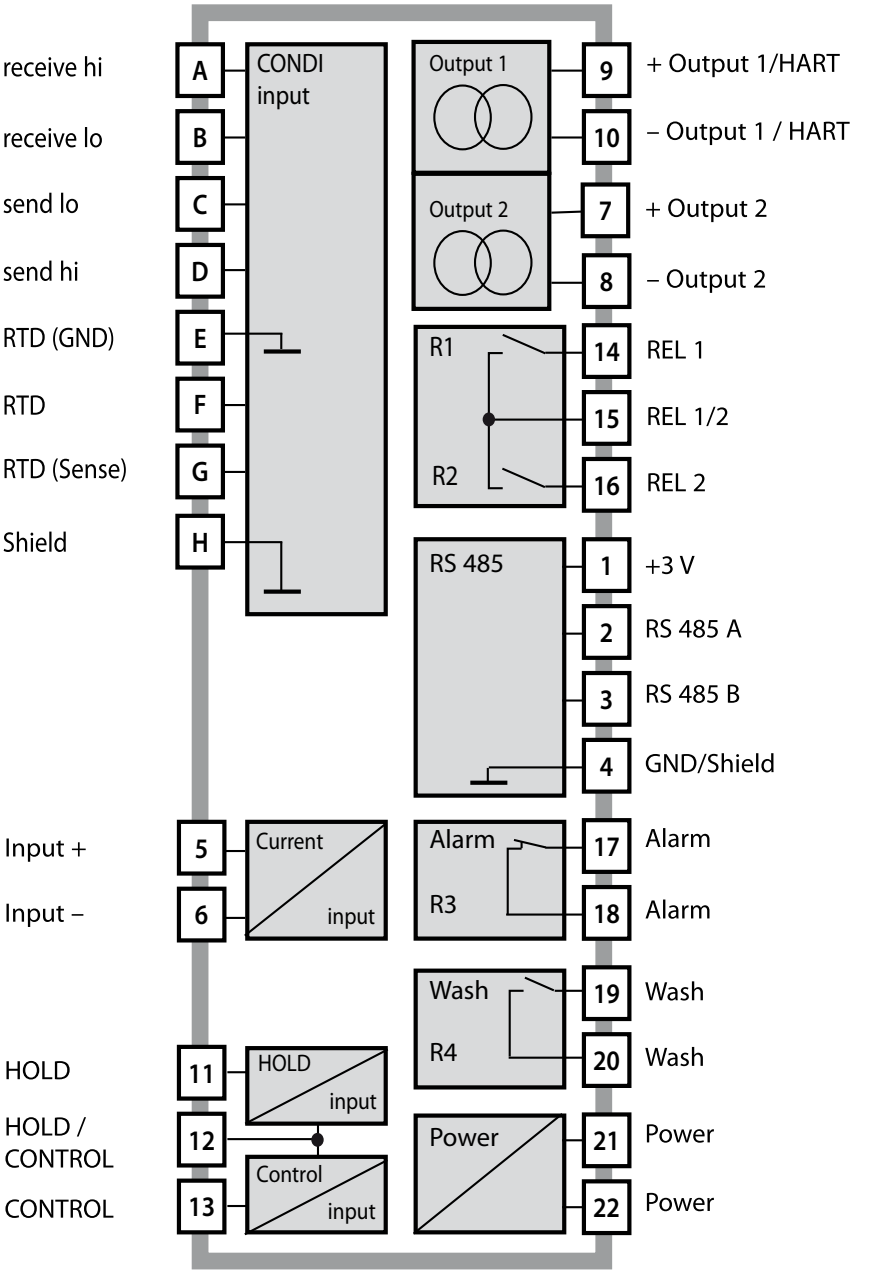
Note:
Before commissioning you must prove that the device may be connected with other equipment.

Application in hazardous locations:

Stratos A401B is approved for operation in hazardous locations.
Observe all applicable local codes and standards for the installation of electrical equipment in hazardous locations.
For orientation, please refer to NFPA 70 (NEC), ANSI/ISA-RP12.06.01.

- When installing the device in a hazardous location, observe the specifications of the Control Drawing (download: www.knick.de).
- Before commissioning, you must provide proof that the device may be connected with other equipment, such as a supply unit including cables and wires.
- In hazardous locations the device shall only be cleaned with a damp cloth to prevent electrostatic charging.
- Devices which have already been used shall be subjected to a professional routine test before they may be operated in another zone or another type of protection.

Overview of Stratos Pro A401B CONDI



Package Contents

Check the shipment for transport damage and completeness!

The package should contain:

- Front unit, rear unit, bag containing small parts
- Specific test report
- Documentation (cf p. 3)

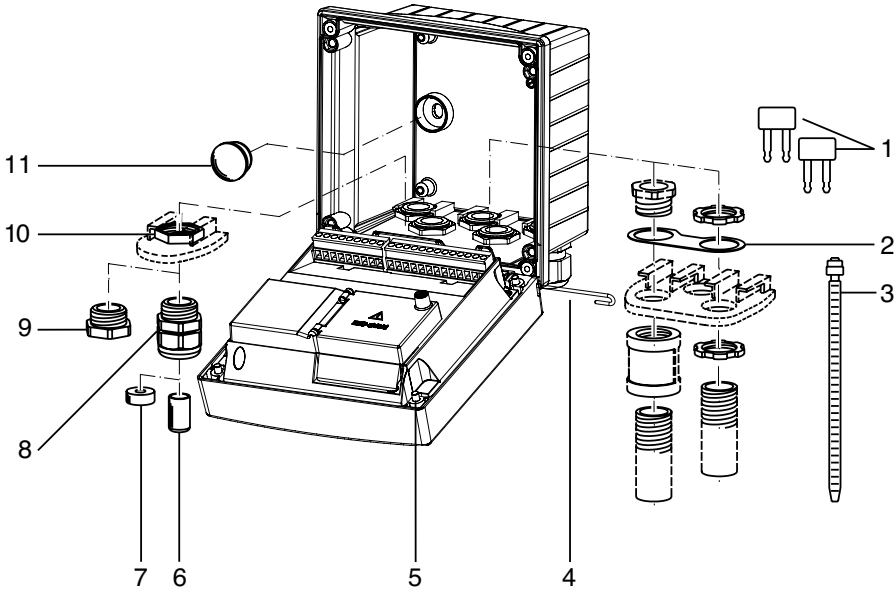
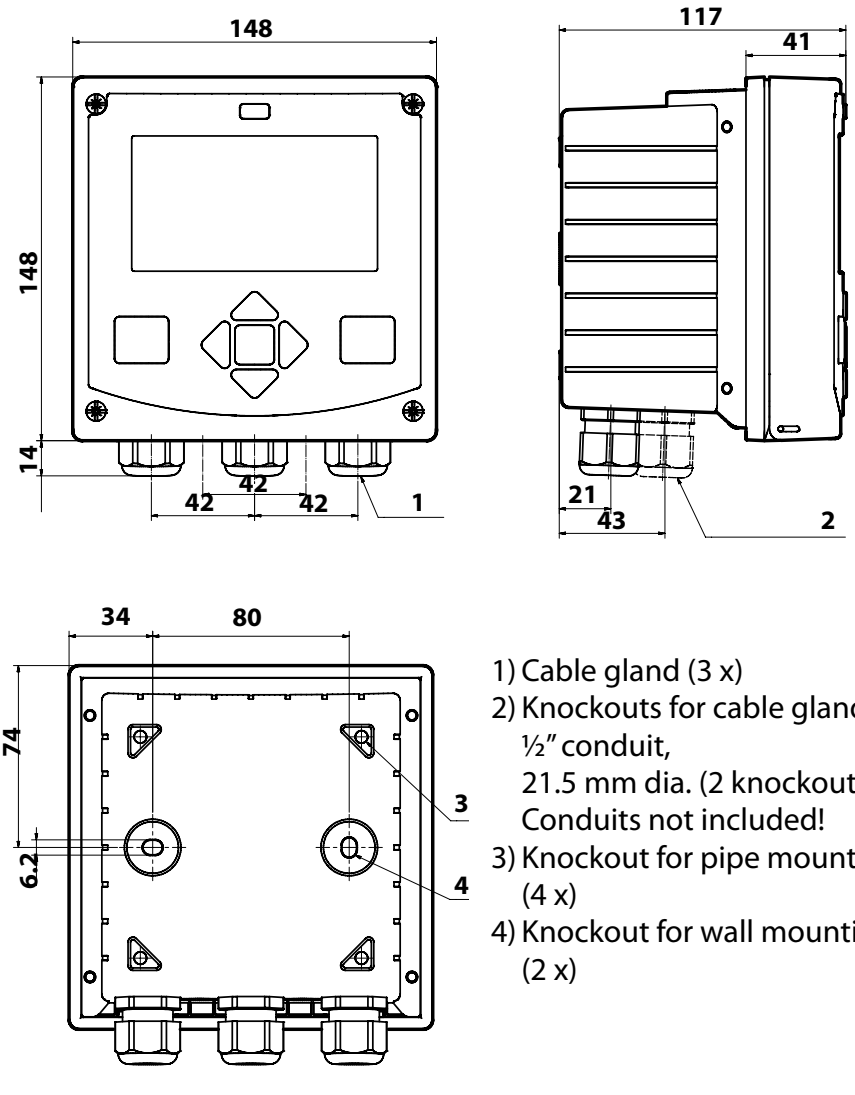


Fig.: Assembling the enclosure

1) Jumper (3 x)
2) Washer (1 x), for conduit mounting: Place washer between enclosure and nut
3) Cable tie (3 x)
4) Hinge pin (1 x), insertable from either side
5) Enclosure screw (4 x)
6) Sealing insert (1 x)
7) Rubber reducer (1 x)
8) Cable gland (3 x)
9) Filler plug (3 x)
10) Hexagon nut (5 x)
11) Sealing plug (2 x), for sealing in case of wall mounting

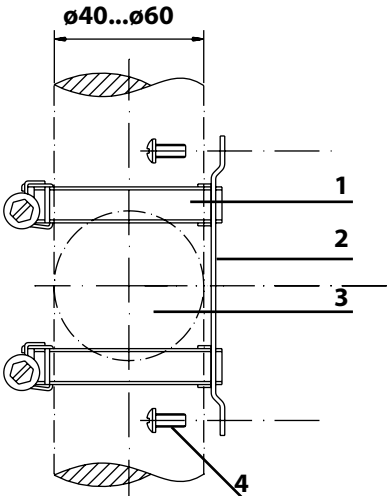
Mounting Plan, Dimensions



1) Cable gland (3 x)
2) Knockouts for cable gland or ½" conduit,
   21.5 mm dia. (2 knockouts)
   Conduits not included!
3) Knockout for pipe mounting (4 x)
4) Knockout for wall mounting (2 x)

Fig.: Mounting plan (All dimensions in mm!)

Pipe Mounting, Protective Hood



1) Hose clamp with worm gear drive to DIN 3017 (2 x)
2) Pipe-mount plate (1 x)
3) For vertical or horizontal posts or pipes
4) Self-tapping screw (4 x)

Fig.: Pipe-mount kit, accessory ZU 0274 (All dimensions in mm!)

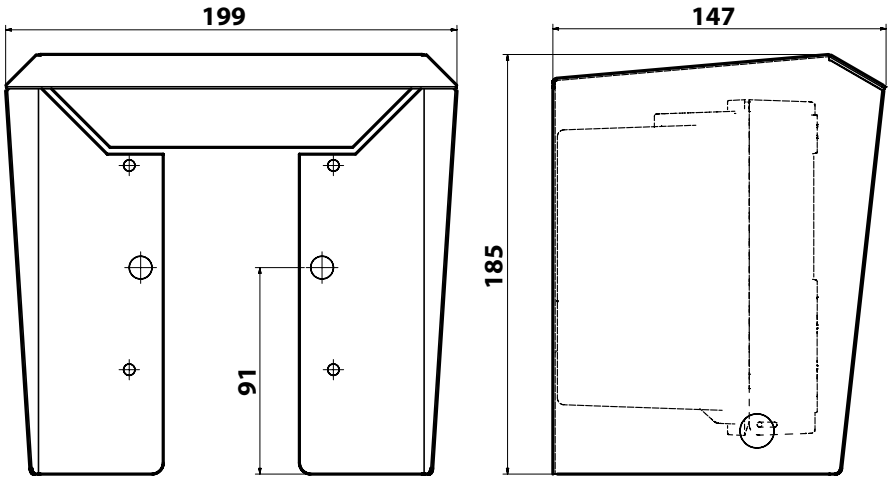
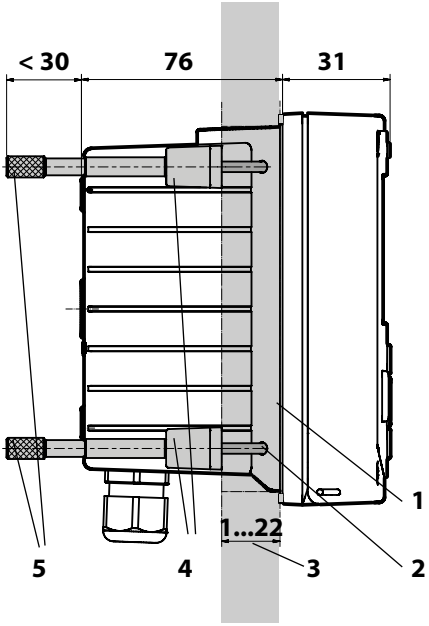


Fig.: Protective hood for wall and pipe mounting, accessory ZU 0737 (All dimensions in mm!)

Panel Mounting



1) Circumferential sealing (1 x)
2) Screws (4 x)
3) Position of control panel
4) Span piece (4 x)
5) Threaded sleeve (4 x)

Cutout
138 x 138 mm (DIN 43700)

Fig.: Panel-mount kit, accessory ZU 0738 (All dimensions in mm!)

Safety Precautions for Installation

- Installation of the device must be carried out by trained experts in accordance with this user manual and as per applicable local and national codes.
- Be sure to observe the technical specifications and input ratings during installation!
- Be sure not to notch the conductor when stripping the insulation!
- Before connecting the device to the power supply, make sure that its voltage lies within the range 80 ... 230 V AC or 24 ... 60 V DC!
- A signal current supplied to the current input must be galvanically isolated. If not, connect an isolator module.
- All parameters must be set by a system administrator prior to commissioning!
- The electrical installation shall conform to the national regulations for electrical installations and/or other applicable national or local codes or regulations.
- The power supply shall be disconnectable from the device by a two-pole circuit breaker.
- Switch and circuit breaker shall be located in close proximity to the equipment and be easily accessible by the OPERATOR. They shall be marked as disconnect switch for the device.
- Be sure to disconnect the mains supply and any relay contacts which are connected to separate current sources before starting maintenance operations.

Terminals:
Screw terminals, suitable for single or stranded wires up to 2.5 mm^2 (AWG 14).
Recommended torque for the terminal screws: 0.5 ... 0.6 Nm.

Application in Hazardous Locations
See page 13.

Rating Plates / Terminal Assignments

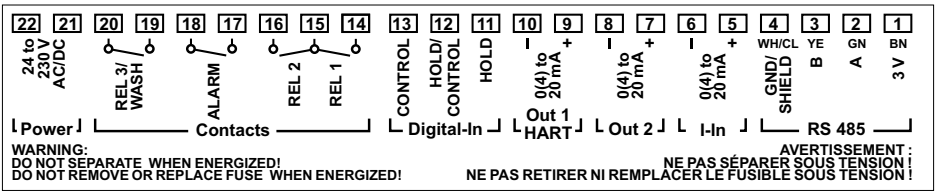


Fig.: Terminal assignments of Stratos Pro A401B

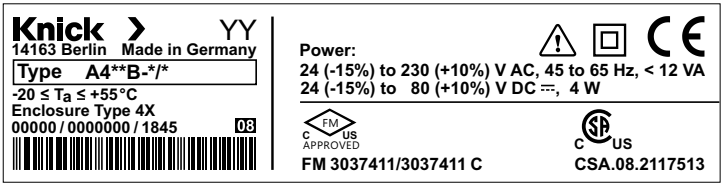


Fig.: Stratos Pro A401B rating plate,
outside at the bottom of the front unit

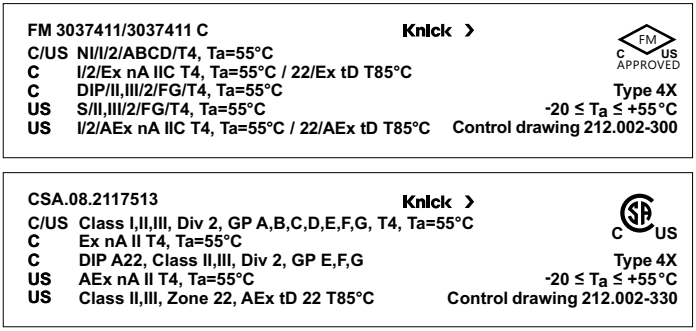
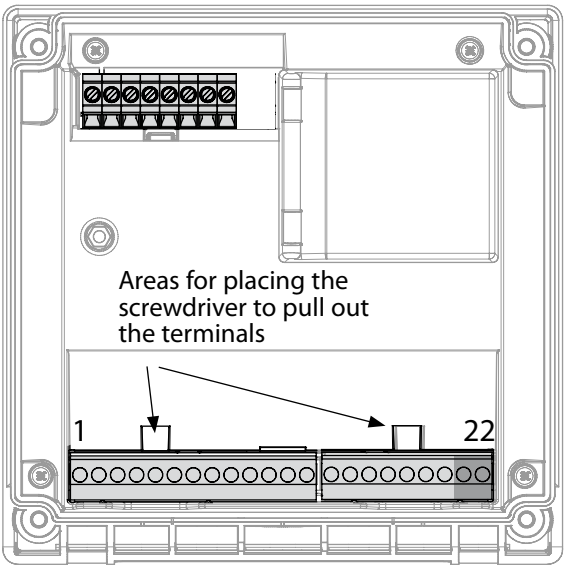


Fig.: Approval plates,
at the inside of the front unit (left and right side)

Connect the power supply for Stratos Pro A401B CONDI
to terminals 21 and 22
(24 ... 230 V AC, 45 ... 65 Hz / 24 ... 80 V DC)

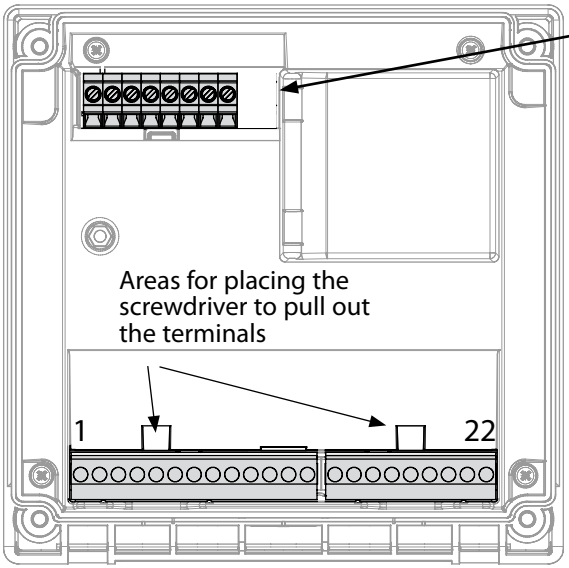


Terminal assignments	
1	+3 V
2	RS 485 A
3	RS 485 B
4	GND/shield
5	+ input
6	– input
7	+ out 2
8	– out 2
9	+ out 1/HART
10	– out 1/HART
11	hold
12	hold/control
13	control
14	REL 1
15	REL 1/2
16	REL 2
17	alarm
18	alarm
19	wash
20	wash
21	power
22	power

Fig.: Terminals, device opened, back of front unit

Connecting the Sensor

Connect the sensor lines with the sensor connection terminals (module terminals A...K).



Sensor connection MK-CONDI module	
A	receive hi
B	receive lo
C	send lo
D	send hi
E	RTD (GND)
F	RTD
G	RTD (Sense)
H	Shield

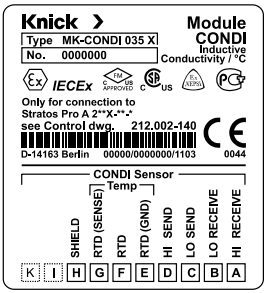
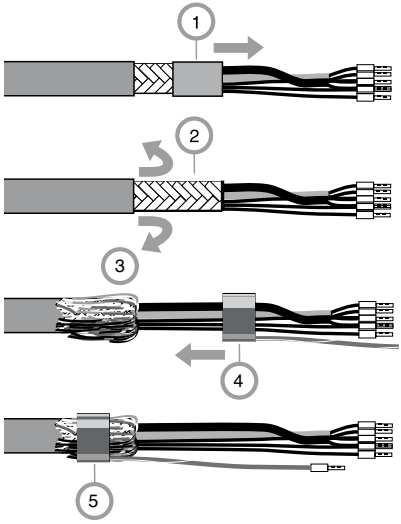


Fig.: MK-CONDI module terminal assignments

Fig.: Terminals, device opened, back of front unit

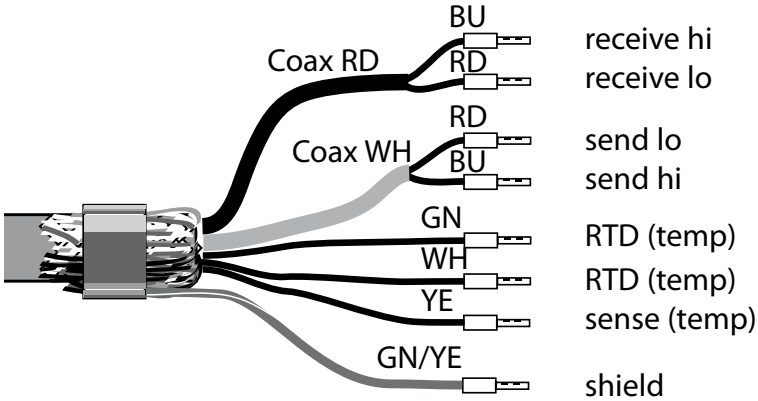
Preparing the shield connection

Pre-assembled special cable for SE 655 / SE 656 sensors



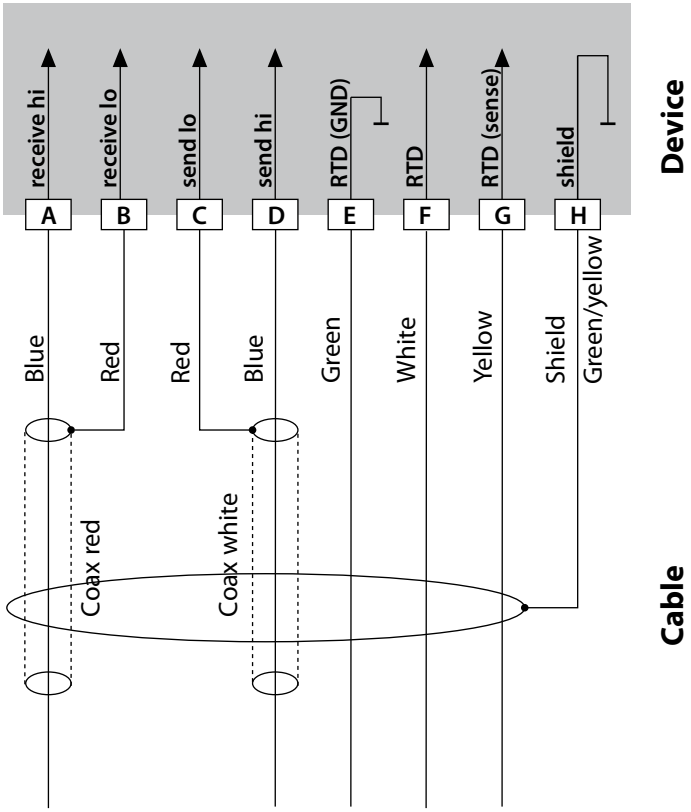
- Insert the special cable through the cable entry into the terminal compartment.
- Remove the already separated part of the cable insulation (1).
- Turn the shielding mesh (2) over the cable insulation (3).
- Then shift the crimp ring (4) over the shielding mesh and tighten it using a pince (5)

The pre-assembled special cable:

