

Bedienungsanleitung
Instruction Manual
Notice d'utilisation

Transmitter Cond 7100 PA



69953

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Gewährleistung

Innerhalb von 1 Jahr ab Lieferung auftretende Mängel werden bei freier Anlieferung im Werk kostenlos behoben.

Softwareversion: 2.x

Stand Bedienungsanleitung: 06.06.2005

Warranty

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

Software release: 2.x

Date of issue: June 6, 2005

Garantie

Tout défaut constaté dans les 1 an à dater de la livraison sera réparé gratuitement dans notre usine à réception franco de l'appareil.

Version logiciel : 2.x

Version du mode d'emploi : 06.06.2005



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1 Information on this instruction manual

1.1 Markings



The warning symbol means that the instructions given must always be followed for your own safety.

Failure to follow these instructions may result in injuries



Notes provide important information that should be strictly followed when using the device.



When a key is shown, its function is explained.



When a display is shown, the corresponding information or operating instructions are provided.

Operating instructions

- Each operating instruction is preceded by a dot.

Enumerations

- Each enumeration is preceded by a dash.

Model designation

For practical purposes, the Transmitter Cond 7100 PA is simply referred to as Transmitter in this instruction manual.

Trademarks

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

- Registered trademarks
 - Sensocheck®
 - Sensoface®
 - GainCheck®
 - InPro®

2 Safety information

2.1 Be sure to read and observe the following instructions!

The device has been designed in accordance with the state of the art and complying with the applicable safety regulations.

When operating the device, certain conditions may nevertheless be dangerous for the operator or cause damage to the device.



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 stress

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.



The Transmitter is approved for installation in ATEX, FM Zone 1 with measurement in Zone 0, and FM Class I Div 1.



Before commissioning it must be proved that the intrinsic safety is maintained when connecting the device to other equipment, such as segment coupler and cable.



For hazardous-area applications, the Transmitter may only be connected to explosion-proof segment couplers, power supplies

The Transmitter may be operated in accordance with the FISCO model.



The stipulations of EN 60079-10: 1996 and the following must be observed for the installation.



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

3 PROFIBUS technology

3.1 General

PROFIBUS is a digital communication system that connects different field devices over a common cable and integrates them into a control system. In the long term, PROFIBUS will replace the 4-20 mA technology, which only supplies pure measured values.

Advantages of the PROFIBUS technology are:

- easy and cost-saving cabling
- convenient operation over a central control station
- transmission, evaluation and control of high amounts of data from field device to control station.

3.2 Variants and basic characteristics

PROFIBUS determines the technical and functional characteristics of a serial bus system.

There are three PROFIBUS variants:

- PROFIBUS-FMS (FMS protocol)
 - is particularly suited for exchanging large amounts of data between control devices. It operates according to the RS 485 standard with transmission rates up to 12 MBits/sec.
- PROFIBUS-DP (decentralized peripherals)
 - is tailored for communication of automation systems and distributed peripherals. It operates according to the RS 485 standard with transmission rates up to 12 MBits/sec.
- PROFIBUS-PA (process automation)
 - is dedicated to the process industry. It permits connection of

3.3 Definitions for PROFIBUS-PA

The bus protocol defines type and speed of the data exchange between master and slave devices and determines the transmission

- devices installed in hazardous locations are configured and maintained from the control station

PROFIBUS is the leading open fieldbus system in Europe. Its application range covers manufacturing, process and building automation. As open fieldbus standard to EN 50170, PROFIBUS ensures communication of different devices over one bus.

The PROFIBUS User Organization provides for further development and maintenance of the PROFIBUS technology. It combines the interests of users and manufacturers.

sensors and actuators to a common bus even in hazardous locations. PROFIBUS-PA has a transmission rate of 31.25 kBits/sec.

PROFIBUS distinguishes between two types of devices:

- Masters
 - control the data traffic on the bus. They send messages without external request.
- Slaves
 - are peripheral devices such as valves, drives, transmitters and analyzers. They can react acyclically to servicing, configuration and diagnostic tasks of the master. The central controller cyclically reads the measurement data with status.

protocol of the respective PROFIBUS system.

PROFIBUS-PA permits cyclic and acyclic services.

- Cyclic services are used for transmission of measurement data and actuating commands with status information.
- Acyclic services are used for device configuration, maintenance and diagnostics during operation.

The device profile defines the device class and typical functionalities with parameters, ranges and limit values.

The FISCO model developed by the German PTB for hazardous locations permits connection of several devices to one common bus and defines permissible limits for device and cable parameters.

3.4 PROFIBUS-PA with the Transmitter

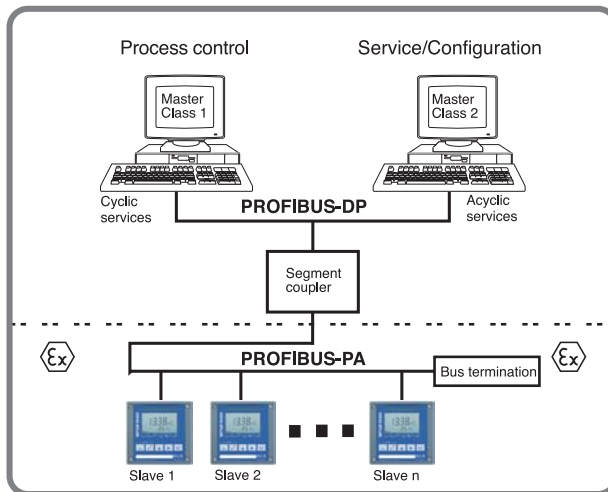


Fig. 3.1 Typical configuration of a PROFIBUS system with the Transmitter

4 Description

4.1 Intended use

The Transmitter is a PROFIBUS-PA analyzer. It is used for conductivity measurement in biotechnology, food processing, pharmaceutical and chemical industry, water/waste-water treatment, as well as for monitoring ultrapure water.

The rugged molded enclosure can be wall mounted or fixed into a control panel. It can also be mounted at a post or pipe.

The protective hood provides additional protection against direct weather exposure and mechanical damage.

The device can be easily replaced since the terminals are of a plug-in design.

4.2 Technical features

Communication between measuring point and control room is via PROFIBUS-PA. The data exchange (cyclic and acyclic) is performed

in accordance with the PROFIBUS-DP/V1 protocol.

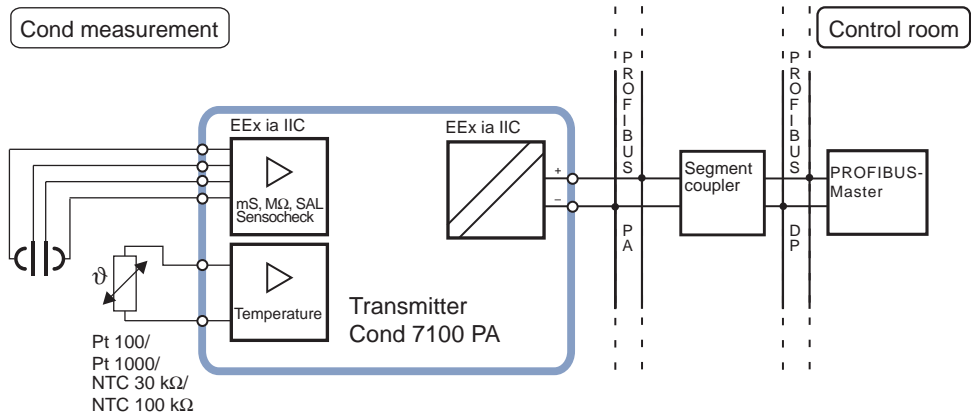


Fig. 4.1 System functions (hardware)

4.3 Communication model

The device performance is described by function blocks according to the PNO profile for Process Control Devices. The respective blocks contain different parameters and functions.

