Instruction manual

Cond Transmitter 7100e FF

METTLER TOLEDO

Warranty

Defects occurring within 1 year from delivery date shall be remedied free of charge at our plant (carriage and insurance paid by sender).

Subject to change without notice.

Return of products under waranty

Please contact METTLER TOLEDO's Customer Service Dept. 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 decontaminated/disinfected before shipment. In that case, please attach a corresponding certificate, for the health and safety of our service personnel.

Disposal (Directive 2002/96/EC of January 27, 2003)
Please observe the applicable local or national regulations concerning the disposal of "waste electrical and electronic equipment".

CE

FM

Mettler-Toledo GmbH, Process Analytics, Industrie Nord,
CH-8902 Urdorf, Tel. +41 (01) 736 22 11 Fax +41 (01) 736 26 36
Subject to technical changes. Mettler-Toledo GmbH, 11/04.
Printed in Germany.

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Safety information

Be sure to read and observe the following 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.

Caution!
Commissioning may only be carried out by trained experts. 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 above 70 °C
- after severe transport stresses

Before recommissioning the device, a professional routine test in accordance with EN 61010-1 must be performed. This test should be carried out by the manufacturer.

Caution!
Before commissioning it must be proved that the device may be connected with other equipment, such as coupling elements and cables.

Safety information

Safety precautions for installation

- The stipulations of EN 60079-10 / EN 60079-14 must be observed during commissioning.
- The **Cond Transmitter 7100e FF** is approved for installation in ATEX, FM Zone 1 with measurement in Zone 0, and FM Class I Div 1.

Connection to supply and coupling elements

- **The Cond Transmitter 7100e FF** may only be connected to explosion-proof power supply and coupling elements (for input ratings refer to annex of EC-Type-Examination Certificate).

  Before commissioning it must be proved that the intrinsic safety is maintained when connecting the device to other equipment, such as supply elements and cables.

Terminals:
suitable for single wires / flexible leads up to 2.5 mm^2 (AWG 14)

Cleaning in a hazardous location

In hazardous locations the device may only be cleaned with a damp cloth to prevent electrostatic discharge.

Intended use / Short description

The Cond Transmitter 7100e FF is an analyzing device with digital communication via Foundation Fieldbus (FF).
It is used for measurement of electrical conductivity and temperature in liquids.
Fields of application are: biotechnology, chemical and pharmaceutical industry, environment, food processing, pulp and paper, water/waste-water treatment.
During measurement three measured values can be cyclically transmitted at the same time (conductivity, concentration, resistivity, salinity, cell constant, temperature). Temperature compensation can be linear or nonlinear (for natural waters to EN 27888 and for ultrapure water with traces of impurities: NACl, HCl, NH_3)
The bus address is automatically assigned by the control system, but can also be adjusted on the device.

The rugged molded enclosure can e fixed into a control panel or mounted on a wall or at a post. The protective hood provides additional protection against direct weather exposure and mechanical damage. The device has been designed for 2- and 4-electrode sensors.

- The **Cond Transmitter 7100e FF** is an intrinsically safe equipment for operation in the following locations: ATEX, FM Zone 1 with measurement in Zone 0, and FM Class I Div 1.
  Power is supplied (intrinsically safe) via the fieldbus.

Trademarks

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

Sensoface
Sensocheck
GainCheck

EC Declaration of Conformity

Mettler-Toledo GmbH
Process Analytics

Adresse | Im Hackacker 15 (Industrie Nord), CH-8902 Urdorf, Schweiz
Briefadresse | Postfach, CH-8902 Urdorf
Telefon | 01-736 22 11
Telefax | 01-736 26 36
Internet | www.mt.com
Bank | Credit Suisse First Boston, Zürich (Acc. 0835-370501-21-90)

Declaration of conformity
Konformitätserklärung
Déclaration de conformité

CE 0820

Wer/ Wir/Nous

Mettler-Toledo GmbH, Process Analytics
Im Hackacker 15
8902 Urdorf
Switzerland

declare under our sole responsibility that the product,
erklären in alleiniger Verantwortung, dass dieses Produkt,
déclarons sous notre seule responsabilité que le produit,

Description
Beschreibung/Description

Cond 7100e FF
to which this declaration relates is in conformity with the following standard(s) or other normative document(s).
auf welches sich diese Erklärung bezieht, mit der/den folgenden Norm(en) oder Richtlinie(n) übereinstimmt.
auquel se réfère cette déclaration est conforme à la (aux) norme(s) ou au(x) document(s) normative(s).

EMC Directive/ EMV-Richtlinie
Directive concernant la CEM

89/336/EWG

Low voltage directive/
Niederspannungsrichtlinie/
Directive basse tension

73/23/ EWG

Explosion protection/
Explosionsschutzrichtlinie/
Prot. contre les explosions

94/9/EG
Prüf- und Zertifizierungsstelle ZELM
ZELM 00 ATEX 0037
D-38124 Braunschweig, ZELM 0820

Place and Date of issue/
Ausstellungsort/ - Datum
Lieu et date d'émission

Urdorf, September 1st, 2004

Mettler-Toledo GmbH, Process Analytics

Waldemar Rauch
General Manager PO Urdorf

Christian Zwicky
Head of Marketing

Norm/ Standard/ Standard

EN 50014 EN 50020
DIN EN 61326/ VDE 0843 Teil 20
EN 61010/ VDE 0411 Teil 1

METTLER TOLEDO

KE_Cond7100e_FF_Int.doc

EC-Type-Examination Certificate

Prüf- und Zertifizierungsstelle

ZELM Ex

(1) **EC-TYPE-EXAMINATION CERTIFICATE**
(Translation)

(2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres - **Directive 94/9/EC**

(3) EC-TYPE-EXAMINATION CERTIFICATE Number:

ZELM 00 ATEX 0037

(4) Equipment: **Conductivity Transmitter type Cond 7100 PA**

(5) Manufacturer: **Mettler Toledo GmbH**

(6) Address: **CH – 8902 Urdorf**

(7) This equipment and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.

(8) The Prüf- und Zertifizierungsstelle ZELM Ex, notified body No. 0820 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive.

The examination and test results are recorded in the confidential report ZELM Ex 0120019047.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 50 014: 1997 **EN 50 020: 1994**

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-type-examination Certificate relates only to the design and construction of the specified equipment in accordance with Directive 94/9/EC. Further requirements of this Directive apply to the manufacture and supply of this equipment.

(12) The marking of the equipment shall include the following:

Ex **II 2 (1) G EEx ia IIC T4**

Zertifizierungsstelle **ZELM Ex**

Dipl.-Ing. Harald Zelm

Zertifizierungsstelle ZELM Ex Prüf- und

Braunschweig, June 26, 2000

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EC-type-examination Certificates without signature and stamp are not valid. The certificates may only be circulated without alteration. Extracts or alterations are subject to approval by the Prüf- und Zertifizierungsstelle ZELM Ex.
In case of dispute, the German text shall prevail.

Prüf- und Zertifizierungsstelle ZELM Ex • Siekgraben 56 • D-38124 Braunschweig

Prüf- und Zertifizierungsstelle

ZELM Ex

(13) **SCHEDULE**

(14) **EC-TYPE-EXAMINATION CERTIFICATE ZELM 00 ATEX 0037**

(15) Description of equipment

The Conductivity Transmitter type Cond 7100 PA is preferably used for the recognition and processing of electrochemical quantities and is equipped with an input for inductive conductivity measurements and a temperature measuring input.

The maximum permissible ambient temperature is 55 °C.

Electrical data

BUS- / Supply loop (terminals 11 and 10)

type of protection Intrinsic Safety EEx ia IIC/IIB
resp. EEx ib IIC/IIB

only for the connection to a certified intrinsically safe circuit (for example FISCO – supply unit) with the following maximum values:

	FISCO-supply unit	linear barrier
U_{omax}	17,5 V	24 V
I_{omax}	280 mA	200 mA
P_{omax}	4,9 W	1,2 W

effective internal capacitance: $C_i \leq 1$ nF
effective internal inductance: $L_i \leq 10$ µH

conductivity measuring loop (terminals 1, 2, 3, 4 and 5)

type of protection Intrinsic Safety EEx ia IIC/IIB
resp. EEx ib IIC/IIB

maximum values: $U_o = 11{,}8$ V
$I_o = 145$ mA
$P_o = 165$ mW
(trapeziodal characteristic)

effective internal capacitance: $C_i \leq 5$ nF
The effective internal inductance is negligibly small.

	IIC resp.	IIB
max. permissible external inductance	1,3 mH	7 mH
max. permissible external capacitance	1,5 µF	9,9 µF

or

	IIC resp.	IIB
max. permissible external inductance	1 mH	5 mH
max. permissible external capacitance	350 nF	977 nF

SCHEDULE TO EC-TYPE-EXAMINATION CERTIFICATE ZELM 00 ATEX 0037

Temperature measuring loop (terminals 7 and 8)	type of protection Intrinsic Safety resp.	EEx ia IIC/IIB EEx ib IIC/IIB
	maximum values:	U_o = 5,9 V I_o = 3,71 mA P_o = 5,5 mW (linear characteristic)
	effective internal capacitance:	C_i ≤ 250 nF

The effective internal inductance is negligibly small.

	IIC	resp.	IIB
max. permissible external inductance	1000 mH		1000 mH
max. permissible external capacitance	42,7 µF		1000 µF

(only valid if external inductance and external capacitance do not exist in concentrated form at the same time)

	IIC	resp.	IIB
max. permissible external inductance	1 mH		5 mH
max. permissible external capacitance	1,85 µF		6,85 µF

(also valid if external inductance and external capacitance exist in concentrated form at the same time)

EP (terminal 9)	for the connection to the equipotential bonding system

References:

Connecting the equipotential bonding is absolutely required to guarantee electrostatical leakage.

The BUS- / Supply loop is safely electrically isolated from the other loops up to a voltage of 60 V.

The operation manual has to be considered.

(16) Report No.

ZELM Ex 0120019047

(17) Special conditions for safe use

not applicable

(18) Essential Health and Safety Requirements

met by standards

Zertifizierungsstelle **ZELM** Ex

Dipl.-Ing. Harald Zelm

Braunschweig, June 26, 2000

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Prüf- und Zertifizierungsstelle

ZELM Ex

1.Supplement

(Supplement according to EC-Directive 94/9 Annex III letter 6)

to EC-type-examination Certificate

ZELM 00 ATEX 0037

Equipment:	**Conductivity Transmitter Type Cond 7100e FF**
Manufacturer:	**Mettler-Toledo GmbH**
Address:	**Im Hackacker 15, CH – 8902 Urdorf**

Description of supplement

The Conductivity Transmitter Type Cond 7100 PA was extended by the Conductivity Transmitter Type Cond 7100e FF with Foundation Fieldbus communication interface.

The type of protection, the electrical and all further data of the device remain unchanged.

The Foundation Fieldbus version of the Transmitter may be manufactured in future in consideration of this supplement.

References:

The Operating Instructions has to be considered.

Report No.: ZELM Ex 1020417315

Special conditions for safe use

not applicable

Essential Health and Safety Requirements

met by adherence to the standards

EN 50 014: 1997+A1+A2 **EN 50 020: 1994**

Zertifizierungsstelle **ZELM** Ex

Braunschweig, October 28, 2004

Dipl.-Ing. Harald Zelm

Zertifizierungsstelle ZELM Ex

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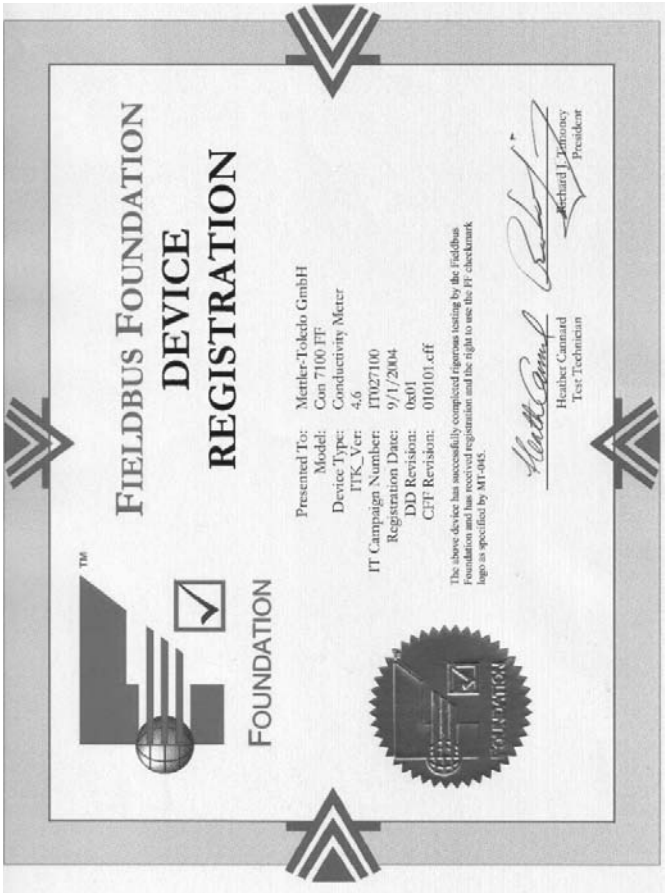
Fieldbus Foundation Device Registration



Foundation Fieldbus (FF) technology

General

Foundation Fieldbus (FF) is a digital communication system that connects different field devices over a common cable and integrates them into a control system.
Its application range covers manufacturing, process, and building automation.
As fieldbus standard according to EN 61158-2 (IEC 1158-2) the Foundation Fieldbus ensures the communication of different devices over one bus line.

Basic properties

The "Data Link Layer" of the Fieldbus Foundation protocol defines 3 device types:

The **Active Link Master** plans all activities as "Link Active Scheduler" (LAS). It controls the complete data traffic on the bus. Several Link Masters on one bus increase safety, but only one is active at a time.

Basic devices are peripheral devices such as valves, drives, transmitters, or analyzers. They can react acyclically to servicing, configuration and diagnostic tasks of the master. The Link Master cyclically reads the measurement data with status.

Bridges can connect a network from different bus systems.

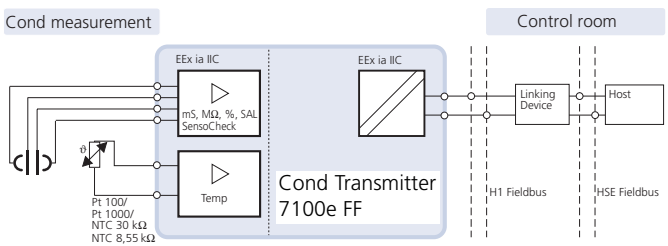
Bus communication

Foundation Fieldbus (FF) permits cyclic and acyclic services:

Cyclic Services – Scheduled Communication
are used to transmit measurement data with status information.
The Link Active Scheduler maintains a list of transmission times for all data in all devices that need to be cyclically transmitted. When it is time to transmit data, the LAS issues a "Compel Data (CD)" start signal to the respective device. Upon receipt of the "Compel Data" signal, the device broadcasts the data to all devices on the fieldbus.