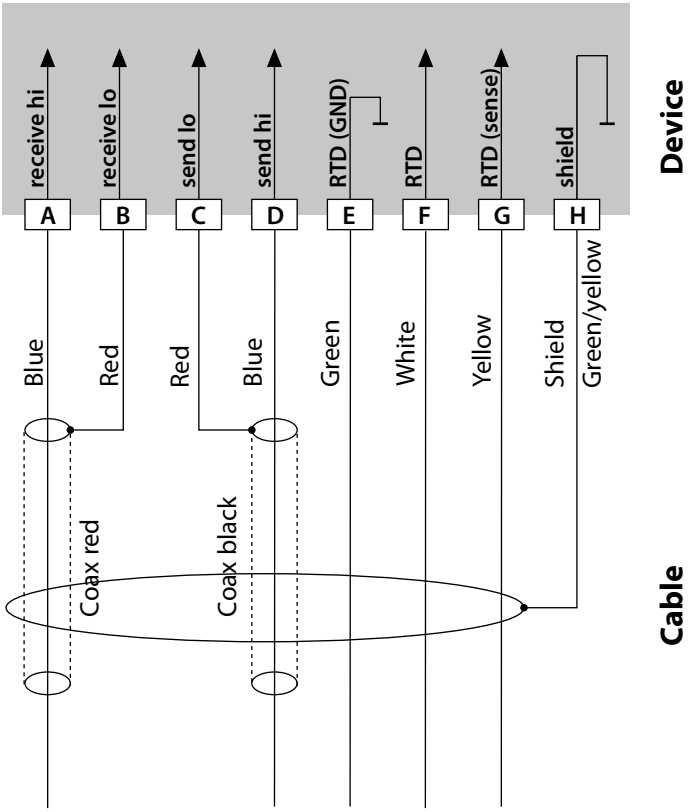


Wiring Example: SE 655 / SE 656

Measuring task: Conductivity, temperature
Sensors: SE 655/SE 656 sensor
Connecting the pre-assembled cable

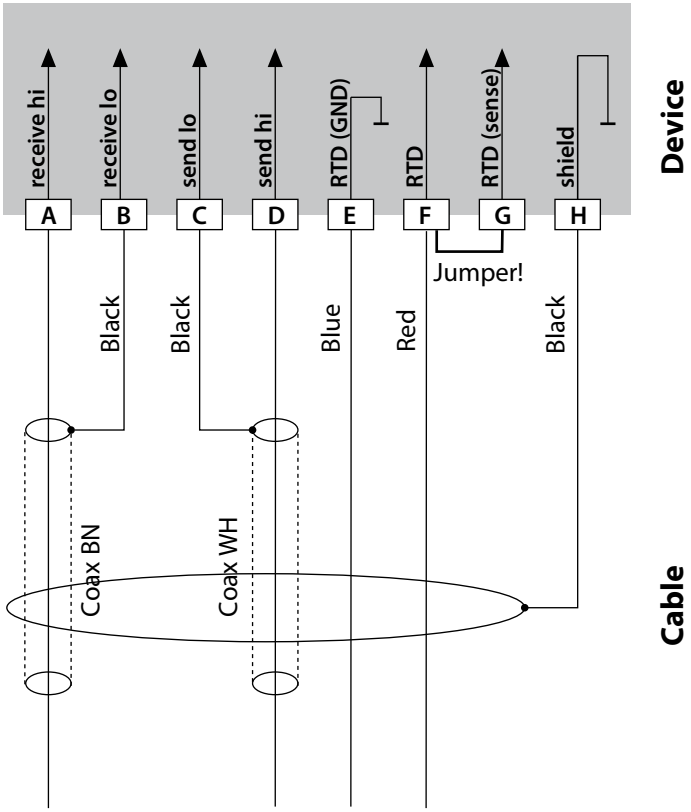


Measuring task: Conductivity, temperature
Sensor: SE 660 sensor



Wiring Example: Yokogawa ISC 40

Measuring task: Conductivity, temperature
Sensor: Yokogawa ISC40 (Pt 1000)

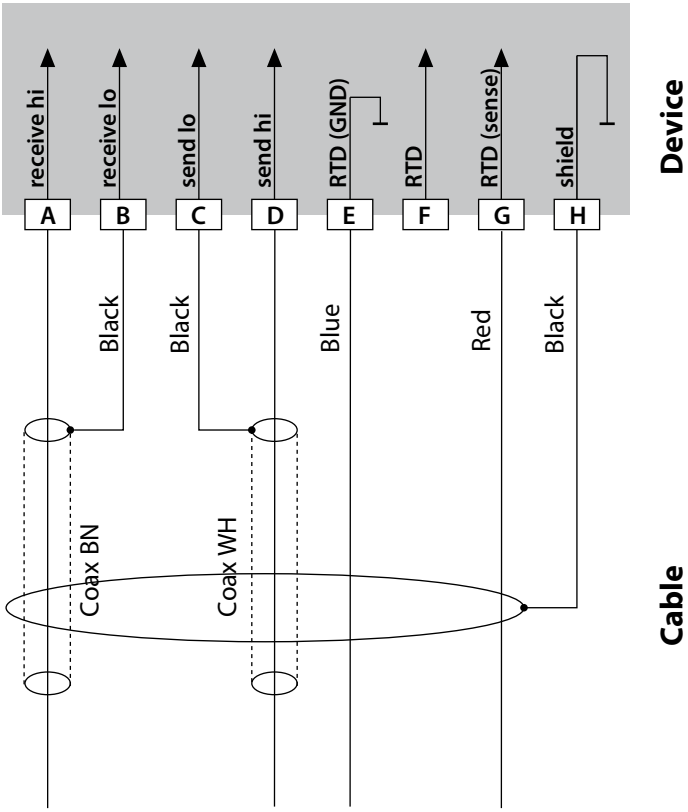


Configuration settings for this sensor:

Sensor:	Conductivity, temperature
SENSOR	OTHER
RTD TYPE	1000Pt
CELL FACTOR	1.88
TRANS RATIO	125

Wiring Example: Yokogawa IC 40S

Measuring task: Conductivity, temperature
Sensor: Yokogawa IC40S (NTC 30k)

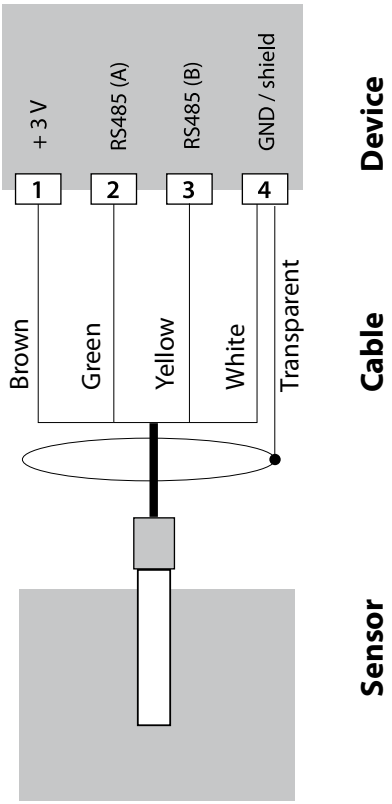


Configuration settings for this sensor:

Sensor:	Conductivity, temperature
SENSOR	OTHER
RTD TYPE	30 NTC
CELL FACTOR	Approx. 1.7
TRANS RATIO	125

Wiring Example: SE 670

Measuring task: Conductivity, temperature
Sensor: SE 670

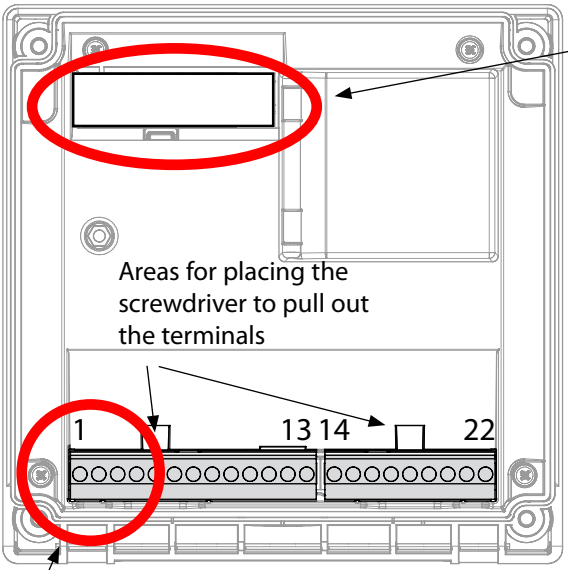


Cable types:
M12/ferrules

5 m	CA/M12-005NA
10 m	CA/M12-010NA
20 m	CA/M12-020NA

The SE 670 sensor is connected to the RS-485 interface of the device – for an A2... Series (2-wire) device, the measuring module slot must be empty. Therefore, first remove the measuring module from the slot (see next page).
When the SE 670 sensor is selected in the Configuration menu, the default values are taken as calibration data. They can then be modified by calibration.

Connecting the SE 670 Sensor

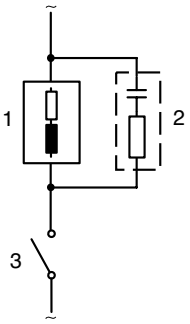


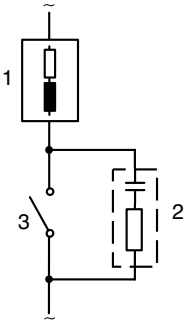
NOTICE!
The slot for the MK-CONDI module must be empty – be sure to remove the module!

Connection of SE 670:		Wire color
1	+3 V	Brown
2	RS 485 A	Green
3	RS 485 B	Yellow
4	GND/shield	White, transparent shield

Protective Wiring of Relay Contacts

Relay contacts are subject to electrical erosion. Especially with inductive and capacitive loads, the service life of the contacts will be reduced. For suppression of sparks and arcing, components such as RC combinations, nonlinear resistors, series resistors and diodes should be used.

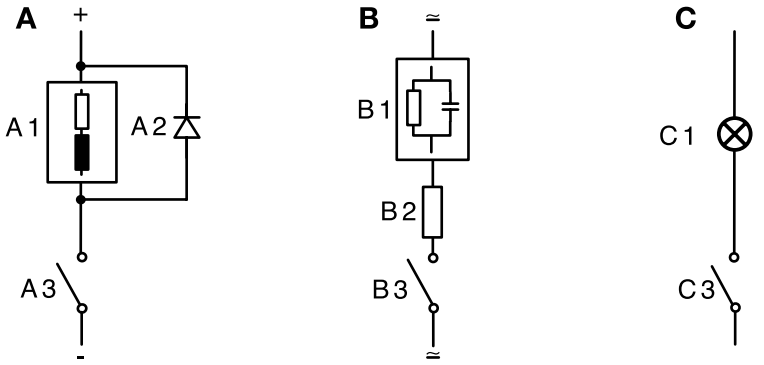




Typical AC applications with inductive load

1) Load
2) RC combination,
   e.g. RIFA PMR 209
   Typical RC combinations for 230 V AC:
   capacitor 0.1 µF / 630 V,
   resistor 100 Ω / 1 W
3) Contact

Typical Protective Wiring Measures



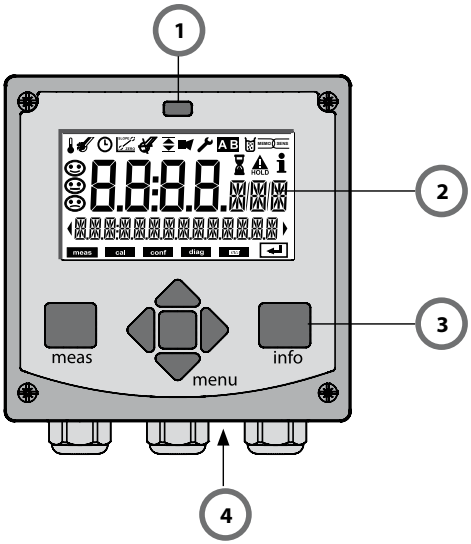
A: DC application with inductive load
B: AC/DC applications with capacitive load
C: Connection of incandescent lamps

A1 Inductive load
A2 Free-wheeling diode, e.g. 1N4007 (Observe polarity)
A3 Contact
B1 Capacitive load
B2 Resistor, e.g. 8 Ω / 1 W at 24 V / 0.3 A
B3 Contact
C1 Incandescent lamp, max 60 W / 230 V, 30 W / 115 V
C3 Contact

⚠ WARNING!

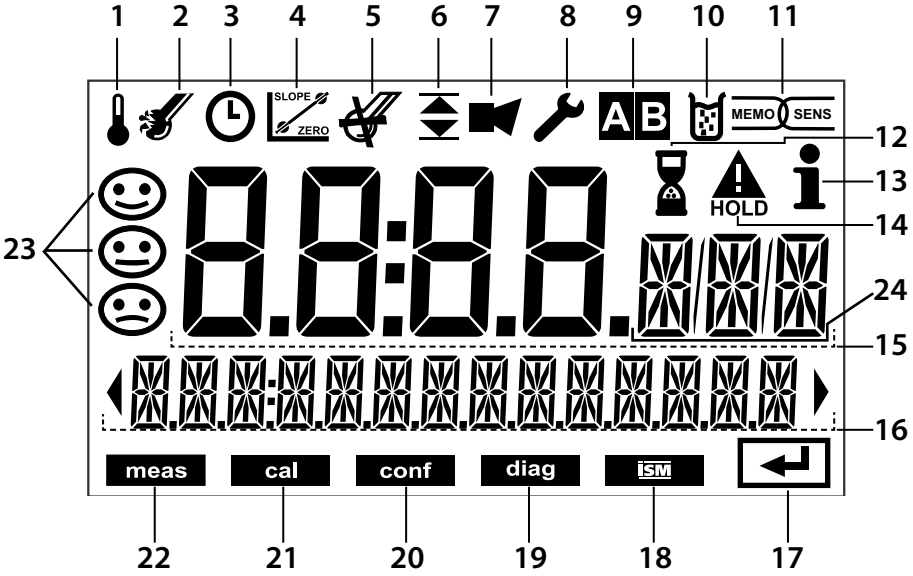
Make sure that the maximum ratings of the relay contacts are not exceeded even during switching!

User Interface, Keypad



1 IrDA transmitter/receiver
2 Display
3 Keypad
4 Rating plate (enclosure bottom)

Key	Function
meas	• Return to last menu level • Directly to measuring mode (press > 2 s) • Measuring mode: other display
info	• Retrieve information • Show error messages
enter	• Configuration: Confirm entries, next configuration step • Calibration: Continue program flow
menu	• Measuring mode: Call menu
Arrow keys up / down	• Menu: Increase/decrease a numeral • Menu: Selection
Arrow keys left / right	• Previous/next menu group • Number entry: Move between digits



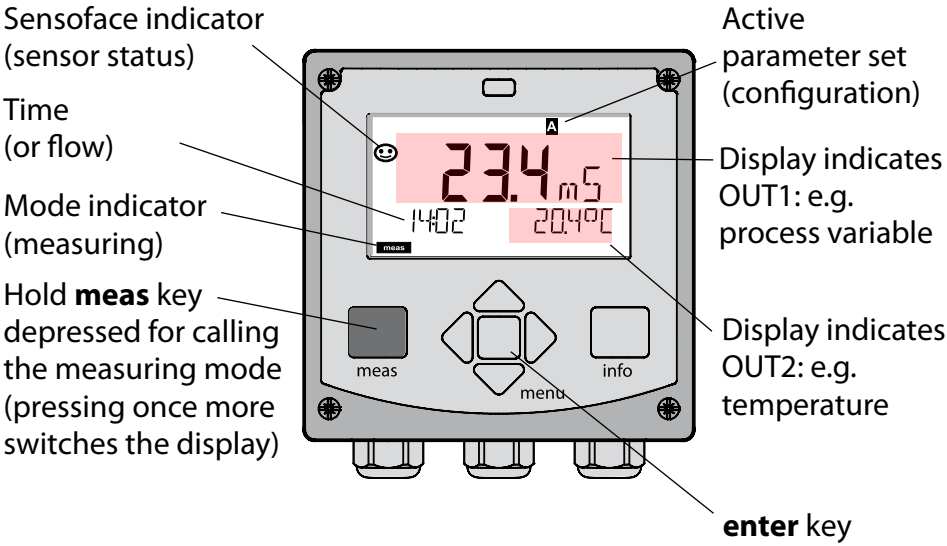
1 Temperature
2 Sensocheck
3 Interval/response time
4 Sensor data
5 Not used
6 Limit message:
Limit 1 ▼ or Limit 2 ▲
7 Alarm
8 Service
9 Parameter set
10 Calibration
11 Memosens
12 Waiting time running
13 Info available
14 Hold mode active
15 Main display
16 Secondary display
17 Proceed using enter
18 Not used
19 Diagnostics
20 Configuration mode
21 Calibration mode
22 Measuring mode
23 Sensoface
24 Unit symbols

Signal Colors (Display Backlighting)

Red	Alarm (in case of fault: display values blink)
Red blinking	Input error: illegal value or wrong passcode
Orange	HOLD mode (Calibration, Configuration, Service)
Turquoise	Diagnostics
Green	Info
Purple	Sensoface message

Measuring Mode

After the operating voltage has been connected, the analyzer automatically goes to "Measuring" mode. To call the measuring mode from another operating mode (e.g. Diagnostics, Service): Hold **meas** key depressed (> 2 s).



Depending on the configuration, one of the following displays can be set as standard display for the measuring mode (see page 36):

- Measured value, time and temperature (default setting)
- Measured value and selection of parameter set A/B or flow
  Measured value and tag number ("TAG")
- Time and date
- Output currents
- Controller:
  upper display: controller output Y, lower display: setpoint

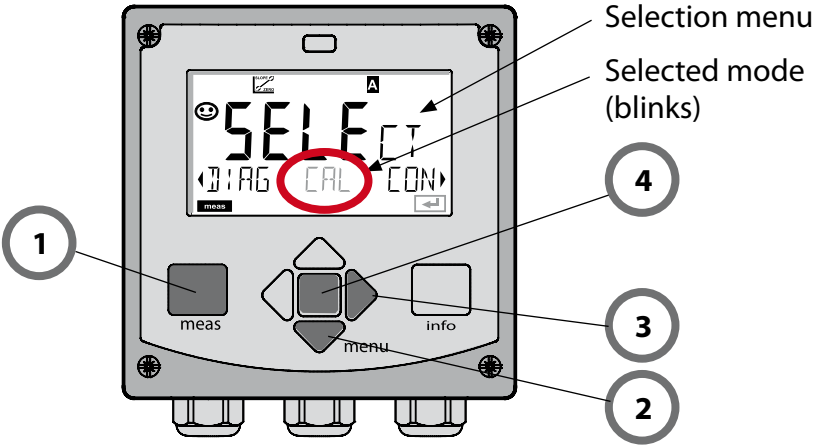
Note: By pressing the **meas** key in measuring mode you can view the displays for approx. 60 sec.

You must configure the device for the respective measurement task!

Selecting the Mode / Entering Values

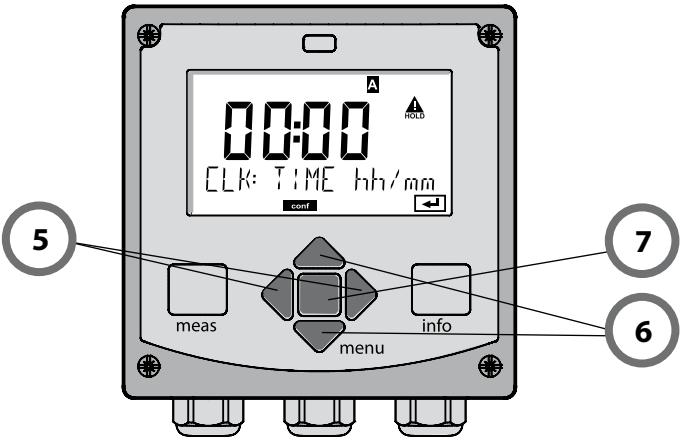
To select the operating mode:

1) Hold **meas** key depressed (> 2 s) (directly to measuring mode)
2) Press **menu** key: the selection menu appears
3) Select operating mode using left / right arrow key
4) Press **enter** to confirm the selected mode

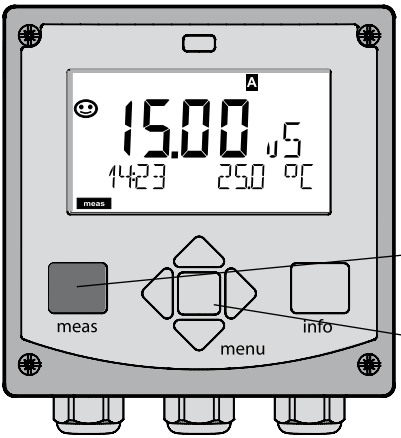


To enter a value:

5) Select numeral: left / right arrow key
6) Change numeral: up / down arrow key
7) Confirm entry by pressing **enter**



Display in Measuring Mode



The MAIN DISPLAY is the display which is shown in measuring mode. To call the measuring mode from any other mode, hold the **meas** key depressed for at least 2 sec.

meas key

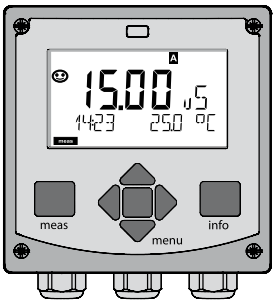
enter key

By pressing **meas** briefly you can step through further displays such as tag number (TAG) or flow (L/h).
These displays are turquoise.
After 60 sec they switch back to the main display.

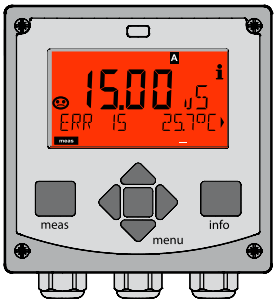
Press **enter** to select a display as MAIN DISPLAY – the secondary display shows "MAIN DISPLAY – NO".
Use the **UP** / **DOWN** arrow keys to select "MAIN DISPLAY – YES" and confirm by pressing **enter**.
The display color changes to white.
This display is now shown in measuring mode.

Color-Coded User Interface

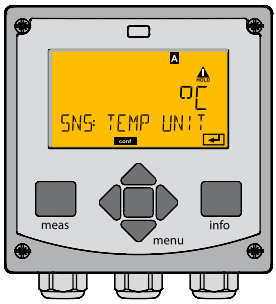
The color-coded user interface guarantees increased operating safety. Operating modes are clearly signaled.
The normal measuring mode is white. Information text appears on a green screen and the diagnostic menu appears on turquoise. The orange HOLD mode (e.g. during calibration) is quickly visible as is the magenta screen which indicates asset management messages for predictive diagnostics – such as maintenance request, pre-alarm and sensor wear.
The alarm status has a particularly noticeable red display color and is also signaled by flashing display values. Invalid inputs or false pass-codes cause the entire display to blink red so that operating errors are noticeably reduced.



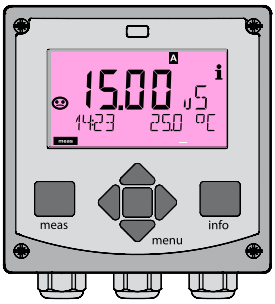
White:
Measuring mode



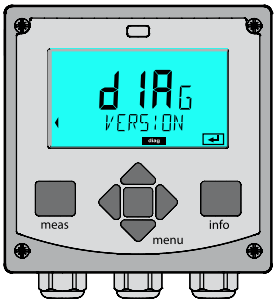
Red blinking:
Alarm, errors



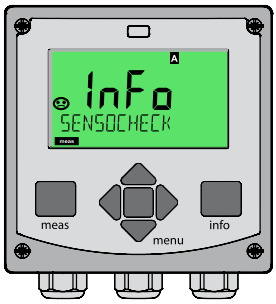
Orange:
HOLD mode



Magenta:
Maintenance request



Turquoise:
Diagnostics



Green:
Information texts

Operating Modes

Diagnostics
Display of calibration data, display of sensor data, performing a device self-test, viewing the logbook entries, display of hardware/software versions of the individual components. The logbook can store 100 events (00...99). They can be displayed directly on the device. The logbook can be extended to 200 entries using a TAN (Option).

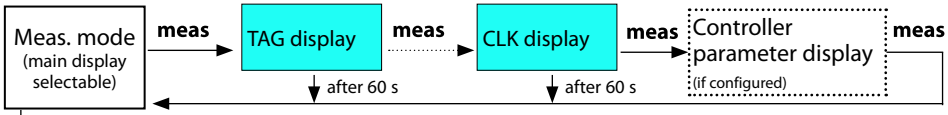
HOLD
Manual activation of HOLD mode, e.g. for servicing. The signal outputs adopt a defined state.

Calibration
Every sensor has typical characteristic values. Calibration is required to supply a correct measured value. The device checks which value the sensor delivers when measuring in a known solution. When there is a deviation, the device can be "adjusted". In that case, the device displays the "actual" value and internally corrects the measurement error of the sensor. During calibration the device is in HOLD mode.
During calibration the device remains in the HOLD mode until it is stopped by the operator.

Configuration
The analyzer must be configured for the respective measurement task. In the "Configuration" mode you select the connected sensor, the measuring range to be transmitted, and the conditions for warning and alarm messages. During configuration the device is in HOLD mode.
Configuration mode is automatically exited 20 minutes after the last keystroke. The device returns to measuring mode.

