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Instruction Manual

Transmitter O_2 4100 PA

69955

METTLER TOLEDO

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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: 24.06.2005

Warranty

Defects occurring within 1year 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 24, 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 : 24.06.2005

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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 O_2 4100 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
  - InPro®
  - Sensocheck®
  - Sensoface®
  - Calimatic®
  - GainCheck®

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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 lead to danger for the operator or 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 O_2 4100 PA 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 O_2 4100 PA may only be connected to explosion-proof segment couplers, power supplies ....

The Transmitter O_2 4100 PA 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.

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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.
- 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 (PNO) provides for further development and maintenance of the PROFIBUS technology. It combines the interests of users and manufacturers.

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 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.

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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 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

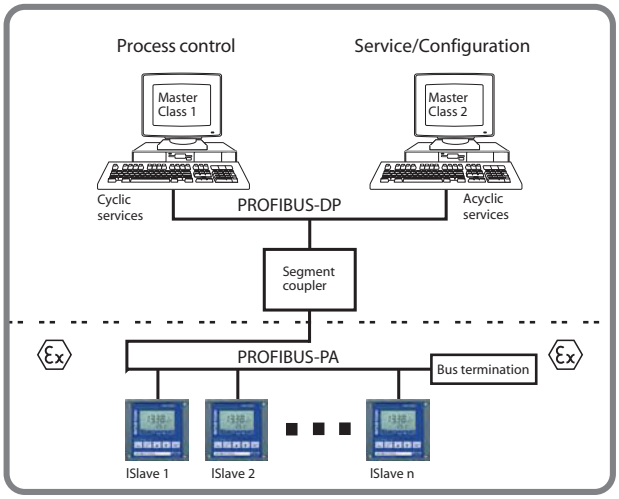


Fig. 3.1 Typical configuration of a PROFIBUS system with the Transmitter

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4 Description

4.1 Proper use

The Transmitter is a PROFIBUS-PA analyzer. The Transmitter is used for dissolved oxygen and temperature measurement in biotechnology, pharmaceutical industry, as well as in the field of environment, food processing and sewage treatment.

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

The Transmitter has been designed for application with amperometric sensors.

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.

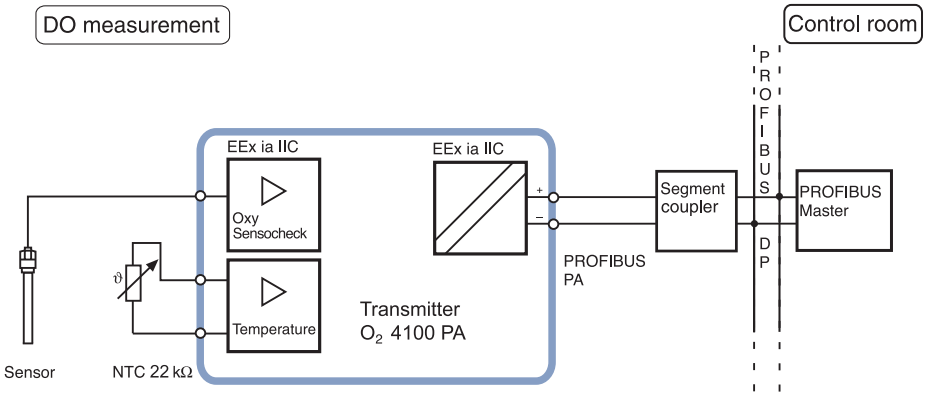


Fig. 4.1 System functions (hardware)

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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.

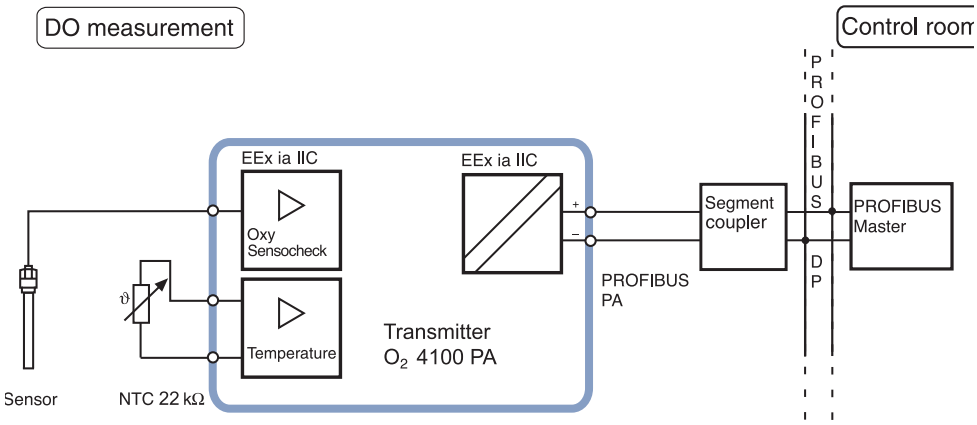


Fig. 4.2 Communication model Transmitter O_2 4100 PA according to the Profile for Process Control Devices (PNO)

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Type of block	Block contents (general)	Block contents (detailed)
Physical Block (PB)	Device description	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 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 Calibration data
Transfer Transducer Block	Pre-processing of a measured value	Measured value pre-processing Temperature compensation Selection of 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)

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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 Limit value message/status Signal inversion Fail-safe behavior
Transducer Alarm Block	Signaling of states and events	Required maintenance, function check, errors, limit values incl. summing
Logbook Function Block	Registration of states and events	Power on, power off, reset State of execution Navigation through entries

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

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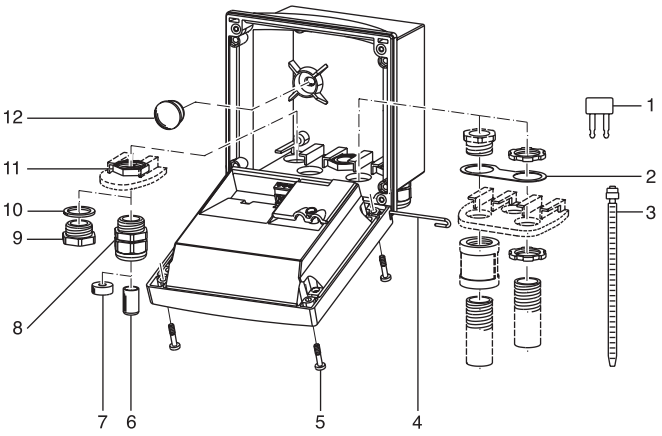
5 Assembly