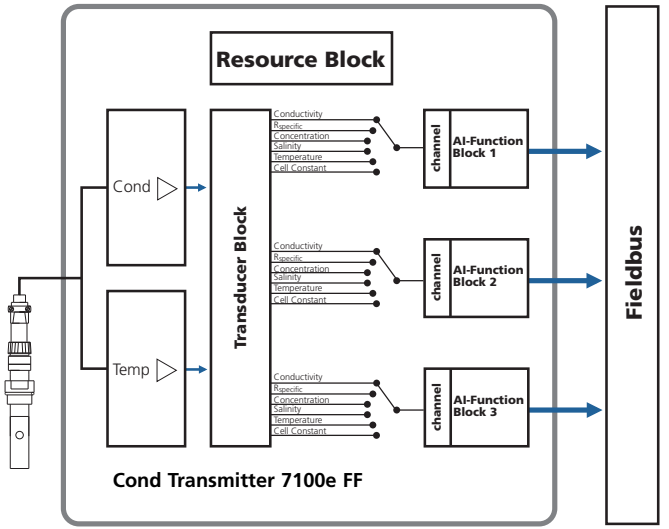
Acyclic Services – Unscheduled Communication:
are used for device configuration, remote maintenance, and diagnostics during operation.
All devices are given the chance to send acyclic (unscheduled) messages between transmissions of cyclic (scheduled) data. The LAS grants permission to a device to broadcast acyclic messages by issuing a "Pass Token (PT)" message. Upon receipt of the "Pass Token", the device starts data transmission.

Technical features of Cond Transmitter 7100e FF
Communication between the field devices and control room is effected by Foundation Fieldbus (FF). Data exchange is cyclic and acyclic.



Communication model

The device performance is described by function blocks according to the "Fieldbus Specification" for process control devices.



Function blocks

All variables and parameters of the transmitter are assigned to blocks. The Cond Transmitter 7100e FF is equipped with the following blocks:

Standard Resource Block (RB)
describes the transmitter characteristics (manufacturer, device name, operating status, global status).

Standard Analog Input Block (AI)
Three Analog Input Function Blocks provide for cyclic transmission of measured values (currently measured value with status, alarm limits, freely selectable process variable).

Transducer Block (TB) with calibration possibility
provides for acyclic data transmission.
Calibration, configuration, and maintenance commands coming from the control station are processed in the Transducer Block.
The sensor signal is first preprocessed in the Transducer Block. From here, the measured value is sent to the Analog Input Blocks where it can be further processed (limit values, scaling).

Commissioning and configuration via Foundation Fieldbus

Commissioning on the Foundation Fieldbus

Different configuration tools from different manufacturers are available. They can be used to configure the device and the Foundation Bus.

Note:
Be sure to observe the operating instructions and the menu guidance of the control system or the configuration tool during installation and configuration via the control system.

Installing the DD (Device Description):

During initial installation the device description (*.sym, *.ffo) must be installed in the control system.
For network projecting, you require the CFF file (Common File Format).

These files can be obtained from:

- the included CD
- www.mtpro.com/transmitters
- Foundation Fieldbus: www.fieldbus.org.

Identifying the transmitter

There are several possibilities to identify a FF transmitter in the network. The most important one is the "Device Identifier" or DEV_ID. It consists of the manufacturer ID, device type, and serial number XXXXXXX.

The DEVICE_ID is: 4652551BBC V2_01__XXXXXXX00
Manufacturer ID
Mettler-Toledo: MANUFAC_ID = 0x465255
Device type
Cond Transmitter 7100e FF: DEV_TYPE = 7100

Initial commissioning

1. Supply the device with power (see "Installation and wiring", Pg 32).
2. Open the configuration program of the control system.
3. Load DD and CFF file.
   After the first connection establishment, the device answers as follows:

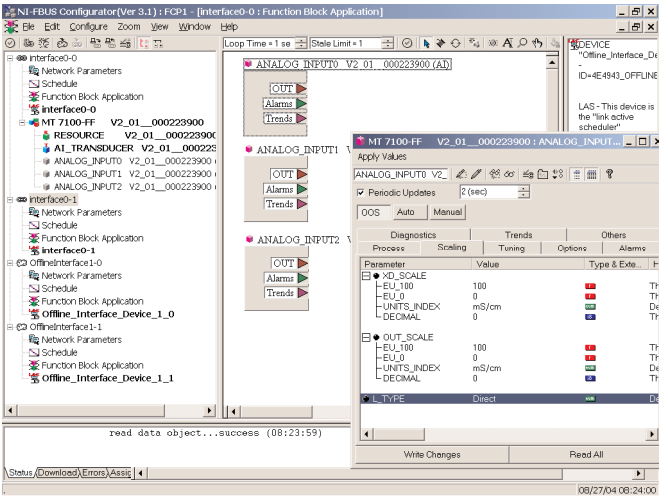
MT 7100-FF V2_01__XXXXXXX00- ID= 4652551BBC V2_01__XXXXXXX00

4. Assign the desired name to the field device. (PD_TAG)

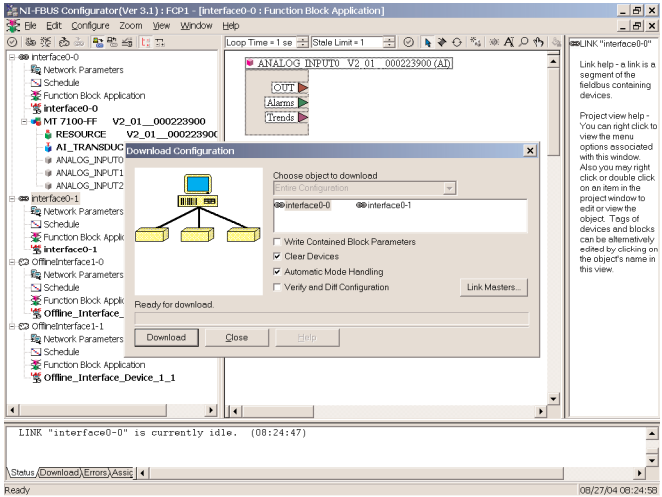
Setting the Resource Block (RB) parameters

5. Make sure that the WRITE_LOCK parameter is set to "NOT LOCKED".
6. Set the MODE_BLK. TARGET to Auto.

Setting the Analog Input Block (AI) parameters



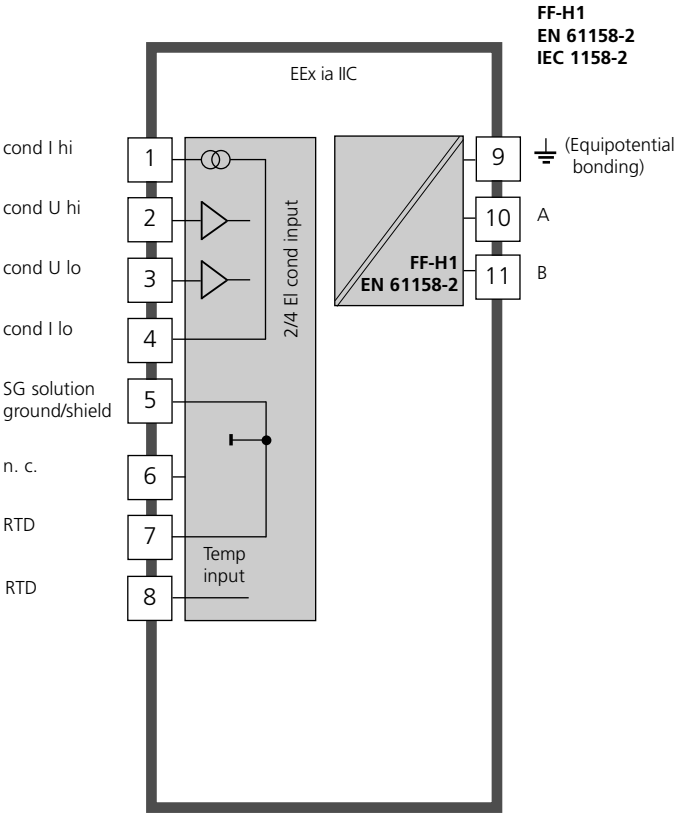
7. Set MODE_BLK. TARGET to OOS (Out Of Service).
8. Select the desired process variable from the CHANNEL parameter. See table on Page 90.
9. Select the unit belonging to the process variable from the XD_SCALE parameter.
10. Select the unit belonging to the process variable from the OUT_SCALE parameter.
11. Set the LIN_TYPE linearization type to Direct
12. If these steps are not properly executed, the "Block Configuration Error" is generated when the block is set to "Auto".



This step is mandatory since otherwise the target mode of the Analog Input Block cannot be set to "Auto".
Using the NI-FBUS Configurator from National Instruments, for example, you can graphically connect the function blocks and then load the system configuration in the device.

13. Download all data and parameters to the field device.
14. Set the target modes of all Analog Input Blocks to "Auto".

Overview of the transmitter

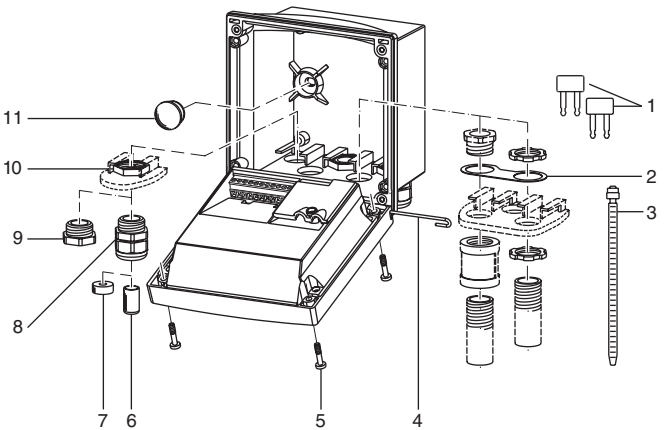


Assembly

Packing list

Check the shipment for transport damage and completeness.
The package should contain:

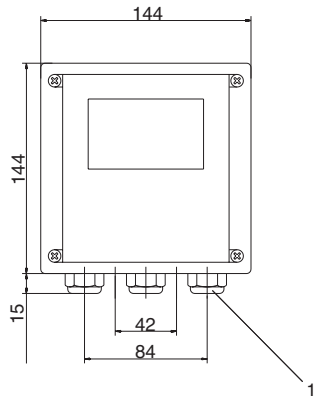
- Front unit
- Lower case
- Bag containing small parts
- Instruction manual
- Specific test report
- CD with Device Description
  * .sym, * .ffo
  Common File Format
  CFF-File

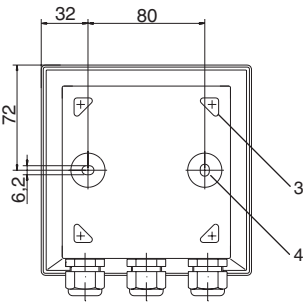


1 Jumper (2 piece)
2 Washer (1 piece), for conduit mounting: place washer between enclosure and nut
3 Cable ties (3 pieces)
4 Hinge pin (1 piece), insertable from either side
5 Enclosure screws (4 pieces)
6 Sealing inserts (1 piece)
7 Rubber reducer (1 piece)
8 Cable glands (3 pieces)
9 Filler plugs (3 pieces)
10 Hexagon nuts (5 pieces)
11 Sealing plugs (2 pieces), for sealing in case of wall mounting

Fig.: Assembling the enclosure

Mounting plan

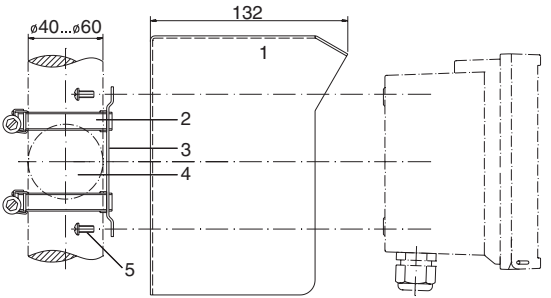




1 Cable gland (3 pieces)
2 Breakthroughs for cable gland or conduit 1/2”, ø 21.5 mm (2 breakthroughs) Conduits not included!
3 Breakthroughs for pipe mounting (4 breakthroughs)
4 Breakthroughs for wall mounting (2 breakthroughs)

Fig.: Mounting plan

Pipe mounting, panel mounting



1 Protective hood (if required)
2 Hose clamps with worm gear drive to DIN 3017 (2 pieces)
3 Pipe-mount plate (1 piece)
4 For vertical or horizontal posts or pipes
5 Self-tapping screws (4 pieces)

Fig.: Pipe-mount kit

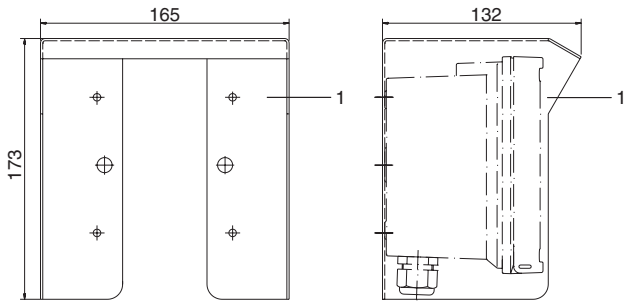


Fig.: Protective hood for wall and pipe mounting

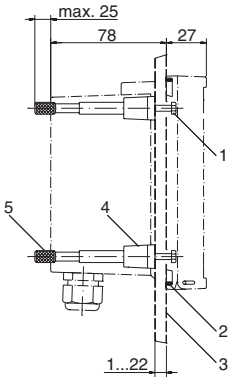


Fig.: Panel-mount kit

1 Screws (4 pieces)
2 Gasket (1 piece)
3 Panel
4 Span pieces (4 pieces)
5 Threaded sleeves (4 pieces)

Panel cutout 138 x 138 mm
(DIN 43700)

Installation and connection

- The **Cond Transmitter 7100e FF** may only be connected to explosion-proof power supply and coupling elements (for input ratings refer to annex of Type Examination Certificate). Before commissioning it must be proved that the device may be connected to other equipment, such as supply elements and cables.
- Installation may only be carried out by trained experts in accordance with this instruction manual and as per applicable local and national codes. Be sure to observe the technical specifications and input ratings during installation.
- Be sure to observe the IEC 60079-27 "Fieldbus Intrinsically Safe Concept (FISCO)" and the "Fieldbus Non-Incendive Concept (FNICO)"
- Be sure not to notch the conductor when stripping the insulation.
- When commissioning, a complete configuration must be carried out by the system administrator.

For easy installation, the terminal strips are of a plug-in design.
Terminals: suitable for single wires / flexible leads up to 2.5 mm² (AWG 14)
A special twisted and shielded two-wire cable (e.g. Siemens) is used as bus cable.

FM **Division 2 wiring:** Refer to page 119.
Control Drawing: Refer to page 120.

