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Transmitter CO_2 5100 e
Sensor InPro® 5000

CO_2 measuring systems for fermentation control

Technical data



Transmitter CO_2 5100 e



Sensor InPro 5000

Short description

The measuring system consisting of the CO_2 sensor InPro 5000 is and the CO_2 transmitter 5100 e is specifically designed for reliable, in-line measurement in processes under sterile, hygienic conditions. The system satisfies most standard measurement requirements for fermentation processes especially in cell culture applications:

Transmitter features

- Display: %, mg/l and hPa
- Two 0/4 … 20 mA current outputs
- Two limit contacts
- Alarm & wash contact
- Continuous monitoring of sensor and transmitter performance
- Sensor diagnostics
- Easy operation with help of pictographs
- PID controller
- Communication with EasyClean, the METTLER TOLEDO cleaning and calibration system for sensors

Sensor features

- Easy-to-replace membrane body reduces service time
- Durable and rugged sensor design for increased resistance to harsh environments
- FDA compliant materials of construction and easy-to-clean high-polished surface finish (Ra ≤16 µ inch) to satisfy stringent regulatory requirements
- Suitable for hygienic applications: EHEDG certified
- Enhanced membrane (patented) with no interference of volatile acids as found in bioprocesses

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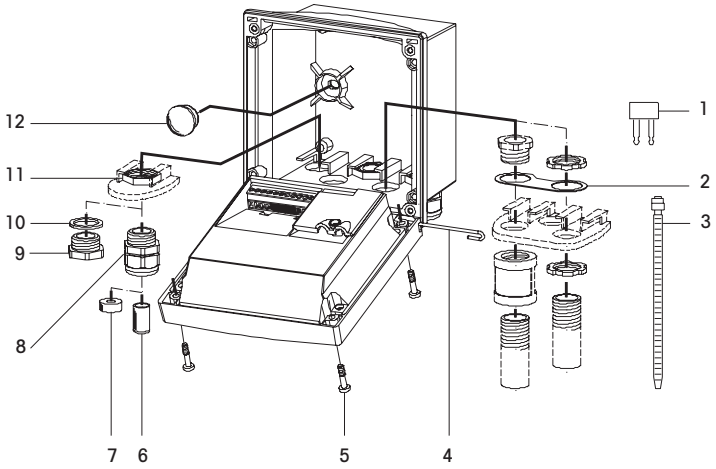
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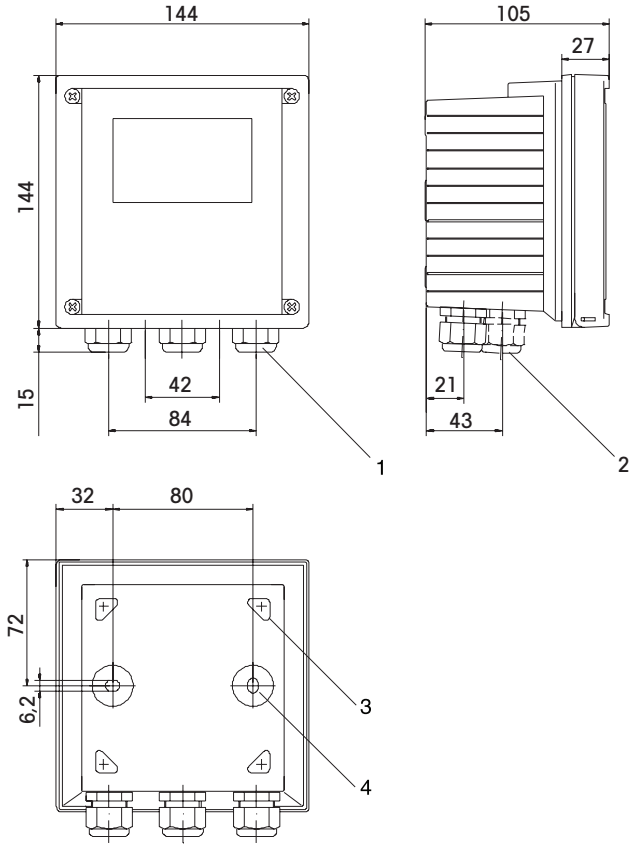
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Assembly



1 Jumper (1 piece)
2 Washer (1 piece)
3 Cable ties (3 pieces)
4 Hinge pin (1 piece)
5 Enclosure screws (4 pieces)
6 Pg plug (1 piece)
7 Rubber reducer (1 piece)
8 Pg cable glands (3 pieces)
9 Filler plugs (3 pieces)
10 Gaskets (3 pieces)
11 Hexagon nuts (5 pieces)
12 Sealing plugs (2 pieces)