Service
- Maintenance functions (current source, relay test, controller test)
- IrDA operation
- Passcode assignment
- Reset to factory settings
- Enabling options via TAN

Menu Structure of Modes and Functions



Pressing the **menu** key (down arrow) opens the selection menu.
Select the menu group using the left/right arrow keys.
Pressing **enter** opens a menu item. Press **meas** to return.

DIAG	CALDATA	Display of calibration data
	SENSOR	Display of sensor data
	SELFTEST	Self test: RAM, ROM, EEPROM, module
	LOGBOOK	Logbook: 100 events with date and time
	MONITOR	Display of direct, uncorrected sensor signals
	VERSION	Display of software version, model designation, serial number
HOLD		Manual activation of HOLD mode, e.g. for sensor replacement. The signal outputs behave as configured (e.g. last measured value, 21 mA)
CAL	CAL_SOL	Calibration with calibration solution
	CAL_CELL	Calibration by input of cell factor
	CAL_ZERO	Zero calibration
	P_CAL	Product calibration
	CAL_RTD	Adjustment of temperature probe
CONF	PARSET A	Configuring parameter set A
	PARSET B	Configuring parameter set B
SERVICE (Access via code, factory setting: 5555)	MONITOR	Display of measured values for validation (simulators)
	OUT1	Current source, output 1
	OUT2	Current source, output 2
	RELAIS	Relay test
	CONTROL	Controller: manual specification of controller output
	IRDA	Activating the IrDA interface
	CODES	Specifying access codes for operating modes
	DEFAULT	Reset to factory setting
	OPTION	Enabling an option via TAN

HOLD Mode

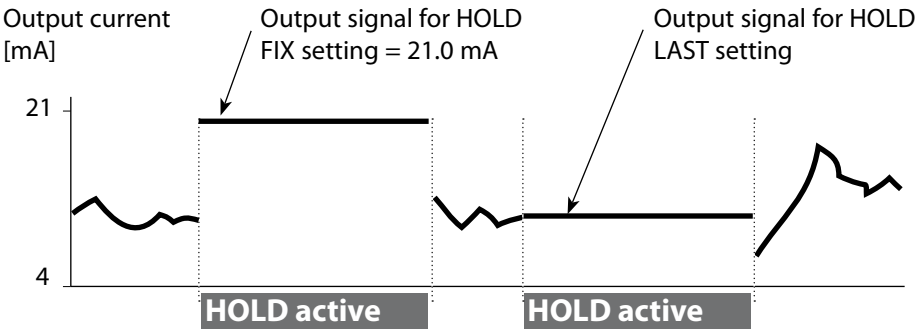
The HOLD mode is a safety state during configuration and calibration.
Output current is frozen (LAST) or set to a fixed value (FIX).
Alarm and limit contacts are disabled.
The HOLD mode is indicated by orange display backlighting.

HOLD mode, display icon:

Output signal response

- **LAST:** The output current is frozen at its last value. Recommended for short configuration procedures. The process should not change decisively during configuration. Changes are not noticed with this setting!
- **FIX:** The output current is set to a value that is noticeably different from the process value to signal the control system that the device is being worked at.

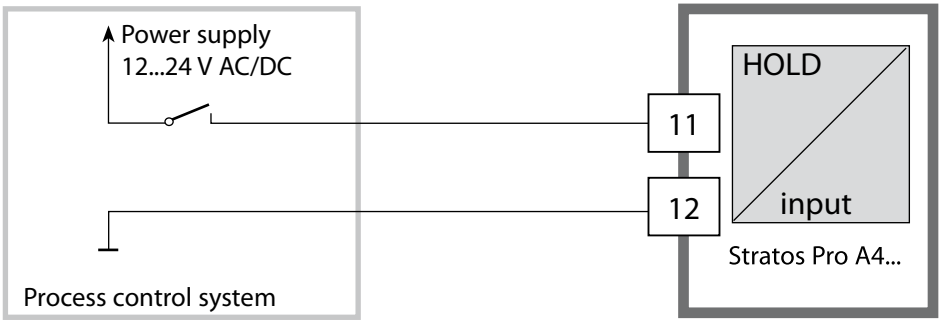
Output signal during HOLD:



Terminating the HOLD mode

The HOLD mode is ended by switching to measuring mode (hold **meas** key depressed). The display reads "Good Bye", after that, the HOLD mode is exited.
When the calibration mode is exited, a confirmation prompt ensures that the installation is ready for operation (e.g.: sensor reinstalled, located in process).

External activation of HOLD (SW-A005)
The HOLD mode can be activated from outside by sending a signal to the HOLD input (e.g. from the process control system).



HOLD inactive	0...2 V AC/DC
HOLD active	10...30 V AC/DC

Manual activation of HOLD
The HOLD mode can be activated manually from the HOLD menu. This allows checking or replacing a sensor, for example, without provoking unintended reactions of outputs or contacts.
Press **meas** key to return to selection menu.

Alarm

When an error has occurred, **Err xx** is displayed immediately.
Only after expiry of a user-defined delay time will the alarm be registered and entered in the logbook.
During an alarm the display blinks, the display backlighting turns **red**.

Error messages can also be signaled by a 22 mA output current (see Configuration).
The alarm contact is activated by alarm and power failure, see also "Configuration / Alarm Settings".
2 sec after the failure event is corrected, the alarm status will be deleted.

Alarm and HOLD Messages

Message	Released by	Cause
Alarm	Sensocheck	Polarization / Cable
(22 mA)	Error Messages	Flow (CONTROL input)
Alarm contact opens		ERR 10: Conductance > 3500 mS
HOLD	HOLD	HOLD via menu or input
(Last/Fix)	CONF	Configuration
	CAL	Calibration
	SERVICE	Service

Generating a message via the CONTROL input (min. flow / max. flow)

The CONTROL input can be used for parameter set selection or for flow measurement (pulse principle), depending on its assignment in the "Configuration" menu.

When preset to flow measurement

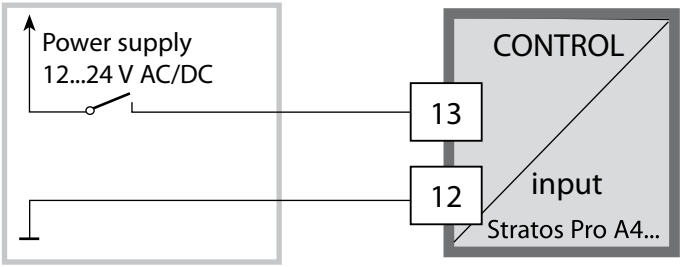
CONF/CNTR_IN/CONTROL = FLOW

an alarm can be generated when the measured flow exceeds a specified range:

CONF/ALA/FLOW CNTR = ON

CONF/ALA/FLOW min (specify value, default: 5 liters/h)

CONF/ALA/FLOW max (specify value, default: 25 liters/h)



Configuration

The configuration steps are assigned to different menu groups.
With the left/right arrow keys you can jump between the individual menu groups.
Each menu group contains menu items for setting the parameters.
Pressing **enter** opens a menu item. Use the arrow keys to edit a value.
Press **enter** to confirm/save the settings. Return to measurement:
Hold **meas** key depressed (> 2 s).

Select menu group	Menu group	Code	Display	Select menu item
	Sensor selection	SNS:		enter
		Menu item 1		enter
		⋮		
		Menu item ...		enter
	Current output 1	OT1:		enter
	Current output 2	OT2:		
	Compensation	COR:		
	Control input (parameter set or flow measurement)	IN:		
	Alarm mode	ALA:		
	Relay outputs	REL:		
	Cleaning	WSH:		
	Setting the clock	CLK:		
	Tag number	TAG:		

Parameter set A/B: configurable menu groups

The device provides 2 parameter sets "A" and "B". By switching between the parameter sets you can adapt the device to different measurement situations, for example. Parameter set "B" only permits setting of process-related parameters.

Menu group	Parameter set A	Parameter set B
SENSOR	Sensor selection	---
OUT1	Current output 1	Current output 1
OUT2	Current output 2	Current output 2
CORRECTION	Compensation	Compensation
CNTR_IN	Control input	---
ALARM	Alarm mode	Alarm mode
REL 1/REL 2	Relay outputs	Relay outputs
WASH	Cleaning	---
PARSET	Parameter set selection	---
CLOCK	Setting the clock	---
TAG	Tag number	---

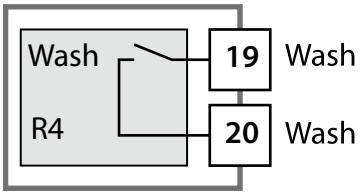
External switchover of parameter sets A/B

You can switch between parameter sets A and B by applying a signal to the CONTROL input (parameter setting: CNTR-IN – PARSET).

Parameter set A active	0...2 V AC/DC
Parameter set B active	10...30 V AC/DC

Parameter Set A/B
Manual Selection. Signaling via WASH Contact.

Display	Action	Remark
	To switch between parameter sets: Press **meas**.	Manual selection of parameter sets must have been preset in CONFIG mode. Default setting is a fixed parameter set A. Wrong settings change the measurement properties!
	PARSET blinks in the lower line. Select parameter set using ◂ and ▸ keys	
	Select PARSET A / PARSET B Press **enter** to confirm. Cancel by pressing **meas**	



The active parameter set can be signaled using the WASH contact:

If configured correspondingly, the WASH contact signals:
“Parameter set A“ (open contact)
“Parameter set B“ (closed contact)

Configuration			Choices	Default
Sensor (SENSOR)				
SNS:			SE 655 SE 656 SE 660 SE 670 OTHER	SE 655
	OTHER	RTD TYPE	100PT / 1000PT / 30 NTC	1000PT
		CELL FACTOR	XX.XXx	01.980
		TRANS RATIO	XXX.Xx	120.0
	MEAS MODE		Cond Conc % Sal ‰	Cond
	Cond	MEAS RANGE	x.xxx mS/cm xx.xx mS/cm xxx.x mS/cm x.xxx S/m xx.xx S/m	x.xxx mS/cm
	Conc	Solution	-01- (NaCl) -02- (HCl) -03- (NaOH) -04- (H2SO4) -05- (HNO3) -06- (H2SO4) -07- (HCl) -08- (HNO3) -09- (H2SO4) -10- (NaOH)	-01- (NaCl)
	TEMP UNIT		°C / °F	°C
	CIP COUNT		ON/OFF	OFF
	SIP COUNT		ON/OFF	OFF

Configuration			Choices	Default
Output 1 (OUT1)				
OT1:	RANGE		0–20 mA 4–20 mA	4–20 mA
	Channel		Cond/TMP	Cond
	Output (with Cond only)		LIN / BiLIN / LOG	LIN
	LIN	BEGIN (0) 4mA	xxxx	000.0 mS/cm
		END 20 mA	xxxx	100.0 mS/cm
	BiLIN	BEGIN (0) 4 mA		
		END 20 mA		
		CORNER X	Input range: selected CHANNEL Vertex X : BEGIN ≤ CORNER X ≤ END (rising) BEGIN ≥ CORNER X ≥ END (falling)	
		CORNER Y	Input range: selected CHANNEL Default: 12 mA Vertex Y: (0) 4 mA ≤ CORNER Y ≤ 20 mA	
	LOG	BEGIN (0) 4mA	Decades	
		END 20 mA	Decades	
	TMP °C	BEGIN (0) 4mA	–50...250 °C	
		END 20 mA	–50...250 °C	
	TMP °F	BEGIN (0) 4mA	–58...482 °F	
		END 20 mA	–58...482 °F	
	FILTERTIME		0...120 SEC	0000 SEC
	22mA-FAIL		ON/OFF	OFF
	HOLD MODE		LAST/FIX	LAST
	FIX	HOLD-FIX	(0) 4...22 mA	021.0 mA

Configuration				Choices	Default
Output 2 (OUT2)					
OT2:	RANGE			0–20 mA / 4–20 mA	4–20 mA
	CHANNEL			Cond/TMP	TMP
	... other steps like output 1				
Temperature compensation (CORRECTION)					
COR:	TC SELECT			OFF LIN, NLF, NaCl	OFF
	LIN	TC LIQUID		00.00 ...19.99%/K	00.00%/K
		REF TEMP		000.0 ... 199.9 °C	025.0 °C
	I-INPUT (only with TEMP EXT selected – The I-input option must be enabled via TAN)				
	TEMP EXT	I-INPUT		0–20 mA / 4–20 mA	4...20 mA
		°C	BEGIN 4 mA	–50...250 °C	000.0 °C
			END 20 mA	–50...250 °C	100.0 °C
		°F	BEGIN 4 mA	–58...482 °F	
			END 20 mA	–58...482 °F	
Control input (CNTR_IN)					
IN:	CONTROL			Parameter-set switchover (PARSET) or flow measurement (FLOW)	PARSET
	FLOW	FLOW ADJUST		12000 pulses/liter	000.0 ... 20000 pulses/liter
Alarm (ALARM)					
ALA:	DELAYTIME			0...600 SEC	0010 SEC
	SENSOCHECK			ON/OFF	OFF
	FLOW CNTR *)			ON/OFF	OFF
	ON	FLOW MIN **)		005.0 L/h	0 ... 99.9 L/h
		FLOW MAX**)		025.0 L/h	0 ... 99.9 L/h

*) These menu items appear only if selected.
**) Hysteresis fixed at 5% of threshold value

Configuration				Choices	Default
Switching outputs (Rel1/Rel2)					
REL:	Selected in text line			LIMITS CONTROLLER	LIMITS
	RL1	CHANNEL		Cond/TMP/FLOW	Cond
		FUNCTION		Lo LEVL Hi LEVL	Lo LEVL
		CONTACT		N/O, N/C	N/O
		LEVEL		Within meas. range	
		HYSTERESIS		0 ... 50 % full scale	
		DELAYTIME		0000...9999 SEC	0010 SEC
	RL2	CHANNEL		Cond/TMP/FLOW	Cond
		FUNCTION		Lo LEVL Hi LEVL	Hi LEVL
		CONTACT		N/O, N/C	N/O
		LEVEL		Within meas. range	
		HYSTERESIS		0 ... 50 % full scale	
		DELAYTIME		0000...9999 SEC	0010 SEC
	CTR	CHANNEL		COND/TMP	COND
		TYPE		PLC/PFC	PLC
		PLC	PULSE LENGTH	0000...0600 SEC	0010 SEC
		PFC	PULSE FREQ.	0000...0180 P/M	0060 P/M
		SETPOINT		Within meas. range	
		DEAD BAND		0 ... 50 % full scale	
		P-GAIN		0010...9999%	0100%
		I-TIME		0000...9999 SEC	0000SEC
		D-TIME		0000...9999 SEC	0000SEC
		HOLD MODE		Y LAST / Y OFF	Y LAST

Configuration			Choices	Default
Cleaning contact (WASH)				
WSH:	Selected in text line		WASH PARSET A/B	WASH
	WASH	WASH CYCLE	000.0...999.9 h	000.0 h
		WASH TIME	0000...9999 SEC	0060 SEC
		CONTACT	N/O, N/C	N/O
Parameter set (PARSET)				
PAR:	Select fixed parameter set (A) or switch between A/B via control input or manually in measuring mode		PARSET FIX / CNTR INPUT / MANUAL	PARSET FIX (fixed parameter set A)
Real-time clock (CLOCK)				
CLK:	FORMAT		24 h / 12 h	
	24 h	TIME hh/mm	00..23:00...59	
	12 h	TIME hh/mm	00...11:00...59 AM/PM:	
	DAY/MONTH		01...31/01...12	
	YEAR		2000...2099	
Tag number (TAG)				
TAG:	(Input in text line)			___

Configuration (Original for Copy)

Two complete parameter sets are stored in the EEPROM.
As delivered, the two sets are identical but can be edited.

Note:
Fill in your configuration data on the following pages or use them as original for copy.

Parameter	Parameter set A	Parameter set B
SNS: Sensor type		--- *)
SNS: RTD type		---
SNS: Cell factor		---
SNS: Transfer ratio		---
SNS: Measuring mode		---
SNS: Measuring range		---
SNS: Concentration determination		---
SNS: Temperature unit		---
SNS: CIP counter		---
SNS: SIP counter		---
OT1: Current range		
OT1: Process variable		
OT1: Lin/bilin/log output		
OT1: Current start		
OT1: Current end		
OT1: Vertex X (bilinear curve only)		
OT1: Vertex Y (bilinear curve only)		
OT1: Filter time		
OT1: 22 mA error current		
OT1: HOLD mode		
OT1: HOLD-FIX current		

*) These parameters cannot be adjusted in parameter set B, the values are the same as in parameter set A.

(Original for Copy) Configuration

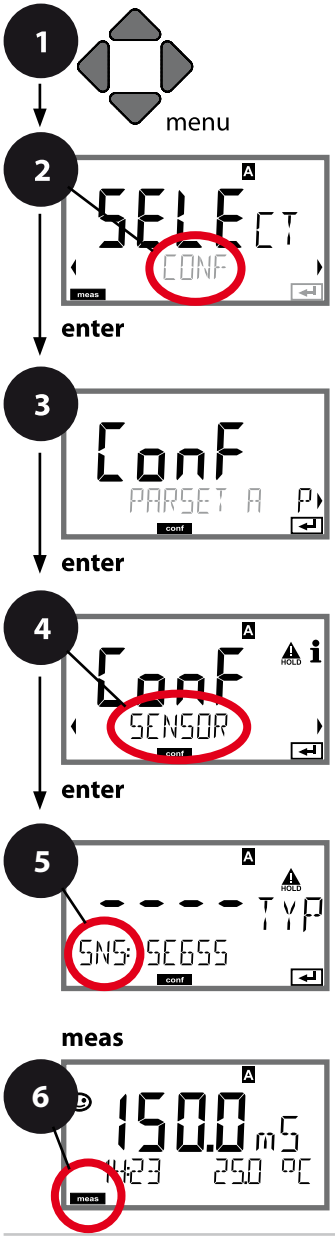
Parameter	Set A	Set B
OT2: Current range		
OT2: Process variable		
OT2: Lin/bilin/log output		
OT2: Current start		
OT2: Current end		
OT2: Vertex X (bilinear curve only)		
OT2: Vertex Y (bilinear curve only)		
OT2: Filter time		
OT2: 22 mA error current		
OT2: HOLD mode		
OT2: HOLD-FIX current		
COR: TC SELECT		
COR: Temp coefficient		
COR: Reference temperature		
COR: Current range		
COR: Current start		
COR: Current end		
IN: Parameter set A/B or flow		
IN: (Flow meter) Adjusting pulses/liter		
ALA: Delay		
ALA: Sensocheck on/off		
ALA: Flow control FLOW CNTR on/off		
ALA: Minimum flow (hysteresis fixed at 5 %)		
ALA: Maximum flow (hysteresis fixed at 5 %)		
REL: Usage		
RL1: Process variable		
RL1: Function		
RL1: Contact response		
RL1: Setpoint		
RL1: Hysteresis		
RL1: Delay		

Parameter	Set A	Set B
RL2: Process variable		
RL2: Function		
RL2: Contact response		
RL2: Setpoint		
RL2: Hysteresis		
RL2: Delay		
CTR: Process variable		
CTR: Controller type		
CTR: Pulse length		
CTR: Pulse frequency		
CTR: Setpoint		
CTR: Neutral zone		
CTR: P gain		
CTR: I time		
CTR: D time		
CTR: HOLD mode		
CTR: Delay		
CTR: Contact response		
WSH: Contact function		---*)
WSH: Wash cycle		---*)
WSH: Wash duration		---*)
WSH: Contact response		---*)
CLK: Time & Date		---*)
TAG: Tag number		---*)

*) These parameters cannot be adjusted in parameter set B, the values are the same as in parameter set A.

Sensor

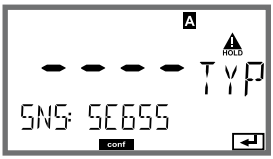
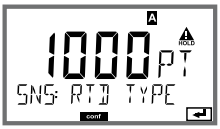
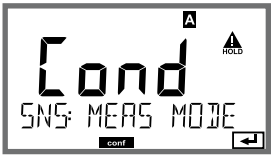
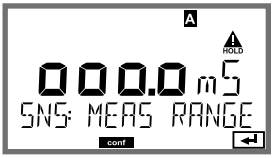
Select: Sensor type, temperature probe, cell factor, transfer ratio, measuring mode, range



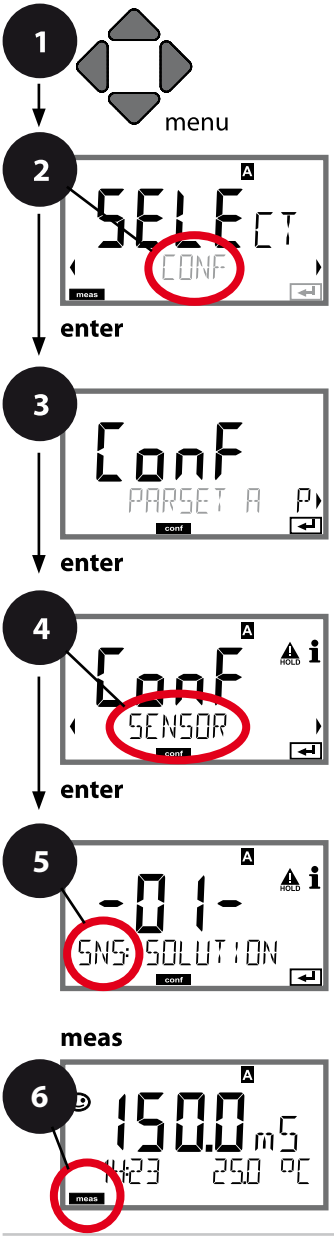
1) Press **menu** key.
2) Select **CONF** using ◂ ▸ keys, press **enter**.
3) Select parameter set using ◂ ▸, press **enter**.
4) Select **SENSOR** menu using ◂ ▸ keys, press **enter**.
5) All items of this menu group are indicated by the "SNS:" code.
   Press **enter** to select menu,
   edit using arrow keys (see next page).
   Confirm (and proceed) using **enter**.
6) Exit: Press **meas** key until the [meas] mode indicator is displayed.

5

Sensor type	enter
Temperature probe	
Cell factor	
Transfer ratio	
Measuring mode	
Measuring range	
Concentration determination	
Temperature unit	
Cleaning cycles	
Sterilization cycles	

Menu item	Action	Choices
Sensor type 	Select sensor type using ▲ ▼ keys. Press **enter** to confirm.	**SE 655** SE 656 SE 660 SE 670 OTHER
Temperature probe  Cell factor Transfer ratio 	**Only with OTHER:** Select type of temperature probe using ▲ ▼ keys. Press **enter** to confirm. Enter cell factor using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm. Enter transfer ratio using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.	**1000PT** 100PT 30 NTC **01.980** XX.XXx **120.00** XXX.Xx
Measuring mode 	Select desired measuring mode using ▲ ▼ keys. Press **enter** to confirm.	**Cond** Conc % Sal ‰
Measuring range 	**For cond measurement only** Select desired range using ▲ ▼ keys. Press **enter** to confirm.	**x.xxx mS/cm**, xx.xx mS/cm xxx.x mS/cm, x.xxx S/m xx.xx S/m

Sensor
Select: Concentration determination, temperature unit

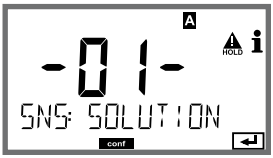
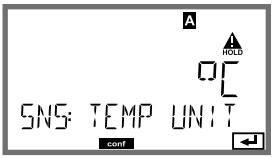
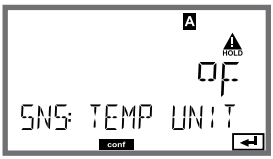


1) Press **menu** key.
2) Select **CONF** using ◂ ▸ keys, press **enter**.
3) Select parameter set using ◂ ▸, press **enter**.
4) Select **SENSOR** menu using ◂ ▸ keys, press **enter**.
5) All items of this menu group are indicated by the "SNS:" code.
   Press **enter** to select menu,
   edit using arrow keys (see next page).
   Confirm (and proceed) using **enter**.
6) Exit: Press **meas** key until the [meas] mode indicator is displayed.