5.1 Package contents and unpacking

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

The package should contain:

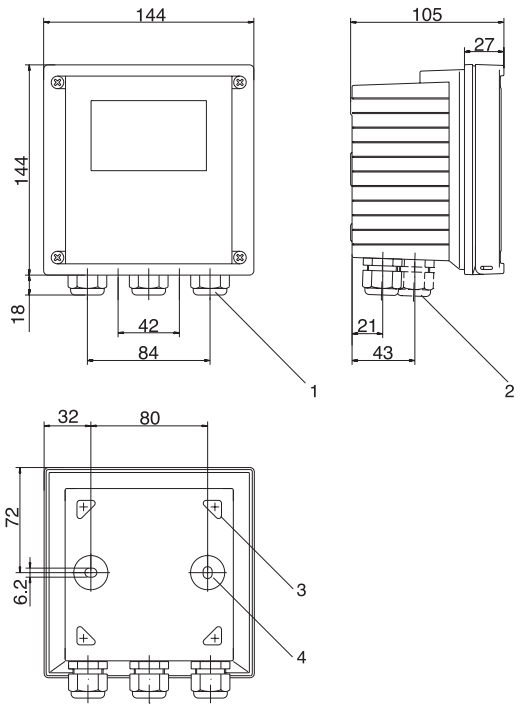
- Front unit of Transmitter
- Lower case
- This instruction manual
- Short instruction sheet
- Floppy disk with GSD file METT7533.GSD
- Bag containing small parts:



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 (3 pieces)
7 Rubber reducer (1 piece)
8 Cable glands (3 pieces)
9 Filler plugs (3 pieces)
10 Gaskets (3 pieces)
11 Hexagon nuts (3 pieces)
12 Sealing plugs (2 pieces): for sealing in case of wall mounting

Fig. 5.1 Assembling the enclosure

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1 Cable gland
(3 pieces)

2 Breakthroughs for cable gland or conduit 1/2", ø = 21.5 mm
(2 breakthroughs)

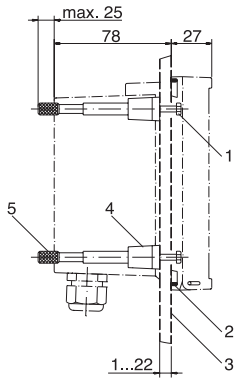
Cable glands and conduits not included!

3 Breakthroughs for pipe mounting
(4 breakthroughs)

4 Breakthroughs for wall mounting
(2 breakthroughs)

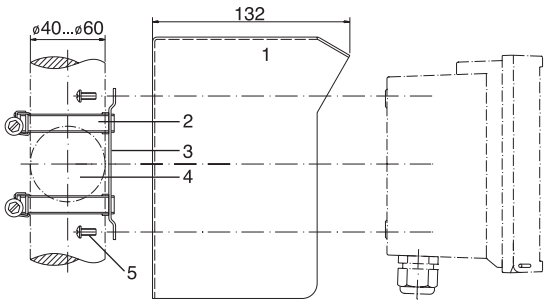
Fig. 5.2 Mounting plan

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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

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1 Protective hood

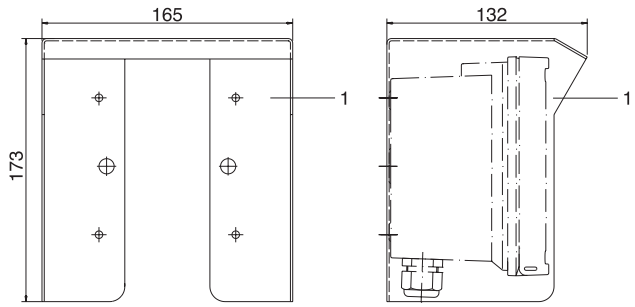


Fig. 5.5 ZU 0276 protective hood for wall and pipe mounting

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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 during installation.

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.

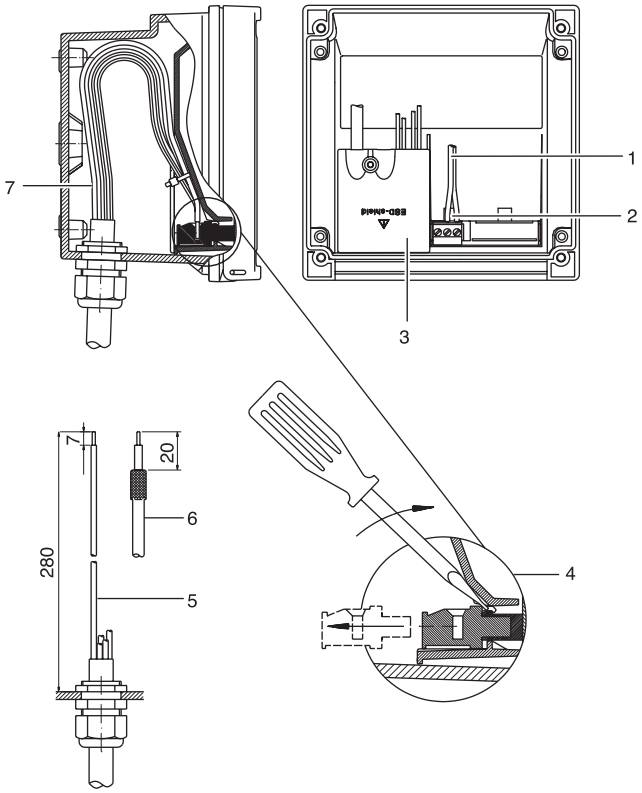
For easier installation, the terminal strips are of a plug-in design. The terminals are suitable for single wires and flexible leads up to 2.5 mm^2 (AWG 14).

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.