Terminal assignments

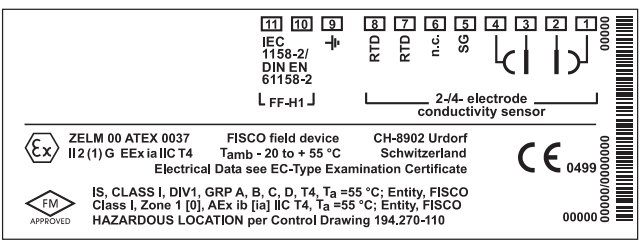
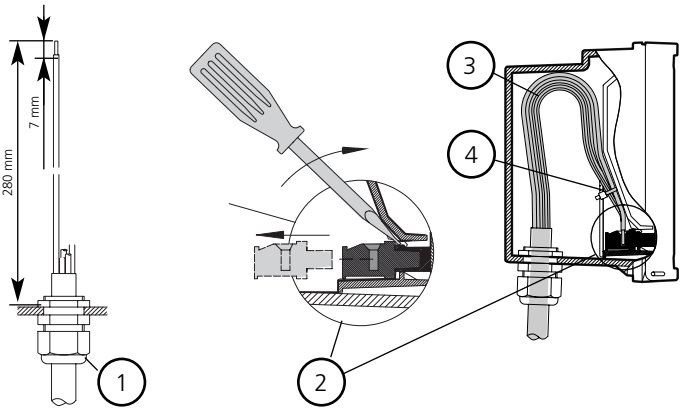
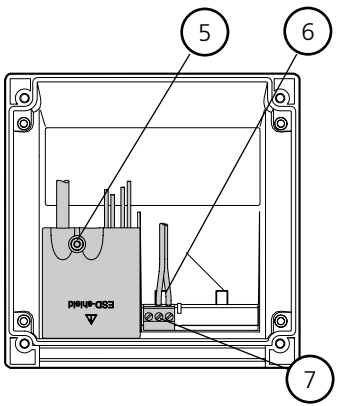


Fig.: Terminal assignments Cond Transmitter 7100e FF





1 Recommended stripping lengths for multi-core cables

2 Pulling out the terminals using a screwdriver (also see **6**)

3 Cable laying in the device

4 Connecting lines for Fieldbus

5 Cover for sensor and temperature probe terminals

6 Area for placing the screwdriver to pull out the terminals

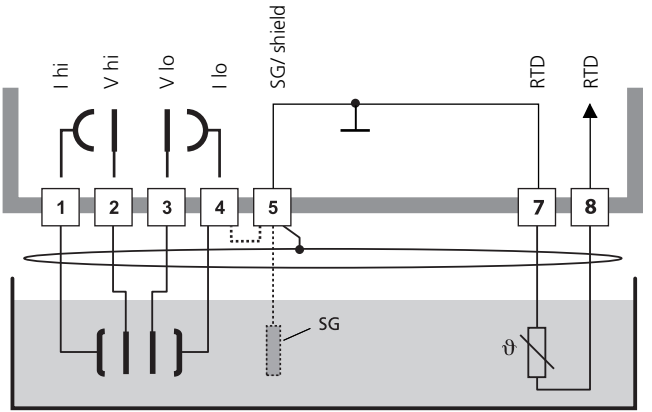
7 Connecting terminals for Fieldbus

Fig.: Information on installation, rear side of device

Wiring examples

Cond measurement with 4-electrode sensor

Cond 7100e FF



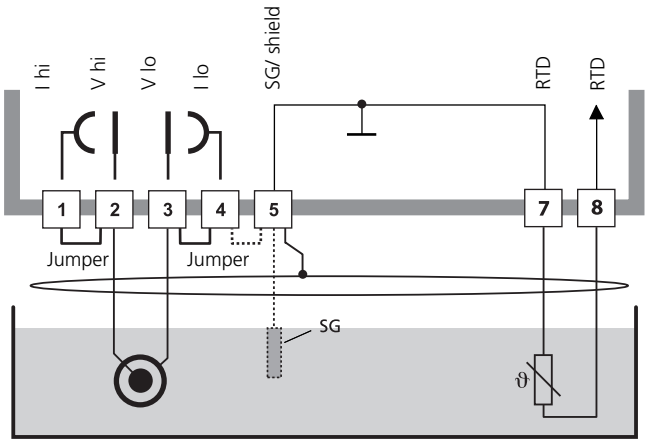
Caution!
Place jumper across terminals 4 and 5!

A solution ground connection is recommended when using free field sensors.

When using a sensor with solution ground connection (SG) or a separate SG connection, the jumper is not required!

Cond measurement with 2-electrode sensor

Cond 7100e FF



Caution!

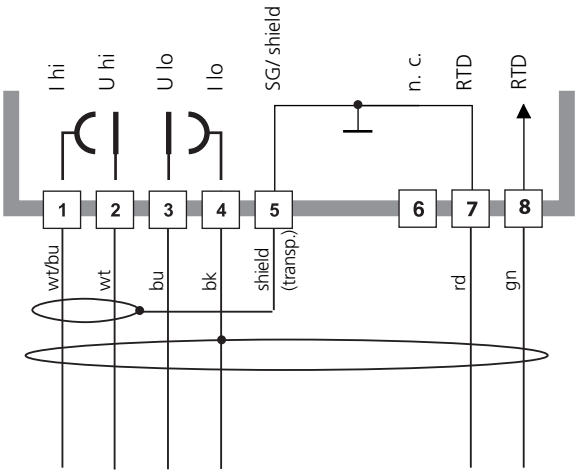
Place jumpers: across terminals 1 and 2
across terminals 3 and 4
across terminals 4 and 5

A solution ground connection is recommended when using free field sensors.

When using a sensor with solution ground connection (SG) or a separate SG connection, the jumper across terminals 4 and 5 is not required!

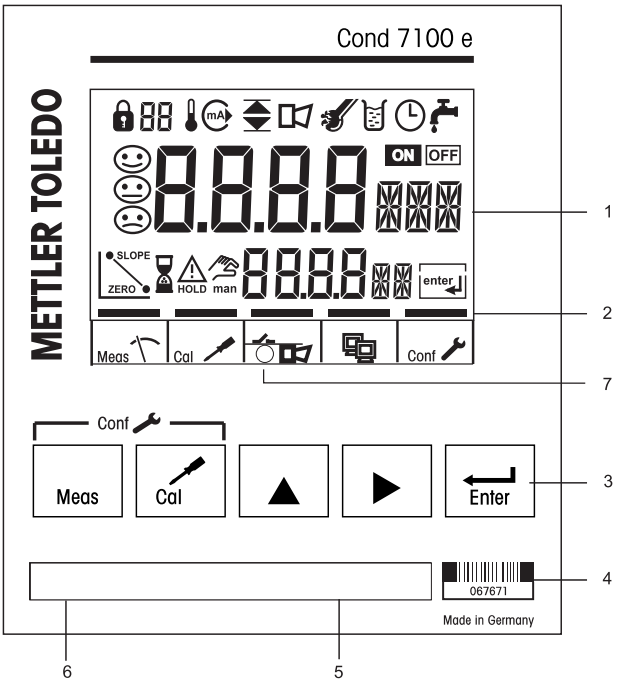
Wiring example

Sensor connection with Mettler-Toledo 2 and 4-electrode sensors via VP cable



User interface and display

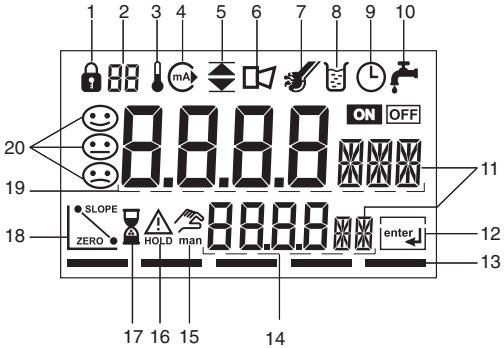
User interface



1 Display
2 Mode indicators (no keys), from left to right:
- Measuring mode
- Calibration mode
- Alarm
- Foundation Fieldbus communication
- Configuration mode

3 Keypad
4 Coding
5 Rating plate
6 Model designation
7 Alarm LED

Display

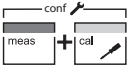


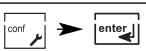
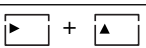
1 Mode code entry
2 Display of measured variable*
3 Temperature
4 Current output
5 Limit values
6 Alarm
7 Sensocheck
8 Calibration
9 Interval/response time
10 Wash contact*
11 Measurement symbols
12 Proceed with **enter**
13 Bar for identifying the device status, above mode indicators from left to right:
- Measuring mode
- Calibration mode
- Alarm
- Foundation Fieldbus communication
- Configuration mode

14 Lower display
15 Manual temp specification
16 Hold mode active
17 Waiting time running
18 Electrode data
19 Main display
20 Sensoface

* Not in use

Operation: Keypad

	Start, end calibration
	Start configuration
	Abort configuration, calibration, then Hold mode is activated.
	Select digit position (selected position flashes)
	Edit digit
	• Calibration: Continue in program sequence • Configuration: Confirm entries, next configuration step • End the Hold mode

	Cal Info, display of cell constant
	Error Info: Display of last error message
	Start GainCheck device self-test

Hold mode

Display: 

The Hold mode is a safety state during configuration and calibration. In Hold mode the last valid value (last usable value) is transmitted.
Measured value status = uncertain : Last_usable_value
If the calibration or configuration mode is exited, the device remains in the Hold mode for safety reasons. This prevents undesirable reactions of the connected peripherals due to incorrect configuration or calibration. The measured value and "HOLD" are displayed alternately. The device only returns to measuring mode after **enter** is pressed and 20 seconds have passed.

Configuration mode is also exited automatically 20 minutes after the last keystroke (timeout). The device returns to measuring mode.

Timeout is not active during calibration.

Alarm

During an error message the alarm LED flashes (or lights).
The alarm response time is permanently set to 10 sec.
The alarm LED on the front panel can be configured as follows:
HOLD off: Alarm: LED flashing
HOLD on: Alarm: LED on. HOLD: LED flashing.
(see Configuration Pg 57).

For alarm handling via Foundation Fieldbus, see Pg 92.

Safety functions

Sensocheck, Sensoface sensor monitoring

Sensocheck continuously monitors the sensor and lines. Sensocheck can be switched off (Configuration, Pg 57).

Sensoface provides information on the conductivity sensor condition. Significant sensor polarization effects or an excessive cable capacitance are indicated.

GainCheck device self test

A display test is carried out, the software version is displayed and the memory and measured value transfer are checked.

Start GainCheck device self-test: [▶] + [▲]

Automatic device self-test

The automatic device self-test checks the memory and measured-value transfer. It runs automatically in the background at fixed intervals.

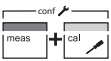
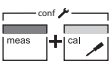
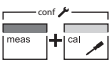
Mode codes

The mode codes allow fast access to the functions

Calibration

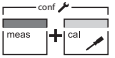
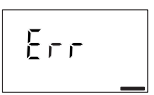
Key + Code	Description	Page
 0000	**Cal Info**	73
 1100	**Calibration:** Entry of cell constant	62
 0110	**Calibration:** Calibration solution	64
 1105	**Product calibration**	66
 1015	**Temp probe adjustment**	68

Configuration

Key + Code	Description	Page
 0000	**Error Info** Display last error and erase	73
 1200	**Configuration**	44
 2222	**Sensor monitor** Display sensor current/temperature	73

Configuration

In the configuration mode on the device you primarily set parameters for the display.

Activate		Activate with **meas + cal**
		Enter mode code "1200" Edit parameter with ▸ and ▴, confirm/continue with **enter**. (End with **meas**, then **enter**.)
Hold During configuration the device remains in the Hold mode.	  HOLD icon	The last valid value (last usable value) is transmitted. Measured value status = uncertain : Last_usable_value. Sensoface is off, "Configuration" mode indicator is on. Red LED flashes when "HOLD ON" has been set.
Input errors		The configuration parameters are checked during the input. In the case of an incorrect input "Err" is displayed for approx. 3 sec. The incorrect parameters cannot be stored. Input must be repeated.
End	 	End with **meas**. The measured value and Hold are displayed alternately "**enter**" flashes. (HOLD symbol is on, "hourglass" flashes, Sensoface is active). Press **enter** to end the Hold mode. The measured value is displayed. Hold remains on for 20 sec (measured value status = uncertain: Last_usable_value.

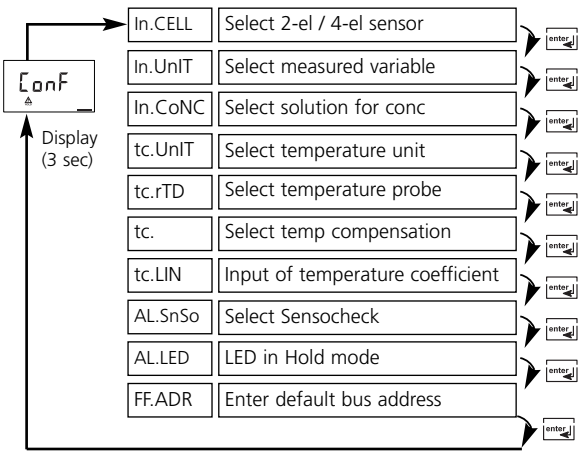
Menu structure of configuration

The configuration steps are optically organized in menu groups:

- Select variable/sensor type, solution for concentration measurement (code: IN.)
- Temperature compensation (code: tc.)
- Alarm settings (code: AL.)
- Input of bus address (code: FF.)

Code: AL.LED

Pressing the **enter** key accesses the next configuration step. The values are edited using the arrow keys. Pressing **enter** confirms/stores the settings and opens the next configuration step.
After the last configuration step the menu starts once more with the welcome text and the first step is opened again.
Return to measurement: Press **meas**.