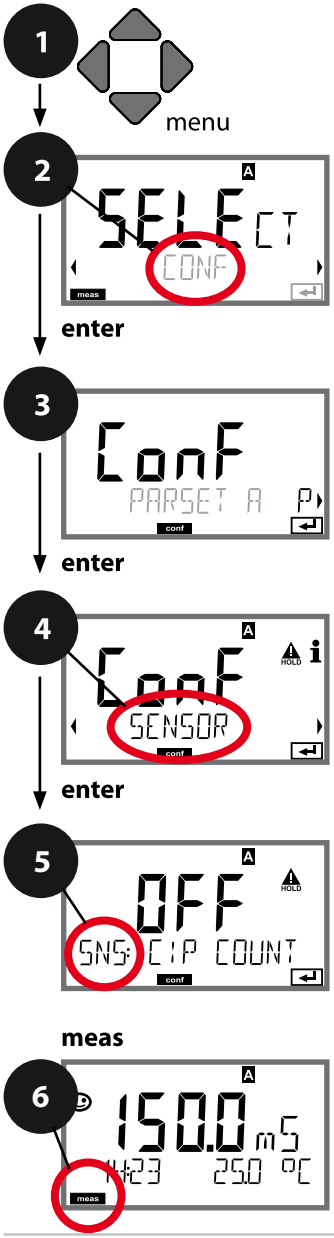
5

Sensor type
Temperature probe
Cell factor
Transfer ratio
Measuring mode
Measuring range
Concentration determination
Temperature unit
Cleaning cycles
Sterilization cycles

enter

Menu item	Action	Choices
Concentration determination 	**For conc measurement only** Select desired concentration solution using ▲ ▼ (see appendix for ranges). Press **enter** to confirm.	**-01- (NaCl)** -02- (HCl) -03- (NaOH) -04- (H_2SO_4) -05- (HNO_3) -06- (H_2SO_4) -07- (HCl) -08- (HNO_3) -09- (H_2SO_4) -10- (NaOH)
Temperature unit  	Select °C or °F using ▲ ▼ keys. Press **enter** to confirm.	**°C** / °F

Sensor (ISM only)
Adjust: CIP cleaning cycles, SIP sterilization cycles

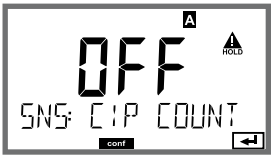
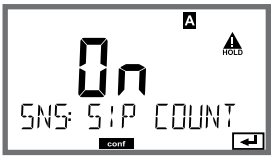


1) Press **menu** key.
2) Select **CONF** using ◂ ▸ keys, press **enter**.
3) Select parameter set using ◂ ▸, press **enter**.
4) Select **SENSOR** menu using ◂ ▸ keys, press **enter**.
5) All items of this menu group are indicated by the "SNS:" code.
   Press **enter** to select menu,
   edit using arrow keys (see next page).
   Confirm (and proceed) using **enter**.
6) Exit: Press **meas** key until the [meas] mode indicator is displayed.

5

Select sensor type
Select temp probe
Select cell factor
Select transfer ratio
Select measuring mode
Select range
Concentration determination
Temperature unit
CIP cleaning cycles
SIP sterilization cycles

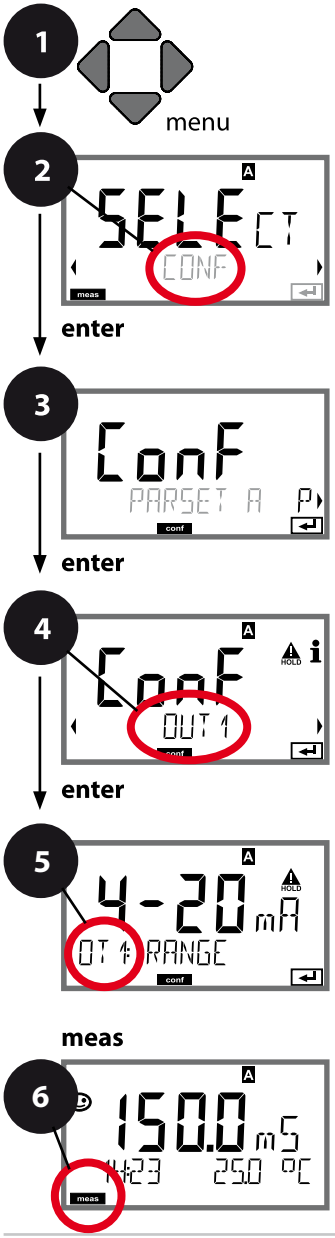
enter

Menu item	Action	Choices
CIP / SIP (ISM only) The following adjustments are possible for ISM sensors:		
Cleaning cycles on/off 	Select ON or OFF using ▲ ▼ keys. Activates/deactivates logging in extended logbook Press **enter** to confirm.	ON/**OFF**
Sterilization cycles on/off 	Select ON or OFF using ▲ ▼ keys. Activates/deactivates logging in extended logbook Press **enter** to confirm.	ON/**OFF**

The cleaning and sterilization cycles are logged to measure the load on the sensor.
Suitable for biochemical applications (process temp approx. 0 ... 50 °C, CIP temp > 55 °C, SIP temp > 115 °C).

Note:
A CIP or SIP cycle is only entered into the logbook 2 hours after the start to ensure that the cycle is complete.

Current Output 1
Output current range. Linear/Logarithmic. Current start.



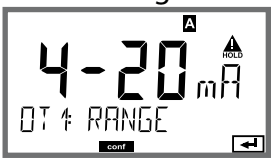
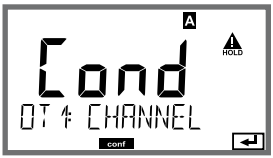
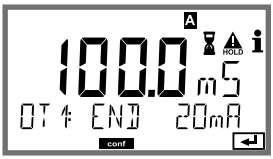
1) Press **menu** key.
2) Select **CONF** using ◂ ▸ keys, press **enter**.
3) Select parameter set using ◂ ▸, press **enter**.
4) Select **OUT1** menu using ◂ ▸ keys, press **enter**.
5) All items of this menu group are indicated by the "OT1:" code.
   Press **enter** to select menu,
   edit using arrow keys (see next page).
   Confirm (and proceed) using **enter**.
6) Exit: Press **meas** key until the [meas] mode indicator is displayed.

5

Current range
Process variable
LIN/biLIN/LOG output*
Current start
Current end
Time averaging filter
Output current during error message
Output current during HOLD
Output current for HOLD FIX

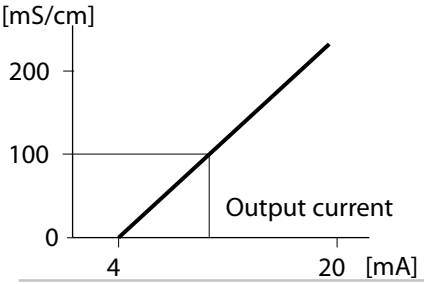
enter

*) for Cond only

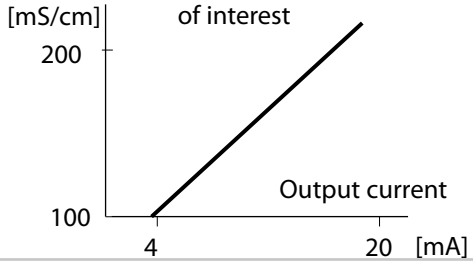
Menu item	Action	Remark
Current range 	Select 4-20 mA or 0-20 mA range using ▲ ▼ keys. Press **enter** to confirm.	**4-20 mA** / 0-20 mA
Process variable 	Select using ▲ ▼ keys: Cond: Conductivity TMP: Temperature Press **enter** to confirm. Then select characteristic (LIN/biLIN/LOG).	Selectable decades with logarithmic setting (LOG): S/cm: 0.001 mS/cm, 0.01 mS/cm, 0.1 mS/cm, 1.0 mS/cm, 10.0 mS/cm, 100.0 mS/cm, 1000 mS/cm S/M: 0.001 S/m, 0.01 S/m, 0.1 S/m, 1.0 S/m, 10.0 S/m, 100 S/m
Current start 	Modify digit using ▲ ▼ keys, select next digit using ◀ ▶ keys. Press **enter** to confirm.	Entered value applies to selected process variable/ range If the adjusted range is exceeded, the device automatically switches to the next higher range (Autorange)
Current end 	Enter value using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.	Entered value applies to selected process variable/ range If the adjusted range is exceeded, the device automatically switches to the next higher range (Autorange)

Assignment of measured values: Current start and current end

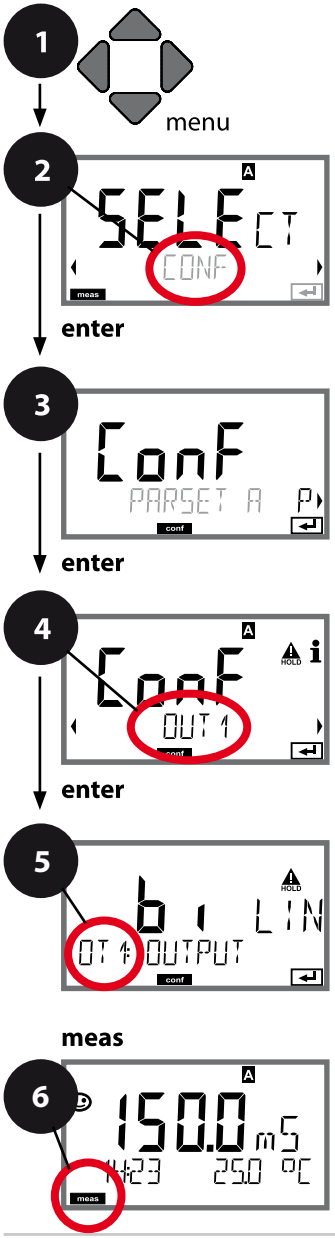
Example 1: Range 0...200 mS/cm



Example 2: Range 100...200 mS/cm
Advantage: Higher resolution in range of interest



Current Output 1
Output current curve, bilinear



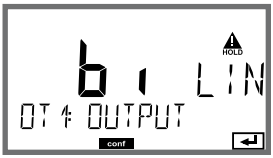
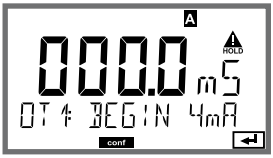
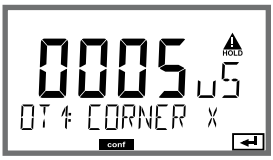
1) Press **menu** key.
2) Select **CONF** using ◂ ▸ keys, press **enter**.
3) Select parameter set using ◂ ▸, press **enter**.
4) Select **OUT1** menu using ◂ ▸ keys, press **enter**.
5) All items of this menu group are indicated by the "OT1:" code.
   Press **enter** to select menu,
   edit using arrow keys (see next page).
   Confirm (and proceed) using **enter**.
6) Exit: Press **meas** key until the [meas] mode indicator is displayed.

5

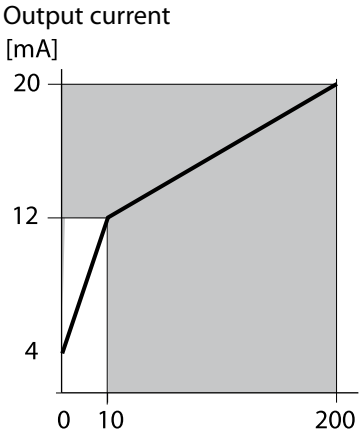
Current range
Process variable
LIN/biLIN/LOG output*
Current start
Current end
Bilinear: Vertex X
Bilinear: Vertex Y
Time averaging filter
Output current during error message
Output current during HOLD
Output current for HOLD FIX

enter

*) for Cond only

Menu item	Action	Choices
Output current curve 	Select using ▲ ▼ keys. Press **enter** to confirm.	**LIN** Linear characteristic biLIN Bilinear curve LOG Logarithmic curve
Current start and current end 	Enter value using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.	Entered value applies to selected process variable/ range If the adjusted range is exceeded, the device automatically switches to the next higher range (Autorange)
Bilinear curve: Vertex X/Y 	Enter value using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.	Entered value applies to selected vertex of bilinear curve "Corner X" (process variable) and "Corner Y (output current) – see figure below.

Vertex of bilinear curve



Example:
Current range 4 ... 20 mA,
Current start: 0 µS/cm
Current end: 200 µS/cm
Vertex:
"CORNER X": 10 µS/cm (process variable)
"CORNER Y": 12 mA (output current)
Result: The output current change in the range 0 ... 10 µS/cm is much greater than in the range 10 ... 200 µS/cm.

Logarithmic Curve

Nonlinear output current characteristic: allows measurements over several decades, e.g. measuring very low values with a high resolution and high values with a low resolution.
Parameters required: Start and end value

Possible start and end values
The start value must be at least one decade lower than the end value.
Start value and end value must be specified in the same units
(either in µS/cm or in S/m, see listing):

0.001 mS/cm	0.001 S/m
0.01 mS/cm	0.01 S/m
0.1 mS/m	0.1 S/m
	1.0 S/m
	10.0 S/m
	100 S/m

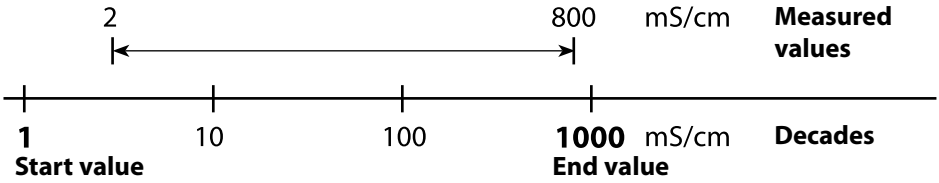
The start value
is the next decade value below the lowest measured value.

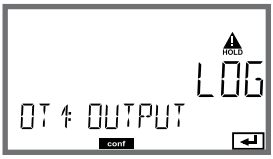
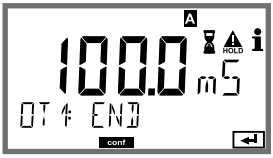
The end value
is the next decade value above the highest measured value.

The number of decades results from:
Number of decades = log (end value) – log (start value)

The output current value is defined as follows:

$$\text{Output current} = 16\ \text{mA} * \frac{\log(\text{measured value}) - \log(\text{start value})}{\text{Number of decades}} + 4\ \text{mA}$$



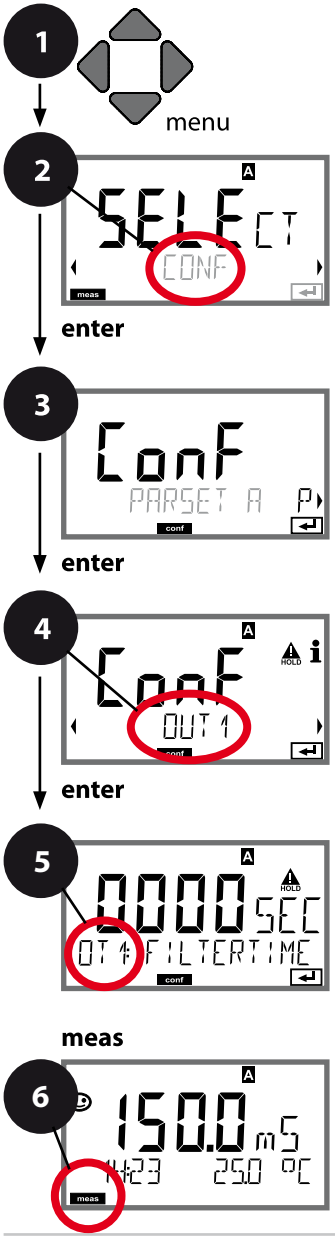
Menu item	Action	Choices
Logarithmic curve of output current 	Select using ▲ ▼ keys. Press **enter** to confirm.	**LOG** Logarithmic curve biLIN Bilinear curve LIN Linear characteristic
Start value 	Enter value using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.	Start value of logarithmic output curve
End value 	Enter value using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.	End value of logarithmic output curve

Possible start and end values for the logarithmic curve

S/cm:
0.001 mS/cm, 0.01 mS/cm, 0.1 mS/cm

S/m:
0.001 S/m, 0.01 S/m, 0.1 S/m, 1.0 S/m, 10.0 S/m, 100 S/m

Current Output 1
Adjusting the time interval of the output filter

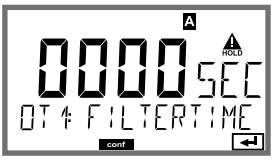


1) Press **menu** key.
2) Select **CONF** using ◂ ▸ keys, press **enter**.
3) Select parameter set using ◂ ▸, press **enter**.
4) Select **OUT1** menu using ◂ ▸ keys, press **enter**.
5) All items of this menu group are indicated by the "OT1:" code.
   Press **enter** to select menu,
   edit using arrow keys (see next page).
   Confirm (and proceed) using **enter**.
6) Exit: Press **meas** key until the [meas] mode indicator is displayed.

5

Current range
Process variable
LIN/biLIN/LOG output
Current start
Current end
Time averaging filter
Output current during error message
Output current during HOLD
Output current for HOLD FIX

enter

Menu item	Action	Choices
Time averaging filter 	Enter value using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.	0...120 SEC (**0000 SEC**)

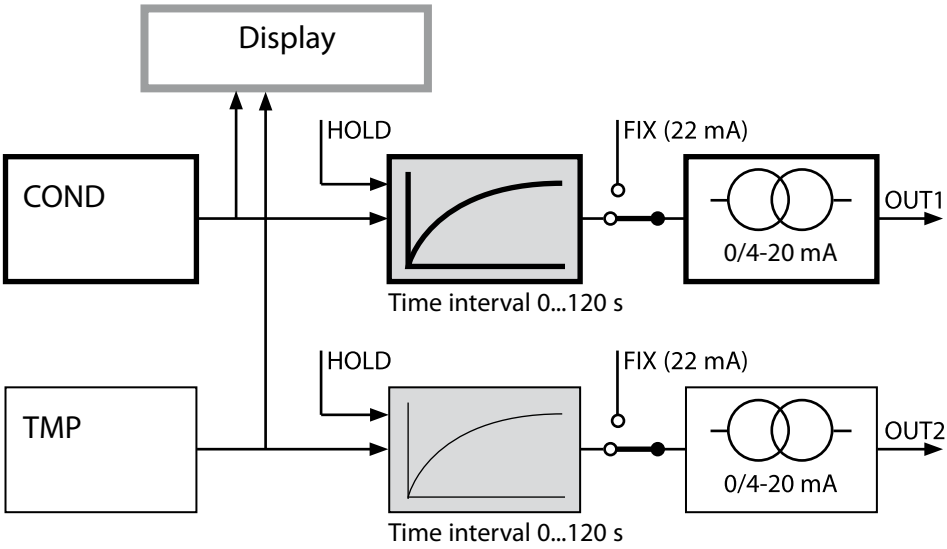
Time averaging filter

To smoothen the current output, a low-pass filter with adjustable filter time constant can be switched on. When there is a jump at the input (100 %), the output level is at 63 % after the time interval has been reached. The time interval can be set from 0 to 120 sec. If the time interval is set to 0 sec, the current output directly follows the input.

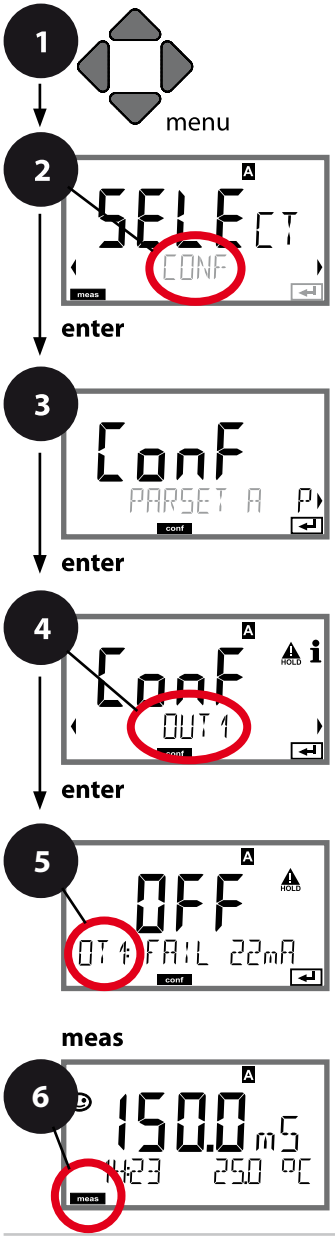
Note:

The filter only acts on the current output, not on the display or the limit value!

During HOLD the filter is not applied. This prevents a jump at the output.



Current Output 1
Output current during Error and HOLD

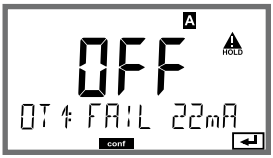
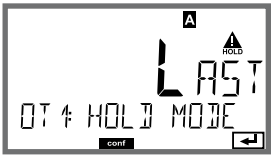


1) Press **menu** key.
2) Select **CONF** using ◂ ▸ keys, press **enter**.
3) Select parameter set using ◂ ▸, press **enter**.
4) Select **OUT1** menu using ◂ ▸ keys, press **enter**.
5) All items of this menu group are indicated by the "OT1:" code.
   Press **enter** to select menu,
   edit using arrow keys (see next page).
   Confirm (and proceed) using **enter**.
6) Exit: Press **meas** key until the [meas] mode indicator is displayed.

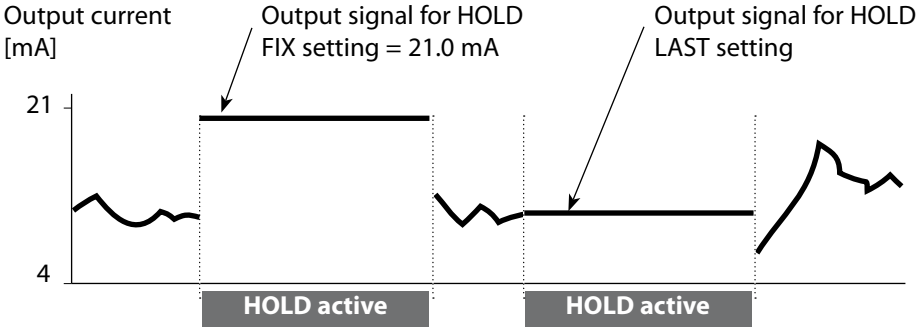
5

Current range
Process variable
LIN/biLIN/LOG output
Current start
Current end
Time averaging filter
Output current during error message
Output current during HOLD
Output current for HOLD FIX

enter

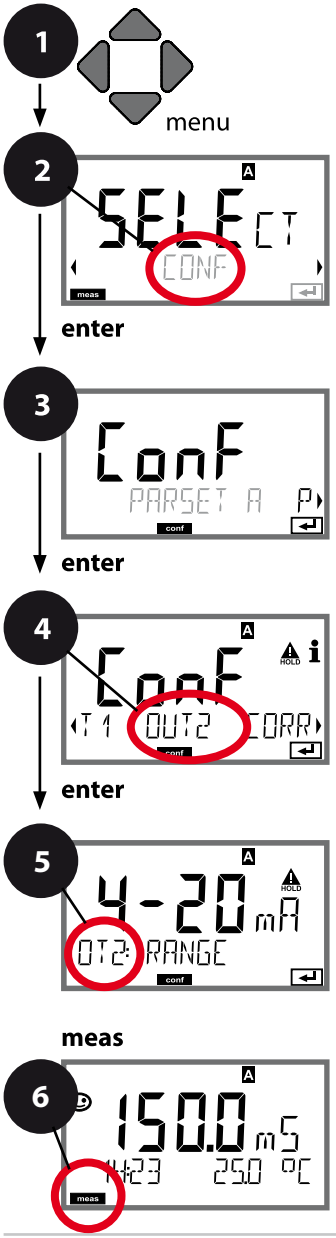
Menu item	Action	Choices
Output current during error message 	Select ON (22 mA for error message) or OFF using ▲ ▼ keys. Press **enter** to confirm.	ON/**OFF**
Output current during HOLD 	LAST: During HOLD the last measured value is maintained at the output. FIX: During HOLD a value (to be entered) is maintained at the output. Select using ▲ ▼ Press **enter** to confirm.	**LAST**/FIX
Output current for HOLD FIX 	Only with FIX selected: Enter current which is to flow at the output during HOLD Enter value using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.	00.00...**21.00 mA**

Output signal during HOLD:



Current Output 2

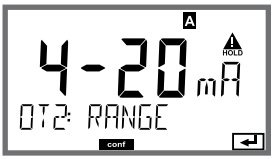
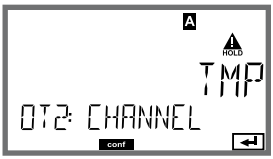
Output current range. Process variable . . .



1) Press **menu** key.
2) Select **CONF** using ◂ ▸ keys, press **enter**.
3) Select parameter set using ◂ ▸, press **enter**.
4) Select **OUT2** menu using ◂ ▸ keys, press **enter**.
5) All items of this menu group are indicated by the "OT2:" code.
   Press **enter** to select menu,
   edit using arrow keys (see next page).
   Confirm (and proceed) using **enter**.
6) Exit: Press **meas** key until the [meas] mode indicator is displayed.

