

# M400 Transmitter Series for pH, Oxygen, Dissolved Carbon Dioxide and Conductivity

Versatile and intelligent

## Technical Data



**ISM**

### Short description

The M400 transmitter series features advanced ISM technology and covers pH/ORP, pH ISFET, Oxygen, Dissolved Carbon Dioxide and Conductivity measurements. Thanks to the mixed-mode input functionality, the M400 accepts any analog or ISM sensor of your choice. Combined with its multi-parameter capabilities, the M400 is the state-of-the-art transmitter for your most demanding applications.

The M400 is a single-channel, multi-parameter unit. The same unit can handle different parameters such as pH/ORP, pH ISFET, Oxygen, Dissolved Carbon Dioxide or Conductivity, depending on the type you choose.

### Features

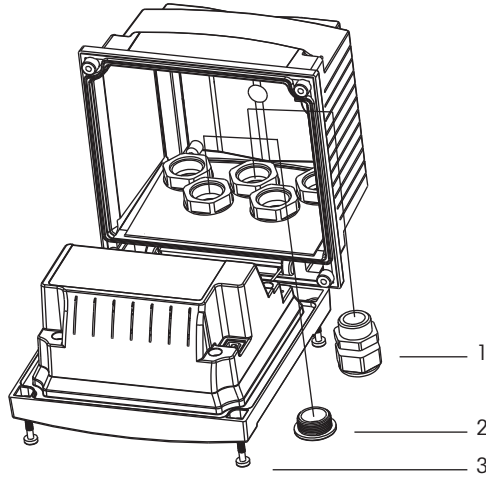
- Mixed-mode input (conventional or ISM sensors accepted)
- Advanced ISM functionalities
- Plug and Measure feature
- Multi-parameter unit
- Dynamic Lifetime Indication
- Adaptive Calibration Timer
- Time to Maintenance Indication
- 4-wire installation
- Four 0/4 ... 20 mA current outputs, galvanically isolated
- 6 freely configurable relays
- IP65 rated
- PID controller with pulse length, pulse frequency or analog control
- Quick setup mode
- 8 languages: english, german, french, italian, spanish, portuguese, russian and japanese

## Contents

Dimensions and installation drawings	2
Specifications	3
Connector pin definitions	6
Ordering information	7