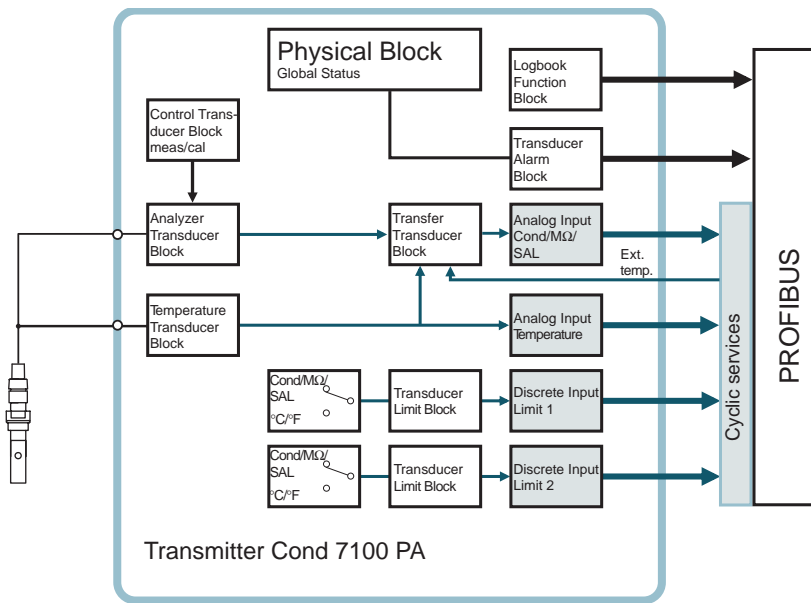


Fig. 4.2 Communication model Transmitter Cond 7100 PA according to the PNO Profile

4.4 Profile for Process Control Devices (extract)

Type of block	Block contents (general)	Block contents (detailed)
Physical Block (PB)	Description of device	Measurement procedure, device configuration Serial number, manufacturer name Operating state (run, maintenance, ...) Global status, diagnostics information
Transducer Block (TB)	Measurement procedure with interpretation	Process variable (plain text and unit) Number of measurement ranges (MR), start and end value of MR, active MR Autorange function On/Off Sampling rate of measured values Uncorrected measured value with status
Control Transducer Block	Control of device functions	Status of function execution of respective Transducer Blocks Slope of sensor characteristic (cell constant)
Transfer Transducer Block	Pre-processing of a measured value	Measured value pre-processing Temperature compensation Selection of pre-processing function
Transducer Limit Block	Limit monitoring	Block (TB) for limit setting Threshold, effective direction, hysteresis On-delay, off-delay Reset behavior, reset confirmation Limit status (active, not active)

Type of block	Block contents (general)	Block contents (detailed)
Analog Input (AI) Function Block	Measured value	Currently measured value with status and scale Rise time, hysteresis of AI limits Upper/lower alarm limit Upper/lower warning limit Switchover manual/automatic operation, measured value simulation Fail-safe behavior
Discrete Input (DI) Function Block	Digital input	Switchover manual/automatic operation Signal inversion Fail-safe behavior Limit value message/status
Transducer Alarm Block	Signaling of states and events	Required maintenance, function check, errors, limit values incl. summing Binary messages (error messages)
Logbook Function Block	Registration of states and events	Power on, power off, reset State of execution (Logbook status) Number of entries Navigation through entries

Tab. 4.1: Profile for Process Control Devices (function contents)

5 Assembly

5.1 Package contents and unpacking

Unpack the device carefully. Check the shipment for transport damage and completeness.

The package should contain:

- Front unit of the Transmitter
- Lower case

- This instruction manual
- Short instruction sheet
- Floppy disk with GSD file METT7533.GSD
- Bag containing small parts:

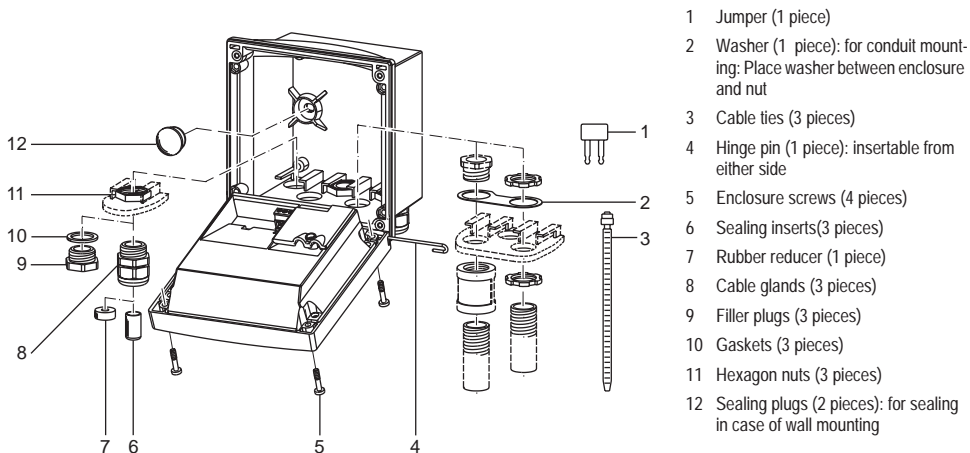


Fig. 5.1 Assembling the enclosure

5.2 Mounting plan

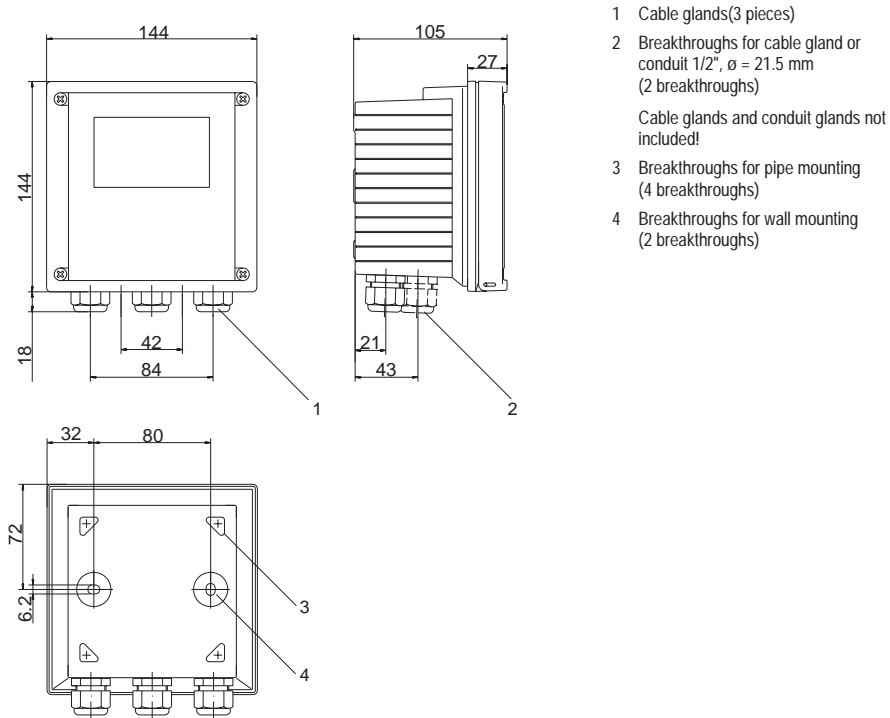
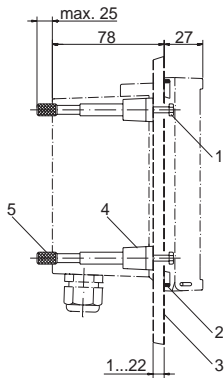
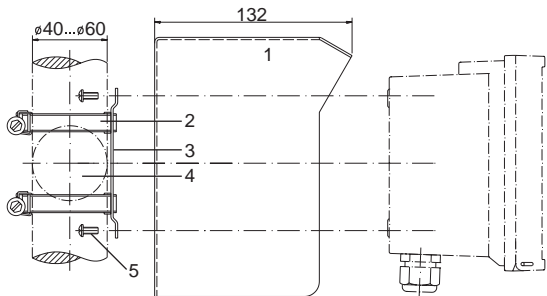