5

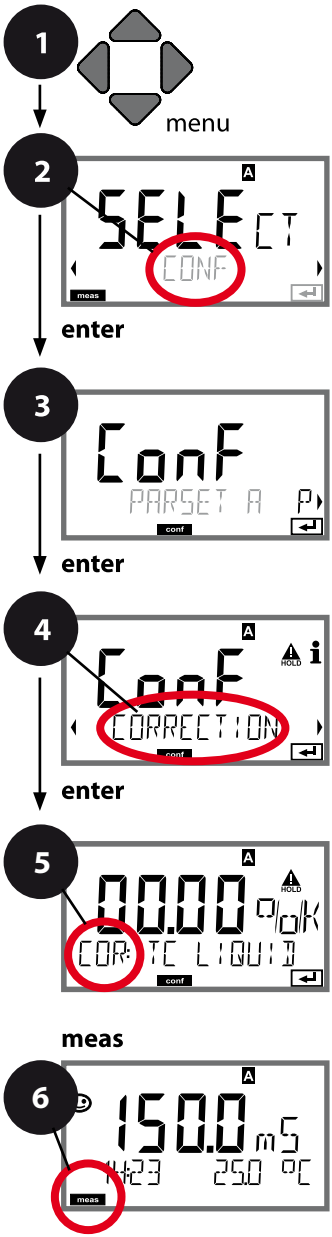
Current range	enter
Process variable	
LIN/biLIN/LOG output	
Current start	
Current end	
Bilinear: Vertex X	
Bilinear: Vertex Y	
Time averaging filter	
Output current during error message	
Output current during HOLD	
Output current for HOLD FIX	

Menu item	Action	Choices
Current range 	Select 4-20 mA or 0-20 mA range using ▲ ▼ keys. Press **enter** to confirm.	**4-20 mA** / 0-20 mA
Process variable 	Select using ▲ ▼ keys: Cond: Conductivity TMP: Temperature Press **enter** to confirm.	Cond/**TMP** Begin: 0 °C End: 100°C
. . .		

All the following adjustments are made as for current output 1 (see there)!

Temperature Compensation

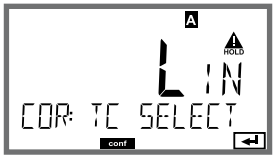
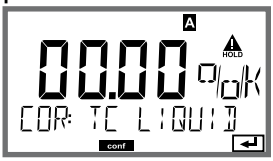
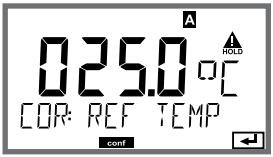
Selecting the compensation method. TC process medium.



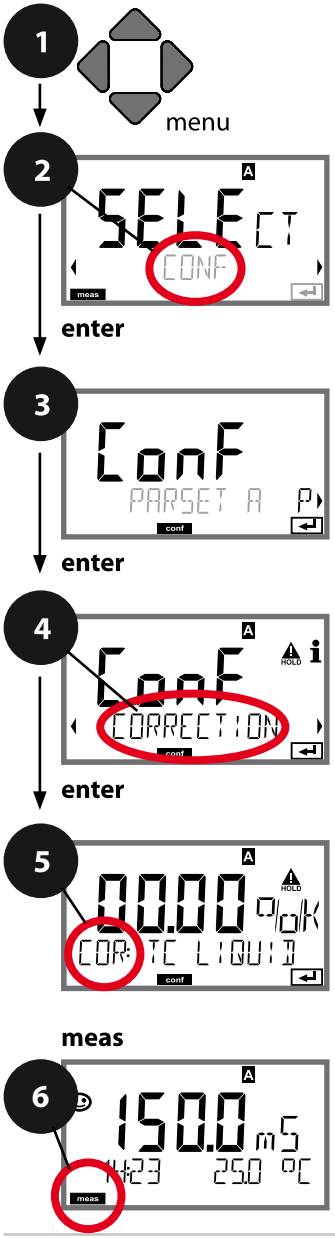
1) Press **menu** key.
2) Select **CONF** using ◂ ▸ keys, press **enter**.
3) Select parameter set using ◂ ▸, press **enter**.
4) Select **CORRECTION** menu using ◂ ▸ keys, press **enter**.
5) All items of this menu group are indicated by the "COR:" code.
   Press **enter** to select menu,
   edit using arrow keys (see next page).
   Confirm (and proceed) using **enter**.
6) Exit: Press **meas** key until the [meas] mode indicator is displayed.

5

Temperature compensation	enter
Current input, external temp measurement	
Current start	
Current end	

Menu item	Action	Choices
Temperature compensation	Select desired compensation using ▲ ▼ keys: **OFF:** Temperature compensation switched off **LIN:** Linear temperature compensation with entry of temperature coefficient **nLF:** Temperature compensation for natural waters to EN 27888 **NaCl:** from 0 to 26 % by wt (0 ... 120 °C) Press **enter** to confirm.	 
Temperature compensation, process medium  Enter reference temperature 	**With linear compensation only:** Step 1: Enter temperature compensation of the process medium. Step 2: Enter reference temperature Enter value using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm. Permissible range: 0 ... 199.9 °C	00.00...19.99 %/K

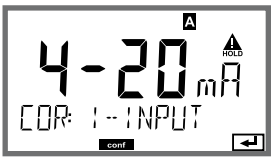
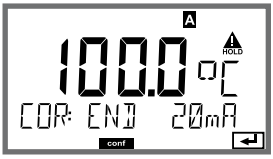
Temperature Compensation
Current input for temp measurement.



1) Press **menu** key.
2) Select **CONF** using ◂ ▸ keys, press **enter**.
3) Select parameter set using ◂ ▸, press **enter**.
4) Select **CORRECTION** menu using ◂ ▸ keys, press **enter**.
5) All items of this menu group are indicated by the "COR:" code.
   Press **enter** to select menu,
   edit using arrow keys (see next page).
   Confirm (and proceed) using **enter**.
6) Exit: Press **meas** key until the [meas] mode indicator is displayed.

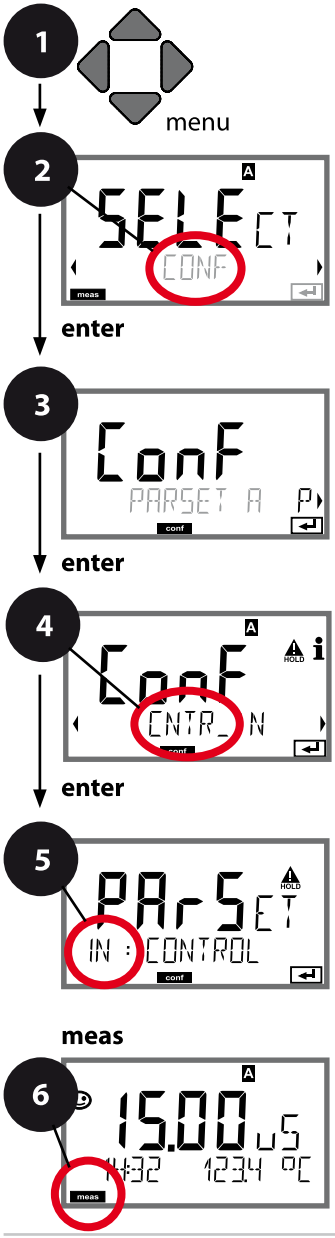
5

Temperature compensation	enter
Current input, external temp measurement (if enabled via TAN)	
Current start	
Current end	

Menu item	Action	Choices
With external temp measurement (current input enabled / TAN):		
Current range 	Select desired range using ▲ ▼ keys. Press **enter** to confirm.	**4-20 mA** / 0-20 mA
Current start	Modify digit using ▲ ▼ keys, select next digit using ◀ ▶ keys. Press **enter** to confirm.	Input range: –50...250 °C / –58...482 °F
Current end 	Enter value using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.	Input range: –50...250 °C / –58...482 °F

CONTROL Input

Parameter set selection via external signal or flow measurement



1) Press **menu** key.
2) Select **CONF** using ◂ ▸ keys, press **enter**.
3) Select parameter set using ◂ ▸, press **enter**.
4) Select **CNTR_IN** menu using ◂ ▸ keys, press **enter**.
5) All items of this menu group are indicated by the "IN:" code.
   Press **enter** to select menu,
   edit using arrow keys (see next page).
   Confirm (and proceed) using **enter**.
6) Exit: Press **meas** key until the [meas] mode indicator is displayed.

5

CONTROL input (function)	enter
PARSET / FLOW	
FLOW: ADJUST	

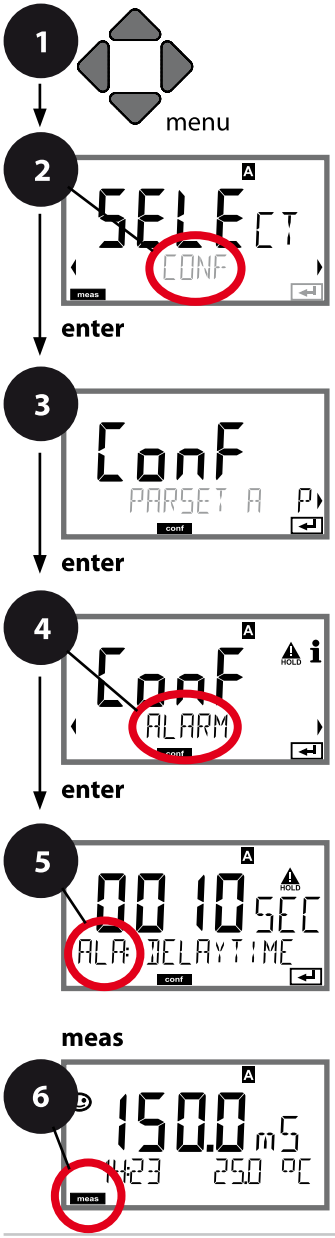
Menu item	Action	Choices
Select function of CONTROL input	Select using ▲ ▼ keys. Press **enter** to confirm.	**PARSET** (selecting parameter set A/B via signal at CONTROL input)
		Flow (for connecting a pulse-output flow meter)
Adjust to flow meter:	**With "Flow" selected**, you must adjust the device to the flow meter used. Enter value using arrow keys. Press **enter** to confirm.	**12000 pulses/liter**

In the alarm menu you can configure flow monitoring. When you have set CONTROL to FLOW, you can specify 2 additional limit values for maximum and minimum flow.
If the measured value lies outside this range, an alarm message and a 22-mA error signal (if configured) will be generated.

Display
Flow measurement in measuring mode

Display
Flow measurement (sensor monitor)

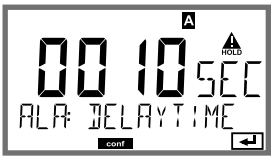
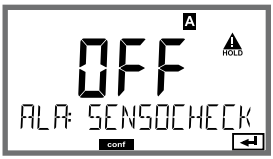
Alarm Settings
Delay. Sensocheck.

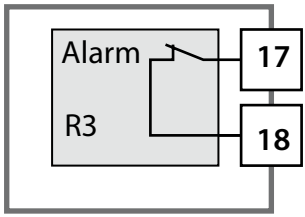


1) Press **menu** key.
2) Select **CONF** using ◂ ▸ keys, press **enter**.
3) Select parameter set using ◂ ▸, press **enter**.
4) Select **ALARM** menu using ◂ ▸ keys, press **enter**.
5) All items of this menu group are indicated by the "ALA:" code.
   Press **enter** to select menu,
   edit using arrow keys (see next page).
   Confirm (and proceed) using **enter**.
6) Exit: Press **meas** key until the [meas] mode indicator is displayed.

5 **enter**

ALARM: Delay
Alarm: Sensocheck
Alarm: CONTROL input
For flow monitoring: Max. flow alarm
For flow monitoring: Min. flow alarm

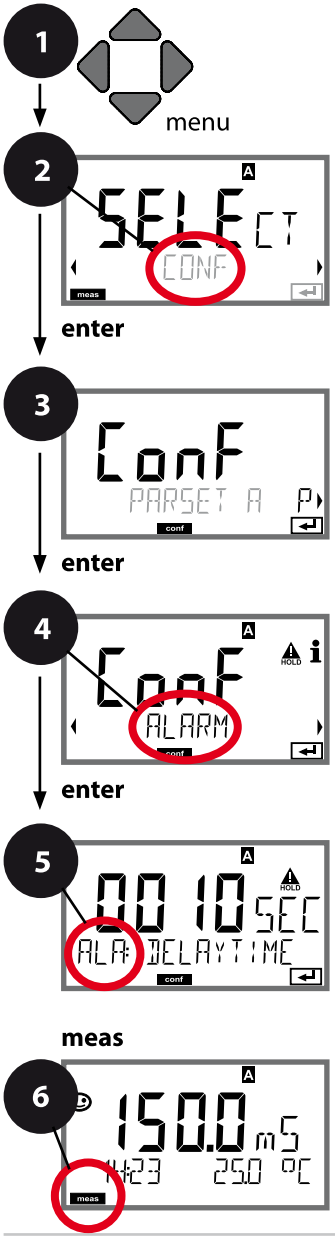
Menu item	Action	Choices
Delay 	Enter value using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.	0...600 SEC (**010 SEC**)
Sensocheck 	Select Sensocheck (continuous monitoring of sensor). Select ON or OFF using ▲ ▼ keys. Press **enter** to confirm (At the same time, Sensoface is activated. With OFF, Sensoface is also switched off.)	ON/**OFF**



Alarm contact
The alarm contact is closed during normal operation (N/C).
It opens in the case of alarm or power outage. As a result, a failure message is provided even in the case of line breakage (fail-safe behavior).
For contact ratings, see Specifications.

Error messages can also be signaled by a 22 mA output current (see Error messages and Configuration Output 1/Output 2).
Operating behavior of the alarm contact: see Operating States table.
The alarm delay time delays the color change of the display backlighting to red, the 22 mA signal (if configured), and the alarm contact switching.

Alarm Settings
CONTROL input (FLOW MIN, FLOW MAX)

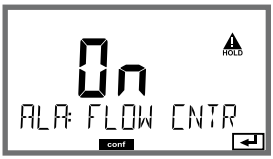


1) Press **menu** key.
2) Select **CONF** using ◂ ▸ keys, press **enter**.
3) Select parameter set using ◂ ▸, press **enter**.
4) Select **ALARM** menu using ◂ ▸ keys, press **enter**.
5) All items of this menu group are indicated by the "ALA:" code.
   Press **enter** to select menu,
   edit using arrow keys (see next page).
   Confirm (and proceed) using **enter**.
6) Exit: Press **meas** key until the [meas] mode indicator is displayed.

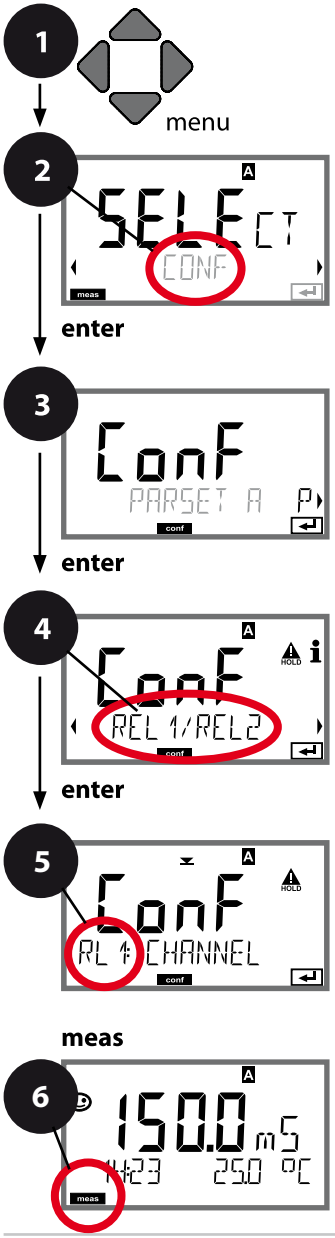
5

ALARM: Delay
Alarm: Sensocheck
Alarm: CONTROL input
For flow monitoring: Max. flow alarm
For flow monitoring: Min. flow alarm

enter

Menu item	Action	Choices
CONTROL input 	The **CONTROL input** can generate an alarm when assigned to FLOW (flow monitoring) in the CONF menu: **FLOW CNTR** **Flow measurement:** allows monitoring the minimum and maximum flow (pulse counter)	ON/**OFF** (FLOW MIN, FLOW MAX.)
Alarm Minimum flow **FLOW MIN**	Specify value	Default: 05.00 liters/h
Alarm Maximum flow **FLOW MIN**	Specify value	Default: 25.00 liters/h

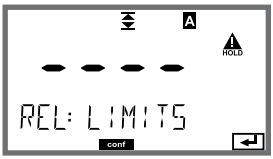
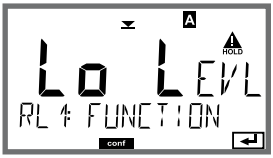
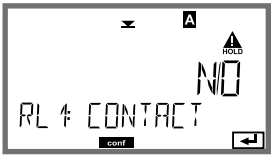
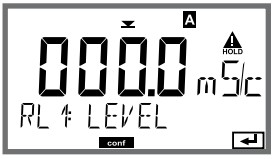
Limit Function
Relay 1



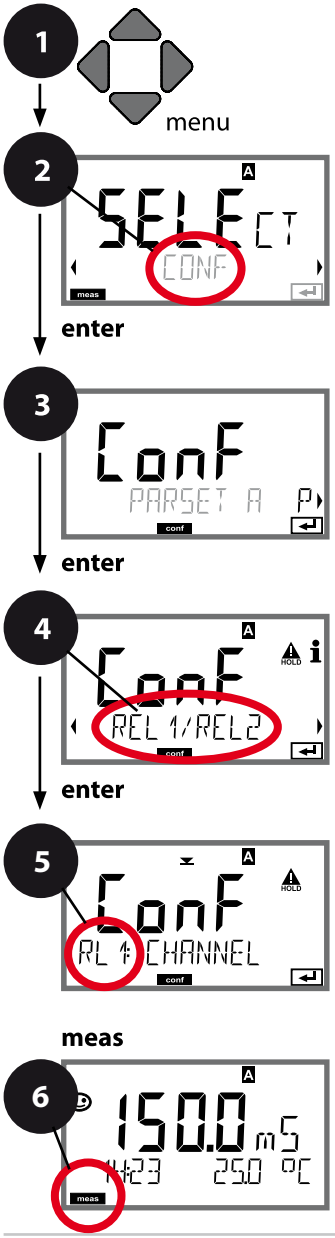
1) Press **menu** key.
2) Select **CONF** using ◂ ▸ keys, press **enter**.
3) Select parameter set using ◂ ▸, press **enter**.
4) Select **REL1/REL2** menu using ◂ ▸ keys, press **enter**.
5) All items of this menu group are indicated by the "RL1:" code.
   Press **enter** to select menu,
   edit using arrow keys (see next page).
   Confirm (and proceed) using **enter**.
6) Exit: Press **meas** key until the [meas] mode indicator is displayed.

5

Use of relays	enter
Select process variable	
Limit 1 switching characteristics (function)	
Limit 1 contact type	
Limit 1 setpoint	
Limit 1 hysteresis	
Limit 1 delay	

Menu item	Action	Choices
Use of relays 	Select in the text line using ▲ ▼ keys: • Limit function (LIMITS) • Controller (CONTROLLER) Press **enter** to confirm.	**LIMITS** / CONTROLLER **Note:** Selecting CONTROLLER leads to Controller menu group CTR.
Select process variable 	Select desired process variable using ▲ ▼ keys. Press **enter** to confirm.	**Cond**/TMP
Limit 1 function 	Select desired function using ▲ ▼ keys. LoLevel: active if value falls below / HiLevel: active if value exceeds setpoint Press **enter** to confirm.	**Lo LEVL** / Hi LEVL Limit 1 icon: ▼
Limit 1 contact response 	N/O: normally open contact N/C: normally closed contact Select using ▲ ▼ keys. Press **enter** to confirm.	**N/O** / N/C
Limit 1 setpoint 	Enter setpoint using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.	Within meas. range

Limit Function
Relay 1

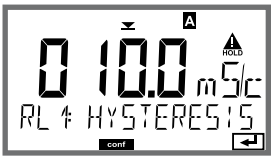
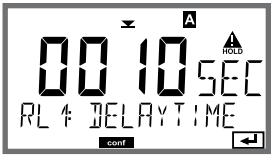


1) Press **menu** key.
2) Select **CONF** using ◂ ▸ keys, press **enter**.
3) Select parameter set using ◂ ▸, press **enter**.
4) Select **REL1/REL2** menu using ◂ ▸ keys, press **enter**.
5) All items of this menu group are indicated by the "RL1:" code.
   Press **enter** to select menu,
   edit using arrow keys (see next page).
   Confirm (and proceed) using **enter**.
6) Exit: Press **meas** key until the [meas] mode indicator is displayed.

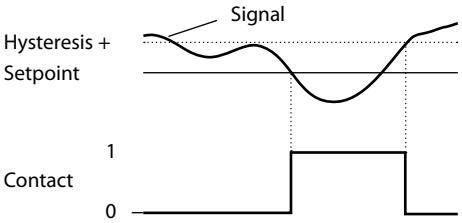
5

Use of relays
Select process variable
Limit 1 switching characteristics (function)
Limit 1 contact type
Limit 1 setpoint
Limit 1 hysteresis
Limit 1 delay

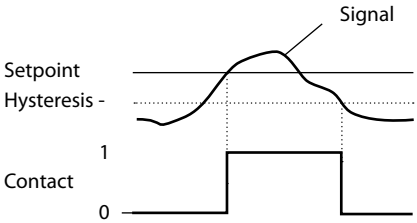
enter

Menu item	Action	Choices
Limit 1 hysteresis 	Select hysteresis using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.	0 ... 50 % full scale
Limit 1 delay 	The contact is activated with delay (deactivated without delay) Adjust delay using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.	0...9999 SEC (**0010 SEC**)

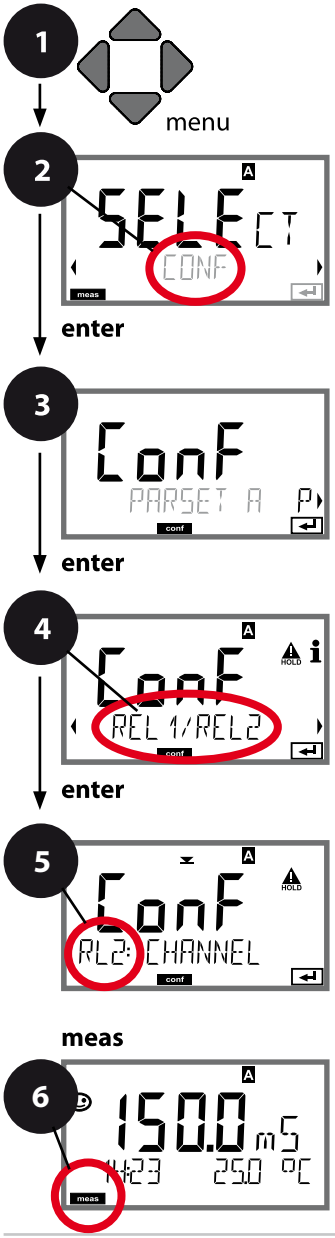
Limit Lo



Limit Hi



Limit Function
Relay 2



1) Press **menu** key.
2) Select **CONF** using ◂ ▸ keys, press **enter**.
3) Select parameter set using ◂ ▸, press **enter**.
4) Select **REL1/REL2** menu using ◂ ▸ keys, press **enter**.
5) All items of this menu group are indicated by the "RL2:" code.
   Press **enter** to select menu,
   edit using arrow keys (see next page).
   Confirm (and proceed) using **enter**.
6) Exit: Press **meas** key until the [meas] mode indicator is displayed.