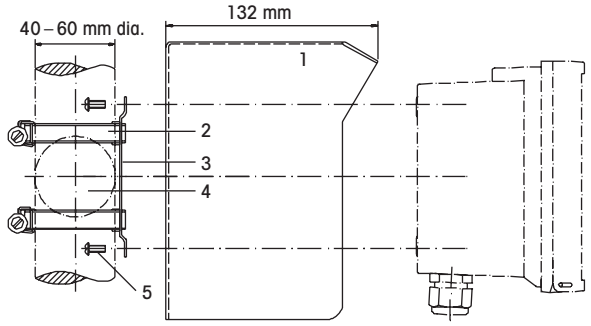
Mounting



1 Cable gland (3 pieces)
2 Breakthroughs for cable gland or conduit ½", ø 21.5 mm (2 breakthroughs). Conduits not included!
3 Holes for post mounting (4 breakthroughs)
4 Holes for wall mounting (2 breakthroughs)

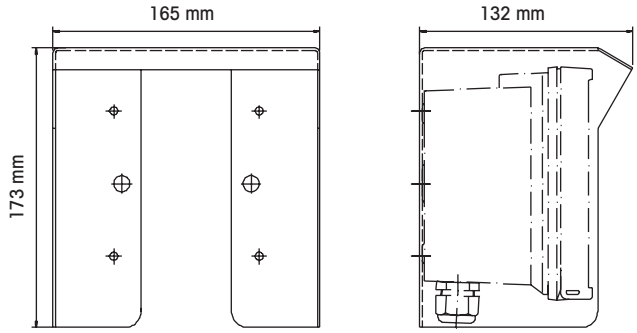
(dimensions in mm)

Pipe mounting with ZU 0274 bracket kit

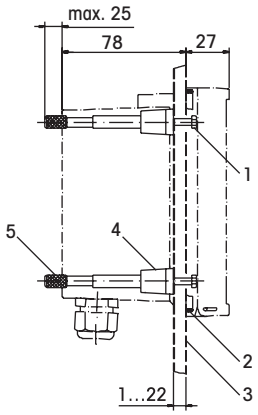


1 Protective hood ZU 0276 (if required)
2 Hose clamps with worm gear drive to DIN 3017 (2 pieces)
3 Postmounting plate (1 piece)
4 For vertical or horizontal post/pipe mounting
5 Self-tapping screws (4 pieces)

Protective hood ZU 0276 for wall and pipe mounting



Panel mount kit ZU 0275



1 Screws (4 pieces)
2 Seal (1 piece)
3 Control panel
4 Span pieces (4 pieces)
5 Threaded sleeves (4 pieces)

(dimensions in mm)

pH/mV input	Input		Glass electrode
	Input		Reference electrode
	Input		Auxiliary electrode
Display range CO_2	Saturation		0.0 ... 200.0 % (0 ... 60 °C/32 ... 140 °F)
	Concentration		0.0 ... 999.9 mg/l (0 ... 60 °C/32 ... 140 °F)
			0000 ... 4000 mg/l (0 ... 60 °C/32 ... 140 °F)
	Partial pressure		0.0 ... 999.9 ... 2000 hPa
	Input glass electrode [1)]	Input resistance	> 0.5 x 10^{12} Ω
		Input current	< 2 x 10^{-12} A
	Input reference electrode [1)]	Input resistance	> 1 x 10^{10} Ω
		Input current	< 1 x 10^{-10} A
	Measuring error [1,2,3)]		< 5 % of measured value +2 mg/l, resp. 0.2 %, resp. 2 hPa
	Process pressure *)		0.000 ... 4.000 bar
	Electrolytes concentration *)		0.000 ... 1.000 mol/l
Electrode standardization pH/CO_2	pH-calibration		
	operating modes	AUT	Auto-calibration with buffer pH 7.00, 9.21
		MAN	manual calibration with input individual buffer values
		DAT	data input of premeasured sensors
	CO_2-calibration	Product calibration	(with separat Mode-Code)
	max. calibration range		
	(asymmetry potential ± 60 mVslope)		80 ... 103 % (47.5 ... 61 mV/pH)
		(possibly restrictive hints by Sensoface)	
Caltimer	0000 ... 9999 h		
Sensocheck	Automatic monitoring of glass and reference electrode (can be disabled) Delay time approx. 30 s		
Sensoface	Provides information on the electrode condition. Evaluation of zero/slope, response, calibration interval, Sensocheck		
Temperature input	Pt 1000 / NTC 30 kW		2-wire connection, adjustable
	Measurement range		– 20.0 ... 150.0 °C / – 4 ... 302 °F
	Adjustment range		10 K
	Resolution		0.1 °C/1 °F
	Meas. error [1,2,3)]		< 0.5 K
HOLD input	Galv. separated (OPTO coupler)		
	Function		Switches device to HOLD mode
	Switching voltage		0 ... 2 V (AC/DC) HOLD sinactive
			10 ... 30 V (AC/DC) HOLD active
CONTROL input	Galv. separated (OPTO coupler)		
	Function		Control input for automatic cleaning/ calibration system
	Switching voltage		0 ... 2 V (AC/DC) inactive
			10 ... 30 V (AC/DC) active