Fig. 5.2 Mounting plan



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

Fig. 5.3 ZU 0275 panel-mount kit, panel cutout 138 x 138 mm (DIN 43700)



- 1 ZU 0276 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. 5.4 ZU 0274 pipe-mount kit

1 Protective hood

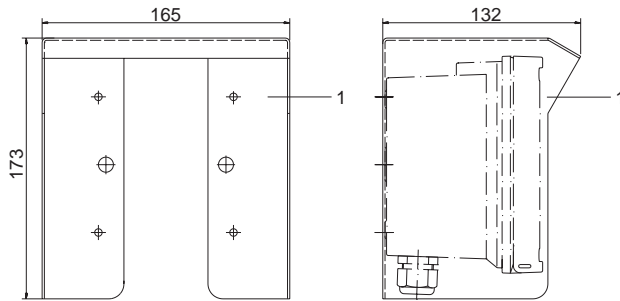


Fig. 5.5 ZU 0276 protective hood for wall and pipe mounting

6 Installation and connection

6.1 Information on installation



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.



According to the PTB FISCO model, the limits of the permissible parameter range must be observed for connection in a hazardous location.

See PROFIBUS Technical Guidelines PNO Order No.: 2.091



Be sure not to notch the conductor when stripping the insulation.

For easier installation, the terminal strips are of a plug-in design. The terminals are suitable for single wires and 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.

Division 2 wiring

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.

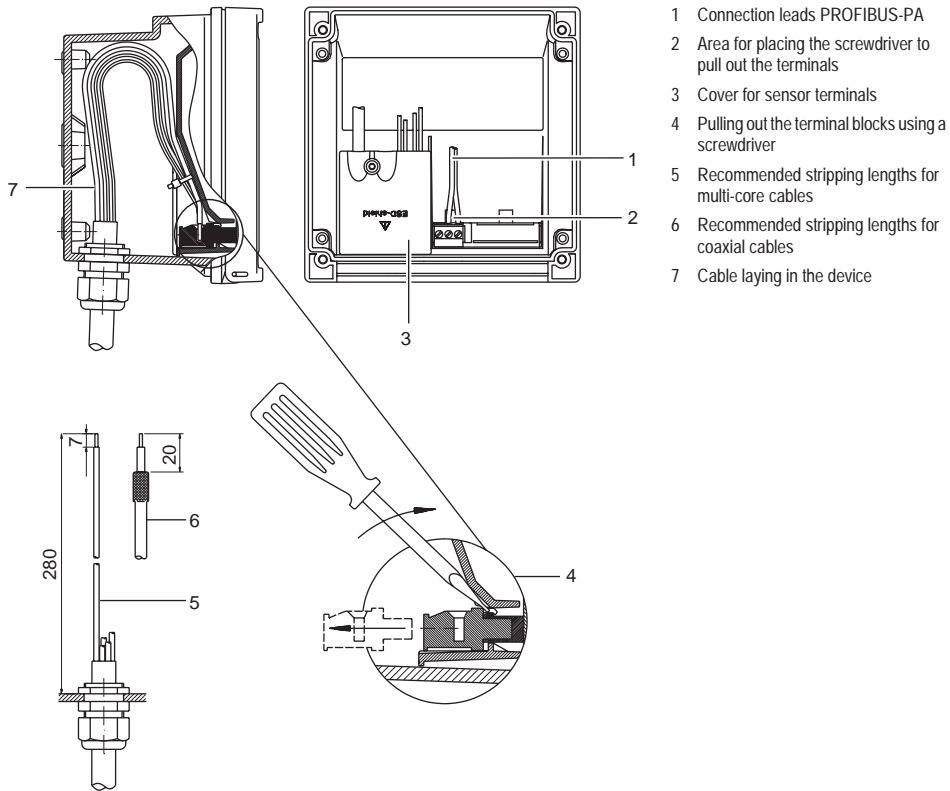


Fig. 6.1 Information on installation

6.2 Terminal assignments

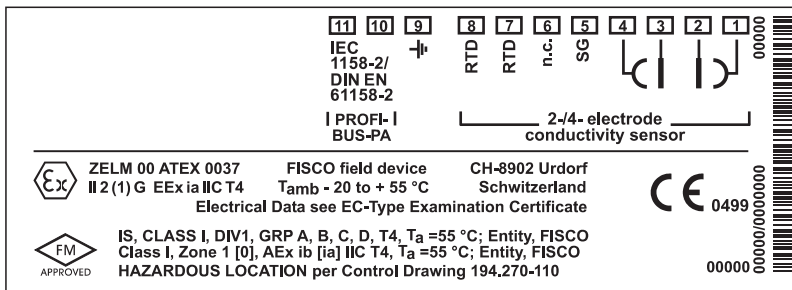
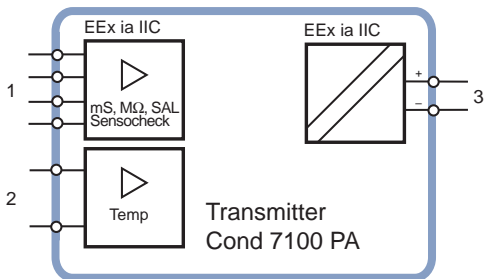


Fig. 6.2 Terminal assignments of the Transmitter

6.3 Overview of the Transmitter

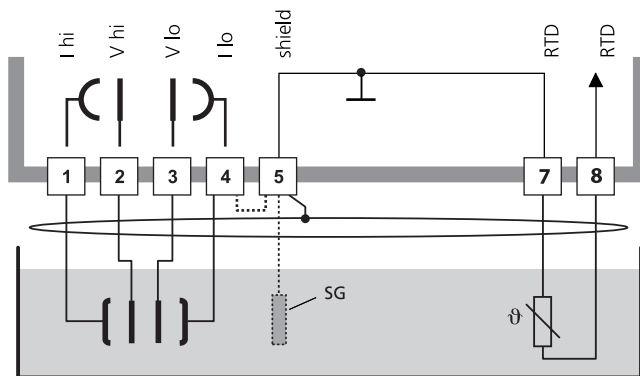


- 1 Input for
- 2- or 4-electrode sensor
- 2 Input for temperature probe
- 3 PROFIBUS-PA

Fig. 6.3 Inputs and outputs

6.4 Typical wiring

Conductivity measurement with 4-electrode sensor



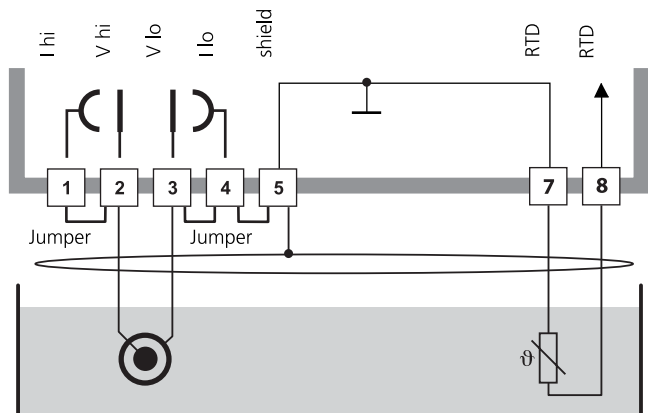
Caution!