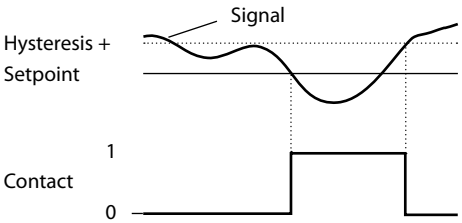
5

Select process variable
Limit 2 switching characteristics (function)
Limit 2 contact type
Limit 2 setpoint
Limit 2 hysteresis
Limit 2 delay

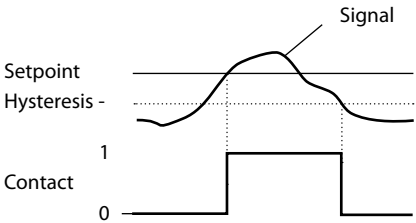
enter

Menu item	Action	Choices
Select process variable (CHANNEL)	Select desired process variable using ▲ ▼ keys. Press **enter** to confirm.	Cond/TMP
Limit 2 function (FUNCTION)	Select desired function using ▲ ▼ keys. Press **enter** to confirm.	Lo LEVL / **Hi LEVL** Limit 2 icon: ⏶
Limit 2 contact type (CONTACT)	N/O: normally open contact N/C: normally closed contact Select using ▲ ▼ keys. Press **enter** to confirm.	**N/O** / N/C
Limit 2 setpoint (LEVEL)	Enter setpoint using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.	Within meas. range
Limit 2 hysteresis (HYSTERESIS)	Select hysteresis using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.	0 ... 50 % full scale
Limit 2 delay (DELAYTIME)	The contact is activated with delay (deactivated without delay) Adjust delay using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.	0...9999 SEC (**0010 SEC**)

Limit Lo



Limit Hi



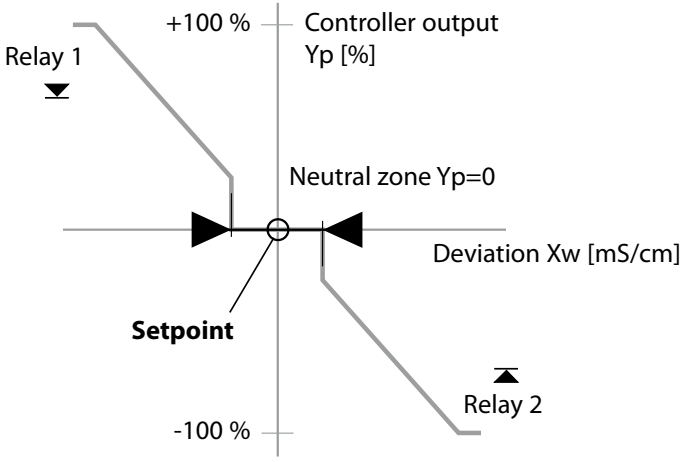
Typical Applications

P controller
Application for integrating control systems
(e.g. closed tank, batch processes).

PI controller
Application for non-integrating control systems (e.g. drains).

PID controller
The additional derivative action compensates for measurement peaks.

Controller characteristic



Controller equations

$$\text{Controller output } Y = \underbrace{Y_P}_{\text{P action}} + \underbrace{\frac{1}{T_R}\int Y_P dt}_{\text{I action}} + \underbrace{T_D \frac{dY_P}{dt}}_{\text{D action}}$$

with:

Y_P	Proportional action
T_N	Reset time [s]
T_D	Rate time [s]
K_C	Controller gain [%]

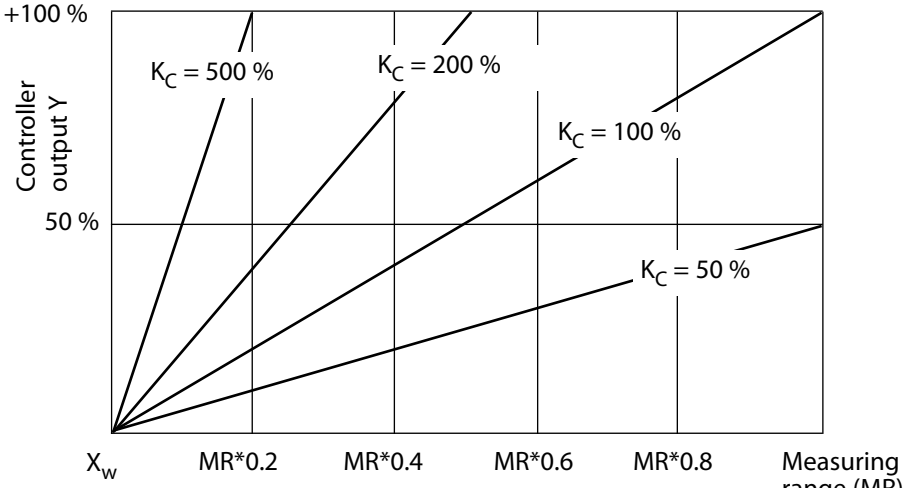
Proportional action Y_P

$$Y_P = \frac{\text{Setpoint - Meas. value}}{\text{Measuring range}} * K_C$$

Neutral zone (Y=0)

Tolerated deviation from desired value.
With the setting "1 mS/cm", for example, a deviation of ± 0.5 mS/cm from the desired value does not activate the controller.

Proportional action (Gradient K_C [%])



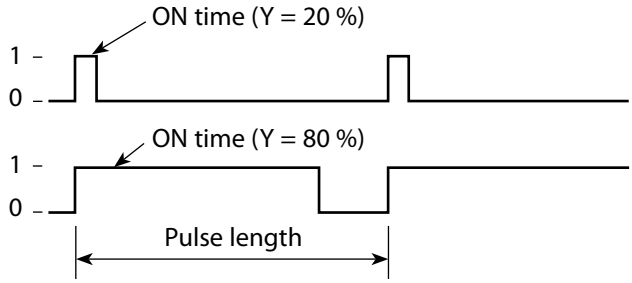
Process variables: Cond, Conc, SAL

Pulse Length / Pulse Frequency Controller

Pulse length controller (PLC)

The pulse length controller is used to operate a valve as an actuator. It switches the contact on for a time that depends on the controller output. The period (pulse length) is constant. A minimum ON time of 0.5 sec is maintained even if the controller output takes corresponding values (Y=0: Off).

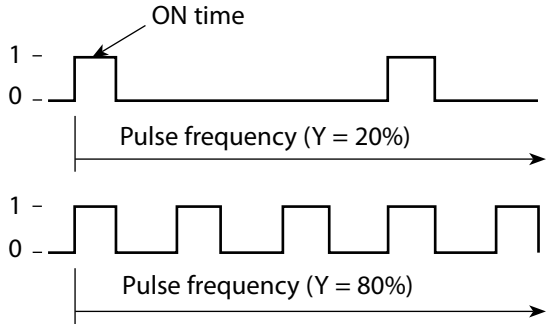
Output signal (relay contact) of pulse length controller



Pulse frequency controller (PFC)

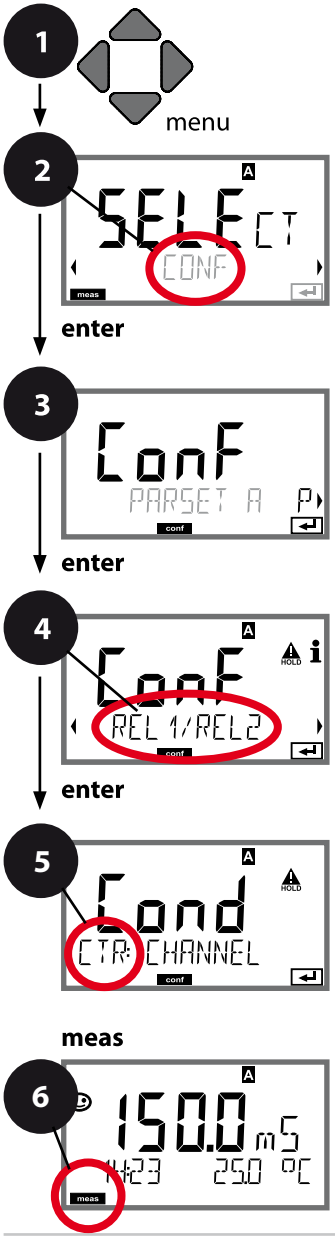
The pulse frequency controller is used to operate a frequency-controlled actuator (metering pump). It varies the frequency with which the contacts are switched on. The maximum pulse frequency [pulses/min] can be defined. It depends on the actuator.
The contact ON time is constant. It is automatically calculated from the user-defined maximum pulse frequency:

Output signal (relay contact) of pulse frequency controller



Controller

(For description, see Controller Functions)
Process variable. Controller type. Setpoint.

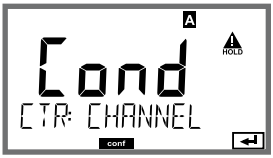
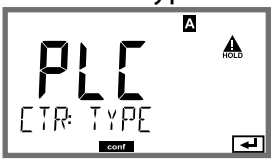


1) Press **menu** key.
2) Select **CONF** using ◂ ▸ keys, press **enter**.
3) Select parameter set using ◂ ▸, press **enter**.
4) Select **REL1/REL2** menu using ◂ ▸ keys, press **enter**.
5) All items of this menu group are indicated by the "CTR:" code.
   Press **enter** to select menu,
   edit using arrow keys (see next page).
   Confirm (and proceed) using **enter**.
6) Exit: Press **meas** key until the [meas] mode indicator is displayed.

5

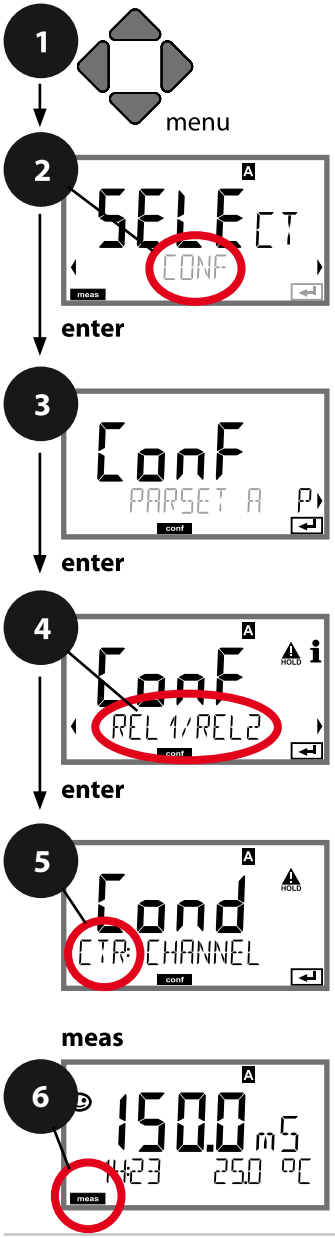
Use of relays
Select process variable
Controller type
Pulse length
Pulse frequency
Setpoint
Neutral zone Controller: P action
Controller: I action
Controller: D action
Behavior during HOLD

enter

Menu item	Action	Choices
Use of relays	Select in the text line using ▲ ▼ keys: • CONTROLLER Press **enter** to confirm.	**LIMITS** / CONTROLLER Selecting CONTROLLER leads to Controller menu group CTR.
Select process variable 	Select desired process variable using ▲ ▼ keys. Press **enter** to confirm.	**Cond**/TMP
Controller type 	Pulse length controller (PLC) or pulse frequency controller (PFC) Select using ▲ ▼ keys. Press **enter** to confirm.	**PLC**/PFC
Pulse length 	Only with PLC: Pulse length Adjust using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.	0...0600 SEC (**0010 SEC**)
Pulse frequency 	Only with PFC: Pulse frequency Adjust using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.	0...0180 P/M (**0060 P/M**) (pulses per minute)
Setpoint 	Adjust setpoint using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.	Within meas. range You can change the input range using the left/right arrow keys.

Controller

(For description, see Controller Functions)
Neutral zone. P, I, D actions. Behavior during HOLD

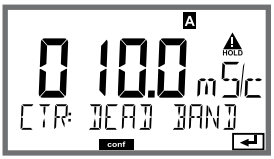
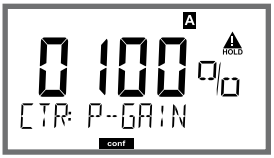
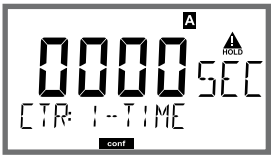
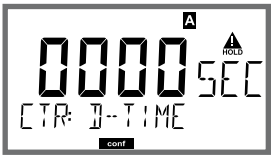
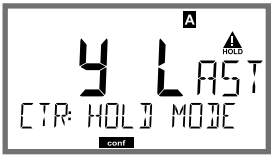


1) Press **menu** key.
2) Select **CONF** using ◂ ▸ keys, press **enter**.
3) Select parameter set using ◂ ▸, press **enter**.
4) Select **REL1/REL2** menu using ◂ ▸ keys, press **enter**.
5) All items of this menu group are indicated by the "CTR:" code.
   Press **enter** to select menu,
   edit using arrow keys (see next page).
   Confirm (and proceed) by pressing **enter**.
6) Exit: Press **meas** key until the [meas] mode indicator is displayed.

5

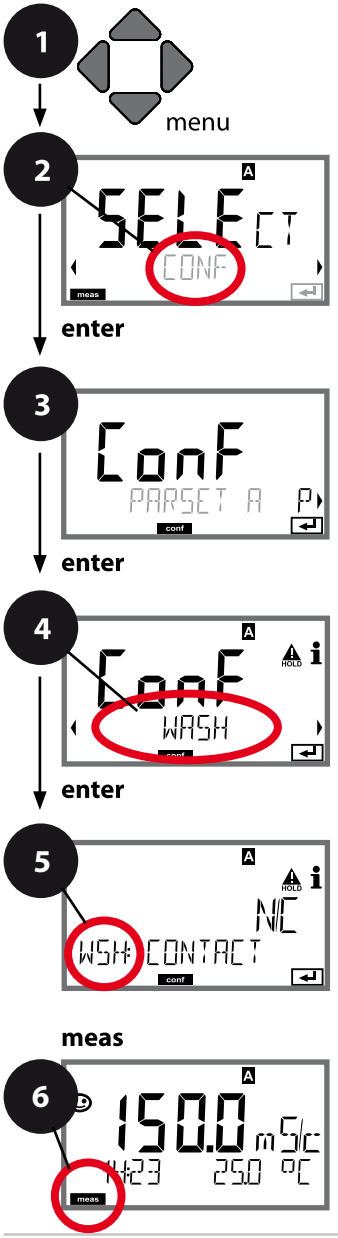
enter

Use of relays
Select process variable
Controller type
Pulse length
Pulse frequency
Setpoint
Neutral zone Controller: P action
Controller: I action
Controller: D action
Behavior during HOLD

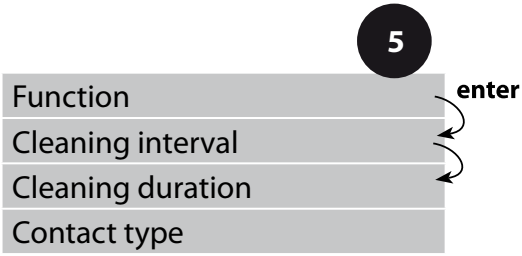
Menu item	Action	Choices
Neutral zone 	Adjust neutral zone using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.	0...50 % full scale You can change the input range using the left/right arrow keys.
Controller: P action 	Adjust P action using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.	10...9999 % (**0100 %**)
Controller: I action 	Adjust I action using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.	0...9999 SEC (**0000 SEC**)
Controller: D action 	Adjust D action using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.	0...9999 SEC (**0000 SEC**)
Behavior during HOLD 	Select response using ▲ ▼ keys. Press **enter** to confirm.	**Y LAST** / Y OFF

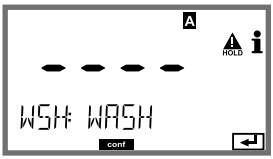
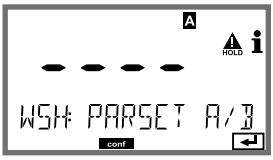
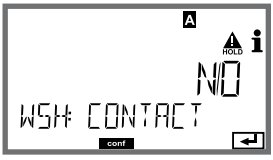
WASH Contact

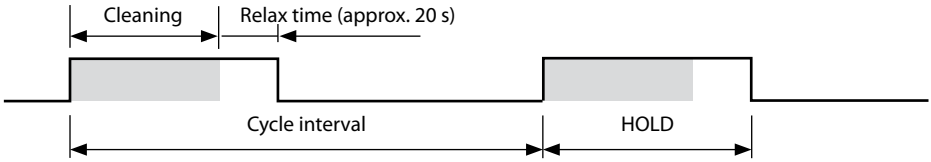
Controlling a rinsing probe or signaling the parameter set



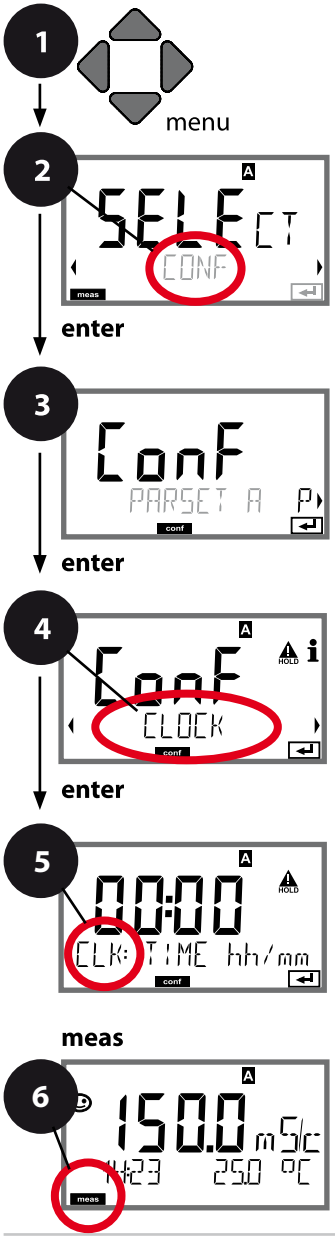
1) Press **menu** key.
2) Select **CONF** using ◂ ▸ keys, press **enter**.
3) Select parameter set A using ◂ ▸ **keys**, press **enter**.
4) Select **WASH** menu using ◂ ▸ keys, press **enter**.
5) All items of this menu group are indicated by the "WSH:" code.
   Press **enter** to select menu,
   edit using arrow keys (see next page).
   Confirm (and proceed) using **enter**.
6) End: Press **meas** key until the [meas] mode indicator is displayed.



Menu item	Action	Choices
Function  	Select WASH contact function using ▲ ▼ keys. Press **enter** to confirm.	**WASH** / PARSET A/B WASH: Control of rinsing probes With PARSET A/B selected, the contact signals: “Parameter set A“ (open contact) “Parameter set B“ (closed contact)
Cleaning interval 	Only with WASH: Adjust value using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.	000.0...999.9 h (**000.0 h**)
Cleaning duration 	Only with WASH: Adjust value using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.	0...9999 SEC (**0060 SEC**)
Contact type 	Only with WASH: N/O: normally open contact N/C: normally closed contact Select using ▲ ▼ keys. Press **enter** to confirm.	**N/O** / N/C



Time and Date
Tag Number



1) Press any arrow key.
2) Select **CONF** using ◂ ▸ keys, press **enter**.
3) Select parameter set A using ◂ ▸ keys**,** press **enter**.
4) Select **CLOCK** or **TAG** using ◂ ▸ keys, press **enter**.
5) All items of this menu group are indicated by the "CLK:" or "TAG" code.
   Press **enter** to select menu,
   edit using arrow keys (see next page).
   Confirm (and proceed) using **enter**.
6) Exit: Press **meas** key until the [meas] mode indicator is displayed.

5

Time format	**enter**
Time	
Day and month	
Year	
Tag number	

Time and Date

Control of the calibration and cleaning cycles is based on the time and date of the integrated real-time clock.
In measuring mode the time is shown in the lower display.
When using digital sensors, the calibration data is written in the sensor head.
In addition, the logbook entries (cf Diagnostics) are provided with a time stamp.

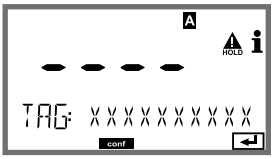
Please note:

- After prolonged power outage (> 5 days) the time display is replaced by dashes and cannot be used for processing.
  Enter the correct time.
- There is no automatic switchover from winter to summer time!
  Be sure to manually adjust the time!

Tag Number (" TAG")

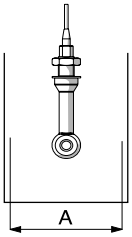
You can enter a designation for the point of measurement (tag number) in the lower display line. Up to 32 digits are possible.
Pressing **meas** (repeatedly) in the measuring mode indicates the tag number.
Being part of the device configuration, the "TAG" can be read out via IrDA.
A standardized tag number helps, for example, to correctly re-install a device after repair.

5

Menu item	Action	Choices
Tag number 	Select character using ▲ ▼ keys, select next digit using ◀ ▶ keys. Press **enter** to confirm.	A...Z, 0...9, – + < > ? / @ The first 10 characters are seen in the display without scrolling.

NOTICE:
- All calibration procedures must be performed by trained personnel. Incorrectly set parameters may go unnoticed, but change the measuring properties.

Calibration can be performed by:
- Determining the cell factor with a known calibration solution taking account of the temperature
- Input of cell factor (e.g. for ultrapure-water sensors)
- Sampling (product calibration)
- Zero calibration in air or with calibration solution
- Temperature probe adjustment



Note:
If measurements are performed in fittings with A < 110 mm, be sure to choose a calibration beaker with the same cross-section and of the same material (metal/plastic)!

Selecting a Calibration Mode

Calibration adapts the device to the individual sensor characteristics. Access to calibration can be protected with a passcode (SERVICE menu).
First, you open the calibration menu and select the calibration mode:

CAL_SOL	Calibration with calibration solution
CAL_CELL	Calibration by entry of cell factor
P_CAL	Product calibration (calibration with sampling)
CAL_ZERO	Zero calibration
CAL_RTD	Temperature probe adjustment

Calibration with Calibration Solution

Input of temperature-corrected value of calibration solution with simultaneous display of cell factor.
Be sure to use known calibration solutions and the respective temperature-corrected conductivity values (see calibration solution tables in the appendix). During the calibration procedure the temperature must be kept constant.

Note:
When using an ARF 210/215 flow-through fitting, you should use the inluded calibration beakers (identical dimensions and materials) for calibration to prevent calibration errors.

Display	Action	Remark
	Select Calibration. Press **enter** to proceed. Select CAL_SOL calibration method. Press **enter** to proceed.	
	Ready for calibration. Hourglass blinks.	Display (3 sec) Now the device is in HOLD mode.
	Immerse sensor in calibration solution. Enter the temperature-corrected value of the calibration solution using the arrow keys (see table in the appendix). Press **enter** to confirm.	Lower line: display of cell factor and temperature

Display	Action	Remark
	The cell factor and zero point are displayed. The "hourglass" icon is blinking.	
	Use the arrow keys to select: • Repeat (repeat calibration) or • Measuring. Press **enter** to confirm.	
	With MEAS selected: Exit calibration by pressing **enter**.	Display of measured variable, Sensoface is active. After end of calibration, the outputs remain in HOLD mode for a short time. After display of GOOD BYE, the device automatically returns to measuring mode.

Product Calibration

(Calibration by sampling)

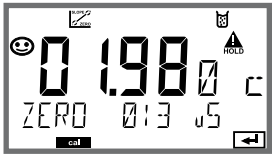
For product calibration, the uncompensated conductivity (mS/cm, S/m) is used. During product calibration the sensor remains in the process. The measurement process is only interrupted briefly.

Procedure:

1) The sample is measured in the lab or directly on the site using a portable meter. To ensure an exact calibration, sample temperature and process temperature should be the same.
   During sampling the device saves the currently measured value and then returns to measuring mode. Then, the "calibration" mode indicator blinks.
2) In the second step you enter the measured sample value in the device. From the difference between the stored measured value and entered sample value, the device calculates the new cell factor.

If the sample is invalid, you can take over the value stored during sampling. In that case the old calibration values are stored. Afterwards, you can start a new product calibration.

Display	Action	Remark
	Select Calibration. Press **enter** to proceed. Select P_CAL calibration method. Press **enter** to proceed.	
	Ready for calibration. Hourglass blinks.	Display (3 sec) Now the device is in HOLD mode.
	Take sample and save value. Press **enter** to proceed.	Now the sample can be measured in the lab.

Display	Action	Remark
	The device returns to measuring mode.	From the blinking CAL mode indicator you see that product calibration has not been terminated.
	Product calibration step 2: When the sample value has been determined, open the product calibration once more	Display (3 sec) Now the device is in HOLD mode.
	The stored value is displayed (blinking) and can be overwritten with the lab value. Press **enter** to proceed.	
 	Display of new cell factor and zero point (based on 25°C). Sensoface is active. Press **enter**. To exit calibration: Select MEAS, then press **enter**	To repeat calibration: Select REPEAT, then press **enter**
	After calibration is ended, the device will switch to measuring mode.	After end of calibration, the outputs remain in HOLD mode for a short time.

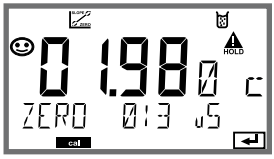
Calibration by Input of Cell Factor

You can directly enter the value for the cell factor of a sensor. This value must be known, e.g. determined beforehand in the laboratory. The selected process variable and the temperature are displayed. This method is suitable for all process variables.

Display	Action	Remark
	Select Calibration. Press **enter** to proceed. Select CAL_CELL calibration method. Press **enter** to proceed.	
	Ready for calibration. Hourglass blinks.	Display (3 sec) Now the device is in HOLD mode.
	Enter cell factor. Press **enter** to proceed.	The selected process variable and the temperature are displayed.
	The device shows the calculated cell factor and zero point (at 25 °C). Sensoface is active.	
	Use the arrow keys to select: • MEAS (exit) • REPEAT Press **enter** to proceed.	Exit: HOLD is deactivated after a short time.