Overview of configuration steps

Code	Menu	Selection / Default (Factory setting bold print)	BUS access
In	**Select sensor, variable, unit, process solution**		
In.CELL	Sensor selection	**2-electrode**, 4-electrode	X
In.UnIT	Select variable/unit	**µS/cm**, mS/cm, S/m, MΩ·cm, SAL, %, USP	X
In.CoNC	Select solution (%) see Pg 52, codes:	**NaCl** HCl NaOH H_2SO_4 HNO_3 **-01-** -02- -03- -04- -05-	X
tc	**Temperature compensation**		
tc.UnIT	Select temperature unit	**°C** / °F	X
tc.rTD	Select temperature probe	Pt100/**Pt1000**/NTC30/NTC8.55	X
tc.	Select temperature compensation (not for SAL)	**OFF**/ LIN / nLF (natural waters) / nACl (NaCl traces) / HCl (HCl traces) / nH3 (NH_3 traces)	X
tc.lin	Only with LIN: Enter temperature coefficient	00.00 ... 19.99 %/K (**02.00 %/K**)	X
AL	**Alarm settings**		
AL.SnSO	Select Sensocheck	ON / **OFF**	X
AL.LED	LED in HOLD mode	ON / **OFF**	X
FF	**Bus address**		
FF.ADR	Adjust bus address	(0017 ... 0031) **(0026)**	X

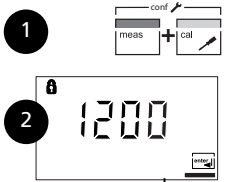
Individual settings

METTLER TOLEDO

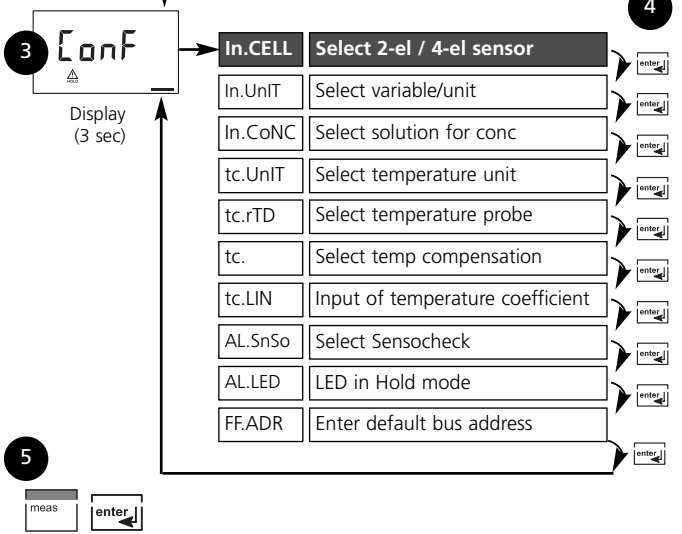
(Original for copy)

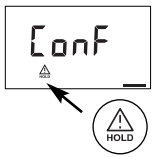
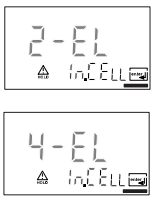
Code	Parameter	Factory settings	Individual settings
In.CELL	Sensor type	2-EL	
In.UnIT	Variable/Unit	µS/cm	
In.CoNC	Concentration	NaCl	
tc.UnIT	Unit °C / °F	°C	
tc.rTD	Temp probe	Pt 1000	
tc.	Temperature compensation	OFF	
tc.LIN	TC process medium	02.00 %/K	
AL.SnSO	Sensocheck	OFF	
AL.LED	LED in Hold mode	OFF	
FF.ADR	Bus address	0026	

Configuration
Select sensor type.



1. Simultaneously press **meas + cal**.
2. Enter mode code "1200", then **enter**.
   The device goes to Hold mode.
3. "ConF" is displayed for 3 sec.
   Then menu step:
   Select sensor: 2-EL/ 4-EL
   Edit with arrow keys (see Pg 49).
   Confirm (and proceed) with **enter**.
4. Pressing **enter** opens the next menu step.
5. End: Press **meas**, then **enter**

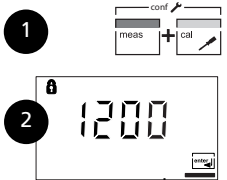


Code	Display	Action	Choices
In.		Select configuration (Press **conf**.)	
		Enter mode code "1200" (Select position with ▸ arrow key and edit number with ▲ key. When the display reads "1200", press **enter** to confirm.)	
		After correct input the welcome text is displayed for approx. 3 sec. The device is in HOLD mode (HOLD icon is active, red LED flashes when "HOLD ON" has been set.).	
		Select sensor 2-electrode sensor / 4-electrode sensor Select with ▸ arrow key Proceed with **enter**	**2-EL** (2-El/ 4-El)

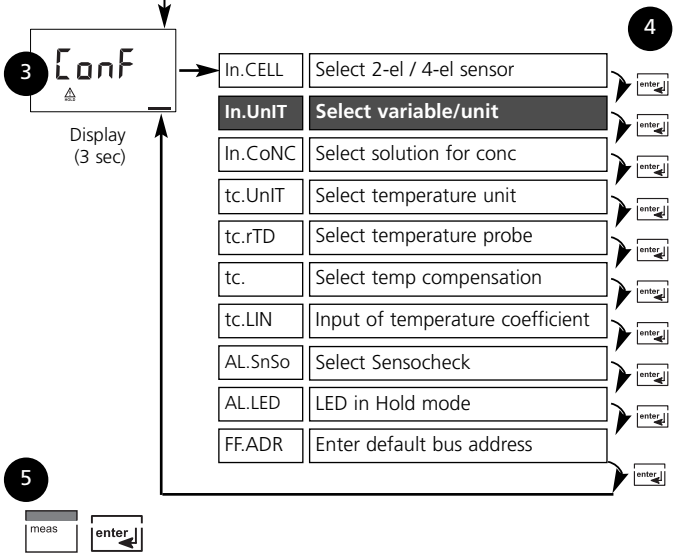
Note: Characters represented in gray are flashing and can be edited.

Configuration

Select variable/unit



1. Simultaneously press **meas + cal**.
2. Enter mode code "1200", then **enter**.
   The device goes to Hold mode.
3. "ConF" is displayed for 3 sec.
   Press **enter** to access **Select variable/unit** menu.
   Edit with arrow keys (see Pg 51).
   Confirm (and proceed) with **enter**.
4. Pressing **enter** opens the next menu step.
5. End: Press **meas**, then **enter**

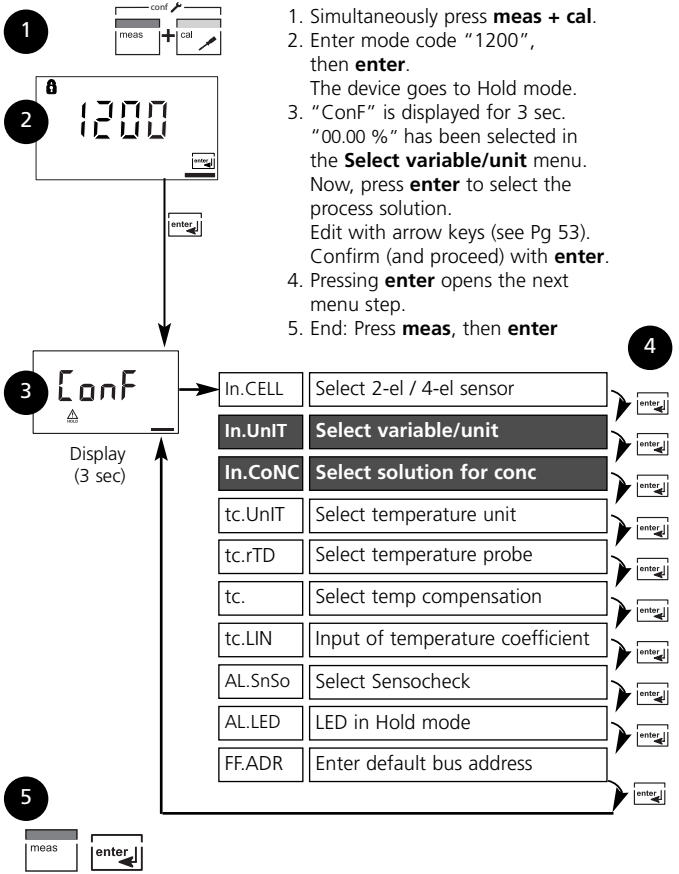


Code	Display	Action	Choices
In.	      	Select variable/unit: Select with ▸ arrow key Proceed with **enter** Conductivity: • 0.000 ... 9.999 µS/cm • 00.00 ... 99.99 µS/cm • 000.0 ... 999.9 µS/cm • 0000 ... 9999 µS/cm • 0.000 ... 9.999 mS/cm • 00.00 ... 99.99 mS/cm • 000.0 ... 999.9 mS/cm • 0.000 ... 9.999 S/m • 00.00 ... 99.99 S/m Resistivity: • 00.00 ... 99.99 MΩ·cm Salinity (SAL): • 0.0 ... 45.0 ‰ (0 ... 35 °C) Concentration (Conc): • 00.00 ... 9.99 % by wt USP: • 00.00 ... 99.99 µS/cm	**000.0 µS** (0.000 µS 00.00 µS 000.0 µS 0000 µS 0.000 mS 00.00 mS 000.0 mS 0.000 S/m 00.00 S/m 00.00 MΩ 0.00 SAL 00.00 % USP)

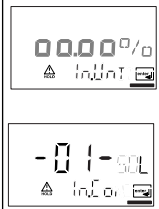
Note: Characters represented in gray are flashing and can be edited.

Configuration

Concentration measurement: Select process solutions



1. Simultaneously press **meas + cal**.
2. Enter mode code "1200", then **enter**.
   The device goes to Hold mode.
3. "ConF" is displayed for 3 sec.
   "00.00 %" has been selected in the **Select variable/unit** menu.
   Now, press **enter** to select the process solution.
   Edit with arrow keys (see Pg 53).
   Confirm (and proceed) with **enter**.
4. Pressing **enter** opens the next menu step.
5. End: Press **meas**, then **enter**

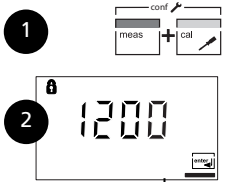
Code	Display	Action	Choices
In.		Only with 00.00 % can you select the process solution: Select with ▸ arrow key **-01-** NaCl (0.00 ... 9.99 % by wt) (-20 ... 50 °C) **-02-** HCl (0.00 ... 9.99 % by wt) (0 ... 50 °C) **-03-** NaOH (0.00 ... 9.99 % by wt) (0 ... 100 °C) **-04-** H_2SO_4 (0.00 ... 9.99 % by wt) (-17 ... 110 °C) **-05-** HNO_3 (0.00 ... 9.99 % by wt) (-17 ... 110 °C) Proceed with **enter**	**-01-SOL** (-01-SOL -02-SOL -03-SOL -04-SOL -05-SOL)

Concentration measurement

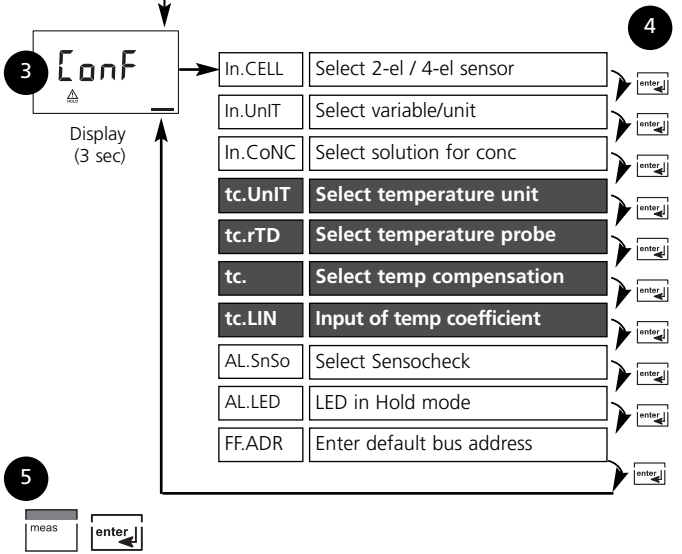
For the solutions listed above, the transmitter can determine the substance concentration from the measured conductivity and temperature values in % by wt. The measurement error is made up of the sum of measurements errors during conductivity and temperature measurement and the accuracy of the concentration curves stored in the transmitter (see Pg 114 et seq.). We recommend to calibrate the transmitter together with the sensor, preferably in the same conductivity range as measured later. 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.

Configuration

Temperature compensation



1. Simultaneously press **meas + cal**.
2. Enter mode code "1200", then **enter**.
   The device goes to Hold mode.
3. "ConF" is displayed for 3 sec.
   Press **enter** to access **Select temperature unit** menu.
   Edit with arrow keys (see Pg 55).
   Confirm (and proceed) with **enter**.
4. Pressing **enter** opens the next menu step.
5. End: Press **meas**, then **enter**

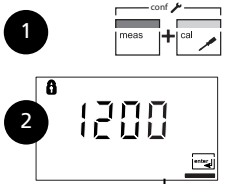


Code	Display	Action	Choices
tc.		Specify temperature unit Select with ▸ arrow key. Proceed with **enter**	**°C** (°F)
		Select temperature probe Select with ▸ arrow key. Proceed with **enter**	**Pt1000** (PT100, NTC30, NTC8.55)
		Temperature compensation selection (not with USP, Conc, Sal) **OFF:** Temperature compensation switched off Select with ▸, proceed with **enter** **LIN:** Linear temperature compensation with entry of temperature coefficient and reference temperature. **nLF:** (nonlinear) Temperature compensation for natural waters to EN 27888 **NaCl (nACL):** Temperature compensation for ultrapure water with NaCl traces **HCl (HCL):** Temperature compensation for ultrapure water with HCl traces **NH3 (nH3):** Temperature compensation for ultrapure water with NH_3 traces	**OFF** (OFF LIN nLF nACL HCL nH3)
		Only with linear temperature compensation (**LIN**) selected: Enter temperature coefficient*. Select position with ▸ key and edit number with ▲ key. Proceed with **enter**	**02.00%/K** (00.00 ... 19.99 %/K)

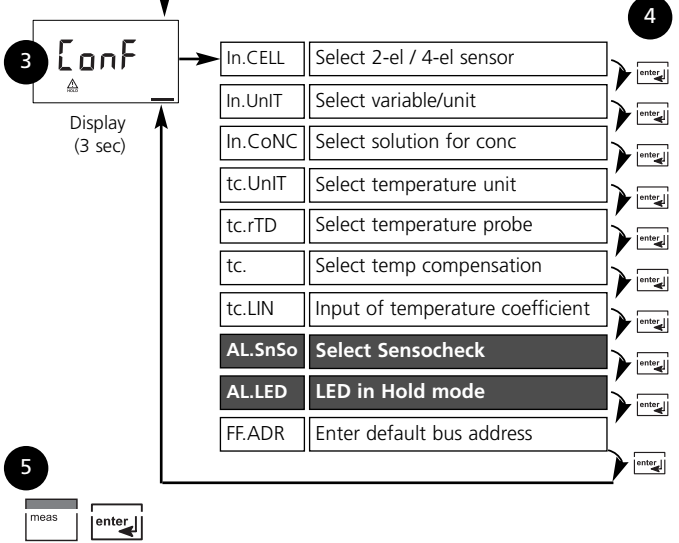
*) Reference temp 25 °C

Configuration

Alarm settings



1. Simultaneously press **meas + cal**.
2. Enter mode code "1200", then **enter**.
   The device goes to Hold mode.
3. "ConF" is displayed for 3 sec.
   Press **enter** to access **Select Sensocheck** menu.
   Edit with arrow keys (see Pg 57).
   Confirm (and proceed) with **enter**.
4. Pressing **enter** opens the next menu step.
5. End: Press **meas**, then **enter**