Place jumper across terminals 4 and 5!

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

Fig. 6.4 Conductivity measurement with 4-electrode sensor

Conductivity measurement with 2-electrode sensor (coaxial electrodes)



Caution!

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

Fig. 6.5 Conductivity measurement with 2-electrode sensor (coaxial electrodes)

Conductivity measurement with Mettler-Toledo
2-electrode sensor via VP plug

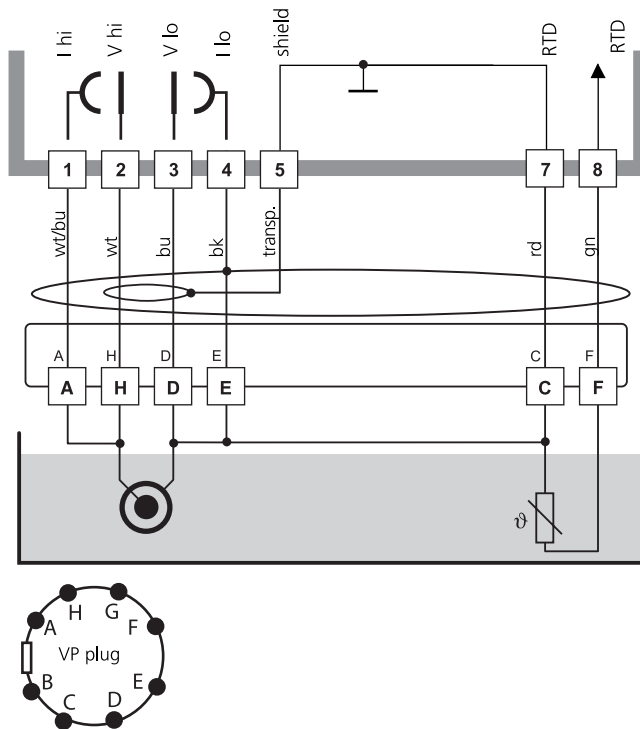


Fig. 6.6 Conductivity measurement with Mettler-Toledo 2-electrode sensor via VP plug

Conductivity measurement with Mettler-Toledo
4-electrode sensor via VP plug

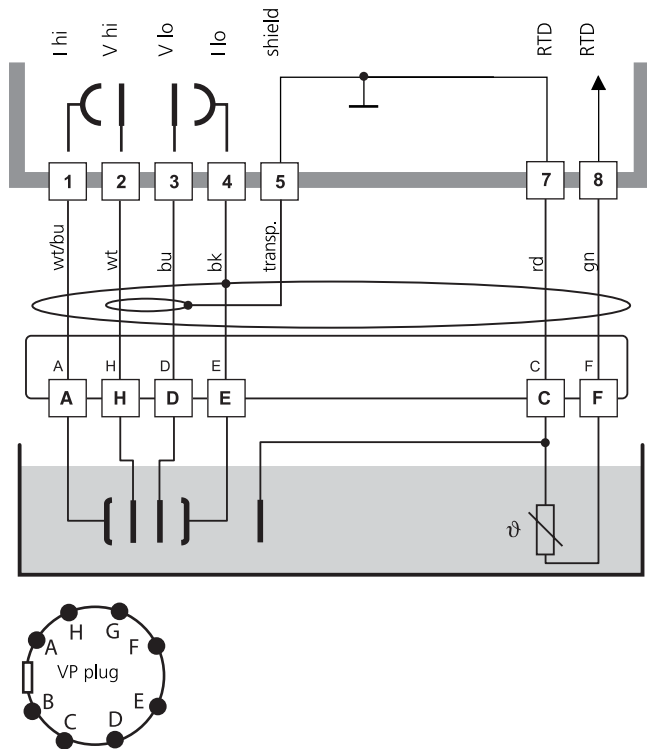


Fig. 6.7 Conductivity measurement with Mettler-Toledo 4-electrode sensor via VP plug

7 Commissioning

7.1 Checklist



Commissioning may only be carried out by trained experts.



Before commissioning the Transmitter, the following requirements must be met:

- The device must not show any damage.
- When recommissioning the device after a repair, a professional routine test in accordance with EN 61010-1 must be performed.
- It must be proved that the intrinsic safety is maintained when connecting the device to other equipment.
- It must be ensured that the device is configured in accordance with the connected peripherals.
- All connected voltage and current sources must correspond to the technical data of the device.
- The device must only be connected to explosion-proof segment couplers, power supplies ...

8 Operation

8.1 Operation possibilities

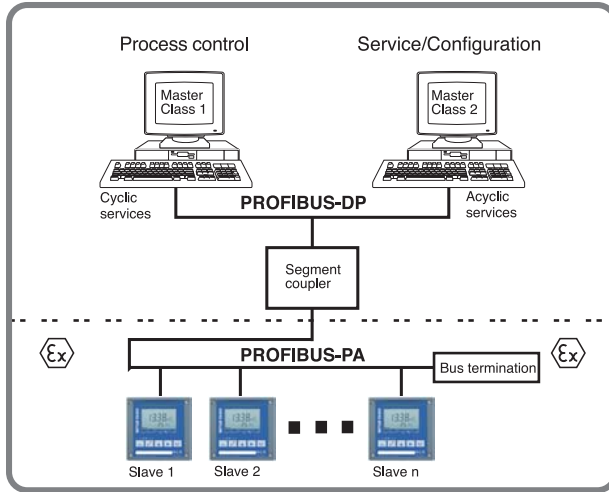


Fig. 8.1 System configuration

The device can be operated as follows:

- using the keypad on the device
- using an operating tool in the service station

8.2 Operation using keypad on the device

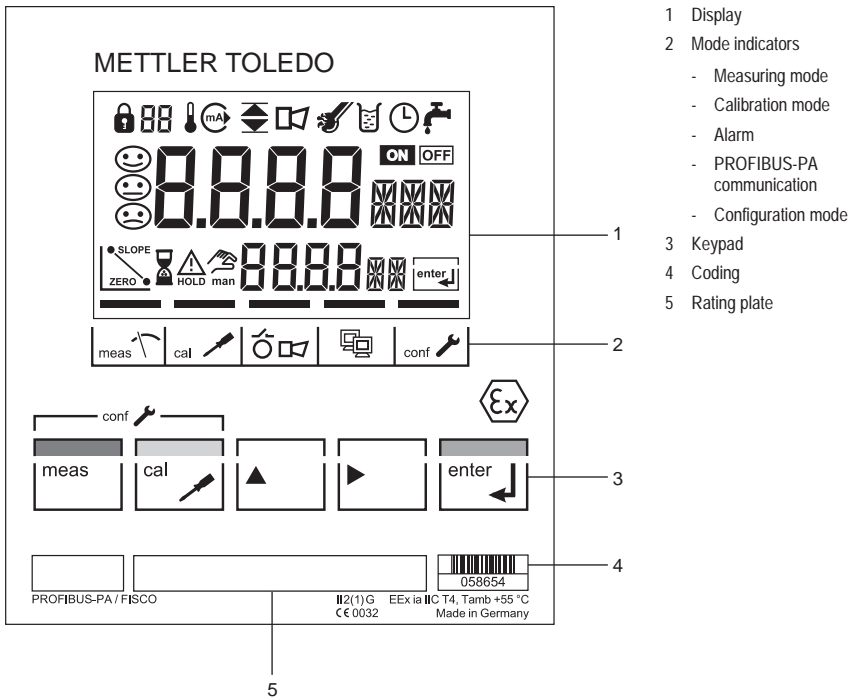
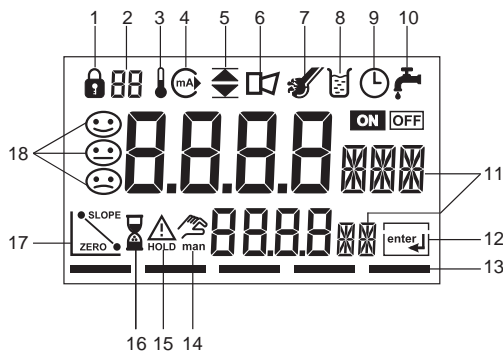