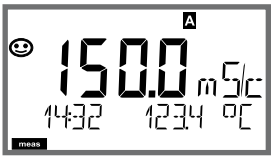
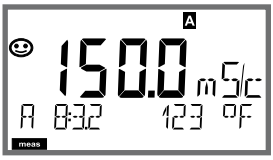
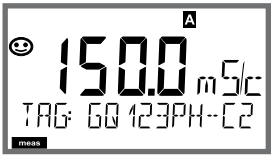
Please refer to the Specifications for the nominal cell factor. When measuring in a restricted space, the individual cell factor must be determined.

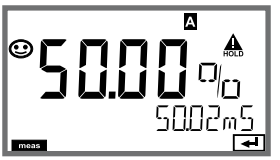
Zero Calibration in Air / with Calibration Solution

Display	Action	Remark
	Select Calibration. Press **enter** to proceed. Select CAL_ZERO calibration method. Press **enter** to proceed.	
	Ready for calibration. Hourglass blinks.	Display (3 sec) Now the device is in HOLD mode.
	Calibration in air. Edit digits until the lower display indicates Zero **Calibration with solution** Edit digits until the lower display indicates the solution value Press **enter** to proceed.	
	The device shows the cell factor (at 25 °C) and the zero point. Sensoface is active.	
	Use the arrow keys to select: • MEAS (exit) • REPEAT Press **enter** to proceed.	Exit: HOLD is deactivated after a short time.

Temp Probe Adjustment

Display	Action	Remark
	Select Calibration. Press **enter** to proceed. Select CAL_RTD calibration method. Press **enter** to proceed.	Wrong settings change the measurement properties!
	Measure the temperature of the process medium using an external thermometer.	Display (3 sec) Now the device is in HOLD mode.
	Enter the measured temperature value. Maximum difference: 10 K. Press **enter** to proceed.	Display of actual temperature (uncompensated) in the lower display.
	The corrected temperature value is displayed. Sensoface is active. To exit calibration: Select MEAS, then press **enter** To repeat calibration: Select REPEAT, then press **enter**	After end of calibration, the outputs remain in HOLD mode for a short time.
	After calibration is ended, the device will switch to measuring mode.	

Display	Remark
 or AM/PM and °F: 	From the configuration or calibration menus, you can switch the device to measuring mode by pressing the **meas** key. In the measuring mode the main display shows the configured process variable (Cond or temperature), the secondary display shows the time and the second configured process variable (Cond or temperature). The [meas] mode indicator lights and the active parameter set (A/B) is indicated. A/B is not displayed with parameter set "Fix A".
Pressing the **enter** key briefly shows the output currents. By pressing the **meas** key you can step through the following displays. When no key has been pressed for 60 sec, the device returns to the standard display.	
  	1) Selecting the parameter set (if set to "manual" in the configuration). Select the desired parameter set using the ◀ ▶ arrow keys (PARSET A or PARSET B blinks in the lower display line). Press **enter** to confirm. Further displays (each with **meas**). 2) Display of tag number ("TAG") 3) Display of time and date

Display	Remark
With activated controller, you can also step through the following displays by pressing the **meas** key. When no key has been pressed for 60 sec, the device returns to the standard display.	
	Upper display: Controller output Y Secondary display: Setpoint Depending on configuration setting: conductivity or temperature.

Note:

- After prolonged power outage (> 5 days) the time display is replaced by dashes and cannot be used for processing. Enter the correct time.

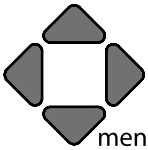
Diagnostics

In the Diagnostics mode you can access the following menus without interrupting the measurement:

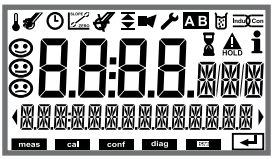
CALDATA	viewing the calibration data
SENSOR	viewing the sensor data
SELFTEST	starting a device self-test
LOGBOOK	viewing the logbook entries
MONITOR	displaying currently measured values
VERSION	displaying device type, software version, serial number

Access to diagnostics can be protected with a passcode (SERVICE menu).

Note:
HOLD is not active during Diagnostics mode!

Action	Key	Remark
Activate Diagnostics	 menu	Press **menu** key to call the selection menu. (Display color changes to turquoise.) Select DIAG using ◂ ▸ keys, press **enter** to confirm.
Select diagnostics option		Use ◂ ▸ keys to select from: CALDATA SENSOR SELFTEST LOGBOOK MONITOR VERSION See next pages for further proceeding.
Exit	**meas**	Exit by pressing **meas**.

Display	Menu item
 	Displaying the calibration data Select CALDATA using ◂ ▸, press **enter** to confirm. Use the ◂ ▸ keys to select the desired parameter from the bottom line of the display (LAST_CAL CELLFACTOR ZERO). The selected parameter is shown in the main display. Press **meas** to return to measurement.

Display	Menu item
	**Device self-test** (To abort, you can press **meas**.) 1) **Display test**: Display of all segments with changing background colors white/green/red. Press **enter** to proceed.
	2) **RAM test:** Hourglass blinks, then display of --PASS-- or --FAIL-- Press **enter** to proceed.
	3) **EEPROM test:** Hourglass blinks, then display of --PASS-- or --FAIL-- Press **enter** to proceed.
	4) **FLASH test:** Hourglass blinks, then display of --PASS-- or --FAIL-- Press **enter** to proceed.
	5) **Module test:** Hourglass blinks, then display of --PASS-- or --FAIL-- Press **enter** or **meas** to return to measuring mode.

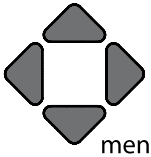
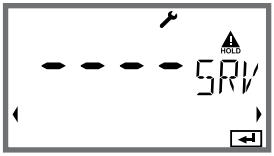
Display	Menu item
   	Displaying the logbook entries Select LOGBOOK using ◀ ▶, press **enter** to confirm. By using the ▲ ▼ keys, you can scroll backwards and forwards through the logbook (entries -00-...-99-), -00- being the last entry. If the display is set to date/time, you can search for a particular date using the ▲ ▼ keys. Press ◀ ▶ to view the corresponding message text. If the display is set to the message text, you can search for a particular message using the ▲ ▼ keys. Press ◀ ▶ to display the date and time. Press **meas** to return to measurement.
	Extended logbook / Audit Trail (via TAN) By using the ▲ ▼ keys, you can scroll backwards and forwards through the extended logbook (entries -000-...-199-), -000- being the last entry. **Display: CFR** Audit Trail also records function activations (CAL CONFIG SERVICE), some Sensoface messages, and opening of the enclosure.
 Display example: 	**Displaying the currently measured values (sensor monitor)** Select MONITOR using ◀ ▶, press **enter** to confirm. Use the ◀ ▶ keys to select the desired parameter from the bottom line of the display (R_COND G_COND RTD TEMP I-INPUT (Option)). The selected parameter is shown in the main display. Press **meas** to return to measurement.

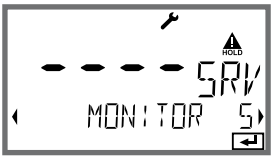
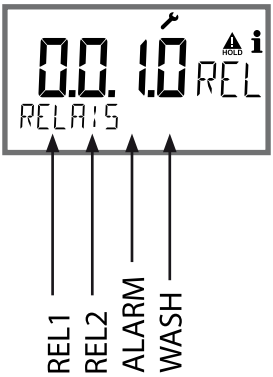
Display	Menu item
	Version Here, you find the data you require for requesting a device-specific Option. Display of **device type, software/hardware version**, and **serial number** for all device components. Use the ▲ ▼ keys to switch between software and hardware version. Press **enter** to proceed to next device component.

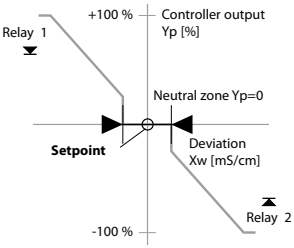
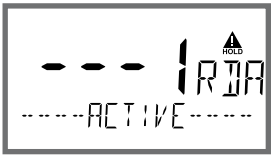
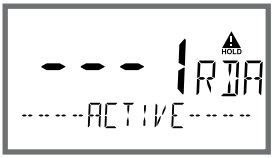
In the Service mode you can access the following menus:

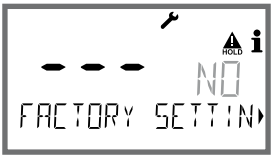
MONITOR	Displaying currently measured values
OUT1	Testing current output 1
OUT2	Testing current output 2
RELAY	Testing the function of the 4 relays
CONTROL	Testing the controller function
IRDA	Activating and communicating via the IrDA interface
CODES	Assigning and editing passcodes
DEFAULT	Resetting the device to factory settings
OPTION	Enabling options via TAN.

Note:
HOLD is active during Service mode!

Action	Key/Display	Remark
Activate Service		Press **menu** key to call the selection menu. Select SERVICE using ◀ ▶ keys, press **enter** to confirm.
Passcode		Enter passcode "5555" for service mode using the ▲ ▼ ◀ ▶ keys. Press **enter** to confirm.
Display		In service mode the following icons are displayed: • HOLD triangle • Service (wrench)
Exit	**meas**	Exit by pressing **meas**.

Display	Menu item
	**Displaying the currently measured values (sensor monitor) with HOLD mode activated:** Select MONITOR using ◀ ▶, press **enter** to confirm. Select variable in the bottom text line using ◀ ▶. The selected parameter is shown in the main display. As the device is in HOLD mode, you can perform validations using simulators without influencing the signal outputs. Press **meas** to return to the service menu. Return to measurement: Press **meas** once more.
	Specifying the current at outputs 1 and 2: Select OUT1 or OUT2 using the ◀ ▶ keys, press **enter** to confirm. Enter a valid current value for the respective output using ▲ ▼ ◀ ▶ keys. Press **enter** to confirm. For checking purposes, the actual output current is shown in the bottom right corner of the display. Exit by pressing **enter** or **meas**.
	**Relay test (manual test of contacts):** Select RELAIS using ◀ ▶, press **enter** to confirm. Now the status of the 4 relays is "frozen". The 4 digits of the main display represent the respective states (from left to right: REL1, REL2, ALARM, WASH). Select one of the 4 relays using the ◀ ▶ keys, close (1) or open (0) using the ▲ ▼ keys. The selected position blinks. The lower display line shows the relay function, e.g. "WASH" or "ALARM". End by pressing **enter**. The relays will be re-set corresponding to the measured value. Press **meas** to return to measurement.

Display	Menu item
	Controller test (manual specification of controller output): This function is used to start up control loops or check the actuators. For bumpless changeover to automatic operation (exiting this function), configure an I-action component (reset time). The lower display shows the currently adjusted controller output Yp. Specify new value for controller output Yp: Enter sign and value in the main display using the ▲ ▼ ◀ ▶ keys. Press **enter** to confirm. The new value is taken into the lower display. Press **enter** or **meas** to return to the service menu. Return to measurement: Press **meas** once more.
Controller characteristic  The arrows indicate which relay (valve) is active: ▲ Relay 2 active (Meas. value > setpoint) ▼ Relay 2 active (Meas. value < setpoint)	Controller output –100...0% Relay 2 active Controller output 0...+100% Relay 1 active
	**IrDA communication:** Select IRDA using ◀ ▶, press **enter** to confirm.
HOLD 	When IrDA communication is active, the device remains in the HOLD mode for reasons of safety. Further operation is performed via IrDA. End communication by pressing **meas**. **Exception: Firmware update (must not be interrupted!)**

Display	Menu item
	Assigning passcodes: In the "SERVICE - CODES" menu you can assign passcodes to DIAG, HOLD, CAL, CONF, and SERVICE modes (Service preset to 5555). **When you have lost the Service passcode**, you have to request an "Ambulance TAN" from the manufacturer specifying the serial number of your device. To enter the "Ambulance TAN", call the Service function and enter passcode 7321. After correct input of the ambulance TAN the device signals "PASS" for 4 sec and resets the Service passcode to 5555.
	**Reset to factory settings:** In the "SERVICE - DEFAULT" menu you can reset the device to factory settings. **NOTICE!** After a reset to factory setting the device must be reconfigured completely, including the sensor parameters!
	Option request: Communicate the serial number and hardware/software version of your device to the manufacturer. These data can be viewed in the Diagnostics/Version menu. The "transaction number" (TAN) you will then receive is only valid for the device with the corresponding serial number. **Release of options:** Options come with a "transaction number" (TAN). This TAN must be entered and confirmed using **enter** to release the option.

Operating States

Operating status	OUT 1	OUT 2	REL1/2 (Limit)	REL1/2 (Control)	ALARM contact	WASH contact	Time out
Measuring							-
Diag							60 s
CAL_SOL Cal solution							No
CAL_CELL Cell factor							No
P_CAL Product cal S1							No
P_CAL Product cal S2							No
CAL RTD Temp adjustm.							20 min
CONF ParSet A							20 min
CONF ParSet B							20 min
CONF Passcodes							20 min
SERVICE MONITOR							20 min
SERVICE OUT 1							20 min
SERVICE OUT 2							20 min
SERVICE RELAIS							20 min
SERVICE CONTROL							20 min

Operating status	OUT 1	OUT 2	REL1/2 (Limit)	REL1/2 (Control)	ALARM contact	WASH contact	Time out
SERVICE IRDA	22 mA	■		■			20 min
Cleaning fct	■	■		■			No
HOLD input	■	■		■			No

Explanation:

■ as configured (Last/Fix or Last/Off)

▒ active

▨ manual

Product Line and Accessories

Order Code Stratos Pro A 4...

								Channel 1		Channel 2	TAN
Example	A	4	0	1	B	-	CONDI	/	0	
4-wire / 20...254 V AC/DC	A	4								B,C,E
Communication										
Without (HART retrofittable via TAN)			0							A
Version number										
Version				1						
Approvals										
General Safety					N					
FM / CSA Zone 2 / Cl 1 Div 2					B					
Meas. channel 1 / Meas. channel 2										
Memosens pH (ORP)				Digital			MSPH		0	G
Memosens pH (ORP) / pH (ORP)				Digital			MSPH		MSPH	
Memosens pH (ORP) / Oxy				Digital			MSPH		MSOXY	
Memosens COND				Digital			MSCOND		0	
Memosens COND / COND				Digital			MSCOND		MSCOND	
Memosens Oxy				Digital			MSOxy		0	
Dual COND (2x2-electrode, analog)				Module			CC		0	
pH / ORP value (ISM digital: TAN)				Module			PH		0	F, G
Cond, 2-/4-electrode				Module			COND		0	
Conductivity, electrodeless				Module			CONDI		0	
Oxygen (ISM digital/Traces: TAN)				Module			OXY		0	D, F

TAN options		
HART	SW-A001	(A)
Logbook	SW-A002	(B)
Extended logbook (Audit Trail)	SW-A003	(C)
Trace oxygen measurement	SW-A004	(D)
Current input + 2 digital inputs	SW-A005	(E)
ISM digital	SW-A006	(F)
Pfaudler	SW-A007	(G)

Mounting accessories	
Pipe-mount kit	ZU 0274
Protective hood	ZU 0737
Panel-mount kit	ZU 0738

CONDI input	Input for toroidal (electrodeless) conductivity sensors SE 655, SE 656, SE 660, SE 670	
Effective ranges	Conductivity	0.000 ... 1999 mS/cm
	Concentration	0.00 ... 100.0% by wt
	Salinity	0.0 ... 45.0 % (0 ... 35 °C / 32 ... 95 °F)
Display ranges	Conductivity	0.000 ... 9.999 mS/cm (not with SE 660 / SE 670)
		00.00 ... 99.99 mS/cm
		000.0 ... 999.9 mS/cm
		0000 ... 1999 mS/cm
		0.000 ... 9.999 S/cm
		00.00 ... 99.99 S/cm
	Concentration	0.00 ... 9.99 % / 10.0 ... +100 %
	Salinity	0.0 ... 45.0 % (0 ... 35 °C / 32 ... 95 °F)
	Response (T90)	Approx. 1 s
Meas. error [1,2,3)]	< 1% meas. val. + 0.005 mS	
Temperature compensation *	(OFF)	Without
	(LIN)	Linear characteristic 00.00 ... 19.99%/K (reference temp user-defined)
	(NLF)	Natural waters to EN 27888 (reference temp 25 °C / 77 °F)
	(NACL)	NaCl from 0 to 26 % by wt (0 ... 120 °C / 32 ... 248 °F) (reference temp 25 °C / 77 °F)
Concentration determination*	–01– NaCl	0 – 26 wt% (0 °C /32 °F) ... 0 – 28 wt% (100 °C/212 °F)
	–02– HCl	0 – 18 wt% (-20 °C /-4 °F) ... 0 – 18 wt% (50 °C/122 °F)
	–03– NaOH	0 – 13 wt% (0 °C /32 °F) ... 0 – 24 wt% (100 °C/212 °F)
	–04– H_2SO_4	0 – 26 wt% (-17 °C/1.4 °F)…0 – 37 wt% (110 °C/230 °F)
	–05– HNO_3	0 – 30 wt% (-20 °C /-4 °F) ... 0 – 30 wt% (50 °C/122 °F)
	–06– H_2SO_4	94 – 99 wt% (-17 °C/1.4 °F)…89 – 99 wt% (115 °C/239 °F)
	–07– HCl	22 – 39 wt% (-20 °C/-4 °F)…22 – 39 wt% (50 °C/122 °F)
	–08– HNO_3	35 – 96 wt% (-20 °C/-4 °F)…35 – 96 wt% (50 °C/122 °F)
	–09– H_2SO_4	28 – 88 wt% (-17 °C/1.4 °F)…39 – 88 wt% (115 °C/239 °F)
	–10– NaOH	15 – 50 wt% (0 °C/32 °F)…35 – 50 wt% (100 °C/212 °F)

Specifications

Sensor standardization	Input of cell factor with simultaneous display of selected process variable and temperature
	Input of calibration solution conductivity with simultaneous display of cell factor
	Product calibration for conductivity
	Zero adjustment
	Temperature probe adjustment
Permissible cell factor	00.100 ... 19.9999 cm^{-1}
Permissible transfer ratio	010.0 ... 199.99 cm^{-1}
Permissible zero offset	± 0.5 mS
Sensocheck	Monitoring of primary and secondary coils and lines for open circuit and of primary coil and lines for short circuit
Delay	Approx. 30 s
Sensoface	Provides information on the sensor condition (zero point, Sensocheck)
Sensor monitor	Direct display of measured values from sensor for validation (resistance/temperature)
Temperature input *	Pt100/Pt1000/NTC 30 kΩ
	3-wire connection, adjustable
Measuring range	Pt 100/Pt 1000 –50 ... +250 °C / –58 ... +482 °F
	NTC 30 kΩ –20 ... +150 °C / –4 ... +302 °F
Resolution	0.1 °C / 0.1 °F
Measurement error [1,2,3)]	< 0.5 K (< 1 K for Pt 100; < 1 K for NTC > 100 °C / 212 °F)
Calibration data	Calibration date, cell factor, zero point

I input (TAN)	Current input 0/4 ... 20 mA / 50 Ω for external temperature signal		
Start/end of scale	Configurable –50 ... +250 °C / –58 ... +482 °F		
Characteristic	Linear		
Measurement error [1,3)]	< 1% current value + 0.1 mA		
HOLD input	Galvanically separated (optocoupler)		
Function	Switches device to HOLD mode		
Switching voltage	0 ... 2 V (AC/DC)	HOLD inactive	
	10 ... 30 V (AC/DC)	HOLD active	
CONTROL input	Galvanically separated (optocoupler)		
Function	Selecting parameter set A/B or flow measurement		
Parameter set A/B	Control input	0 ... 2 V (AC/DC) 10 ... 30 V (AC/DC)	Parameter set A Parameter set B
FLOW	Pulse input for flow measurement 0 ... 100 pulses/s		
Message	via 22 mA, alarm contact or limit contacts		
Display	00.0 … 99.9 l/h		
Output 1	0/4 ... 20 mA, max. 10 V, floating (galv. connected to output 2)		
Process variable *	Conductivity, resistivity, concentration, salinity, or temperature		
Characteristic	Linear, bilinear or logarithmic		
Overrange *	22 mA in the case of error messages		
Output filter *	PT_1 filter, time constant 0 ... 120 s		
Measurement error [1)]	< 0.25 % current value + 0.025 mA		
Start/end of scale *	Configurable within selected range		
Bilinear: Vertex X/Y *	Configurable within selected range		
Minimum span	LIN	5 % of selected range	
	LOG	1 decade	

Output 2	0/4 ... 20 mA, max. 10 V, floating (galv. connected to output 1)	
Process variable *	Conductivity, resistivity, concentration, salinity, or temperature	
Characteristic	Linear, bilinear or logarithmic	
Overrange *	22 mA in the case of error messages	
Output filter *	PT_1 filter, time constant 0 ... 120 s	
Measurement error [1)]	< 0.25 % current value + 0.025 mA	
Start/end of scale *	Configurable within selected range	
Bilinear: Vertex X/Y *	Configurable within selected range	
Minimum span	LIN	5 % of selected range
	LOG	1 decade
Alarm contact	Relay contact, floating	
Contact ratings	AC	< 250 V / < 3 A / < 750 VA
	DC	< 30 V / < 3 A / < 90 W
Contact response	N/C (fail-safe type)	
Response delay	0000 ... 0600 s	
Wash contact	Relay contact, floating	
	For controlling a cleaning system	
Contact ratings	AC	< 250 V / < 3 A / < 750 VA
	DC	< 30 V / < 3 A / < 90 W
Contact response *	N/C or N/O	
Interval *	000.0 ... 999.9 h (000.0 h = cleaning function switched off)	
Cleaning duration *	0000 ... 1999 s	
or		
Parameter set A/B	For signaling parameter set A/B	
Contact ratings	AC	< 250 V / < 3 A / < 750 VA
	DC	< 30 V / < 3 A / < 90 W
Contact response *	Contact open:	Parameter set A active
	Contact closed:	Parameter set B active

Limit values Rel1/Rel2	Rel1/Rel2 contacts, floating, but inter-connected	
Contact ratings	AC	< 250 V / < 3 A / < 750 VA
	DC	< 30 V / < 3 A / < 90 W
Contact response *	N/C or N/O	
Response delay *	0000 ... 9999 s	
Setpoints *	As desired within range	
Hysteresis *	User-defined	
PID process controller	Output via Rel1/Rel2 relay contacts (see limit values)	
Setpoint specification*	Within selected range	
Neutral zone *	Max. 50 % of selected range	
Proportional action*	Controller gain	Kp: 0010 ... 9999 %
Integral action*	Reset time	Tr: 0000 ... 9999 s (0000 s = no integral action)
Derivative action*	Rate time	Td: 0000 ... 9999 s (0000 s = no derivative action)
Controller type *	Pulse length controller or pulse frequency controller	
Pulse period *	0001 ... 0600 s, min. ON time 0.5 s (pulse length controller)	
Max. pulse frequency*	0001 ... 0180 min^{-1} (pulse frequency controller)	
Real-time clock	Different time and date formats selectable	
Power reserve	> 5 days	
Display	LC display, 7-segment with icons, colored backlighting	
Main display	Character height approx. 22 mm, unit symbols approx. 14 mm	
Secondary display	Character height approx. 10 mm	
Text line	14 characters, 14 segments	
Sensoface	3 status indicators (friendly, neutral, sad face)	
Mode indicators	meas, cal, conf, diag	
	Further icons for configuration and messages	
Alarm indication	Display blinks, red backlighting	

Keypad	Keys: meas, menu, info, 4 cursor keys, enter
HART communication	HART version 6 Digital communication by FSK modulation of output current 1 Device identification, measured values, status and messages, parameter setting, calibration, records
Conditions	Output current ≥ 3.8 mA and load resistance ≥ 250 Ω
IrDA interface	Infrared interface for firmware update
FDA 21 CFR Part 11	Access control by editable passcodes Logbook entry and flag via HART in the case of configuration changes Message and logbook entry when enclosure is opened
Diagnostics functions	
Calibration data	Calibration date, sensor parameters
Device self-test	Display test, automatic memory test (RAM, FLASH, EEPROM), module test
Logbook	100 events with date and time
Extended logbook (TAN)	Audit Trail: 200 events with date and time
Service functions	
Sensor monitor	Display of direct sensor signals
Current source	Current specifiable for output 1 and 2 (00.00 ... 22.00 mA)
Relay test	Manual control of the four switching contacts
Manual controller	Controller output entered directly (start of control process)
IrDA	Activating the IrDA function
Passcodes	Assigning passcodes for menu access
Factory setting	Resetting all parameters to factory setting
TAN	Enabling optionally available additional functions
Data retention	Parameters, calibration data, logbook > 10 years (EEPROM)
EMC	EN 61326-1 (General Requirements)
Emitted interference	Class B (residential area)
Immunity to interference	Industry EN 61326-2-3