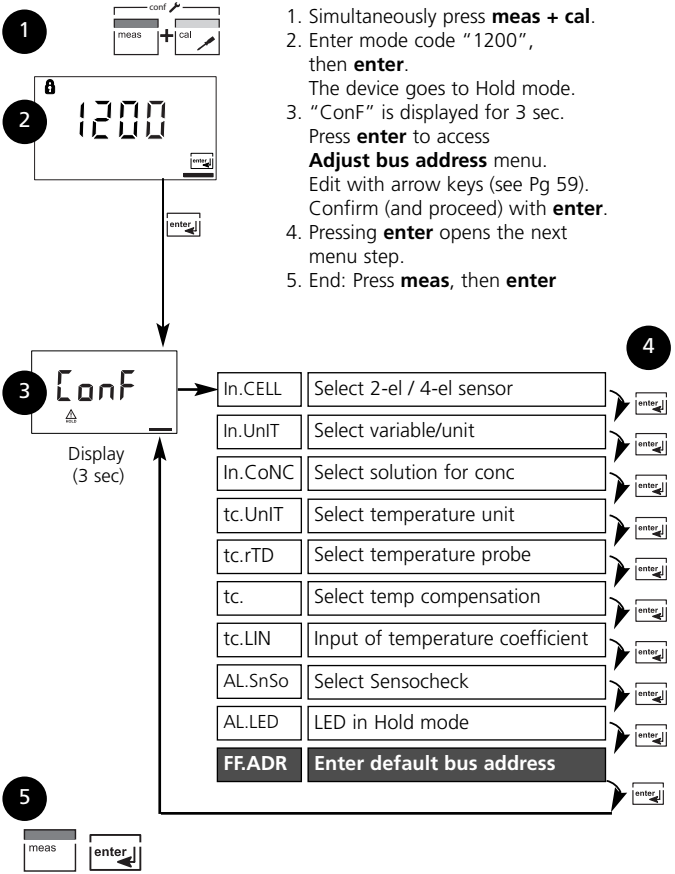


<table>
<tr><th>Code</th><th>Display</th><th>Action</th><th>Choices</th></tr>
<tr><td rowspan="2">AL.</td><td>  </td><td>Select Sensocheck
(Continuous monitoring of sensor properties)
Select with ▸ key.
Proceed with enter</td><td>OFF
(ON / OFF)</td></tr>
<tr><td>  </td><td>LED in HOLD mode
Select with ▸, proceed with enter

LED in HOLD mode:<table><tr><th>Configuration</th><th>Alarm</th><th>HOLD</th></tr><tr><td>ON</td><td>on</td><td>flashes</td></tr><tr><td>OFF</td><td>flashes</td><td>off</td></tr></table></td><td>OFF
(ON / OFF)</td></tr>
</table>

Configuration

Adjust default bus address on the device



1. Simultaneously press **meas + cal**.
2. Enter mode code "1200", then **enter**.
   The device goes to Hold mode.
3. "ConF" is displayed for 3 sec.
   Press **enter** to access **Adjust bus address** menu.
   Edit with arrow keys (see Pg 59).
   Confirm (and proceed) with **enter**.
4. Pressing **enter** opens the next menu step.
5. End: Press **meas**, then **enter**

Code	Display	Action	Choices
FF.		Only when there is no bus connection: The bus address can be manually adjusted from 0017 ... 0036. Select with ▸ key, edit number with ▲ key, proceed with **enter.** When the bus address has been changed, the device automatically restarts to re-initialize the bus parameters.	**0026** (0017 ...0036)

Adjusting a new default bus address on the device

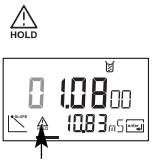
The Fieldbus Foundation automatically assigns an address. Therefore it is not required to manually adjust the bus address.
If the bus address has been changed, the bus configuration is reset to the default values during device restart. All bus parameters are set to their default values.

Note:

When the bus address has been changed, the bus configuration is automatically reset. All bus parameters are set to their default values. All individual settings have to be entered once more. The configuration must be reloaded into the device.

Calibration

Calibration adjusts the device to the sensor.

Activate		Activate with **cal**
		Enter mode code: • 1100 Entry of cell constant • 0110 With calibration solution • 1105 Product calibration • 1015 Temp probe adjustment Select with ▸ key, edit number with ▲ key, proceed with **enter** key (End with **cal**, then **enter**.)
Hold During calibration the device remains in the Hold mode.	 HOLD icon	The last valid value (last usable value) is transmitted. Measured value status = uncertain: Last_usable_value. Sensoface is off, "Calibration" mode indicator is on. Red LED flashes when "HOLD ON" has been set.
Input errors		The calibration parameters are checked during the input. In the case of an incorrect input "Err" is displayed for approx. 3 sec. The incorrect parameters cannot be stored. Input must be repeated.
End	 	End with **cal**. **Safety prompt:** The measured value and Hold are displayed alternately, "**enter**" flashes. Sensoface is active. Press **enter** to end the Hold mode. The measured value is displayed. Measured value status = uncertain: Last_usable_value. (HOLD icon is on, "hourglass" flashes).

Information on calibration

Calibration adapts the transmitter to the conductivity sensor. Calibration can be performed by:

- Input of cell constant (e.g. for ultrapure-water sensors)
- Determining the cell constant with a known calibration solution
- Sampling (product calibration)
- Temperature probe adjustment

Tips for application:

- All calibration procedures must be performed by trained personnel.
- During the calibration procedure the temperature must be kept constant.
- Incorrectly set parameters may go unnoticed, but change the measuring properties.

Particularly with fringe-field sensors, the cell constant can strongly vary when the sensor is mounted in restricted space. In that case, the cell constant should be determined with the sensor mounted using a calibration solution or by a reference measurement at the product.

Calibration by entry of cell constant

Input of cell constant with simultaneous display of the (not temperature-compensated) conductivity and temperature.

Display	Action	Remark
	Press **cal** key, enter mode code 1100. Select with ▸ key, edit number with ▲ key, proceed with **enter**	Device is in the Hold mode. If an invalid code is entered, the device returns to measuring mode.
	Ready for calibration	Display (3 s)
	Enter cell constant of connected sensor: Select with ▸ key, edit number with ▲ key.	The lower display shows the conductivity value. (When there has not been an entry for 6 sec, the lower display alternately shows the conductivity and temperature value.)
		
	A change in the cell constant also changes the conductivity value. Press **enter** to confirm cell constant.	
		

Display	Action	Remark
	The transmitter now displays the conductivity and temperature.	
	The measured value is shown in the main display alternately with "Hold"; "enter" flashes. End calibration with **enter**.	Safety prompt: After end of calibration, the outputs remain in Hold mode for approx. 20 sec.

Calibration with calibration solution

Input of temperature-corrected value of calibration solution with simultaneous display of cell constant

Display	Action	Remark
	Press **cal** key, enter mode code 1100. Select with ▸ key, edit number with ▲ key, proceed with **enter**	Device is in the Hold mode. If an invalid code is entered, the device returns to measuring mode.
	Ready for calibration Dismount and clean sensor	Display (3 sec)
	Immerse sensor in calibration solution. Determine the temperature-corrected conductivity value of the calibration solution from the corresponding table (see Pg 112).	When there has not been an entry for 6 sec, the lower display alternately shows the cell constant and temperature value.
 	Enter value of calibration solution. Select with ▸ key, edit number with ▲ key. Press **enter** to confirm the calibration data.	The cell constant and temperature are alternately displayed in lower display during the input.

Display	Action	Remark
	The determined cell constant is displayed. Confirm with **enter**.	
	Clean sensor and re-place it in the process. The transmitter now displays the conductivity and temperature. The measured value is shown in the main display alternately with "Hold"; "enter" flashes. End calibration with **enter**.	Safety prompt After end of calibration, the outputs remain in Hold mode for approx. 20 sec.

Notes:
(also see Pg 61)

- Be sure to use known calibration solutions with the respective temperature-corrected conductivity values (see Calibration solutions Pg 112).
- During the calibration procedure the temperature must be kept constant.
- For a good mass transfer, the solution should be stirred.

Product calibration

Calibration by sampling

1. The process variable (unit) for product calibration, i.e. conductivity (µS/cm, mS/cm, S/m) or resistivity (MΩ·cm) must have been selected during display configuration (see Pg 51).

2. For product calibration via Foundation Fieldbus, see Pg 80.

During product calibration the sensor remains in the process. The measurement is only interrupted briefly.
Calibration is without TC correction.

Procedure: During sampling the currently measured value is stored in the device. The device immediately returns to measuring mode. The calibration mode indicator flashes and reminds you that calibration has not been terminated.
The sample is measured in the lab or directly on the site using a portable meter. To ensure an exact calibration, the sample temperature should correspond to the measured process temperature.
The measured sample value is then entered in the device.
The new cell constant is calculated from these two values.
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
	Product calibration step 1: Press **cal** key, enter mode code 1105. (Press ▸ key to select position, enter number using ▲ key, confirm with **enter**)	If an invalid code is entered, the device returns to measuring mode.

Display	Action	Remark
		Display (approx. 3 sec)
	Take sample and store value. Proceed with **enter**	The sample is measured in the lab or directly on the site.
	Measuring mode: From the flashing CAL mode indicator you see that product calibration has not been terminated.	While the sample value is determined, the device is in measuring mode.
	Product calibration step 2: When the sample value has been determined, call up the product calibration once more (**cal**, mode code 1105).	Display (approx. 3 sec)
	Enter lab value. The new cell constant is calculated.	
	The new cell constant is displayed. Confirm with **enter**.	New calibration: Press **cal**.
	The measured value is shown in the main display alternately with "Hold"; "enter" flashes. End with **enter**.	Security prompt. After end of calibration, the outputs remain in Hold mode for approx. 20 sec.

Temp probe adjustment

Display	Action	Remark
	Activate calibration (Press **cal**, enter mode code 1015) Select with ▸ key, edit number with ▲ key, proceed with **enter**.	Wrong settings change the measurement properties! If an invalid code is entered, the device returns to measuring mode.
	Ready for calibration	Device is in the Hold mode. Display for approx. 3 sec
	Measure the temperature of the process medium using an external thermometer. Enter the measured temperature value: Select with ▸, edit number with ▲, proceed with **enter**. End adjustment with **enter**. HOLD will be deactivated after 20 sec.	Default: Current value of secondary display.

Display	Remark
	In the measuring mode the main display shows the configured process variable (conductivity, concentration, resistivity, or salinity) and the lower display the temperature. During calibration you can return to measuring mode by pressing the **cal** key, during configuration by pressing **conf** + **enter** (waiting time for measured-value stabilization approx. 20 sec).

Cleaning

To remove dust, dirt and spots, the external surfaces of the device may be wiped with a damp, lint-free cloth. A mild household cleaner may also be used if necessary.

USP function

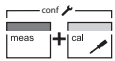
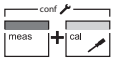
According to the "USP" directive (U.S. Pharmacopeia), Section 645 "Water Conductivity", the conductivity of pharmaceutical waters can be monitored online. To do so, the conductivity is measured without temperature compensation and is compared with limit values (see "Temperature/conductivity table as per USP" on Pg 71).
The water is usable if the conductivity is below the USP limit. For higher conductivities, further test steps must be performed according to the directive.

If the measured value exceeds the USP limit, the status is set to "bad" (see Pg 100).

Configuration
In.UnIT menu: (see Pg 51)
When USP function has been selected, the measurement range is fixed to 00.00 ... 99.99 µS/cm.
Temperature compensation is switched off.
Temperature is monitored

Temperature/conductivity table as per USP

Temp in °C	Conductivity in µS/cm	Temp in °C	Conductivity in µS/cm
0	0.6	55	2.1
5	0.8	60	2.2
10	0.9	65	2.4
15	1.0	70	2.5
20	1.1	75	2.7
25	1.3	80	2.7
30	1.4	85	2.7
35	1.5	90	2.7
40	1.7	95	2.9
45	1.8	100	3.1
50	1.9		

Entry/ Display	Remark
 0000 	**Cal Info: Display of calibration data** Press **cal** while in measuring mode and enter mode code 0000. The current cell constant is shown in the main display. After 20 sec the device returns to measuring mode (immediate return at pressing **enter**).
 2222 	**Sensor monitor** for validation of sensor and complete measured-value processing. Press **meas + cal** while in measuring mode and enter mode code 2222. The measured resistance is shown in the main display, the measuring temperature in the lower display. Press **enter** to return to measurement.
 0000 	**Error Info: Display of last error message** Press **meas + cal** while in measuring mode and enter mode code 0000. The last error message is displayed for approx. 20 sec. After that the message will be deleted. (immediate return to measurement at pressing **enter**).

Sensoface

(Sensocheck must have been activated during configuration.)

The smiley in the display (Sensoface) provides information about the sensor condition (defects, maintenance required, cable capacitance too high).
It alerts to significant sensor polarization or excessive cable capacitance e.g. caused by an unsuitable cable or a cable that is too long. The permitted calibration ranges and the conditions for a friendly, neutral, or sad Sensoface are summarized in the following chart. Additional icons refer to the error cause.

Sensocheck

Continuously monitors the sensor and its wiring.
Sensocheck can be switched off. Critical values make the Sensoface "sad" and the corresponding icon flashes:

The Sensocheck message is also output as error message Err 33. The red LED lights.
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").
To reset the Sensoface indicator, the defect must be remedied and the device be calibrated.

Display	Problem	Status
	Sensor defect	 Wrong or defective sensor Significant polarization of sensor Excessive cable capacitance (also see error message Err 33, Pg 102).
	Temperature error	 Temperature outside range for TC, SAL

Block status

The RS_STATE parameter indicates the operating status of the resource block:

- Standby — The resource block is in OOS mode. The other blocks cannot be executed.
- Online — The resource block is in Auto mode, that is normal state.

Write protection

With the WRITE_LOCK parameter, you can set a write protection for the device.

- UNLOCKED — Device can be written to (default)
- LOCKED — Device is locked.

Key lock

With the DEVICE_LOCK parameter, you can set a key lock.

- UNLOCKED — Device can be operated via keypad.
- LOCKED — Key lock is active.

Alarms

The BLOCK_ALM parameter sends the status of the process alarms to the control system. This parameter specifies whether an alarm must be acknowledged via the control system.

For bus parameters of resource block, see Pg 78.

Communication Fieldbus / Device

Bus Parameters Resource Block (RB)

Index	Parameter	Description	Default	R/W
1	ST_REV	Static revision	0	R
2	TAG_DESC	TAG description	‘	R/W
3	STRATEGY	Strategy	0	R/W
4	ALERT_KEY	Alert key	0	R/W
5	MODE_BLK	Target	OOS	R/W
		Actual	-	
		Permitted	OOS, Auto	
		Normal	Auto	
6	BLOCK_ERR	Block error		R
7	RS_STATE	Resource state	1	R
8	TEST_RW	Test		R/W
9	DD_RESOURCE	DD resource	‘	R
10	MANUFAC_ID	Manufacturer ID	0x465255 for Mettler-Toledo	R
11	DEV_TYPE	Device type	7100	R
12	DEV_REV	Device revision	1	R
13	DD_REV	DD revision	1	R
14	GRANT_DENY	Grant	0	R/W
		Deny	0	R/W
15	HARD_TYPES	Hardware type	1	R
16	RESTART	Restart		R/W
17	FEATURES	Feature supported	Reports/ Soft W Lock	R
18	FEATURES	Feature selected	Reports/ Soft W Lock	R/W
19	CYCLE_TYPE	Cycle type	Scheduled/ Block Execution	R
20	CYCLES_SEL	Cycle selected	Scheduled/ Block Execution	R/W
21	MIN_CYCLE_T	Min cycle time	1600 1/32 msec (50ms)	R
22	MEMORY_SIZE	Memory size		R
23	NV_CYCLE_T	Non-volatile cycle time		R

Index	Mettler-Specific Parameter	Description	
42	DEVICE_LOCK	Locks the device for local access.	