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1 Connection leads PROFIBUS-PA
2 Area for placing the screwdriver to pull out the terminals
3 Cover for DO sensor and temperature probe terminals
4 Pulling out the terminal blocks using a screwdriver
5 Recommended stripping lengths for multi-core cables
6 Recommended stripping lengths for coaxial cables
7 Cable laying in the device

Fig. 6.1 Information on installation

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6.2 Terminal assignments

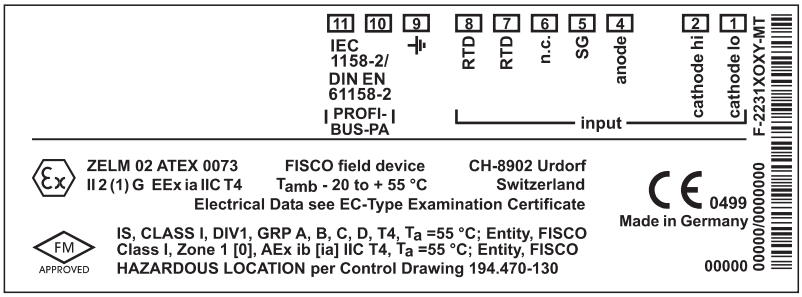
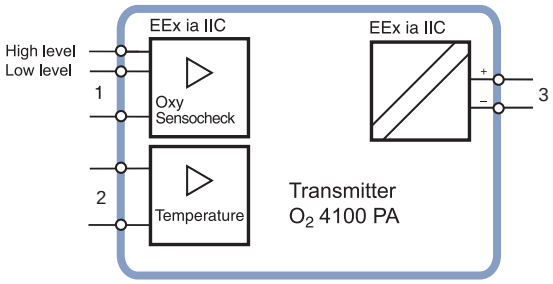


Fig. 6.2 Terminal assignments of the Transmitter

6.3 Overview of the Transmitter



1 Inputs for 2 different DO sensors
2 Input for temperature probe
3 PROFIBUS-PA, protected against polarity reversal

Fig. 6.3 Inputs and outputs

English

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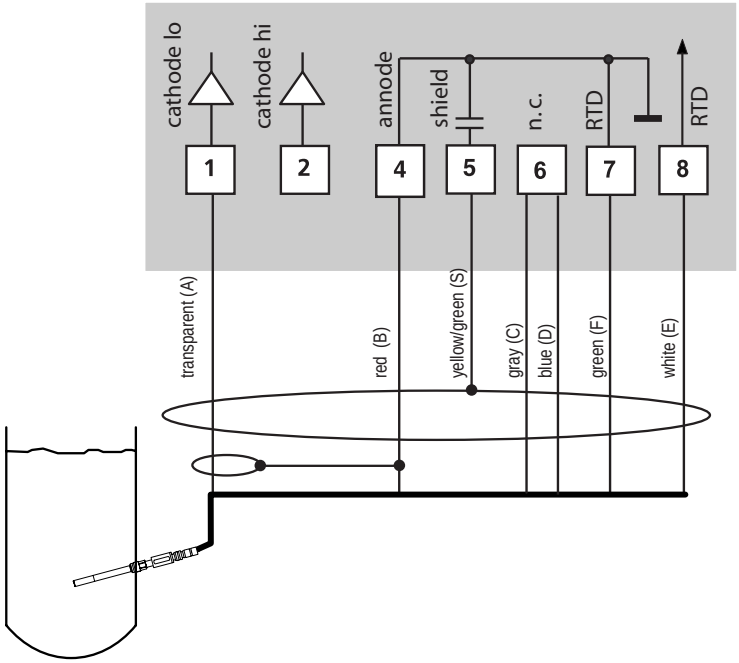


Fig. 6.4 Typical wiring of InPro 6900 trace sensor for low-level range (VP cable connection)

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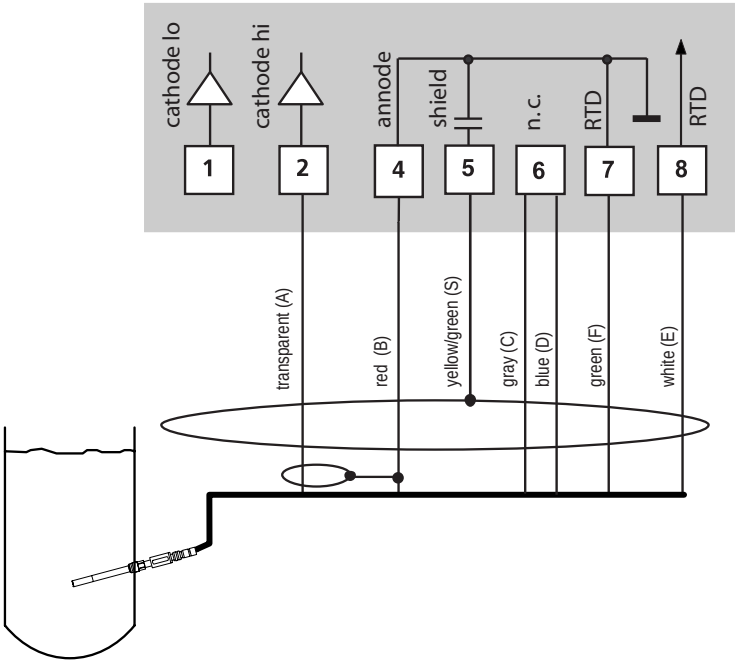


Fig. 6.5 Typical wiring of InPro 6800 sensor for high-level range (VP cable connection)

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7 Commissioning

7.1 Checklist



Commissioning may only be carried out by trained experts.



Before commissioning the Transmitter O 4100 PA, the following requirements must be met: [2]

- 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, ...

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8 Operation

8.1 Operation possibilities

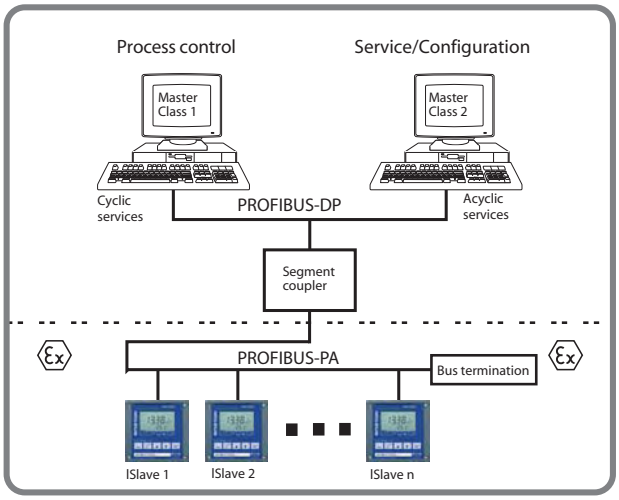
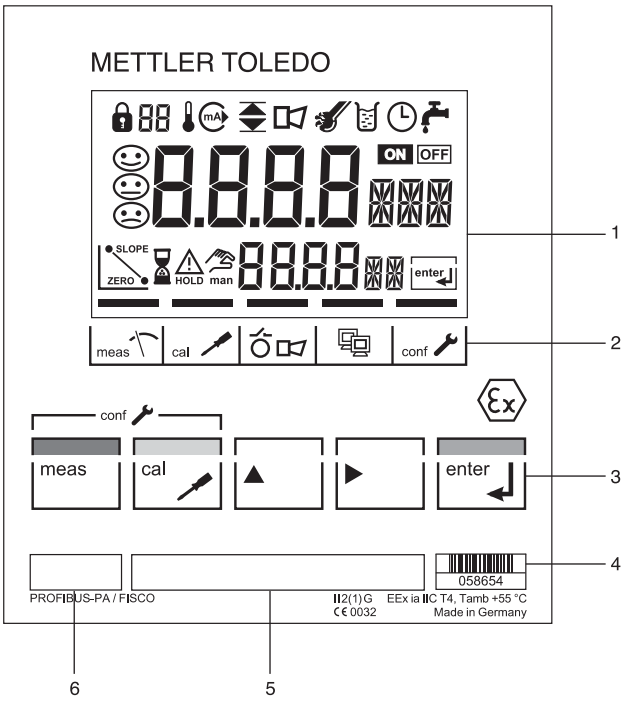