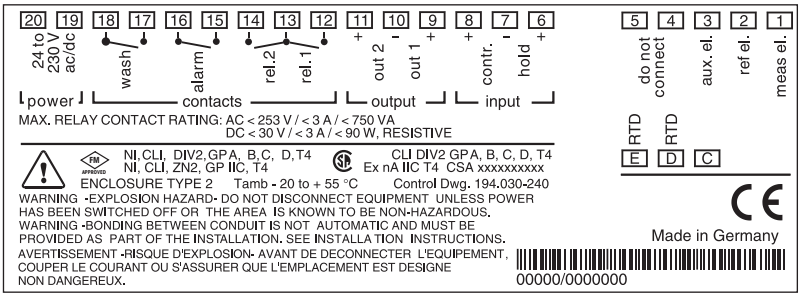
Output 1	0/4 ... 20 mA, max. 10 V, floating (galv. connected to output 2)	
	Measured variable*)	CO_2 value (%, mg/l, hPa)
	Overrange*)	22 mA in the case of error messages
	Output filter*)	PT1-filter, filter time constant 0...120 s
	Meas. error 1)	<0.3 % current value +0.05 mA
	Start / end of scale	as desired within ranges
	Adm. span	2...200 % / 50...4000 mg/l / 50...2000 hPa
Output 2	0/4...20 mA, max. 10 V, floating (galv. connected to output 1)	
	Measured variable	Temperature
	Overrange*)	22 mA in the case of error messages
	Output filter*)	PT1-filter, filter time constant 0...120 s
	Meas. error 1)	<0.3 % current value +0.05 mA
	Start / end of scale*)	as desired within ranges
	Adm. span	10...100 K
Alarm contact	Relay contact, floating	
	Contact ratings	AC <250 V / <3 A / <750 VA
		DC <30 V / <3 A / <90 W
	Contact response	N/C (fail-safe type)
	Alarm delay	0000...0600 s
Limit values	Output via relay contacts R1, R2 (see PID process contoller)	
	Contacts R1, R2 floating, but inter-connected	
	Contact ratings	AC <250 V / <3 A / <750 VA
		DC <30 V / <3 A / <90 W
	Contact response*)	N/C or N/O
	Delay*)	0000 ... 9999 s
	Switching points*)	as desired within range
	Hysteresis*)	max. 40 % of MR floating
PID-Process controller	Output via relay contacts R1, R2 (see limit values)	
	(R1 base valve, R2 acid valve)	
	Set point specification*)	0...100.0 % / 0...1999 mg/l / 0...999.9 hPa
	Neutral zone*)	0...20.0 % / 0...400 mg/l / 0...200.0 hPa
	P-action*) controller gaine	Kr: 0010...9999 %
	I-action*) reset time	Tr: 0000...9999 s
		(0000 s = no integral action)
	D-action*) derivative time	Td: 0000...9999 s
		(0000 s= no derivative action)
	Controller type*)	pulse length controller or pulse frequency controller
	Pulse periode*)	0001...0600 s, min. ON time 0.5 s
		(pulse length controller)
	max. pulse frequency*)	0001...0180 min^{-1}
		(pulse frequency controller)