Index	Parameter	Description	Default	R/W
24	FREE_SPACE	Free space		R
25	FREE_TIME	Free time		R
26	SHED_RCAS			R/W
27	SHED_ROUT			R/W
28	FAULT_STATE	Fault state		R
29	SET_FSTATE	Set fault state	1	R/W
30	CLR_FSTATE	Clear fault state	1	R/W
31	MAX_NOTIFY	Max notifications	20	R
32	LIM_NOTIFY	Limit of notification	8	R/W
33	CONFIRM_TIME	Confirmation time	640000 1/32ms	R/W
34	WRITE_LOCK	Write locking	1 (Unlocked)	R/W
35	UPDATE_EVT	Unacknowledged	0	R/W
		Update state	0	R
		Time stamp	0	R
		Static revision	0	R
		Relative index	0	R/W
36	BLOCK_ALM	Unacknowledged		R/W
		Alarm state		R
		Time stamp		R
		Sub-code		R
		Value		R
37	ALARM_SUM	Current		R
		Unacknowledged		R
		Unreported		R
		Disabled		R/W
38	ACK_OPTION	Automatic acknowledge option	0 (Disabled)	R/W
39	WRITE_PRI	Write priority	0	R/W
40	WRITE_ALM	Unacknowledged		R/W
		Alarm state		R
		Time stamp		R
		Sub-code		R
		Value		R
41	ITK_VER	ITK_version	4	R

	Default Value	R/W	Bytes	Data type	Range
	0 = Unlocked	R/W	1	uns8	0 = Unlocked 1 = Locked

Communication Fieldbus / Device

Transducer Block (TB)

Configuration

In the Transducer Block you can configure the device via Fieldbus. The required parameters are listed in the table on Pg 82.

Calibration

For product calibration the process variable / unit is used as configured: see Pg 50.

Conductivity: PRIMARY_VALUE_TYPE = µS/cm, mS/cm, S/m
Resistivity: PRIMARY_VALUE_TYPE = MΩ·cm

With 3 parameters, product calibration for the respective variable can be performed via Fieldbus.

Product calibration via Fieldbus

Example for conductivity measurement
Configuring the conductivity range:
PRIMARY_VALUE_TYPE = µS/cm, mS/cm, S/m, MΩ·cm

1. Set CAL_SAMPLE_PRD parameter to Sample.
   The device stores the conductivity value of the sample.
   After the writing, the parameter is automatically reset to NOP.
2. Read out CAL_SAMPLE_PRD_STORED_VAL parameter.
   It contains the stored value.
3. Write lab value of the sample in the CAL_PRODUCT parameter. The CAL_SAMPLE_PRD_STORED_VAL parameter is reset to zero. Now the device is calibrated.

Note:
When step 1 has been performed directly on the site on the device, the operation on the Fieldbus as described in point 1 is omitted.

Error messages
The LAST_ERROR parameter always indicates the last error:

01	Sensor
02	Sensor
03	Temperature probe
33	Sensocheck
98	System error
99	Factory settings

If now a "bad" status occurs for the OUT_Value in the Analog Input, the user can take this parameter to draw conclusions about the problem.

Communication Fieldbus / Device

Bus Parameters of Standard Transducer Block (TB)

Index	Parameter	Description
1	ST_REV	The revision of the static data associated with the function block. Used by the host to determine when to re-read the static data.
2	TAG-DESC	The user description of the intended application of the block.
3	STRATEGY	The strategy field can be used to identify a grouping of blocks. Can be used for any purpose by the user.
4	ALERT_KEY	Identification number that may be used by the host system to sort alarms and other device information.
5	MODE_BLK	Allows the user to set the Target, Permitted, and Normal device mode. Displays the Actual mode. Target Actual Permitted Normal
6	BLOCK_ERR	Reflects the error status associated with the hardware or software of the block. It is a bit string so multiple errors may be shown.
7	UPDATE_EVENT	Unacknowledged Update State Time Stamp Static Rev Relative Index
8	BLOCK_ALM	Unacknowledged Alarm State Time Stamp Subcode Value
9	TRANSDUCER_DIRECTORY	Directory that specifies the number and the starting indices of the transducers in the transducer block.

	Default Value	R/W	Bytes	Data type	Range
	The revision value is incremented every time a static parameter in the block is changed.	R	2		
	Text	R/W	32		
	0	R/W	2		
	0	R/W	1		
	Available Modes: Automatic, Out Of Service (OOS), Manual	 R/W R R/W R/W	 1 1 1 1		
		R	2		
	0 0 0 0 0	R	1 1 8 2 2		
	0 0 0 0 0	R	1 1 8 2 1		
		R	4		

Communication Fieldbus / Device

Bus Parameters of Standard Transducer Block (TB)

Index	Parameter	Description	
10	TRANSDUCER_TYPE	Identifies the transducer type.	
11	XD_ERROR	A transducer block sub-code. XD_ERROR contains the highest priority alarm that has been activated in the TB_DETAILED_STATUS parameter.	
12	COLLECTION_DIRECTORY	A directory that specifies the number, starting indicies, and DD item of IDs of the data collection in each transducer within a transducer block. Used by the host for efficient transfer of information.	
	Mettler-Specific Parameters – Output		
13	SENSOR_CONNECTION	Selects the connection of the sensor	
14	PRIMARY_VALUE	Shows the primary value and status Value Status	
15	PRIMARY_VALUE_TYPE	Selects the displayed primary value	
16	CONCENTRATION	Selects the solution used for concentration measurement.	

	Default Value	R/W	Bytes	Data type	Range
	65535 = other	R	2		
	0	R	1		
		R	36		
	0 = 2 wire	R/W	1	uns8	0 = 2 wire 1 = 4 wire
		R	4 1	DS-65	
	2 = 000.0 µS/ cm	R/W	1	uns8	0 = 0.000 µS/cm 1 = 00.00 µS/cm 2 = 000.0 µS/cm 3 = 0000 µS/cm 4 = 0.000 mS/cm 5 = 00.00 mS/cm 6 = 000.0 mS/cm 7 = 0.000 S/m 8 = 00.00 S/m 9 = 00.00 MOhm cm 10 = SAL 11 = 00.00 % 12 = USP
	1 = -01- NaCl	R/W	2	uns8	1 = -01- NaCl 2 = -02- HCl 3 = -03- NaOH 4 = -04- H2SO4 5 = -05- HNO3

Communication Fieldbus / Device

Bus Parameters of Standard Transducer Block (TB)

Index	Parameter	Description	
	Mettler-Specific Parameters – Temperature		
17	SECONDARY_VALUE_2	Process temperature value and status Value Status	
18	SECONDARY_VALUE_UNIT_2	Degree C or degree F. Changes the unit of temperature being displayed and transmitted.	
19	TEMP_SENSOR_TYPE	Type of temperature sensor. The value entered must correspond to the temp. sensor being used.	
20	TEMP_COMPENSATION	Selects the temperature compensation	
21	TEMP_COEFFICIENT	Sets the temperature coefficient if the TEMP_COMPENSATION is set to Lin	
22	TEMP_WIRE_IMPEDANCE	Sets the wire impedance of the temp. sensor. Typically 0 unless the wire of the sensor gets too long	
23	TEMP_SENSOR_CAL	Desired temperature reading, used for temperature measurement calibration.	
	Mettler-Specific Parameters – Calibration		
24	CELL_CONSTANT	Sets the cell constant.	
25	CAL_SAMPLE_PRD	Starts the 1st part of conductivity product calibration.	
26	CAL_SAMPLE_PRD_STORED_VAL	Shows the stored value of the first step of conductivity product calibration	
27	CAL_PRODUCT	Sets the value for the 2nd part of conductivity product calibration.	

	Default Value	R/W	Bytes	Data type	Range
		R R	4 1	DS_65	
	1001 = °C	R/W	2	uns16	1001 = °C 1002 = °F
	200 = Pt1000	R/W	2	uns16	128 = Pt100 200 = Pt1000 1000 = NTC30 1001 = NTC8.55
	0 = OFF	R/W	1	uns8	0 = TC OFF 1 = TC Lin 2 = TC nLF 3 = pure water (NaCl) 4 = pure water (HCl) 5 = pure water (NH3)
	2.00 %/ K	R/W	4	float	00.00 ... 19.99 %/ K
	0 Ohm	R/W	4	float	
	0	R/W	4	float	-10 ... +10K
	1.0	R/W	4	float	0 ... 20.00
	0 = Nop	R/W	1	uns8	0 = Nop 1 = Sample
	0 if step 1 of product calibration was not started	R		float	
	0.0	R/W	4	float	

Communication Fieldbus / Device

Bus Parameters of Standard Transducer Block (TB)

Index	Parameter	Description	
	Mettler-Specific Parameters – Alert		
28	HOLD	Sets the device to HOLD mode.	
29	SENSOCHECK	Enables or disables Sensocheck.	
30	ALARM_LED_MODE	Sets the LED to HOLD mode.	
31	LAST_ERROR	Shows the last error.	
32	SENSOFACE_STATUS	Shows the current status of the Sensoface.	
	Mettler-Specific Parameters – Identification and Local Parameter Setting		
33	SW_REV_LEVEL	Software revision number	
49	HW_REV_LEVEL	Hardware revision number	

	Default Value	R/W	Bytes	Data type	Range
	0 = Off	R/W	1	uns8	0 = Off 1 = On
	0 = Off	R/W	1	uns8	0 = Off 1 = On
	0 = Off	R/W	1	uns8	0 = Off 1 = On
	0 = None	R	2	uns16	0...100
	0 = Good	R	1	uns8	0 = Good 1 = Neutral 2 = Bad
		R	2	uns16	
		R	1	uns8	

Communication Fieldbus / Device

Analog Input Blocks (AI) of Cond Transmitter 7100e FF

Setting the operating mode

The following operating modes can be set in the MODE_BLK parameter:

- OOS
- MAN
- Auto

When there is no write protection, the OOS mode allows unlimited access to all parameters.

Selecting the process variables and units

The Cond Transmitter 7100e FF provides 3 Analog Input blocks. The respective process variable can be selected in the CHANNEL parameter.
The corresponding measurement unit is selected in the UNITS subparameter of the XD_SCALE parameter.
The following variables are available:

CHANNEL	Function	Unit	Unit_Value
1	Conductivity	µS/cm mS/cm S/m	1586 1302 1299
2	Concentration	% percent	1342
3	Temperature	°C °F	1001 1002
4	Salinity	per mill	2003
5	Resistance	MOhm-cm	1587
6	Cell constant	1/cm	2004

Linearization types
The input value can be linearized in the AI with the LIN_TYPE parameter:

- **Direct:**
The measured value is directly led from the Transducer block to the Analog Input block, avoiding the linearization function. Here, you must make sure that the units in the XD_SCALE and OUT_SCALE parameters are identical.

- **Indirect**
Here, the measured value of the TB is linearly scaled over the input scale (XD_SCALE) to the output scale (OUT_SCALE).

- **Indirect Square Root**
The input value is rescaled over the XD_SCALE parameter and recalculated using a root function. Then the value is further scaled to OUT_SCALE.

Diagnostics
The BLOCK_ERR parameter indicates the current block status.

Analog Input Blocks (AI) of Cond Transmitter 7100e FF

Alarm handling

The process control system receives the alarm status via the BLOCK_ALM parameter. In the ACK_OPTION parameter you specify whether an alarm must be acknowledged via the control system.

Block alarms

An AI can generate the following block alarms via the BLOCK_ERR parameter:

- Simulate Active
- Input Failure
- Block Configuration Error
- Out Of Service

Limit alarms

If an OUT measured value falls below or exceeds the defined limit, the control system is alerted.
The following limit parameters are defined:

- HI_HI_LIM
- HI_LIM
- LO_LIM
- LO_LO_LIM

The behavior is defined by the respective priorities.

Examples of alarm handling in the Cond Transmitter 7100e FF

Example 1: Device failure ERR 99
During measurement a device failure occurs.
The measured value is given the BAD_DEVICE_FAILURE status.
The BLOCK_ERROR parameter (Diagnostics parameter of AI) changes to INPUT_FAILURE. The Analog Input Block generates the "Input Failure" block alarm.
When the LAST_ERROR parameter is read out in the Transducer Block, the Err 99 error is detected.
Measure: Replace device.

Example 2: Sensor defective
Prerequisite: Sensocheck has been set to "ON" in the configuration.
During measurement the sensor fails. The measured value is given the BAD_SENSOR_FAILURE status (see Pg 102).
To analyze the error, the SENSOFACE_STATUS parameter can be read out from the TB (Good / Bad).
Measure: Replace the sensor.

The BLOCK_ERROR parameter (Diagnostics parameter of AI) changes to INPUT_FAILURE.
The Analog Input Block generates the "Input Failure" block alarm.
When the LAST_ERROR parameter is read out in the Transducer Block, the Err 33 error is detected.
Measure: Replace sensor.

Alarm diagnostics / Bus parameters
In the case of an alarm the following bus parameters must be evaluated:
- AI block OUT parameter (currently measured value)
- TD LAST_ERROR parameter (error indication 1 ... 100)
- TD SENSOFACE_STATUS parameter
  (0 = Good, 2 = Bad)

Communication Fieldbus / Device
Bus Parameters / Analog Input Blocks (AI)

Index	Parameter	Description	Default	R/W
1	ST_REV	Static Revision	0	R
2	TAG_DESC	TAG Description		R/W
3	STRATEGY	Strategy	0	R/W
4	ALERT_KEY	Alert Key	0	R/W
5	MODE_BLK	Target	OOS	R/W
		Actual	-	
		Permitted	OOS, Auto	
		Normal	Auto	
6	BLOCK_ERR	Block Error		R
7	PV	Process Value		R
		Status		R
8	OUT	Measured Value		R
		Status		R
9	SIMULATE	Simulate Status		R/W
		Simulate Value		R/W
		Transducer Status		R
		Transducer Value		R
		Simulate Enable / Disable		R/W
10	XD_SCALE	High Range	100	R/W
		Low Range	0	R/W
		Units Index	0	R/W
		Decimal Point	0	R/W
11	OUT_SCALE	High Range	100	R/W
		Low Range	0	R/W
		Units Index	0	R/W
		Decimal Point	0	R/W
12	GRANT_DENY	Grant	0	R/W
		Deny	0	R/W
13	IO_OPTS	IO Block Options	0	R/W
14	STATUS_OPTS	Status Options		
15	CHANNEL	Channel	1	R/W
16	L_TYPE	Linearization Type	0	R/W
17	LOW_CUT	Low Cut Off	0	R/W
18	PV_TIME	Filter Time	0	R/W
19	FIELD_VAL	Percent Value		R
		Status		R
20	UPDATE_EVT	Unacknowledged	0	R/W
		Update State	0	R
		Time Stamp	0	R
		Static Revision	0	R
		Relative Index	0	R

Index	Parameter	Description	Default	R/W
21	BLOCK_ALM	Unacknowledged	0	R/W
		Alarm State	0	R
		Time Stamp	0	R
		Sub-code	0	R
22	ALARM_SUM	Current	0	R
		Unacknowledged	0	R
		Unreported	0	R
		Disabled	0	R/W
23	ACK_OPTION	Automatic Acknowledge Option	0	R/W
24	AlARM_HYS	Alarm Hysteresis	0.50%	R/W
25	HI_HI_PRI	High High Priority	0	R/W
26	HI_HI_LIM	High High Limit	INF	R/W
27	HI_PRI	High Priority	0	R/W
28	HI_LIM	High Limit	INF	R/W
29	LO_PRI	Low Priority	0	R/W
30	LO_LIM	Low Limit	- INF	R/W
31	LO_LO_PRI	Low Low Priority	0	R/W
32	LO_LO_LIM	Low Low Limit	- INF	R/W
33	HI_HI_ALM	Unacknowledged	0	R/W
		Alarm State	0	R
		Time Stamp	0	R
		Sub-code	0	R
		Value	0	R
34	HI_ALM	Unacknowledged	0	R/W
		Alarm State	0	R
		Time Stamp	0	R
		Sub-code	0	R
		Value	0	R
35	LO_ALM	Unacknowledged	0	R/W
		Alarm State	0	R
		Time Stamp	0	R
		Sub-code	0	R
		Value	0	R
36	LO_LO_ALM	Unacknowledged	0	R/W
		Alarm State	0	R
		Time Stamp	0	R
		Sub-code	0	R
		Value	0	R

Communication Fieldbus / Device

Cyclic measured value status

Priority	Quality	Sub-status	Bin-coding without limit bits	Hex-coding
Low ↓ High	Good	Good Non-Specific	10 00 00 00	0 x 80
		Good Active Advisory Alarm	10 00 10 xx	0 x 88
		Good Active Critical Alarm	10 00 11 xx	0 x 8C
	Uncer-tain	Uncertain Non-Specific	01 00 00 xx	0 x 40
		Last Usable Value (LUV)	01 00 01 xx	0 x 44
		Substitute-Set	01 00 10 xx	0 x 48
		Initial Value	01 00 11 xx	0 x 4C
		Sensor Conversion Not Accurate	01 01 00 xx	0 x 50
		Engineering Unit Violation	01 01 01 xx	0 x 54
		Sub-Normal	01 01 10 xx	0 x 58
	Bad	Non-Specific	00 00 00 xx	0 x 00
		Sensor Failure	00 01 00 xx	0 x 10
		Device Value	00 00 11 xx	0 x 0C
		Out of Service	00 01 11 xx	0 x 1C

The respective status bit is set when the condition occurs. It is reset as soon as the condition does not exist any more.