Fig. 8.1 System configuration

The device can be operated as follows:

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

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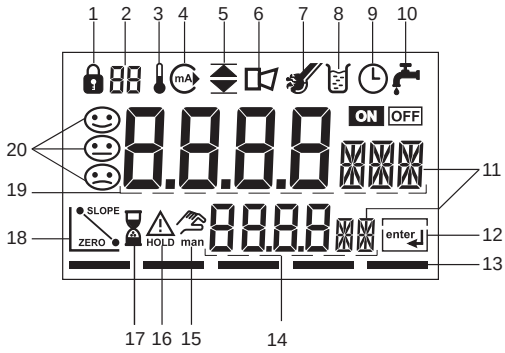


1 Display
2 Mode indicators (no keys)
- Measuring mode
- Calibration mode
- Alarm
- PROFIBUS-PA communication
- Configuration mode

3 Keypad
4 Coding
5 Rating plate
6 Model designation

Fig. 8.2 Front view of the Transmitter

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1	Mode code entry	11	Measurement symbols
2	Display of measured variable	12	Proceed with enter
3	Temperature	13	Bar for device status
4	Not connected	14	Lower display
5	Limit values	15	Manual temp indicator
6	Alarm	16	Hold state active
7	Sensocheck	17	Wait
8	Calibration	18	Sensor data
9	Interval/ response time	19	Main display
10	Not connected	20	Sensoface

Fig. 8.3 Transmitter display

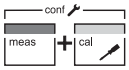
Keypad functions



Measurement



Calibration



Configuration



Select digit position
Selected position flashes



Change digit



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



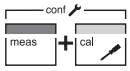
Further key combinations are explained in the respective function descriptions.

English

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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, 1001	Zero point calibration
cal, 1105	Product calibration



cal, 0000	Cal Info
cal, 1015	Adjusting temp probe
cal, 1100	Calibration mode
cal, 2222	Display sensor current (uncompensated)/ temperature

8.4 Safety functions

Sensocheck, Sensoface sensor monitoring

Sensocheck monitors the sensor and lines for short circuits or open connections.

Sensocheck can be switched off.



Sensoface provides information on the sensor condition.

The zero point, slope and response time during calibration are evaluated.

The three Sensoface indicators provide the user with information about wear and required maintenance of the sensor.

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.

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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 = Temp probe adjustment
  - Mode code 1100 = Calibration mode
  - Mode code 2222 = Display of sensor potential
- Configuration
  - Mode code 1200 = Configuration mode

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 device 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



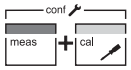
The Transmitter is in configuration mode.

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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



Welcome text 3 sec



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

For configurable parameters, see ”Configuration parameters” Page 27.



- Select or edit parameter



- Confirm entries



The configuration parameters are checked during the input.



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

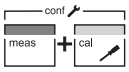


- End configuration

The measured value and Hold are displayed alternately.

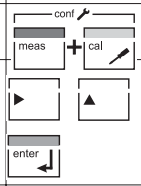
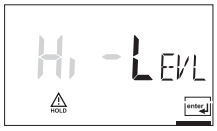
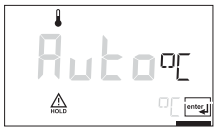


- End the Hold state / accept configuration or



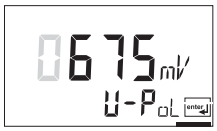
- Repeat configuration

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Display	Action	Choices	Factory setting
	Activate configuration (simultaneously press meas and cal)		
	Enter mode code “1200” (Press arrow key ▶ to select position, enter number using ▲ key, confirm with enter)		
	Device is in Hold state. • Select sensor (type A / B) Proceed with enter • Switch over: arrow keys • Proceed: enter key	Sensor Type A (general sensor) Sensor Type B (InPro6900) Low Level High Level	Type A Hi-Level
	Selection of variable to be displayed • Switch over: arrow keys • Proceed: enter key	With Low Level selected: µg/l • ppb • mg/l • ppm • % With High Level selected: mg/l • ppm • %	%
	Selection of process temp • Switch over: arrow keys • Proceed: enter key	man °C / man °F auto °C / auto °F BUS °C / BUS °F: -20 to +150 °C or -4 to +302 °F	Auto °C
	Selection of temp probe (NTC) • Switch over: arrow keys • Proceed: enter key	Only with Auto selected: 22 kΩ 30 kΩ	22 NTC

English

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Display	Action	Choices	Factory setting
	Selection of pressure measurement unit • Switch over: arrow keys • Proceed: enter key	BAR • PSI • KPA	BAR
	Selection of process pressure • Switch over: arrow keys • Proceed: enter key	0.000 to 9.999 bars	1.013 bars
	Selection of salinity • Switch over: arrow keys • Proceed: enter key	00.00 to 45.00 g/kg or %, resp.	00.00
	Selection of polarization voltage • Switch over: arrow keys • Proceed: enter key	0 mV to 800 mV (0 mV = Off)	675 mV
	Selection of Sensocheck On, Off • Switch over: arrow keys • Proceed: enter key	On Off	Off

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Display	Action	Choices	Factory setting
	Selection of calibration mode • Switch over: arrow keys • Proceed: enter key	- Saturation (Sat) - Concentration (Conc)	Conc
	Selection of cal timer interval		0000 (Off)
	Selection of bus address		126

Tab. 8.1: Configuration parameters

Configuration is circular. To stop, press meas key.