Cleaning function*)	Relay contact, floating for controlling a simple rinsing system or an automatic cleaning system	
	Contact ratings	AC <250 V / <3 A / <750 VA DC <30 V / <3 A / <90 W
	Contact response*)	N/C or N/O
	Rinsing interval*)	000.0 ... 999.9 h (000.0 h ... = cleaning function switched off)
	Cleaning interval*)	0000 ... 1999 s
	Post-delay	20 s
Display	LC display	7-segment with icons
	Main display	Characters height 17 mm, unit symbols 10 mm
	Secondary display	Characters height 10 mm, unit symbols 7 mm
	Sensoface	3 status indicators (friendly, neutral, sad smiley)
	Mode indication	5 status bars: "meas", "cal", "alarm", "cleaning", "config" 18 further icons for configuration and messages
	Alarm indication	red LED in case of alarm or HOLD, user-defined
Keypad	5 keys: [cal] [conf] [►] [▲] [enter]	
Service functions	Current source	Current adjustable for output 1 and 2 (00.00 to 22.00 mA)
	Manual controller	Controller output entered directly (startup of control process)
	Device self-test	Automatic memory test (RAM, FLASH, EEPROM)
	Display test	Display of all segments
	Last error	Display of last error occurred
	Sensor monitor	Display of direct, uncorrected sensor signal (electrode)
	Relay test	Manual control of the four switching contacts
Parameter sets*)	Two selectable parameter sets for different applications	
Explosion protection	NI, Class I, Div 2, Group A, B, C, D (USA/Canada)	
Data retention	Parameters and calibration	>10 years (EEPROM)
EMV	DIN EN 61326 VDE 0843 part 20/01.98 DIN EN 61326/A1 VDE 0843 part 20/A1/05.99	
Lightning protection	DIN EN 61000-4-5, installation class 2	

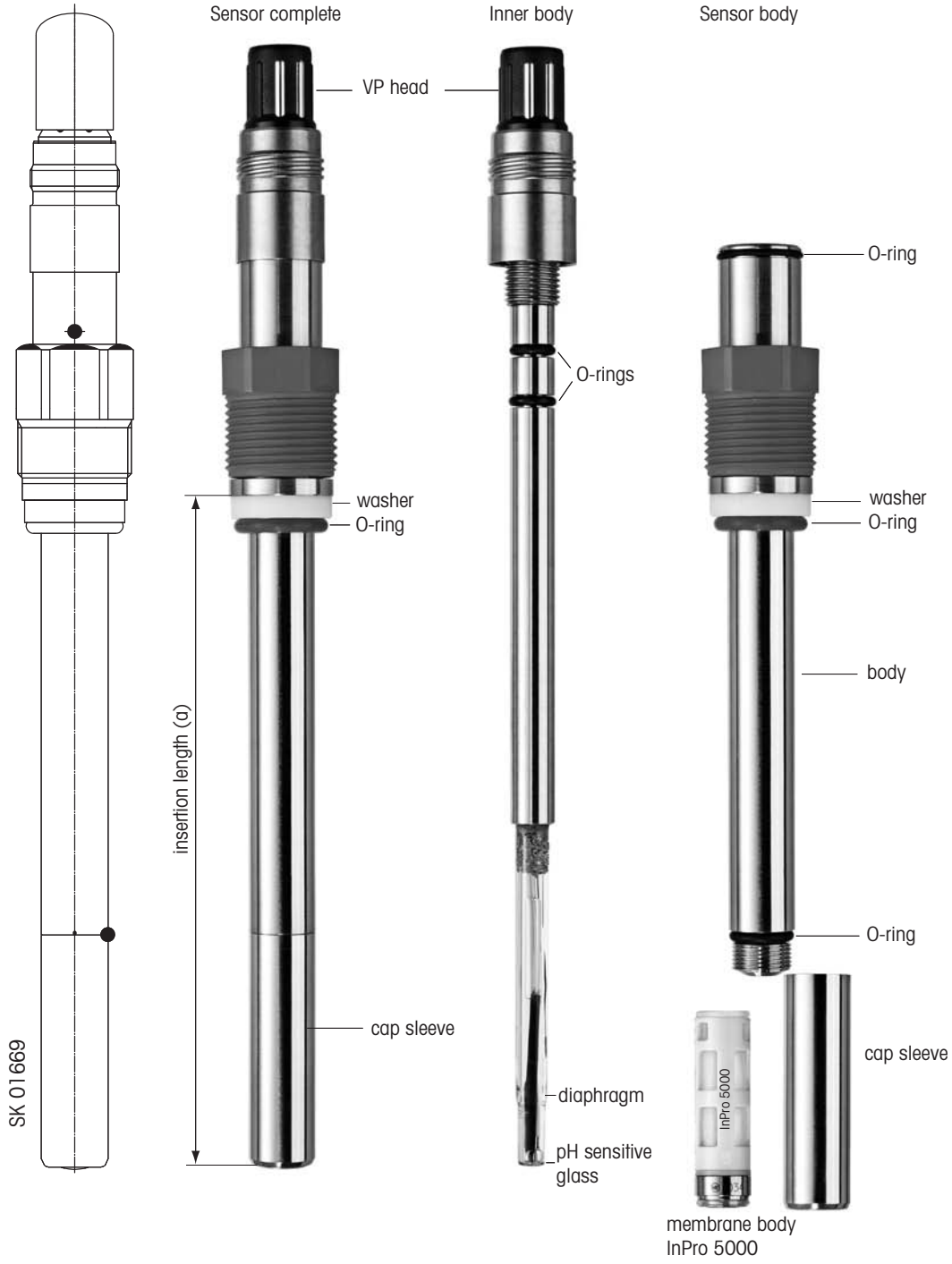
Protection against electrical shock	Protective separation of all extra-low-voltage circuits against mains by double insulation as per EN 61010-1	
Power supply	24 (−15 %) ... 230 (+15 %) V AC/DC ca. 2 VA AC: 45 ... 65 Hz Overvoltage category II, Class II	
Nominal operatings condition	Ambient temperature Transport/Storage temp Relative humidity	−20 ... +55 °C (−4 ... 131 °F) −20 ... +70 °C (−4 ... 158 °F) 10 ... 95 % not condensing
Enclosure	Molded enclosure made of PBT (polybutylene terephtalate)	
	Color	bluish gray RAL 7031
	Assembly	• Wall mounting • Pipe mounting: dia 40 to 60 mm, dia 30 to 45 mm • Panel mounting, cutout to DIN 43700 Sealed against panel
	Dimensions	H 144 mm, W 144 mm, D 105 mm
	Ingress protection	IP65/NEMA 4X
	Cable glands	3 breakthroughs for cable glands M20x1.5 2 breakthroughs for NPT 1/2" or Rigid Metallic Conduit
	Weight	approx. 1 kg