Explosion protection Stratos Pro A401B	FM	C/US	NI/I/2/ABCD/T4 / S/II,III/2/FG/T4, Type 4X
		C	I/2/Ex nA IIC T4 / 22/Ex tD T85 °C, Type 4X
		US	I/2/AEx nA IIC T4 / 22/AEx tD T85 °C, Type 4X
	CSA	C/US	Class I,II,III Div 2, GP A,B,C,D,E,F,G T4, Type 4X
		C	Ex nA II T4 / DIP/II,III/2/EFG, Type 4X
		US	AEx nA II T4 / II, III/22/AEx tD 22, T85 °C, Type 4X

Power supply	24 (–15%) ... 230 (+10%) V AC/DC[4]; < 12 VA, < 4 W AC: 45 ... 65 Hz Overvoltage category II, protection class II
Nominal operating conditions	
Ambient temperature	–20 ... +55 °C
Transport/Storage temperature	–30 ... +70 °C
Relative humidity	10 ... 95% not condensing
Power supply	24 (–15%) ... 230 (+10%) V AC/DC (DC ≤ 80V)
Frequency for AC	45 ... 65 Hz

Specifications

Enclosure	Molded enclosure made of glass-reinforced PBT, PC
Mounting	Wall, pipe/post or panel mounting
Color	Gray, RAL 7001
Ingress protection	IP 67, NEMA 4X
Flammability	UL 94 V-0
Dimensions	148 mm x 148 mm x 117 mm
Control panel cutout	138 mm x 138 mm to DIN 43 700
Weight	Approx. 1200 g (1600 g incl. accessories and packaging)
Cable glands	3 knockouts for M20 x 1.5 cable glands 2 knockouts for NPT ½" or rigid metallic conduit
Connections	Terminals, conductor cross-section max. 2.5 mm^2

*) User-defined

1) Acc. to EN 60746, at nominal operating conditions

2) ± 1 count

3) Plus sensor error

4) DC ≤ 80 V

Potassium Chloride Solutions

(Conductivity in mS/cm)

Temperature	Concentration [1]		
[°C]	0.01 mol/l	0.1 mol/l	1 mol/l
0	0.776	7.15	65.41
5	0.896	8.22	74.14
10	1.020	9.33	83.19
15	1.147	10.48	92.52
16	1.173	10.72	94.41
17	1.199	10.95	96.31
18	1.225	11.19	98.22
19	1.251	11.43	100.14
20	1.278	11.67	102.07
21	1.305	11.91	104.00
22	1.332	12.15	105.94
23	1.359	12.39	107.89
24	1.386	12.64	109.84
25	1.413	12.88	111.80
26	1.441	13.13	113.77
27	1.468	13.37	115.74
28	1.496	13.62	
29	1.524	13.87	
30	1.552	14.12	
31	1.581	14.37	
32	1.609	14.62	
33	1.638	14.88	
34	1.667	15.13	
35	1.696	15.39	
36		15.64	

1) Data source: K. H. Hellwege (Editor), H. Landolt, R. Börnstein: Zahlenwerte und Funktionen ..., volume 2, part. volume 6

Sodium Chloride Solutions

(Conductivity in mS/cm)

Temperature	Concentration		
[°C]	0.01 mol/l [1]	0,1 mol/l [1]	Saturated [2]
0	0.631	5.786	134.5
1	0.651	5.965	138.6
2	0.671	6.145	142.7
3	0.692	6.327	146.9
4	0.712	6.510	151.2
5	0.733	6.695	155.5
6	0.754	6.881	159.9
7	0.775	7.068	164.3
8	0.796	7.257	168.8
9	0.818	7.447	173.4
10	0.839	7.638	177.9
11	0.861	7.831	182.6
12	0.883	8.025	187.2
13	0.905	8.221	191.9
14	0.927	8.418	196.7
15	0.950	8.617	201.5
16	0.972	8.816	206.3
17	0.995	9.018	211.2
18	1.018	9.221	216.1
19	1.041	9.425	221.0
20	1.064	9.631	226.0
21	1.087	9.838	231.0
22	1.111	10.047	236.1
23	1.135	10.258	241.1
24	1.159	10.469	246.2
25	1.183	10.683	251.3
26	1.207	10.898	256.5
27	1.232	11.114	261.6
28	1.256	11.332	266.9
29	1.281	11.552	272.1
30	1.306	11.773	277.4
31	1.331	11.995	282.7
32	1.357	12.220	288.0
33	1.382	12.445	293.3
34	1.408	12.673	298.7
35	1.434	12.902	304.1
36	1.460	13.132	309.5

1) Data source: Test solutions calculated according to DIN IEC 746-3
2) Data source: K. H. Hellwege (Editor), H. Landolt, R. Börnstein: Zahlenwerte und Funktionen ..., volume 2, part. volume 6

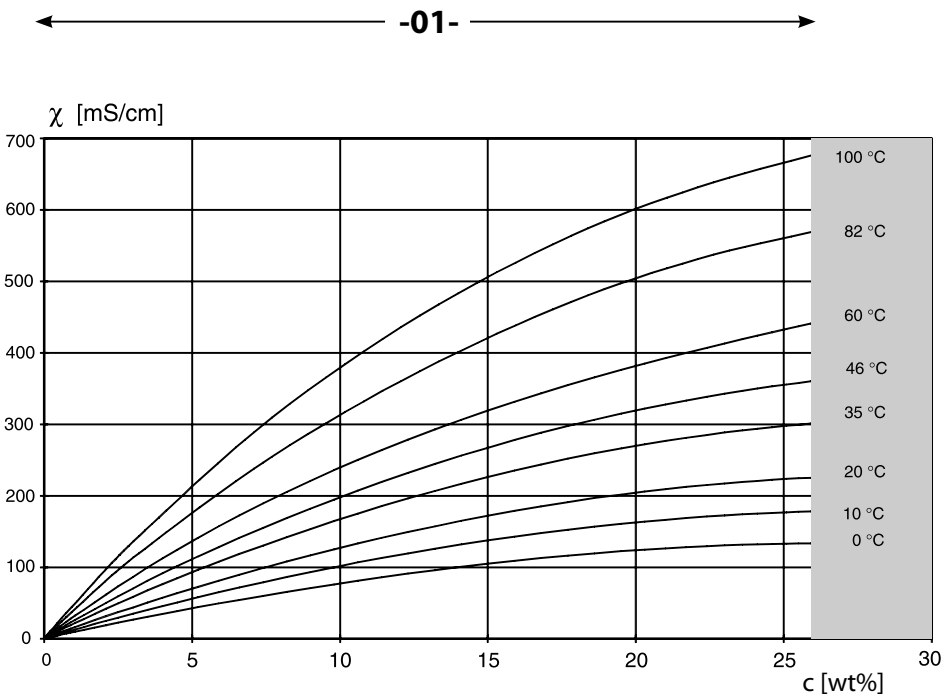
Ranges

Substance	Concentration ranges		
NaCl Configuration	0-26wt% (0°C) 0-26wt% (100°C) **-01-**		
HCl Configuration	0-18wt% (-20 °C) 0-18wt% (50 °C) **-02-**	22-39wt% (-20 °C) 22-39wt% (50°C) **-07-**	
NaOH Configuration	0-13wt% (0 °C) 0-24wt% (100 °C) **-03-**	15-50wt% (0 °C) 35-50wt% (100 °C) **-10-**	
H_2SO_4 Configuration	0-26wt% (-17 °C) 0-37wt% (110 °C) **-04-**	28-77wt% (-17°C) 39-88wt% (115°C) **-09-**	94-99wt% (-17 °C) 89-99wt% (115 °C) **-06-**
HNO_3 Configuration	0-30wt% (-20°C) 0-30wt% (50°C) **-05-**	35-96wt% (-20°C) 35-96wt% (50°C) **-08-**	

For the solutions listed above, the device can determine the substance concentration from the measured conductivity and temperature values in wt%. The measurement error is made up of the sum of measurements errors during conductivity and temperature measurement and the accuracy of the concentration curves stored in the device. We recommend to calibrate the device together with the sensor, e.g. directly to concentration using the CAL_CELL method. For exact temperature measurement, you should perform a temperature probe adjustment. For measuring processes with rapid temperature changes, a separate temperature probe with fast response should be used.
When measuring processes such as dilution or intensification of CIP solutions (Clean-In-Place), it is helpful to switch between the parameter sets for measuring the process medium and for measuring the CIP solution.

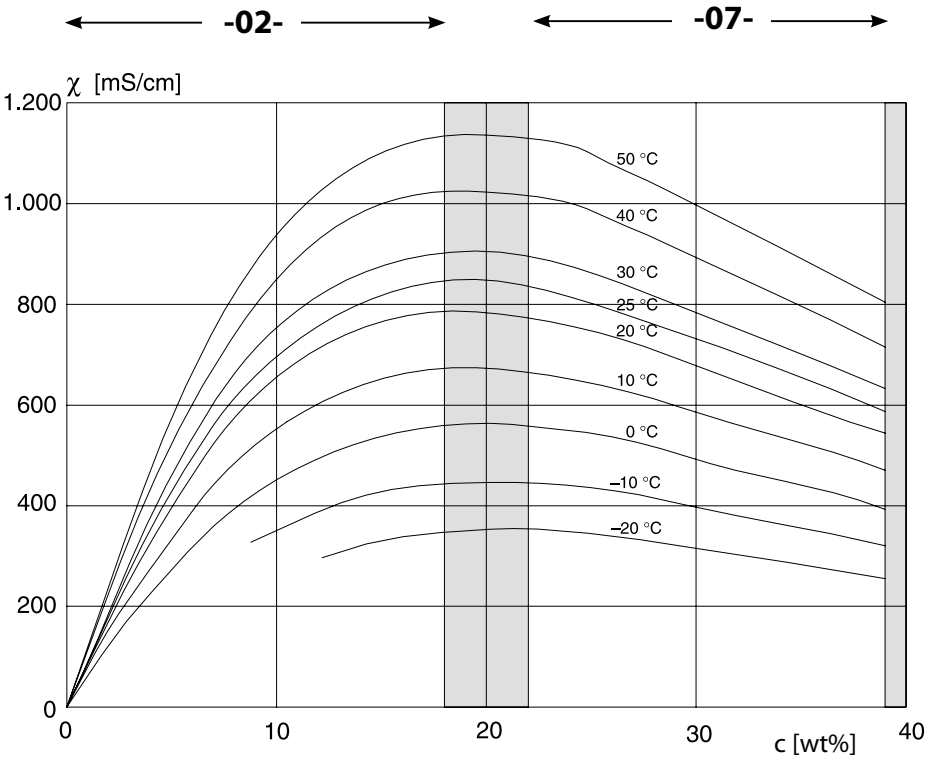
Concentration Curves

-01- Sodium chloride solution NaCl



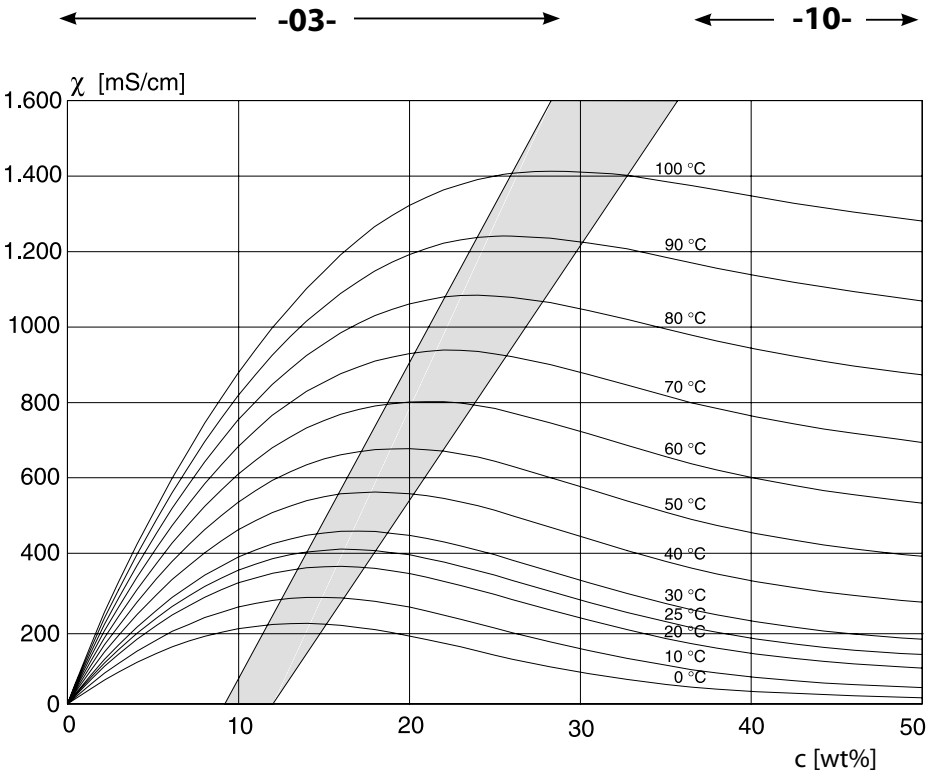
Conductivity versus substance concentration and process temperature for sodium chloride solution (NaCl)

-02- Hydrochloric acid HCl
-07-



Conductivity versus substance concentration and process temperature for hydrochloric acid (HCl)
Source: Haase/Sauermann/Dücker; Z. phys. Chem. New Edition, Vol. 47 (1965)

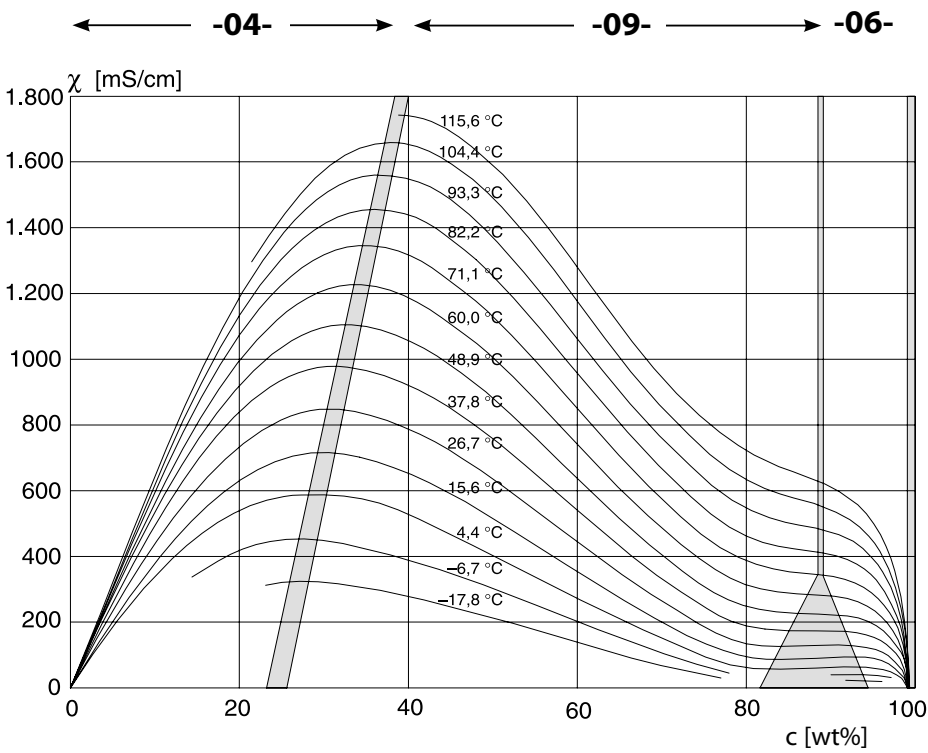
-03- Sodium hydroxide solution NaOH
-10-



Concentration measurement not possible in this range.

Conductivity versus substance concentration and process temperature for sodium hydroxide solution (NaOH)

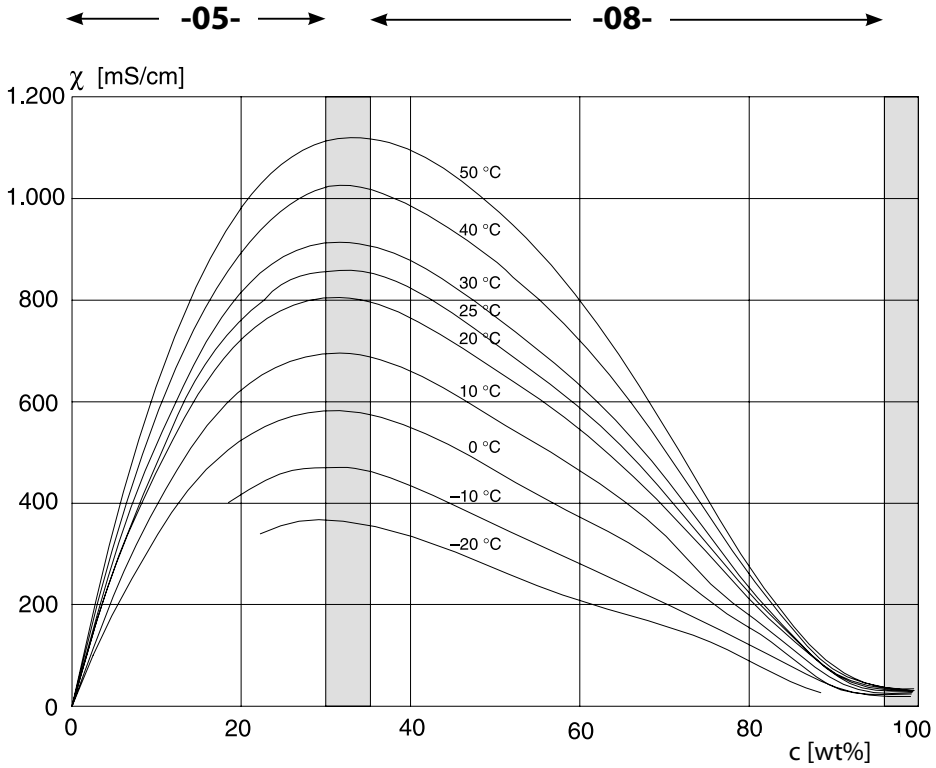
-04- Sulfuric acid H_2SO_4
-06-
-09-



Concentration measurement not possible in this range.

Conductivity versus substance concentration and process temperature for sulfuric acid (H_2SO_4)
Source: Darling; Journal of Chemical and Engineering Data; Vol.9 No.3, July 1964

-05- Nitric acid HNO_3
-08-



Conductivity versus substance concentration and process temperature for nitric acid ($HN0_3$)
Source: Haase/Sauermann/Dücker; Z. phys. Chem. New Edition, Vol. 47 (1965)

Error Handling

Alarm condition:

- The display backlighting turns **red**
- The alarm icon is displayed
- The complete measured-value display blinks
- "**ERR xxx**" is displayed in the lower menu line

Press the [**info**] key to view a short error text:

- The error text appears in the lower menu line
- The main display reads "**InFo**".

Parameter errors:

Configuration data such as current range, limit values, etc are checked during the input.
If they are out of range,

- "**ERR xxx**" is displayed for 3 sec,
- the display backlighting flashes red,
- the respective maximum or minimum value is shown,
- input must be repeated.

If a faulty parameter arrives through the interface (IrDA, HART),

- an error message will be displayed: "**ERR 100...199**"
- the faulty parameter can be localized by pressing the [**info**] key

Calibration errors:

If errors occur during calibration,

- an error message will be displayed

Sensoface:

If the Sensoface becomes sad,

- the display backlighting will turn purple
- the cause can be seen by pressing the **info** key
- the calibration data can be seen in the Diagnostics menu

Error	Info text (is displayed in case of fault when the Info key is pressed)	Problem Possible causes
ERR 99	DEVICE FAILURE	**Error in factory settings** EEPROM or RAM defective This error message only occurs in the case of a total defect. The device must be repaired and recalibrated at the factory.
ERR 98	CONFIGURATION ERROR	**Error in configuration or calibration data** Memory error in device program Configuration or calibration data defective; completely reconfigure and recalibrate the device.
ERR 97	NO MODULE INSTALLED	**No module** Please have the module replaced in the factory.
ERR 96	WRONG MODULE	**Wrong module** Please have the module replaced in the factory.
ERR 95	SYSTEM ERROR	**System error** Restart required. If error still persists, send in the device for repair.
ERR 100	INVALID SPAN OUT1	Span Out1 configuration error
ERR 101	INVALID SPAN OUT2	Span Out2 configuration error
ERR 104	INVALID PARAMETER CONTROLLER	Controller configuration error
ERR 105	INVALID SPAN I-INPUT	I-Input configuration error

Error	Info text (is displayed in case of fault when the Info key is pressed)	Problem Possible causes
ERR 10	CONDUCTANCE TOO HIGH	**Measuring range of conductance exceeded** > 3500 mS
ERR 11	CONDUCTIVITY RANGE CONCENTRATION RANGE SALINITY RANGE	**Display range violation** Cond > 1999 mS/cm > 99.99 S/m Conc > 99.9 % SAL > 45.0 ‰
ERR 13	TEMPERATURE RANGE	**Temperature range violation**
ERR 15	SENSOCHECK	**Sensocheck**
ERR 60	OUTPUT LOAD	**Load error**
ERR 61	OUTPUT 1 TOO LOW	**Output current 1** < 0 (3.8) mA
ERR 62	OUTPUT 1 TOO HIGH	**Output current 1** > 20.5 mA
ERR 63	OUTPUT 2 TOO LOW	**Output current 2** < 0 (3.8) mA
ERR 64	OUTPUT 2 TOO HIGH	**Output current 2** > 20.5 mA
ERR 72	FLOW TOO LOW	Flow too low
ERR 73	FLOW TOO HIGH	Flow too high
ERR 108	OUT1 INVALID CORNER X/Y	Bilinear curve: Invalid vertex point
ERR 109	OUT2 INVALID CORNER X/Y	

(Sensocheck must have been activated during configuration.)

The smiley in the display (Sensoface) alerts to sensor problems (defective sensor, defective cable, maintenance required). The permitted calibration ranges and the conditions for a friendly, neutral, or sad Sensoface are summarized in the following table. Additional icons refer to the error cause.

Sensocheck
Continuously monitors the sensor and leads for short circuits or open circuits. Critical values make the Sensoface "sad" and the corresponding icon blinks:

The Sensocheck message is also output as error message Err 15.
The alarm contact is active, the display backlighting turns red, output current 1 is set to 22 mA (when configured correspondingly).
Sensocheck can be switched off during configuration (then Sensoface is also disabled).
Exception:
After a calibration a smiley is always displayed for confirmation.

Note:
The worsening of a Sensoface criterion leads to the devaluation of the Sensoface indicator (Smiley becomes "sad"). An improvement of the Sensoface indicator can only take place after calibration or removal of the sensor defect.

Display	Problem	Status	
	Sensor defect		Wrong or defective sensor or excessive cable capacitance (see also error message Err 15).
	Temperature		Temperature outside range for TC, conc, sal

Conformity with FDA 21 CFR Part 11

In their directive "Title 21 Code of Federal Regulations, 21 CFR Part 11, Electronic Records; Electronic Signatures" the US American health agency FDA (Food and Drug Administration) regulates the production and processing of electronic documents for pharmaceutical development and production. This results in requirements for measuring devices used for corresponding applications. The following features ensure that the measuring devices of this Series meet the demands of FDA 21 CFR Part 11:

Electronic Signature – Passcodes

Access to the device functions is regulated and limited by individually adjustable codes – "Passcodes" (see SERVICE). This prevents unauthorized modification of device settings or manipulation of the measurement results. Appropriate use of these passcodes makes them suitable as electronic signature.

Audit Trail

Every (manual) change of device settings can be automatically documented. Each change is tagged with a "Configuration Change Flag", which can be interrogated and documented using HART communication. Altered device settings or parameters can also be retrieved and documented using HART communication.

Extended logbook

Audit Trail also records function activations (CAL, CONFIG, SERVICE), some Sensoface messages (cal timer, wear), and opening of the enclosure.

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Trademarks

The following names are registered trademarks. For practical reasons they are shown without trademark symbol in this manual.

Stratos®
Sensocheck®
Sensoface®
Memosens® is a registered trademark of Endress+Hauser Conducta GmbH and Knick Elektronische Messgeräte GmbH & Co. KG.
HART® is a registered trademark of the HART Communication Foundation.

Passcodes

In the SERVICE – CODES menu you can assign passcodes to protect the access to certain functions.

Mode of operation	Passcode
Service (SERVICE)	**5555**
Diagnostics (DIAG)	
HOLD mode	
Calibration (CAL)	
Configuration (CONF)	

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