8.7 Calibration

Calibration is used to adapt the device to the DO sensor. Depending on the configuration, the device can be calibrated with regard to saturation or concentration. For each calibration mode, the Transmitter suggests useful calibration parameters. Of course, they can be edited as required.

Note:

When a 2-point calibration is required, the zero point calibration should be performed prior to saturation or concentration calibration, resp.

All calibration procedures must be performed by trained personnel.

During calibration, the output current is frozen, limit and alarm contacts are inactive.

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

If calibration is exited, the Transmitter remains in the Hold state for reasons of safety. The measured value and Hold are displayed alternately. Now you can check whether the measured value is plausible

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and specifically end the Hold state with enter or press cal to repeat calibration.

If you end the Hold state, the Transmitter will return to measuring mode after 20 sec (for the sensor to adjust).

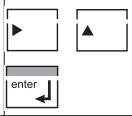
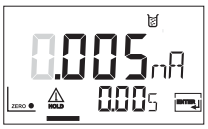
Zero point calibration

A zero point calibration is not required for most of the biotechnological processes. For these processes, we recommend to set the input current for the zero point to 0.0 nA and then perform a one-point calibration (saturation). If a zero point calibration is performed, the DO sensor should remain for at least 10 to 30 minutes in the calibration medium in order to obtain accurate values. A drift check is not performed.

Zero point current should be < 0.5 % of air current. The display (secondary: measured value, main: entered value) does not change until an input current is entered for the zero point.

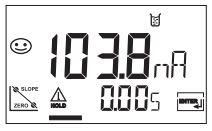
When measuring in an oxygen-free medium, the displayed current can be taken directly.

When the zero point has changed, the slope is automatically adjusted so that the 100% point remains valid.

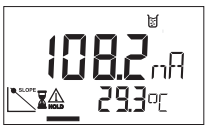
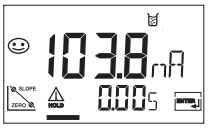
Display	Zero point calibration – Action	Selection / Remarks
	• Activate calibration (press cal key)	
1001	• Enter mode code “1001” (Press arrow key ▶ to select position, enter number using ▲ key, confirm with enter) • Place sensor in oxygen-free medium	
	Lower display: actually measured current Main display: value for zero point • Confirm with enter or correct using arrow keys and then confirm with enter	
	Display of slope Display of new zero point • Place sensor in process • End calibration with enter	After end of calibration, the Transmitter remains in Hold state for approx. 20 sec. The oxygen value is displayed.

Saturation calibration

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Display	Action	Selection / Remarks
	Select calibration, enter mode code “1100”	cal key, arrow keys
	• Enter relative humidity Default for aqueous media rH = 100 % • Proceed with enter	
	• Enter calibration pressure, proceed with enter Default: configured process pressure • If temperature display follows, temperature can be entered manually, see remarks • Proceed with enter	If "man" or "BUS" has been selected during configuration, the configured process temperature will be displayed. The internal temperature probe is not used.
	• Automatic drift check: Measurement Display of input current (temperature-compensated) and of measuring temp	Drift check can be stopped after > 10 sec by pressing cal (accuracy reduced).
	• Change default value if required	Default: last value entered
	• Display of new slope and zero point related to 25°C at 1013 mbars • End calibration with enter	After end of calibration, the oxygen value is displayed for approx. 20 sec. Then the Transmitter will return to measuring mode.

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Display	Action	Selection / Remarks
	Select calibration, enter mode code “1100”	cal key, arrow keys
	Place DO sensor in air for calibration • Enter relative humidity • Proceed with enter	Default for aqueous media rH = 50 %
	• Enter calibration pressure, proceed with enter • If temperature display follows, temperature can be entered manually, see remarks • Proceed with enter	Default: normal pressure 1013 mbars. If "man" or "BUS" has been selected during configuration, "25 °C" will be displayed. The internal temperature probe is not used.
	• Measurement Display of input current (temperature-compensated) and of measuring temp	Drift check can be stopped after > 10 sec by pressing cal (accuracy reduced).
	• Default value calculated from rel. humidity, cal pressure and cal temp (theoretical concentration for saturation)	Edit default value if required.
	Display of new slope and zero point related to 25°C at 1013 mbars • End calibration with enter	After end of calibration, the oxygen value is displayed for approx. 20 sec. Then the Transmitter will return to measuring mode.

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Display	Action	Selection / Remarks
	Select calibration, enter mode code “1105”	cal key, arrow keys
	Product calibration 1st step	Display (approx. 3 sec)
	• Take sample and store value • Proceed with enter	Now the sample can be measured in the lab. The Transmitter is in measuring mode.
	• Measuring mode While the sample value is determined, the device is in measuring mode. From the flashing CAL mode indicator you see that sample calibration has not been terminated.	
	• When the sample value has been determined, call up the product calibration once more (CAL key, mode code 1105). Product calibration 2nd step	Display (approx. 3 sec)
	Enter lab value. The new slope is calculated. Then zero point and slope are displayed as for ordinary calibration.	Arrow keys

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Wrong settings change the measurement properties!

The following steps must be executed:

- Activate calibration
- Enter mode code “1015” and confirm
- Measure the temperature of the process medium using an external thermometer



A welcome text ("CAL TMP") is displayed for 3 sec.

- Then enter the determined temperature value in the main display (arrow keys)

If the value of the main display is set to the value of the secondary display, a correction is not made.

- Confirm with enter

HOLD

HOLD will be deactivated after 20 sec.

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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 slope and zero point current.



- Activate "Cal Info" function



- Mode code



- Confirm

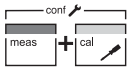
"Cal Info" shows the current calibration data for approx. 20 sec.



- 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"

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9 Diagnostics

9.1 Sensocheck, Sensoface

Three Smileys provide information on wear and required maintenance. This does not affect the measurement process.



Sensoface provides information on the status of the sensor.

The zero point, slope and response time during calibration are evaluated.

A Smiley can only be displayed when Sensocheck has been activated.



The basis for accurate Sensoface indication is proper calibration.



The worsening of a Sensoface criterion leads to the devaluation of the Sensoface indicator (average/poor).



An improvement of the Sensoface indicator can only take place after calibration or removal of a sensor defect.



The Sensoface status does not influence the measured value display.