Measured-value limits: limit bits

Bin-coding of limit bits	Meaning of limit bits
00	ok
01	Low limited
10	High limited
11	Constant

When the measured-value status is “BAD”, the AI block BLOCK_ERR parameter indicates an “Input Failure”.

Operating states / Measured value status

Operating state (Activation)	Red LED	Time out	Status AI 1	
Measuring	live	-	**good**	
Cal Info (**cal**) 0000	live	20 s	**good**	
Error Info (**meas + cal**) 0000	live	20 s	**good**	
Configuration (**meas + cal**) 1200	Hold[1)]	20 min	**uncertain** last usable value	
Calibration (**cal**) 1100	Hold[1)]	-	**uncertain** last usable value	
Calibration (**cal**) 0110	Hold[1)]	-	**uncertain** last usable value	
Temp probe adjustment (**cal**) 1015	Hold[1)]	-	**uncertain** last usable value	
Product calibration (Cond, MΩ·cm) Step 1 (**cal**) 1105	live	-	**good**	
Step 2 (**cal**) 1105	Hold[1)]	-	**uncertain** last usable value	
Sensor monitor (**meas + cal**) 2222	live	20 min	**good**	

1) LED flashes when "HOLD ON" has been set (see Pg 56).

	Status AI 2	Status AI 3
	good	**good**
	good	**good**
	good	**good**
	uncertain last usable value	**uncertain** last usable value
	uncertain last usable value	**uncertain** last usable value
	uncertain last usable value	**uncertain** last usable value
	uncertain last usable value	**uncertain** last usable value
	good	**good**
	uncertain last usable value	**uncertain** last usable value
	good	**good**

Error messages / Measured value status

Error	Display	Problem Possible causes	Sensoface	Red LED	Status AI Cond	
ERR 99	"FAIL" flashes	**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.		x	**bad** device_failure	
ERR 98	"Conf" flashing	**System error** Configuration or calibration data defective. Completely reconfigure and recalibrate the device. Memory error in device program		x	**bad** device_failure	
ERR 01	Measured value flashes	**Sensor** Wrong cell constant; Sensor connection or cable defective. Measurement range violation: **Conductivity:** < 0 µS; > 99.99 mS **Resistivity** < 0; > 99,99 MΩ · cm **USP limit value:** < 0; > 99.99 µS/cm		x	**bad** sensor_failure	
		Salinity (SAL): < 0 ; > 45 ‰			**good**	

	Status AI Conc	Status AI Temp	Status AI Salinity	Status AI Cell constant	Status AI Resistivity
	bad device_failure	**bad** device_failure	**bad** device_failure	**bad** device_failure	**bad** device_failure
	bad device_failure	**bad** device_failure	**bad** device_failure	**bad** device_failure	**bad** device_failure
	good	**good**	**good**	**good**	**bad** sensor_failure
	good	**good**	**bad** sensor_failure	**-**	**good**

Error messages / Measured value status

Error	Display	Problem Possible causes	Sensoface	Red LED	Status AI Cond	
ERR 02	Measured value flashes	**Concentration range** exceeded > 9.99 % by wt		x	**good**	
ERR 03	 flashes	**Temperature range** violation		x	**bad** [1)] sensor_failure	
ERR 33	 flashes 	**Sensocheck:** Wrong or defective sensor / Polarization effects at the sensor / cable too long or defective / plug defective see Pg 74	x	x	**bad** [2)] sensor_failure	
		**Cell constant:** see Pg 74	x		**uncertain** sensor_ conversion_ not _accurate	
		Temperature outside TC tables (TC, SAL)			**uncertain** subnormal	

	Status AI Conc	Status AI Temp	Status AI Salinity	Status AI Cell constant	Status AI Resistivity
	bad sensor_failure	**good**	**good**	**good**	**good**
	bad device_failure	**bad** device_failure	**uncertain** subnormal	**good**	**bad** [1] sensor_failure
	bad [2] sensor_failure	**bad** [2] sensor_failure	**bad** [2] sensor_failure	**good**	**bad**
	uncertain sensor_ conversion_ not _accurate	**uncertain** sensor_ conversion_ not _accurate	**uncertain** sensor_ conversion_ not _accurate	**bad** sensor_failure	**uncertain** sensor_ conversion_ not _accurate
	bad sensor_failure	**good**	**uncertain** subnormal	**good**	**uncertain** subnormal

1) When TC has been corrected
2) When Sensocheck has been set to "ON"

Product line and accessories

Devices	Order no.
Cond Transmitter 7100e FF	52 121 247
Mounting accessories	
Pipe-mount kit	52 120 741
Panel-mount kit	52 120 740
Protective hood	52 120 739

Sensors
Mettler-Toledo GmbH, Process Analytics offers a wide range of 2-electrode and 4-electrode sensors for the following fields of applications:
- Chemical process industry
- Pharmaceutical industry
- Food and beverage industry
- Pulp and paper industry
- Water/waste-water treatment

For more information concerning our sensors and housings program, please refer to our website.

The Device Description (DD file) and the Common File Format (CFF file) for network project are included in the shipment. They can also be downloaded at:

http://www.mtpro.com/transmitters

Specifications

Conductivity input	Input for 2-electrode/4-electrode sensors	
Effective range	Conductivity 4-el	0.2 µS · c ... 1000 mS · c
	Conductivity 2-el	0.2 µS · c ... 200 mS · c
	(Display range limited to 3500 mS)	
Ranges *	Conductivity	0.000 ... 9.999 µS/cm
(Display)		00.00 ... 99.99 µS/cm
		000.0 ... 999.9 µS/cm
		0000 ... 9999 µS/cm
		0.000 ... 9.999 mS/cm
		00.00 ... 99.99 mS/cm
		000.0 ... 999.9 mS/cm
		0.000 ... 9.999 S/m
		00.00 ... 99.99 S/m
	Resistivity	00.00 ... 99.99 MΩ·cm
	Concentration	0.00 ... 9.99 % by wt
	Salinity	0.0 ... 45 ‰ (0 ... 35 °C)
	USP	00.00 ... 99.99 µS/cm
Measurement error [1,2,3]	< 1 % meas. val. +0.4 µS · c	

Temperature compensation *
(Reference temp 25 °C)

(OFF) none
(Lin) Linear characteristic 00.00 ... 19.99%/K
(NLF) Natural waters to EN 27888 (0...120°C)
(nACL) Ultrapure water with NaCl traces (0...120°C)
(HCL) Ultrapure water with HCl traces (0...120°C
(nH3) Ultrapure water with NH_3 traces (0...120°C)

Concentration determination

Operating modes: *

-01- NaCl 0.00 ... 9.99 % by wt (0 ... 100 °C)
-02- HCl 0.00 ... 9.99 % by wt (-20 ... 50 °C)
-03- NaOH 0.00 ... 9.99 % by wt (0 ... 100 °C)
-04- H_2SO_4 0.00 ... 9.99 % by wt (-17...110 °C)
-05- HNO_3 0.00 ... 9.99 % by wt (-17 ... 50 °C)

See graphs in the Appendix Pg 114 et seq.

Sensor standardization

Operating modes:
- Input of cell constant with simultaneous display of conductivity and temperature
- Input of onductivity of calibration solution with simultaneous display of cell constant and temperature
- Product calibration
- Temperature probe adjustment

Adm. cell constant: 00.0050 ... 20.0000 cm^{-1}

Sensor monitoring

Sensocheck: Polarization detection and monitoring of cable capacitance

Sensoface: Provides information on the sensor condition (Sensocheck)

Sensor monitor: Direct display of measured values from sensor for validation (resistance / temperature)

USP function: Water monitoring in the pharmaceutical industry (USP)

Temperature input *): Pt100 / Pt1000 / NTC 30 kΩ / NTC 8.55 kΩ (Betatherm)
2-wire connection, adjustable

Meas. range:

Pt100/Pt1000:	-20 .. +200 °C (-4 ... 392 °F)
NTC 30 kΩ	-20 ... +150 °C (-4 ... 302 °F)
NTC 8.55 kΩ	-10 ... +130 °C (+14 ... 266 °F)

Resolution: 0.1 °C / 1 °F

Measurement error [1,2,3)]: 0.5 K
(< 1K for Pt100; < 1K for NTC > 100°C)

Specifications

FF communication	FF_H1 (Foundation Fieldbus)	
Physical interface	To EN 61 158-2 (IEC 1158-2)	
Address range	017 ... 246	Factory setting: 026
Mode of operation	Bus-powered device with constant current consumption	
Supply voltage	FISCO	≤ 17.5 V (trapezoidal or rectangular characteristic) ≤ 24 V (linear characteristic)
Current consumption	< 13.2 mA	
Max. current in case of fault (FDE)	< 17.6 mA	
FF communication model	Certified to ITK 4.6	
1 resource block		
1 transducer block		
3 AI function blocks switchable:	Conductivity, resistivity, concentration, salinity, temperature, cell constant	
Execution time	50 ms	
Display	LC display, 7-segment with icons	
Main display	Character height 17 mm, unit symbols 10 mm	
Secondary display	Character height 10 mm, unit symbols 7 mm	
Sensoface	3 status indicators (friendly, neutral, sad Smiley)	
Mode indication	5 mode indicators "meas", "cal", "alarm", "FF communication", "config" 18 further icons for configuration and messages	
Alarm indication	Red LED in case of alarm or HOLD, user defined	
Keypad	5 keys: [cal] [conf] [▸] [▲] [enter]	

* User-defined
1) To IEC 746 Part 1, at nominal operating conditions
2) ± 1 count
3) Plus sensor error

Service functions

Device self-test	Automatic memory test (RAM, ROM, EEPROM)
Display test	Display of all segments
Last Error	Display of last error occurred
Sensor monitor	Display of direct, uncorrected sensor signal (resistance/temperature)

Data retention	Parameters and calibration data > 10 years (EEPROM)
EMC	EN 61326
Emitted interference:	Class B (residential area)
Immunity to interference:	Industry
USA: FCC:	FCC rules part 15/B class A
Lightning protection	EN 61000-4-5, Installation Class 2

Explosion protection	ATEX:	II 2(1)G EEx ia IIC T4
	FM:	IS, Class I Div1, Group A, B, C, D T4 FISCO I / 1[0] / AEx ib [ia] / IIC / T4 FISCO NI, Class I Div2, Group A, B, C, D T4 NIFW

Nominal operating conditions

Ambient temperature	–20 ... +55 °C
Transport/Storage temp	–20 ... +70 °C

Enclosure	Molded enclosure made of PBT (polybutylene terephtalate)
Color	Bluish gray RAL 7031
Mounting	• Wall mounting • Pipe mounting: Ø 40 ... 60 mm, □ 30 to 45 mm • Panel mounting, cutout to DIN 43 700 Sealed against panel
Dimensions	H 144 mm, W 144 mm, D 105 mm
Protection	IP 65/NEMA 4X (USA, Canada: indoor use only)
Cable glands	3 breakthroughs for M20x1.5 cable glands 2 breakthroughs for NPT 1/2" or Rigid Metallic Conduit
Weight	Approx. 1 kg

Patents/ Intellectual Property Rights

Patent/Application	Title
U.S. 6,424,872	Block Oriented Control System
U.S. 6,594,530	Block Oriented Control System, Cont'd.
U.S. App. 09/598,697	Block Oriented Control System on High Speed Ethernet
European Patent App.* 941594.4	Block Oriented Control System on High Speed Ethernet
China Patent App.* 00809263.X	Block Oriented Control System on High Speed Ethernet
Hong Kong Patent App.* 2107127.9	Block Oriented Control System on High Speed Ethernet
U.S. App. 10/453596	Flexible Function Blocks
U.S. App. 10/826,576	System and Method for Implementing Safety Instrumented Systems in a Fieldbus Architecture
PCT App. US/04/11616	System and Method for Implementing Safety Instrumented Systems in a Fieldbus Architecture
U.S. 5,909,368	Process Control System Using a Process Control Strategy Distributed among Multiple Control Elements
U.S. 5,333,114	Field Mounted Control Unit
U.S. 5,485,400	Field Mounted Control Unit
U.S. 5,825,664 Japan Patent # 3137643 Australian Patent # 638507 Canadian Patent # 2,066,743 European Patent # 0495001 Validated in: UK Patent # 0495001 France Patent # 0495001 Germany Patent # 69032954T Netherlands Patent # 0495001	Field Mounted Control Unit
U.S. 6,055,633 European Patent App.* Publication No. EP1029406A2	Method of Reprogramming Memories in Field Devices Over a Multidrop Network

U.S. 6,104,875	Method for Field Programming an Industrial Process Transmitter

Australian Patent App.*
Publication No. AU9680998A1

The Foundation may acquire or hold patent rights in addition to those listed.