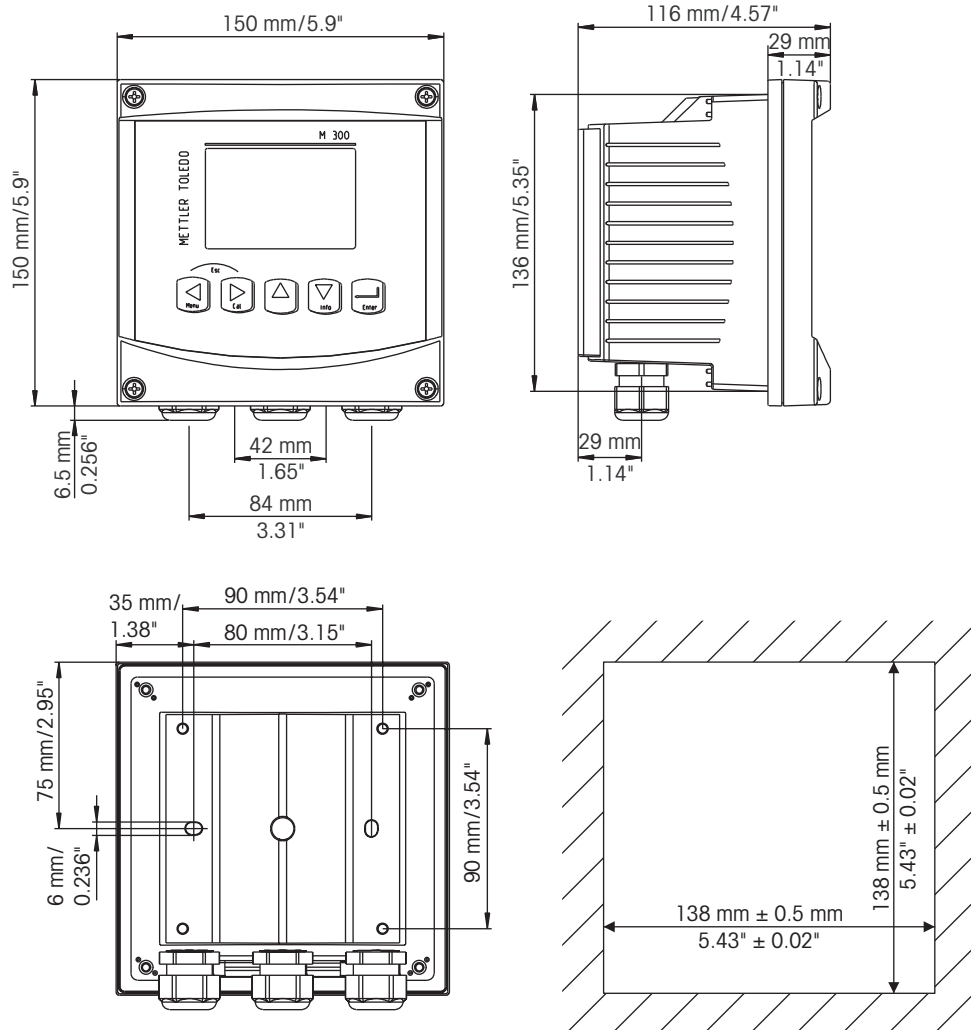
**METTLER TOLEDO**

Assembly



- 1 3 Pg 13.5 cable glands
- 2 2 plastic plugs
- 3 4 screws

Dimension drawings



**pH/ORP incl. ISFET**

Measurement parameters	pH, mV, and temperature
pH, ORP input range	-1500 to 1500 mV
pH display range	-2 to 16 pH
Resolution	Auto/0.001/0.01/0.1/1 (can be selected)
Relative accuracy*	± 0.03 pH; ± 2 mV
Temperature input	Pt1000, Pt100
Temperature compensation	Automatic/manual
Temperature measuring range	-30 to 130 °C (-22 to 266 °F)
Temperature resolution	Auto/0.001/0.01/0.1/1 °C/°F (can be selected)
Temperat. measurement error*	± 0.25 °C (± 0.45 °F)
Max. length sensor cable	Analog: 20 m (65ft), depending on sensor; ISM 80 m (260ft)
Calibration	1 or 2 point calibration, process calibration

\* For analog input signal (ISM input signal causes no additional error)

**Oxygen amperometric**

Measurement parameters	- Dissolved oxygen: Saturation or concentration and temperature - Oxygen in gas: Concentration and temperature
Current range	0 to 900 nA
Oxygen measuring ranges	- Dissolved oxygen: Saturation 0 to 500 % air, 0 to 200 % O <sub>2</sub> Concentration 0.1 ppb (µg/L) to 50.00 ppm (mg/L) - In gas: 0 to 9999 ppm O <sub>2</sub> gas, 0 to 100 vol % O <sub>2</sub>
Oxygen accuracy*	
- Dissolved oxygen	Saturation: ±0.5% of the measured value or ±0.5%, depending on which is larger. Concentration at high values: ±0.5% of the measured value or ±0.050 ppm / ±0.050 mg/L, depending on which is larger. Concentration at low values: ±0.5% of the measured value or ±0.001 ppm / ±0.001 mg/L, depending on which is larger.
- In gas	±0.5% of the measured value or ±5 ppb, depending on which is larger for ppm O <sub>2</sub> gas. ±0.5% of the measured value or ±0.01%, depending on which is larger for vol % O <sub>2</sub> .
Resolution current	30 pA
Polarization voltage	-674 mV (for analog sensors)
Temperature input	NTC 22 kΩ
Temperature compensation	Automatic
Temperature measuring range	-30 to 150 °C (-22 to 302 °F)
Temperature accuracy*	± 0.25 K in the range of -10 to + 80 °C (14 to + 176 °F)
Max. length sensor cable	Analog: 20 m (65 ft); ISM 80 m (260ft)
Calibration	1-point (slope or offset) calibration, process calibration (slope or offset) calibration