Sensoface displays

Display	Problem	Status	
	Sensor response time		The sensor adjusts slowly to the measured value. Maybe it has not been polarized sufficiently. You should consider replacing the membrane module and electrolyte.
			The sensor adjusts very slowly to the measured value. Correct measurement is no longer ensured. If this occurs in spite of sufficient polarization, you should replace the membrane module and electrolyte.
	Slope		Sensor slope is still okay. However, membrane module and electrolyte should be replaced soon.
			Sensor slope has reached a value which no longer ensures proper measurement. You should replace membrane module and electrolyte.

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Display	Problem	Status	
	Calibration timer		Over 80 % of the calibration interval has already past.
			The calibration interval has been exceeded.
	Sensor defect		Check membrane module and electrolyte and the sensor connections.

Tab. 9.1: Sensoface display

9.2 PROFIBUS-PA limit monitoring

The Transmitter is equipped with two limit blocks that can be separately configured for temperature and/or the process variable.

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.

English

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9.3 Error messages

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

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

The alarm response time is permanently set to 10 sec.

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	550 %o	DO sensor	- Sensor defect - Incorrect sensor connected - Measurement range (%) exceeded Current range (mA) exceeded
Err 02	55 mg/l	DO sensor	- Sensor defect - Measured concentration value lower than 0 mg/l (ppm) or higher than 50 mg/l (ppm)
Err 03		Temperature probe	- Open or short circuit in temperature probe - Measured temperature below -10 °C or above +150 °C
Err 33		DO sensor	- Membrane defective
Err 98	ConF	System error	- Configuration or calibration data defective; completely reconfigure and recalibrate the device - Memory error in device program (PROM defective)
Err 99	FAIL	Factory settings	- EEPROM or RAM defective This error message only occurs in the case of a complete defect. The Transmitter must be repaired and recalibrated at the factory.

Tab. 9.2: Error messages

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Calibration error messages only occur during calibration.

Display (flashing)	Problem	Possible causes
	Sensor slope out of range	- Wrong calibration values specified (relative humidity, pressure, saturation, concentration)
	Calibration was canceled after approx. 12 minutes, because the sensor drift was too large.	- Sensor defective or dirty - No electrolyte in the sensor - Sensor cable insufficiently shielded or defective - Strong electric fields influence the measurement - Temperature fluctuation of calibration solution

Tab. 9.3: Calibration error messages

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User interface / display of device				Cause	Communication via PROFIBUS				
Display pictograph	Display message	Sensoface	LED	For comments see Pg 38 through Pg 39	No. of binary message (logbook)	Analog input status	Physical Block (PB) Global status	Text of binary message (factory setting)	Logbook entry (factory setting)
FAIL	Err 99		X	Factory settings defective	1	0000 11xx	Failure	ERR SYSTEM	X
ConF	Err 98		X	Configuration data defective, Gaincheck	2	0000 11xx	Failure	ERR PARAMETERS	X
ConF	Err 98		X	Memory error (RAM, ROM, EPROM)	3	0000 11xx	Failure	ERR MEMORY	X
	Err 01		X	Measurement range violation	4	0100 0111 0100 1111	Failure	ERR SAT VALUE	X
	Err 02		X	Measurement range violation	5	0100 0111 0100 1111	Failure	ERR CONC VALUE	X
	Err 03		X	Temp range violation Temperature probe	6	0100 0111 0100 1111	Failure	ERR TEMP VALUE	X
	Err 33		X	Membrane defective	7	0100 0111 0100 1111	Failure	ERR SENSOCHECK	X

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User interface / display of device				Cause	Communication via PROFIBUS				
Display pictograph	Display message	Sensoface	LED	For comments see Pg 38 through Pg 39	No. of binary message (logbook)	Analog input status	Physical Block (PB) Global status	Text of binary message (factory setting)	Logbook entry (factory setting)
				Zero point/ Slope	8	0101 00xx	Mainte-nance required	CHK ZERO/SLOPE	X
				Sensor response time	9	0101 00xx	Mainte-nance required	CHK EL. RESPONSE	X
				Calibration timer Cal prompt	10	0101 00xx	Mainte-nance required	CAL REQUIRED	X
				Calibration	11	0100 0111 0100 1111	Function check	CAL RUNNING	X
				Configuration	12	0100 0111 0100 1111	Function check	CONF RUNNING	X
				HOLD (Device state = Mainte-nance)	13	0100 0111 0100 1111	Function check	HOLD	X
				HI_HI_LIM FB analysis	14	1000 1110	Limit 1 Bit 1	HI_HI_LIMIT OXY	
				HI_LIM FB analysis	15	1000 1010	Limit 1 Bit 2	HI_LIMIT OXY	
				LO_LIM FB analysis	16	1000 1001	Limit 1 Bit 3	LO_LIMIT OXY	

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User interface / display of device				Cause	Communication via PROFIBUS				
Display pictograph	Display message	Sensoface	LED	For comments see Pg 38 through Pg 39	No. of binary message (logbook)	Analog input status	Physical Block (PB) Global status	Text of binary message (factory setting)	Logbook entry (factory setting)
				LO_LO_LIM FB analysis	17	1000 1101	Limit 1 Bit 4	LO_LO_LIMIT OXY	
				HI_HI_LIM FB temperature	18	1000 1110	Limit 2 Bit 1	HI_HI_LIMIT TEMP	
				HI_LIM FB temperature	19	1000 1010	Limit 2 Bit 2	HI_LIMIT TEMP	
				LO_LIM FB temperature	20	1000 1001	Limit 2 Bit 3	LO_LIMIT TEMP	
				LO_LO_LIM FB temperature	21	1000 1101	Limit 2 Bit 4	LO_LO_LIMIT TEMP	
				Logbook empty	22		Function check	EMPTY LOGBOOK	

Tab. 9.4: Display messages and PROFIBUS communication

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Cal Info

"Cal Info" shows the slope and zero point current.



- Activate "Cal Info" function



- Mode code



- Confirm

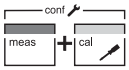
The current calibration data are displayed for approx. 20 sec.



- 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"

Display of sensor current

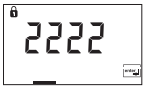


This symbol indicates that the temperature will be manually specified.

During sensor maintenance it is useful to directly indicate the sensor current. This allows, for example, to check sensor response after cleaning.



- Select function



- Enter mode code "2222"



- Confirm

The sensor current is displayed.



- End display mode



During sensor current display the Transmitter is in the Hold state.