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

Transmitter CO_2 5100 e



Dimensions and modularity



InPro 5000

Measuring range	0 … 1000 mbar pCO_2 (1 mbar = 1 hPa)
Lower detection limit	10 mbar pCO_2
Accuracy	± 10 % (pCO_2 10 – 900 mbar) ≥ ± 10 % (pCO_2 > 900 mbar)
Response time	90 % of final value <120 sec (at 25 °C [77 °F] from air to CO_2)
Temperature range	0 … 60 °C (32 … 140 °F) for measurement
Sterilization temperature	≤ 130 °C (266 °F) in-situ or autoclavable
Pressure range	0.2 … 2 bar absolute for measurement (3 … 30 psi)
Mechanical pressure resistance max.	3 bar at 25 °C (77 °F) (max. 42 psi)
Known interferences	SO_2, NH_3, H_2S
Measuring principle	potentiometric (Severinghaus)
Wetted metal parts	stainless steel DIN 1.4435 (similar AISI 316L) surface roughness N5 Ra <0.4 µm (16 µ inch)
Membrane material	silicone reinforced
O-ring materials	Viton®, silicone, FDA compliant
Temperature sensor	Pt 1000
Plug head	VarioPin (VP), Pg 13.5 thread, washer PTFE, O-ring Viton®
VP-connector	IP 68, autoclavable
Certificate	3.1B for stainless steel parts EHEDG

Sensor InPro 5000

Description	Sensor length (a)	Order number	Suitable housing
InPro 5000/12/120	120 mm	52 206 067	InFit 761
InPro 5000/12/220	220 mm	52 206 068	InFit 761
InPro 5000/12/320	320 mm	52 206 069	InTrac 797e, InFit 761

Transmitter CO_2 5100e

CO_2 5100e		52 121 105

Cables

	length	
VP6-ST/3 m	3 m	52 300 108
VP6-ST/5 m	5 m	52 300 109
VP6-ST/10 m	10 m	52 300 110

Spare parts

Membrane kit InPro 5000	4 membrane bodies, 1 O-ring set, 25 ml electrolyte	52 206 055
Interior body InPro 5000	a=120 mm	52 206 057
	a=220 mm	52 206 084
	a=320 mm	52 206 085

Accessories

pH-Simulator 112	31 112 3003
VP-Simulator	52 120 939
Cap sleeve with protective cage, P type 1.4404	52 200 038
Cap sleeve, N type 1.4435	52 201 153
Cap sleeve, P type 1.4435	52 201 154

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