\* For analog input signal (ISM input signal causes no additional error)

**Oxygen optical**

Measurement parameters	D.O. saturation or concentration and temperature
DO concentration range	0.1 ppb (µg/L) to 50.00 ppm (mg/l)
DO saturation range	0 to 500 %, 0 to 100 % O <sub>2</sub>
DO resolution	Auto/0.001/0.01/0.1/1 (can be selected)
DO accuracy	± 1 digit
Temperature measuring range	-30 to +150 °C (-22 to 302 °F)
Temperature resolution	Auto/0.001/0.01/0.1/1 °C (°F) (can be selected)
Temperature accuracy	± 1 digit
Temperature compensation	Automatic
Max. length sensor cable	15 m (50 ft)
Calibration	1-point (depending on sensor model), 2-point, process calibration

**Conductivity 2-e/4-e**

Measurement parameters	Conductivity, and temperature	
Conductivity ranges	<b>2-electrode sensor:</b> 0.02 to 2000 $\mu\text{S}/\text{cm}$ ( $500 \Omega \times \text{cm}$ to $50 \text{M}\Omega \times \text{cm}$ ) C = 0.01            0.002 to 200 $\mu\text{S}/\text{cm}$ C = 0.1            0.02 to 2000 $\mu\text{S}/\text{cm}$ C = 1                15 to 4000 $\mu\text{S}/\text{cm}$ C = 3                15 to 12000 $\mu\text{S}/\text{cm}$ C = 10              50 to 40000 $\mu\text{S}/\text{cm}$ <b>4-electrode sensor:</b> 0.01 to 650 $\text{mS}/\text{cm}$ ( $1.54 \Omega \times \text{cm}$ to $0.1 \text{M}\Omega \times \text{cm}$ )	
Temperature input	Pt1000	
Temperature measuring range	-40 to 200 °C (-40 to 392 °F)	
Max. length sensor cable	60 m (196.9 ft) with 2-electrode sensor 15 m (50 ft) with 4-electrode sensor 80 m (260 ft) with ISM sensor	
Cond/Res accuracy*	$\pm 0.5\%$ of reading or $0.25 \Omega$ , whichever is greater, up to $18 \text{M}\Omega \times \text{cm}$	
Cond/Res repeatability*	$\pm 0.25\%$ of reading or $0.25 \Omega$ , whichever is greater	
Cond/Res resolution	Auto/0.001/0.01/0.1/1 (can be selected)	
Temperature resolution	Auto/0.001/0.01/0.1/1 °C/°F (can be selected)	
Temperature accuracy*	$\pm 0.25 \text{°C}$ ( $\pm 0.45 \text{°F}$ )	
Temperature repeatability*	$\pm 0.13 \text{°C}$ ( $\pm 0.23 \text{°F}$ )	
Chemical concentration curves	NaCl            0-26% @ 0 °C to 0-28% @ +100 °C NaOH          0-12% @ 0 °C to 0-16% @ +40 °C to 0-6% @ +100 °C HCl            0-18% @ -20 °C to 0-18% @ 0 °C to 0-5% @ +50 °C HNO <sub>3</sub> 0-30% @ -20 °C to 0-30% @ 0 °C to 0-8% @ +50 °C H <sub>2</sub> SO <sub>4</sub> 0-26% @ -12 °C to 0-26% @ +5 °C to 0-9% @ +100 °C H <sub>3</sub> PO <sub>4</sub> 0-35% @ +5 °C to +80 °C User-defined concentration table (9 × 9 matrix)	
TDS ranges	NaCl, CaCO <sub>3</sub>	
Calibration	1 or 2 point calibration, process calibration	