English

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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.

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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.

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11 Appendix

11.1 Product line

Devices

Model designation	Ref. No.
Transmitter O_2 4100 PA for hazardous- and safe-area applications	52 121 091

Mounting accessories

Accessories	Ref. No.
ZU 0274 pipe-mount kit	52 120 741
ZU 0275 panel-mount kit	52 120 740
ZU 0276 protective hood	52 120 739

11.2 Specifications

General specifications

Manufacturer / ID	Mettler-Toledo GmbH / METT
Model designation / ID	Transmitter O_2 4100 PA / 2533

Applications

Measurement of dissolved oxygen and temperature

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DO input	Sensor Type A (High Level):	InPro 6800
	Sensor Type B (Low Level):	InPro 6900
Range 1 (low level)	Measuring current	-2 to +600 nA, resolution 10 pA
	Saturation (-10 °C to +80 °C)	0.0 to 120.0 %
	Meas. error[1,2,3]	0.5 % meas. value + 0.1 % saturation
	Concentration (-10 °C to +80 °C)	0000 to 9999 µg/l 0000 to 9999 ppb 0000 to 9999 ppm 0000 to 9999 mg/l
	Meas. error[1,2,3]	0.5 % meas. value + 5 µg/l or 5 ppb, resp.
Range 2 (high level)	Measuring current	-2 to +1800 nA, resolution 30 pA
	Saturation (-10 °C to +80 °C)	0 to 500 %
	Meas. error[1,2,3]	0.5 % meas. value + 0.5 % saturation
	Concentration (-10 °C to +80 °C)	0.0 to 50.00 mg/l 0.0 to 50.00 ppm
	Meas. error[1,2,3]	0.5 % meas. value + 50 µg/l or 50 ppb, resp.
Polarization voltage	0 to 1000 mV	
Process pressure	0.000 to 9.999 bars 999.9 kPa 145.0 psi	
Salt correction	0.00 to 45.00 g/kg	
Sensocheck	Monitoring for short circuits or open circuits (can be disabled)	

English

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Sensor standardization (cal)	Zero point calibration Calibration with entry of oxygen saturation Calibration with entry of oxygen concentration at saturation Product calibration	
Calibration range	Zero	± 2 nA
	Slope	Sensor Type A: 25 to 130 nA Sensor Type B: 200 to 550 nA (InPro6900)
Cal timer*	0 to 9999 h	
Pressure correction	Calibration pressure to be entered manually or via PROFIBUS	
Temperature input	NTC 22kΩ or NTC 30 kΩ, 2-wire connection, ± 5 K adjustable	
Range	-20.0 to +150.0 °C / -4 to +302 °F	
Resolution	0.1 °C / 1 °F	
Meas. error[1,2,3]	< 0.5 K (< 1 K bei > 100 °C)	
Temperature compensation	Automatic with NTC or manual temperature	
Logbook	Recording of error messages	
Storage capacity	40 entries, can be read out via Profibus (see profile description)	
Limit values	Cyclical discrete signal (DI) via Profibus (see profile description) User-defined via Profibus for: Oxygen saturation Oxygen concentration Temperature	
Alarms and messages	Binary messages to PNO profile 3.0 Signalling via PROFIBUS and logbook entry	

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

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Conditions for use

Temperature	Operation	-20 to +55 °C	
	Transport and storage	-20 to +70 °C	
Electromagnetic compatibility	Emitted interference	EN 61 326 Class B	
	Immunity to interference	EN 61 326, EN 61 326/A1	
Ingress protection	Enclosure	IP 65	
Explosion protection	PROFIBUS-PA according to FISCO model of PTB	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 terephtalate)
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

English

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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	µg/l, mg/l, ppb, ppm, %, temperature
		3 Sensoface states	Good / average / poor
		5 mode indicators	meas / cal / alarm / online / conf
	Alarm LED	Error message	
Operation	5 keys	meas / cal / up / right / enter	
Operating tool		Device description (DD) implemented in SIMATIC PDM	

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

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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 02 ATEX 0073

(4) Equipment: **O_2 - Transmitter Typ 4100 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 0370112102.

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

EN 50 014: 1997+A1+A2 **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, Januar, 08. 2002

Sheet 1/3

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Prüf- und Zertifizierungsstelle

ZELM Ex

(13) **SCHEDULE**

(14) **EC-TYPE-EXAMINATION CERTIFICATE ZELM 02 ATEX 0073**

(15) Description of equipment

The O2 - Transmitter Typ 4100 PA with Profibus – PA – communication interface is preferably used for the recognition and processing of electrochemical quantities and is equipped with an input for measurements of the oxygen partial pressure 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 resp. — EEx ia IIC/IIB / EEx ib IIC/IIB

for the connection to a certified intrinsically safe circuit only (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

Oxygen measuring loop (terminals 1/2, 4 and 5)

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

maximum values:

$U_o = 10$ V
$I_o = 11$ mA
$P_o = 14$ mW
$R = 475$ Ω
(linear characteristics)

	IIC	resp.	IIB
max. permissible external inductance	1 mH		5 mH
max. permissible external capacitance	925 nF		4 µF

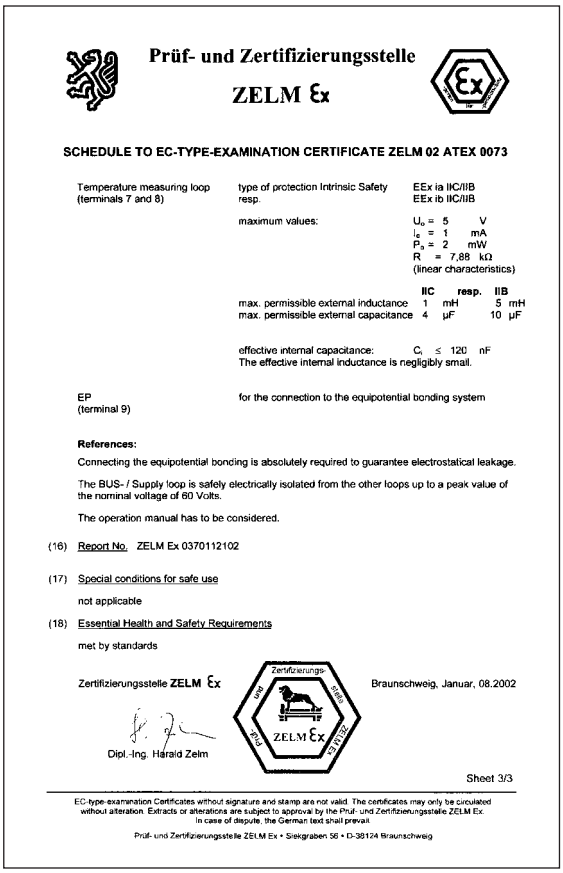
effective internal capacitance: $C_i \leq 25$ nF
The effective internal inductance is negligibly small.