Fig. 8.2 Front view of the Transmitter

Display



- | | |
|--------------------------------|--------------------------|
| 1 Mode code entry | 10 Not connected |
| 2 Display of measured variable | 11 Unit symbol |
| 3 Temperature | 12 Proceed with enter |
| 4 Not connected | 13 Bar for device status |
| 5 Limit values | 14 Manual temp indicator |
| 6 Alarm | 15 Hold state active |
| 7 Sensocheck | 16 Wait |
| 8 Calibration | 17 Sensor data |
| 9 Interval/response time | 18 Sensoface |

Fig. 8.3 Transmitter display

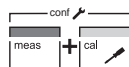
Keypad functions



Measurement



Calibration



Configuration



Select digit position
Selected position flashes



Change digit



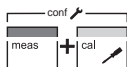
Prompt in display:
Continue in program sequence
Calibration/configuration: Confirm entries,
next configuration step



Further key combinations are explained in the
respective function descriptions.

8.3 Mode code

After pressing meas and/or cal you can enter one of the following mode codes to access the designated mode:



conf, 0000 Error Info
conf, 1200 Configuration mode



cal, 0000 Cal Info
cal, 1015 Adjusting temp probe
cal, 1100 Calibration mode
cal, 2222 Test mode

8.4 Safety functions

Sensocheck, Sensoface sensor monitoring
Sensocheck continuously monitors the sensor.
Sensocheck can be switched off.

value transfer. It runs automatically in the background at fixed intervals.



Sensoface provides information on the sensor condition.

The monitoring function alerts for significant sensor polarization or excessive cable capacitance caused by an unsuitable cable or a cable that is too long.

GainCheck manual device self-test

A display test is carried out, the software version is displayed and the memory and measured value transfer are checked. The GainCheck function ensures device operability.



Start GainCheck
manual device self-test

Automatic device self-test

The automatic device self-test checks the memory and measured-

Hold state

The Hold state is a safety state that is activated in the case of interventions such as configuration and calibration. The Transmitter freezes the last valid measured value and sends a status message to the control system.



This symbol indicates that the device is in the "Hold" state.

The Hold state is activated by the following mode codes:

- Calibration
 - Mode code 1015
 - Mode code 1100
 - Mode code 2222

- Configuration
 - Mode code 1200

The measured value and Hold are displayed alternately

- Check whether the measured value is plausible
- End the Hold state



After 20 sec (for measured value stabilization) the Transmitter returns to measuring mode.

8.5 Mode indicators

Measuring mode



The Transmitter is in measuring mode.

Calibration mode



Calibration mode is active.

Alarm



During an error message the red alarm LED beneath the display flashes.

The alarm response time is permanently set to 10 sec.

PROFIBUS-PA communication



The Transmitter communicates via PROFIBUS-PA and can be configured from the service station. Measured values, messages and device identification can be downloaded at any time. This allows integration in fully automatic process cycles.

Configuration mode

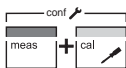


The Transmitter is in configuration mode.

8.6 Configuration

In the configuration mode the device parameters are set.

The following steps must be executed:



- Activate configuration



- Enter mode code "1200"



- Confirm entry



- Welcome text 3 sec



During configuration the Transmitter remains in the Hold state for reasons of safety.



- Select or edit parameter



- Confirm entries

All configurable parameters are shown in the "Configuration parameters" table (See Page 29).



The configuration parameters are checked during the input.

Err

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 configuration

The measured value and Hold are displayed alternately



- End the Hold state / accept configuration or



- Repeat configuration











- End the Hold state



The menus are cyclically displayed.

Configuration parameters

Pictograph/display	Parameter	Selection/input	Comment	Factory setting
	Sensor	2-EL 4-EL	Sensor selection: - 2-EL sensor - 4-EL sensor	2-EL
	Process variable and range	x.xxx μS / xx.xx μS / xxx.x μS / xxxx μS x.xxx mS / xx.xx mS / xxx.x mS / xxxx mS x.xxx MΩ / xx.xx MΩ / xxx.x MΩ xxx.x SAL	The selected process variable is shown in the display.	000.0 mS
	Temperature	°C °F	Temperature display selection	°C
	Temperature probe	Pt 100 Pt 1000 NTC 30 NTC 100	Selection of temperature probe	Pt 100
		BUS EXT	External temp during meas. [°C] Manual temp during calibration [°C]	
	Temperature compensation (Step omitted for SAL.)	OFF LIN NLF -01- FCT -02- FCT -03- FCT	Temp compensation selection: Linear Nonlinear, natural waters Ultrapure water with NaCl traces Ultrapure water with HCl traces Ultrapure water with NH ₃ traces	OFF

Pictograph/display	Parameter	Selection/input	Comment	Factory setting
	Temperature coefficient	xx.xx %/K	Input of temperature coefficient Only with temp compensation LIN	02.00 %/K
	Sensocheck	ON OFF	Sensor monitoring on or off	OFF
	PROFIBUS device address	0001 to 0126	Entry of PROFIBUS address of device. Be sure that the device is not communicating via PROFIBUS.	0126

Tab. 8.1: Configuration parameters

8.7 Calibration

Calibration procedures (configurable)

- Calibration by specifying the cell constant of the sensor used (See Page 31)
- Calibration with calibration solution (See Page 32)
- Adjustment of temperature probe (See Page 33)

Information on calibration

Calibration is performed by entering the cell constant or by determining the cell constant with a known calibration solution under consideration of the temperature.



All calibration procedures must be performed by trained personnel.



Incorrectly set parameters may go unnoticed, but change the measuring properties.



The calibration is directly conducted on the device.
Calibration via PROFIBUS-PA is not provided.



During calibration the Transmitter remains in the Hold state for reasons of safety.



In the case of an incorrect input "Err" is displayed for approx. 3 sec. The incorrect parameters cannot be stored. Input must be repeated.



For keypad functions see Page 25.

Calibration by input of cell constant

The following steps must be executed:



- Activate calibration



- Enter mode code "1100"



- Confirm entry



Welcome text 3 sec



- Enter cell constant
- The lower display shows the conductivity value.



A change in the cell constant also changes the conductivity value.



When there has not been an entry for 6 sec, the lower display alternately shows the conductivity and temperature value.



- Confirm cell constant



- End the Hold state

After 20 sec (for measured value stabilization) the Transmitter returns to measuring mode.

Calibration with calibration solution



Be sure to use known calibration solutions and the respective temperature-corrected conductivity values (See "Calibration solutions" Page 56).



During the calibration procedure the temperature must be kept constant.

The following steps must be executed:



- Activate calibration



- Enter mode code "1100"



- Confirm entry



Welcome text 3 sec



- Immerse sensor in calibration solution



When there has not been an entry for 6 sec, the lower display alternately shows the conductivity and temperature value.