FOUNDATION:
FIELDBUS FOUNDATION, a Minnesota not-for-profit corporation

Calibration solutions

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

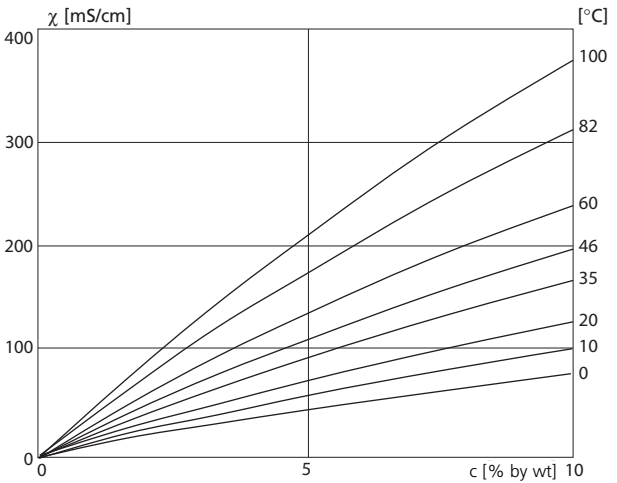
(Conductivity in mS/cm)

Temperature	Concentration		
[°C]	0.01 mol/l *	0.1 mol/l *	saturated **
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

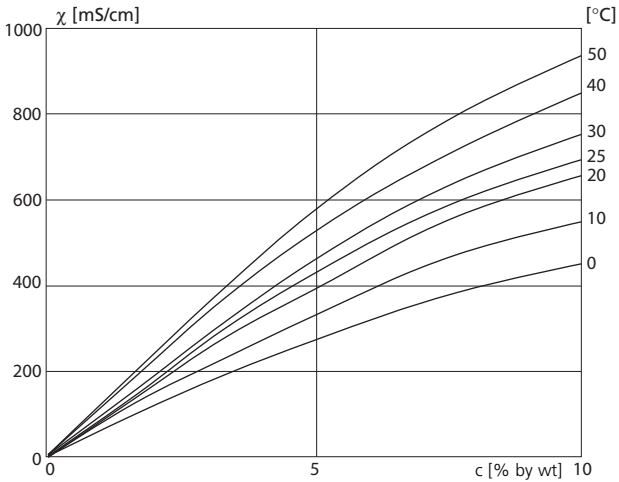
Concentration curves

-01- Sodium chloride solution NaCl



Conductivity in dependence on substance concentration and process temperature for sodium chloride solution (NaCl)

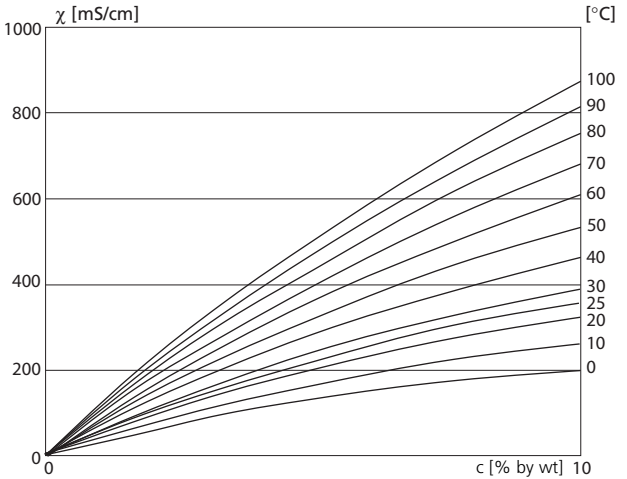
-02- Hydrochloric acid HCl



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

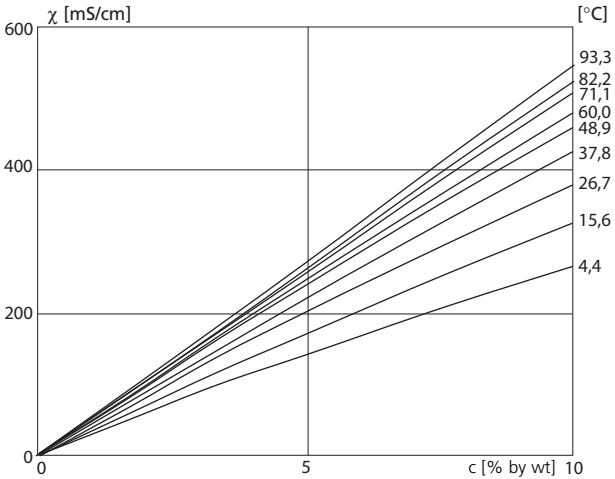
Concentration curves

-03- Sodium hydroxide solution NaOH



Conductivity in dependence on substance concentration and process temperature for sodium hydroxide solution (NaOH)

-04- Sulphuric acid H_2SO_4

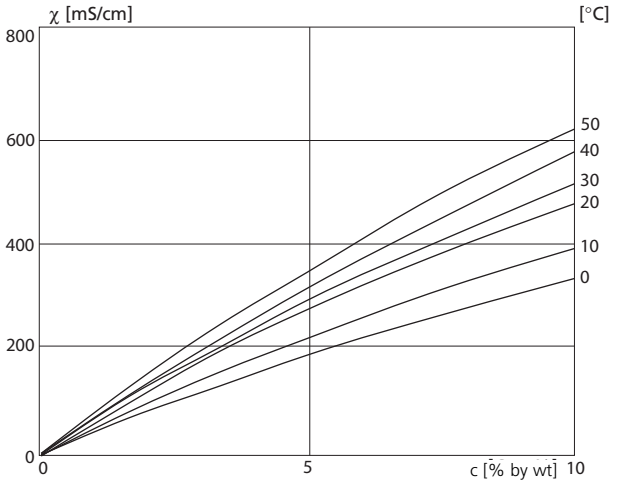


Conductivity in dependence on substance concentration and process temperature for sulfuric acid (H_2SO_4)

Source: Source: Darling; Journal of Chemical and Engineering Data; Vol.9 No.3, July 1964

Concentration curves

-05- Nitric acid HNO_3



Conductivity in dependence on substance concentration and process temperature for nitric acid ($HN0_3$)

Source: Haase/Sauermann/Dücker; Z. phys. Chem. New Edition, Vol. 47 (1965)

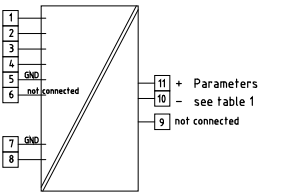
The connections to the Transmitter must be installed in accordance with the National Electric Code (ANSI-NFPA 70) Division 2 hazardous (classified) location non-incendive wiring techniques.

FM Control Drawing

Conductivity Transmitter
Cond 7100 PA
Cond 7100e FF
IS/I/1/ABCD/T4, Ta=55°C; Entity; FISCO
I/1 [0]/AEx ib [ia]/IIC/T4, Ta=55°C; Entity; FISCO
NI/I/2/ABCD/T4, Ta=55°C; NIFW

Entity Parameters:

Terminals 1, 2, 3, 4, 5 and 6
V_t = 12 V C_a = 1.41 µF
I_t = 147 mA L_a = 1.3 mH
P_{max} = 172 mW

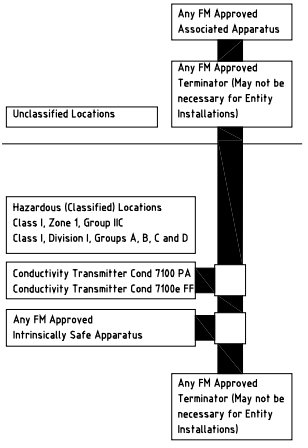


Terminals 7 and 8
V_{oc} = 6 V C_a = 40 µF
I_{sc} = 3.71 mA L_a = 1 H
P_{max} = 5.5 mW

The intrinsically safe equipment connecting to 1, 2, 3, 4, 5, 6 and 7, 8 must be FM Approved or be simple apparatus, a device which will neither generate nor store more than 1.5 V, 0.1 A, 25 mW.

table 1

Concept	Groups	V_{max} (V)	I_{max} (mA)	P_{max} (W)	C_i (nF)	L_i (µH)
Entity	IIC/ABCD	24	200	1.2	1.2	7
FISCO	IIC/ABCD	17.5	280	4.9		



FISCO rules
The FISCO Concept allows the interconnection of intrinsically safe apparatus to associated apparatus not specifically examined in such combination. The criterion for such interconnection is that the voltage (V_{max}), the current (I_{max}) and the power (P_i) which intrinsically safe apparatus can receive and remain intrinsically safe, considering faults, must be equal or greater than the voltage (U_o, V_{oc}, V_t), the current (I_o, I_{sc}, I_t) and the power (P_o) which can be provided by the associated apparatus (supply unit). In addition, the maximum unprotected residual capacitance (C_i) and inductance (L_i) of each apparatus (other than the terminators) connected to the Fieldbus must be less than or equal to 5 nF and 10 µH respectively.
In each I.S. Fieldbus segment only one active source, normally the associated apparatus, is allowed to provide the necessary power for the Fieldbus system. The allowed voltage (U_o, V_{oc}, V_t) of the associated apparatus used to supply the bus must be limited to the range of 14 V d.c. to 24 V d.c. All other equipment connected to the bus cable has to be passive, meaning that the apparatus is not allowed to provide energy to the system, except to a leakage current of 50 µA for each connected device. Separately powered equipment needs a galvanic isolation to insure that the intrinsically safe Fieldbus circuit remains passive.
The cable used to interconnect the devices needs to comply with the following parameters:
Loop resistance R': 15 ... 150 Ω/km
Inductance per unit length L': 0.4 ... 1 mH/km

Capacitance per unit length C': 80 ... 200 nF/km
C' = C' line/line + 0.5 C' line/screen, if both lines are floating
or
C' = C' line/line + C' line/screen, if the screen is connected to one line
Length of spur Cable: max. 30 m
Length of trunk cable: max. 1 km
Length of splice: max. 1 m
Terminators
At each end of the trunk cable an approved line terminator with the following parameters is suitable:
R = 90 .. 100 Ω
C = 0 ... 2.2 µF
System evaluation
The number of passive devices like transmitters, actuators, connected to a single bus segment is not limited due to I.S. reasons. Furthermore, if the above rules are respected, the inductance and capacitance of the cable need not to be considered and will not impair the intrinsic safety of the installation.

Installation Notes For FISCO and Entity Concepts

1. The Intrinsic Safety Entity concept allows the interconnection of FM Approved Intrinsically safe devices with entity parameters not specifically examined in combination as a systems when: U_o or V_{oc} or $V_t \leq V_{max}$, I_o or I_{sc} or $I_t \leq I_{max}$, $P_o \leq P_i$, C_a or $C_o \geq \sum C_i + \sum C_{cable}$.
   For inductance use either L_a or $L_o \geq \sum L_i + \sum L_{cable}$ or $L_a/R_a \leq (L_i/R_i$ or $L_o/R_o)$ and $L_i/R_i \leq (L_a/R_a$ or $L_o/R_o)$
2. The Intrinsic Safety FISCO concept allows the interconnection of FM approved intrinsically safe devices with FISCO parameters not specifically examined in combination as a system when: U_o or V_{oc} or $V_t \leq V_{max}$, I_o or I_{sc} or $I_t \leq I_{max}$, $P_o \leq P_i$.
3. Dust-tight conduit seals must be used when installed in Class II and Class III environments.
4. Control equipment connected to the Associated Apparatus must not use or generate more than 250 Vrms or Vdc.
5. Installation should be in accordance with ANSI/ISA RP12.06.01 (except chapter 5 for FISCO Installations). "Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations" and the National Electrical Code® (ANSI/NFPA 70) Sections 504 and 505.
6. The configuration of associated Apparatus must be FM Approved under the associated concept.
7. Associated Apparatus manufacturer's installation drawing must be followed when installing this equipment.
8. The Cond 7100 PA, Cond 7100e FF Series are Approved for Class 1, Zone 0, applications. If connecting AEx [ib] associated Apparatus or AEx ib I.S. Apparatus to the Cond 7100 PA, Cond 7100e FF Series the I.S. circuit is only suitable for Class 1, Zone 1, or Class 1, Zone 2, and is not suitable for Class 1, Zone 0 or Class 1, Division 1, Hazardous (Classified) Locations.
9. No revision to drawing without prior FM Approvals authorisation.
10. Simple Apparatus is defined as a device that does not generates more than 1.5 V, 0.1 A or 25 mW.

Verteiler: FUL (2x)		Zul. Abweichungen für Maße ohne Toleranzangabe	Oberfläche	Maßstab			
		ISO 2768 - m		Holzzeug			
			Datum	Name	Benennung	control drawing DIV 1 Cond 7100 PA, Cond 7100e FF	
		Bearb.	13.01.05	dam			
		Gepr.(KON)					
		Freigabe(FGL)					
		Schutzvermerk nach DIN 34 beachten			Zeichnungsnummer	194.270-110	
Nr.	AE	Datum	Bearbeiter FGL KON		Ungültig ab:		Ersetzt durch:

Conductance Conductance G [S] = 1 / R [Ω]

Conductivity Conductivity χ [S/cm] = G [S] · c [1/cm]

Conductivity sensor Either 2- or 4-electrode sensors can be connected. The cell constant of the sensor in use must be entered or be determined using a calibration solution taking account of the temperature.
A special device variant (Cond Ind Transmitter 7100e FF) is provided for electrodeless sensors.

FISCO model (Fieldbus Intrinsically Safe Concept)
FNICO model (Fieldbus Non Incendive Concept)
Permits connection of several devices to a common bus line and defines limit values for device and cable parameters.
This model developed by the German PTB assumes that only one "active" device, i.e. the bus supply is connected to the field bus. All other devices are "passive" with regard to the power supply into the bus.

Salinity
Salt content of water
Measure for the concentration of dissolved salts in salt water and sea water [‰]

Temperature coefficient
With temperature compensation activated, the measured value is calculated to the value at the reference temperature (25 °C) using the temperature coefficient.

Temperature compensation
Calculates the measured conductivity value for a reference temperature.

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BR **Mettler-Toledo Ind. e Com. Ltda.,**
Alameda Araguaia, 451 - Alphaville
BR - 06455-000 Barueri / SP, Brazil
Phone +55 11 4166 74 00
Fax +55 11 4166 74 01

CH **Mettler-Toledo (Schweiz) AG,**
Im Langacher,
CH - 8606 Greifensee, Switzerland
Phone +41 44 944 45 45
Fax +41 44 944 45 10

D **Mettler-Toledo GmbH,** Prozeßanalytik,
Ockerweg 3,
D - 35396 Gießen, Germany
Phone +49 641 507-333
Fax +49 641 507-397

F **Mettler-Toledo Analyse Industrielle Sàrl,**
30 Bld. de Douaumont, BP 949,
F - 75829 Paris Cedex 17, France
Phone +33 1 47 37 06 00
Fax +33 1 47 37 46 26

USA **Mettler-Toledo Ingold, Inc.,**
36 Middlesex Turnpike,
USA - Bedford, MA 01730, USA
Phone +1 781 301-88 00
Fax +1 781 271-06 81

Management-System zertifiziert nach ISO 9001 / ISO 14001

Mettler-Toledo GmbH, Process Analytics
Industrie Nord, CH-8902 Urdorf, Switzerland
Phone + 41 44 736 22 11, Fax +41 44 736 26 36

www.mtpro.com