Sheet 2/3

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ZELM Ex

SCHEDULE TO EC-TYPE-EXAMINATION CERTIFICATE ZELM 02 ATEX 0073

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 V I_o = 1 mA P_o = 2 mW R = 7,88 kΩ (linear characteristics)

	IIC	resp.	IIB
max. permissible external inductance	1	mH	5 mH
max. permissible external capacitance	4	µF	10 µF

effective internal capacitance: $C_i \leq 120$ nF
The effective internal inductance is negligibly small.

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 peak value of the nominal voltage of 60 Volts.

The operation manual has to be considered.

(16) Report No. ZELM Ex 0370112102

(17) Special conditions for safe use

not applicable

(18) Essential Health and Safety Requirements

met by standards

Zertifizierungsstelle **ZELM Ex** Braunschweig, Januar, 08.2002

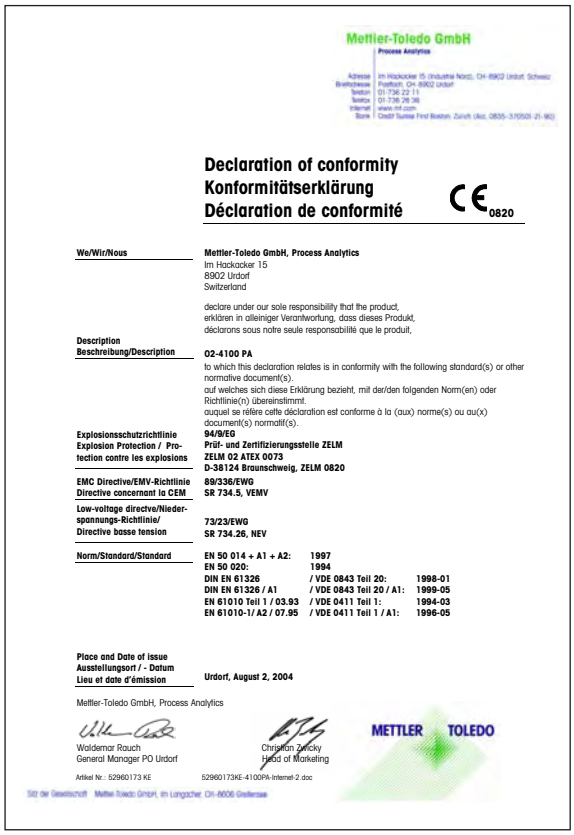
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Sheet 3/3

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Declaration of conformity
Konformitätserklärung
Déclaration de conformité

CE 0820

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Explosionsschutzrichtlinie **Explosion Protection / Protection contre les explosions**	**94/9/EG** **Prüf- und Zertifizierungsstelle ZELM** **ZELM 02 ATEX 0073** **D-38124 Braunschweig, ZELM 0820**
EMC Directive/EMV-Richtlinie **Directive concernant la CEM**	**89/336/EWG** **SR 734.5, VEMV**
Low-voltage directve/Niederspannungs-Richtlinie/ **Directive basse tension**	**73/23/EWG** **SR 734.26, NEV**
Norm/Standard/Standard	**EN 50 014 + A1 + A2: 1997** **EN 50 020: 1994** **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: 1996-05**
Place and Date of issue **Ausstellungsort / - Datum** **Lieu et date d'émission**	**Urdorf, August 2, 2004**

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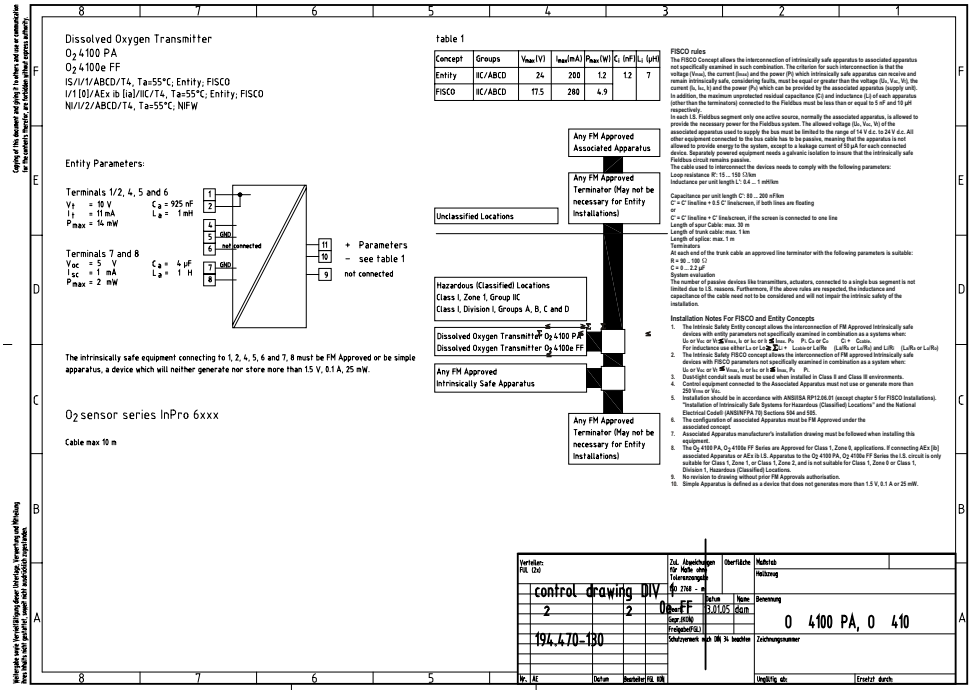
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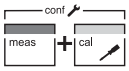
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Mode code



conf, 0000	Error Info
conf, 1200	Configuration mode



cal, 0000	Cal Info
cal, 1001	Zero point calibration
cal, 1015	Adjusting temp probe
cal, 1100	Calibration mode
cal, 1105	Product calibration
cal, 2222	Display sensor current (uncompensated)/ temperature

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Management-System zertifiziert nach ISO 9001 / ISO 14001

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