- Read the conductivity value corresponding to the displayed temperature from the table of the calibration solution used (See "Calibration solutions" Page 56)



- Change cell constant until the display shows the conductivity value from the table



- Confirm cell constant



- End the Hold state

After 20 sec (for measured value stabilization) the Transmitter returns to measuring mode.

Adjustment of temperature probe



Especially for Pt 100 temperature probes, it is advisable to perform an adjustment.

The following steps must be executed:



- Activate calibration



- Enter mode code "1015"



- Confirm entry



Welcome text 3 sec

- Measure the temperature of the process medium using an external thermometer



- Enter the determined temperature value in the main display



The lower display shows the measured temperature without adjustment. If this value is taken over for the upper display, the adjustment is without effect.



- Confirm the temperature value



- End the Hold state

After 20 sec (for measured value stabilization) the Transmitter returns to measuring mode.

8.8 Operating tool

For parameter setting, commissioning and diagnostics of the Transmitter via PROFIBUS, we recommend operating tools such as SIMATIC-PDM Version 5 or higher.

The current device description is included.

8.9 Measurement

Measuring mode

In the measuring mode the main display shows the configured process variable and the lower display the temperature.



The Transmitter returns to measuring mode, also from configuration or calibration mode (after a relax time for measured-value stabilization, if required).

Cal Info

"Cal Info" shows the current cell constant.



- Activate "Cal Info" function



- Mode code



- Confirm

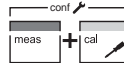
The current cell constant is displayed for approx. 20 sec.



- End "Cal Info"

Error Info

"Error info" shows the most recent error message.



- Activate "Error Info" function



- Mode code



- Confirm

The error message is displayed for approx. 20 sec. After that the message will be deleted.



- End error info

9 Diagnostics

9.1 Sensoscheck, Sensoface

Sensoscheck continuously monitors the sensor.

Sensoscheck can be switched off.



Sensoface provides information on the sensor condition.

The monitoring function alerts for significant sensor polarization or excessive cable capacitance caused by an unsuitable cable or a cable that is too long.



A friendly Smiley can only be displayed when Sensoscheck has been activated.



The Sensoface status does not influence the measured value display.

9.2 PROFIBUS-PA limit monitoring

The Transmitter is equipped with two limit blocks that can be separately configured for the process variables conductivity, salinity or temperature.

Configuration is only performed via the bus.

The limit conditions are transmitted cyclically.

Hysteresis, effective direction, on and off delay can be configured.



Limit value setting and output of limit messages is via the PROFIBUS-PA.



When this symbol is displayed, limit block 1 is active.



When this symbol is displayed, limit block 2 is active.

9.3 Error messages

When one of the following error messages is displayed, the device can no longer determine the measured variable correctly.



The alarm response time is permanently set to 10 sec.



During an error message the red alarm LED beneath the display flashes.











The error messages in the display are sorted according to their priority. A higher-priority message overlays a lower-priority message.





Error No.	Display (flashing)	Problem	Possible causes
Err 01	1179 _{mS}	Sensor	<ul style="list-style-type: none"> - Wrong cell constant - Conductivity ≥ 1000 mS/cm - SAL > 45 ‰ - Sensor connection or cable defective
Err 02	1179 _{mS}	Sensor	<ul style="list-style-type: none"> - Unsuitable sensor
Err 03		Temperature probe	<ul style="list-style-type: none"> - Outside temp range - Outside temp range for TC - Outside temp range for TC
Err 33		Sensocheck	<ul style="list-style-type: none"> - Wrong sensor - Sensor defective - Connecting cable too long or unsuitable - Connection cable or electrode cap defective - Connection terminals or electrode cap dirty
Err 98	CONF	System error	<ul style="list-style-type: none"> - Memory error in device program - Measured value transmission defective - Configuration or calibration data defective • Completely reconfigure and calibrate the device

Error No.	Display (flashing)	Problem	Possible causes
Err 99	FAIL	Factory settings	<ul style="list-style-type: none">- EEPROM or RAM defective- Error in factory settings <p>This error message normally should not occur as the data are protected from loss by multiple safety functions.</p> <ul style="list-style-type: none">• Send in the device for repair and recalibration.

Tab. 9.1: Error messages

9.4 Display messages and PROFIBUS communication

User interface / display of device				Cause	Communication via PROFIBUS					
Display pictograph	Display message	Sensoface	LED	Comments (see Page 37)	No. of binary message (logbook)	Analog input status	Physical Block (PB) Global status	Text of binary message (factory setting)	Logbook entry (factory setting)	
	Err 99		X	Factory settings defective	1	0000 11xx	Failure	ERR SYSTEM	X	
	Err 98		X	Configuration data defective, Gaincheck	2	0000 11xx	Failure	ERR PARAMETERS	X	
	Err 98		X	Memory error (RAM, ROM, EPROM)	3	0000 11xx	Failure	ERR MEMORY	X	
	Err 01		X	Cond, sal range violation	4	0101 01xx	Failure	ERR MEAS VALUE	X	
	Err 02		X	Conductance range violation	5	0100 0111 0100 1111	Failure	ERR COND VALUE	X	
	Err 03		X	Temp range violation Temperature probe	6	0100 0111 0100 1111	Failure	ERR TEMP VALUE	X	
	Err 33		X	Sensocheck	7	0100 0111 0100 1111	Failure	CHK SENSOR	X	

User interface / display of device				Cause	Communication via PROFIBUS				
Display pictograph	Display message	Sensolace	LED	Comments (see Page 37)	No. of binary message (logbook)	Analog input status	Physical Block (PB) Global status	Text of binary message (factory setting)	Logbook entry (factory setting)
				Cell constant	8	1010 01xx	Maintenance req.	CHK SLOPE	X
				Calibration	9	0100 0111 0100 1111	Function check	CAL RUNNING	X
				Configuration	10	1010 00xx	Function check	CONF RUNNING	X
				HOLD (Device state = Maintenance)	11	0100 0111 0100 1111	Function check	HOLD	X
				HI_HI_LIM FB analysis Cond/MΩ/SAL	12	1000 1110	Limit 1 Bit 1	HI_HI_LIMIT COND HI_HI_LIMIT MOcm HI_HI_LIMIT SAL	
				HI_LIM FB analysis Cond/MΩ/SAL	13	1000 1010	Limit 1 Bit 2	HI_LIMIT COND HI_LIMIT MOhm cm HI_LIMIT SAL	
				LO_LIM FB analysis Cond/MΩ/SAL	14	1000 1001	Limit 1 Bit 3	LO_LIMIT COND LO_LIMIT MOhm cm LO_LIMIT SAL	
				LO_LO_LIM FB analysis Cond/MΩ/SAL	15	1000 1101	Limit 1 Bit 4	LO_LO_LIMIT COND LO_LO_LIMIT MOcm LO_LO_LIMIT SAL	

User interface / display of device				Cause	Communication via PROFIBUS				
Display pictograph	Display message	Sensoface	LED	Comments (see Page 37)	No. of binary message (logbook)	Analog input status	Physical Block (PB) Global status	Text of binary message (factory setting)	Logbook entry (factory setting)
				HI_HI_LIM FB temperature	16	1000 1110	Limit 2 Bit 1	HI_HI_LIMIT TEMP	
				HI_LIM FB temperature	17	1000 1010	Limit 2 Bit 2	HI_LIMIT TEMP	
				LO_LIM FB temperature	18	1000 1001	Limit 2 Bit 3	LO_LIMIT TEMP	
				LO_LO_LIM FB temperature	19	1000 1101	Limit 2 Bit 4	LO_LO_LIMIT TEMP	
				Logbook empty	20		Function check	EMPTY LOGBOOK	

9.5 Diagnostics functions

Cal Info

"Cal Info" shows the current cell constant.



- Activate "Cal Info" function



- Mode code



- Confirm

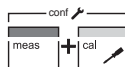
The current cell constant is displayed for approx. 20 sec.



- End "Cal Info"

Error Info

"Error Info" shows the most recent error message.



- Activate "Error Info" function



- Mode code



- Confirm

The error message is displayed for approx. 20 sec. After that the message will be deleted.



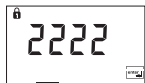
- End "Error Info"

Test mode

In the "Test Mode" you can check the equipment for correct conductivity and temperature measurement using a resistor.



- Activate "Test Mode" function



- Enter mode code "2222"



- Confirm entry

The equivalent resistance value is shown in the main display in $k\Omega$:

- Without consideration of cell constant ($c = 1$)
- Without TC conversion ($TC = 0$)
- Display in the case of a resistance value $\geq 2 M\Omega$

OPEN

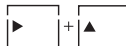


- End "Test Mode"

The device is in Hold state.

GainCheck manual 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 manual 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.

10 Maintenance and Cleaning

10.1 Maintenance

The Transmitter contains no user repairable components.

10.2 Cleaning

To remove dust, dirt and spots, the external surfaces of the Transmitter may be wiped with a soft cloth moistened with water.

A mild household cleaner may also be used if necessary.

11 Appendix

11.1 Product line

Devices

Model designation	Ref. No.
Transmitter Cond 7100 PA for hazardous- and safe-area applications	52121047

Mounting accessories

Accessories	Ref. No.
Pipe-mount kit ZU 0274	52120741
Panel-mount kit ZU 0275	52120740
Protective hood ZU 0276	52120739

11.2 Specifications

General

Manufacturer / ID	Mettler-Toledo GmbH / METT
Model designation / ID	Transmitter Cond 7100 PA / 7533

Applications

Conductivity and temperature measurement
--

Input

Process variable	Cond input 2-/4- electrode sensors	Ranges	Conductivity	0.2 $\mu\text{S}\cdot\text{c}$ to 1000 $\text{mS}\cdot\text{c}$ ^{b)}	
		Display range ^{a)}	Conductivity	0.000 to 9.999 $\mu\text{S}/\text{cm}$	
				00.00 to 99.99 $\mu\text{S}/\text{cm}$	
				000.0 to 999.9 $\mu\text{S}/\text{cm}$	
				0.000 to 9.999 $\mu\text{S}/\text{cm}$	
				00.00 to 99.99 $\mu\text{S}/\text{cm}$	
				000.0 to 999.9 $\mu\text{S}/\text{cm}$	
		Resistivity	0.000 to 9.999 $\text{M}\Omega\cdot\text{cm}$		
			00.00 to 99.99 $\text{M}\Omega\cdot\text{cm}$		
	000.0 to 999.9 $\text{M}\Omega\cdot\text{cm}$				
	Salinity	0.0 to 45.0 ‰ (0 to 35 °C)			
	Temperature input ^{a)}	Temperature sensor ^{a)}	Pt100 / Pt1000 / NTC 30 $\text{k}\Omega$ / NTC 100 $\text{k}\Omega$ (2-wire connection, adjustable)		
		Measurement range	Pt100 / Pt1000	-20.0 to +150.0 °C / -4 to +302 °F	
			NTC 30 $\text{k}\Omega$ / NTC 100 $\text{k}\Omega$	-20.0 to +130.0 °C / -4 to +266 °F	
		Resolution	0.1 °C / 1 °F		
		Temperature compensation (reference temp 25 °C)	(LIN) linear characteristic	00.00 to 19.99 %/K	
			(NLF) nonlinear temperature compensation for natural waters to EN 27888 (0 to 36 °C)		
(-01-) Ultrapure water with NaCl traces (0 to 120 °C)					
(-02-) Ultrapure water with HCl traces (0 to 120 °C)					
(-03-) Ultrapure water with NH ₃ traces (0 to 120 °C)					

a) Configurable

b) c = cell constant

Accuracy (\pm 1 count)

Conductivity value	< 1 % of meas. value +0.4 $\mu\text{S}\cdot\text{cm}^{\text{a}}$
Temperature	< 0.5 K (for Pt 100 \pm 1 K, for NTC: Temp. > 100 °C < 1 K)

a) c = cell constant

Monitoring function

Sensor	Sensocheck (can be disabled)	Polarization detection
		Monitoring of cable capacitance

Sensor standardization

Standardization	Input of cell constant with simultaneous display of conductivity and temperature	
	Temperature probe adjustment	
	Adm. cell constant	0.0050 to 1.9999 cm^{-1}

Conditions for use

Temperature	Operation / environment	-20 to +55 °C	
	Transport / storage	-20 to +70 °C	
Electromagnetic compatibility	RFI suppression	EN 50 081-1, EN 61 326-1	
	Immunity to interference	EN 50 082-2, EN 61 326-1	
Ingress protection	Enclosure	IP65	
Explosion protection	ATEX	II 2(1) G EEx ia IIC T4, FISCO	
	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	
Data retention	Parameters and calibration data	> 10 years	EEPROM

Construction

Dimensions	Height	144 mm	
	Width	144 mm	
	Depth	105 mm	
Weight	Approx. 1 kg		
Material	PBT (polybutylene terephthalate)		
Color	Bluish gray	RAL 7031	
Assembly	Wall mounting		
	Post/pipe mounting	on pipe with 40 to 60 mm diameter on square post with 30 to 45 mm edge length	
	Panel mounting	Cutout to DIN 43 700	
Sealed against panel			
Electrical connection	Cable glands	3 breakthroughs	for included cable glands
		2 breakthroughs	for NPT 1/2" or Rigid Metallic Conduit or cable glands

Display and user interface

Display	LC display, 7-segment	Measured value display	Conductivity value, temperature
		3 Sensoface states	Good / average / poor
		5 mode indicators	meas / cal / alarm / online / conf
	Alarm LED	Error message	
	Display range	3 1/2-digit display	
Automatic selection (Resolution determined by selected range)			
Operation	5 keys	meas / cal / up / right / enter	
Operating tool	Device description (DD) implemented in SIMATIC PDM		

Remote interface

PROFIBUS-PA communication	Digital communication by current modulation of supply current Reading of device identification, measured values, status and message Reading and writing of parameter and configuration data	
	Protocol	PROFIBUS-PA (DPV1)
	Connection	Via segment coupler to SPC, PC, PCS
	Profile	PNO directive: PROFIBUS-PA, Profile for Process Control Devices, Version 3.0
	Physical interface	To IEC 1158-2
	Address range	1 to 126, default: 126
	Supply voltage	FISCO bus supply: 9 to 17.5 V Linear barrier: 9 to 24 V
	Current consumption	< 13.2 mA
	Max. current in case of fault (FDE)	< 17.6 mA



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:



II 2 (1) G EEx ia IIC T4

Zertifizierungsstelle ZELM Ex



Dipl.-Ing. Harald Zelm



Braunschweig, June 26, 2000

Sheet 1/3

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.

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Prüf- und Zertifizierungsstelle

ZELM Ex



SCHEDULE

(13)

(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_{max}	17,5 V	24 V
I_{lim}	200 mA	200 mA
P_{max}	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:
 $U_L = 11,8$ V
 $I_L = 145$ mA
 $P_s = 165$ mW
(trapezoidal 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

Sheet 2/3

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Prüf- und Zertifizierungsstelle

ZELM Ex



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:

$U_L = 5,9 \text{ V}$
 $I_L = 3,71 \text{ mA}$
 $P_L = 5,5 \text{ mW}$
(linear characteristic)

effective internal capacitance:

$C_i \leq 250 \text{ nF}$

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 electrostatic 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 Zeim








Braunschweig, June 26, 2000

Sheet 3/3

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		 Mettler-Toledo GmbH Process Analytics																								
		<small> Adresse: Im Hirsacker 15 (Industrie Nord), CH-8902 Urdorf, Schweiz Buchsadresse: Postfach, CH-8902 Urdorf Telefon: 01 736 22 11 Telefax: 01 736 26 38 E-Mail: mettler@mett.com Bank: Credit Suisse First Boston, Zurich (A/c. 0835-310501-21-90) </small>																								
Declaration of conformity Konformitätserklärung Déclaration de conformité		 0820																								
Wa/Wir/Nous	Mettler-Toledo GmbH, Process Analytics Im Hirsacker 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 7100 PA 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) normatif(s).																									
Explosionsschutzrichtlinie Explosion Protection / Protection contre les explosions	94/0/EG Prüf- und Zertifizierungsstelle ZELM ZELM 00 ATEX 0037 D-38124 Braunschweig, ZELM 0820																									
EMC Directive/EMV-Richtlinie Directive concernent la CEM Low-voltage directive/Niederspannungs-Richtlinie/ Directive basse tension	89/336/EWG SR 734.5, VEMV 73/23/EWG SR 734.26, NEV																									
Norm/Standard/Standard	<table border="0"> <tr> <td>EN 50 014:</td> <td>1997</td> <td></td> </tr> <tr> <td>EN 50 020:</td> <td>1994</td> <td></td> </tr> <tr> <td>DIN EN 50 081-1</td> <td>/ VDE 0839 Teil 81-1:</td> <td>1993-03</td> </tr> <tr> <td>DIN EN 50 082-2</td> <td>/ VDE 0839 Teil 82-1:</td> <td>1996-02</td> </tr> <tr> <td>DIN EN 61326</td> <td>/ VDE 0843 Teil 20:</td> <td>1998-01</td> </tr> <tr> <td>DIN EN 61326 / A1</td> <td>/ VDE 0843 Teil 20 / A1:</td> <td>1999-05</td> </tr> <tr> <td>EN 61010 Teil 1 / 03:93</td> <td>/ VDE 0411 Teil 1:</td> <td>1994-03</td> </tr> <tr> <td>EN 61010-1/A2 / 07:95</td> <td>/ VDE 0411 Teil 1 / A1:</td> <td>1995-05</td> </tr> </table>		EN 50 014:	1997		EN 50 020:	1994		DIN EN 50 081-1	/ VDE 0839 Teil 81-1:	1993-03	DIN EN 50 082-2	/ VDE 0839 Teil 82-1:	1996-02	DIN EN 61326	/ VDE 0843 Teil 20:	1998-01	DIN EN 61326 / A1	/ VDE 0843 Teil 20 / A1:	1999-05	EN 61010 Teil 1 / 03:93	/ VDE 0411 Teil 1:	1994-03	EN 61010-1/A2 / 07:95	/ VDE 0411 Teil 1 / A1:	1995-05
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DIN EN 61326	/ VDE 0843 Teil 20:	1998-01																								
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EN 61010 Teil 1 / 03:93	/ VDE 0411 Teil 1:	1994-03																								
EN 61010-1/A2 / 07:95	/ VDE 0411 Teil 1 / A1:	1995-05																								
Place and Date of Issue Ausstellungsort / - Datum Lieu et date d'émission	Urdorf, August 3, 2004																									
Mettler-Toledo GmbH, Process Analytics																										
 Waldemar Rauch General Manager PO Urdorf	 Christian Ziefky Head of Marketing																									
<small> Artikel Nr.: 52960172 KE Datum: 52960172KE-7100-PA-Internet-2.doc Sitz der Gesellschaft: Mettler-Toledo GmbH, Im Langsacker, CH-8906 Greifensee </small>																										

11.6 Calibration solutions

Potassium chloride solutions

Temperature [°C]	Concentration ^{a)}		
	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	

a) Data source: K. H. Hellwege (Editor), H. Landolt, R. Börnstein:
Zahlenwerte und Funktionen ..., Volume 2, Part. Volume 6

Tab. 11.1: Potassium chloride solutions, conductivity in mS/cm

Sodium chloride solutions

Temperature [°C]	Concentration		
	Saturated ^{a)}	0.1 mol/l ^{b)}	0.01 mol/l ^{b)}
0	134.5	5.786	0.631
1	138.6	5.965	0.651
2	142.7	6.145	0.671
3	146.9	6.327	0.692
4	151.2	6.510	0.712
5	155.5	6.695	0.733
6	159.9	6.881	0.754
7	164.3	7.068	0.775
8	168.8	7.257	0.796
9	173.4	7.447	0.818
10	177.9	7.638	0.839
11	182.6	7.831	0.861
12	187.2	8.025	0.883
13	191.9	8.221	0.905
14	196.7	8.418	0.927
15	201.5	8.617	0.950
16	206.3	8.816	0.972
17	211.2	9.018	0.995
18	216.1	9.221	1.018
19	221.0	9.425	1.041
20	226.0	9.631	1.064
21	231.0	9.838	1.087
22	236.1	10.047	1.111
23	241.1	10.258	1.135
24	246.2	10.469	1.159
25	251.3	10.683	1.183
26	256.5	10.898	1.207
27	261.6	11.114	1.232
28	266.9	11.332	1.256
29	272.1	11.552	1.281
30	277.4	11.773	1.306
31	282.7	11.995	1.331
32	288.0	12.220	1.357
33	293.3	12.445	1.382
34	298.7	12.673	1.408
35	304.1	12.902	1.434
36	309.5	13.132	1.460

a) Data source: K. H. Hellwege (Editor), H. Landolt, R. Börnstein:
Zahlenwerte und Funktionen ..., Volume 2, Part. Volume 6

b) Data source: Test solutions calculated according to DIN IEC 746-3

Tab. 11.2: Sodium chloride solutions, conductivity in mS/cm

11.7 Glossary

2-electrode sensor

Conductivity sensor with two electrodes. Suitable for measuring low conductivity values.

4-electrode sensor

Conductivity sensor with four (2 current and 2 voltage) electrodes. Suitable for measuring high conductivity values.

Conductance

Conductance $G [S] = 1 / R [\Omega]$

Conductivity

Conductivity $\kappa [S/cm] = G [S] \cdot c [1/cm]$

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 for the temperature. A special device variant is provided for electrodeless sensors.

FISCO Model (Fieldbus Intrinsically Safe 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. Within the defined limits, the line characteristics have no influence on the intrinsic safety.

GSD file (device database file)

Contains the communication features of slave devices. During commissioning it is loaded in the process control system.

PROFIBUS-DP (decentralized peripherals)

Standardized specification (EN 50 170) of an open fieldbus system for binary and analog signals of sensors and actuators. It has been designed for high-speed data exchange at the device level.

PROFIBUS-PA (process automation)

Open fieldbus standard for process automation. It makes use of the transmission technology to IEC 1158-2 approved for operation in hazardous locations, which at the same time allows the field devices to be powered over the bus.

SIMATIC-PDM

Tool developed by Siemens for projecting, configuring, commissioning and diagnostic of smart process analyzers. The Transmitter device description (DD) is implemented in the SIMATIC-PDM.

Temperature coefficient

With temperature compensation activated, the measured value is calculated to the value at the reference temperature using the temperature coefficient.

Temperature compensation

Calculates the measured conductivity value for a reference temperature.

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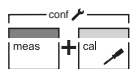
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