\* For analog input signal (ISM input signal causes no additional error)

**Conductivity inductive**

Measurement parameters	Conductivity and temperature	
Conductivity range	0.0 to 2000 $\text{mS}/\text{cm}$	
Temperature input	Pt1000	
Temperature measuring range	-40 to 200 °C (-40 to 392 °F)	
Max. length sensor cable	10 m (33 ft)	
Cond accuracy	$\pm 1\%$ of reading or $\pm 0.005 \text{mS}/\text{cm}$	
Cond repeatability	$\pm 1\%$ of reading or $\pm 0.005 \text{mS}/\text{cm}$	
Cond resolution	Auto/0.001/0.01/0.1/1 (can be selected)	
Temperature resolution	Auto/0.001/0.01/0.1/1 °C/°F (can be selected)	
Temperature accuracy*	$\pm 0.25 \text{°C}$ ( $\pm 0.45 \text{°F}$ )	
Temperature repeatability	$\pm 0.13 \text{°C}$ ( $\pm 0.23 \text{°F}$ )	
Chemical concentration curves	NaCl            0-26% @ 0 °C to 0-28% @ +100 °C NaOH-1        0-13% @ 0 °C to 0-24% @ +100 °C NaOH-2        15-50% @ 0 °C to 30-35% @ +100 °C HCl-1          0-18% @ -20 °C to 0-18% @ +50 °C HCl-2          22-39% @ -20 °C to 22-39% @ +50 °C HNO <sub>3</sub> -1        0-30% @ -20 °C to 0-30% @ +50 °C HNO <sub>3</sub> -2        35-96% @ -20 °C to 35-96% @ +50 °C H <sub>2</sub> SO <sub>4</sub> -1       0-26% @ -12 °C to 0-37% @ +110 °C H <sub>2</sub> SO <sub>4</sub> -2       28-88% @ 0 °C to 39-88% @ +95 °C H <sub>2</sub> SO <sub>4</sub> -3       94-99% @ -12 °C to 89-99% @ +95 °C H <sub>3</sub> PO <sub>4</sub> 0-35% @ +5 °C to 0-35% @ +80 °C User-defined concentration table (9 × 9 matrix)	
TDS ranges	NaCl, CaCO <sub>3</sub>	
Calibration	1 or 2 point calibration, process calibration	

**Dissolved carbon dioxide**

Measurement parameters	Dissolved carbon dioxide and temperature
Dissolved carbon dioxide	0 to 5000 mg/L
range	0 to 200 %sat 0 to 1500 mmHg 0 to 2000 mbar 0 to 2000 hPa
mV range	-1500 to 1500 mV
Total pressure range	0 to 4000 mbar
Dissolved carbon dioxide accuracy	±5 % of reading ±2 mg/L resp. ±0.2 % of reading ±2 hPa
mV accuracy	±1mV
Resolution	Auto/0.001/0.01/0.1/1 (can be selected)
Temperature input	Pt1000/NTC 22kΩ
Temperature range	-30 to 150 °C (-22 to 302 °F)
Temperature resolution	Auto/0.001/0.01/0.1/1 °C/°F (can be selected)
Temperature accuracy	±0.25 °C (±0.45 °F) within -10 to +80 °C
Temperature repeatability	±0.13 °C (±0.23 °F)
Max. length sensor cable	15 m (50 ft)
Calibration	1 or 2 point calibration, process calibration

**Electrical specifications**

Power supply	100 to 240 V AC, or 20 to 30 V DC, 10 VA
Frequency for AC	50 to 60 Hz
Number of outputs (analog)	4
Current output	0/4 to 20 mA, 22 mA alarm, galvanically isolated up to 60 V from input and from earth/ground
Measurement error through analog outputs	< ±0.05 mA over 1 to 20 mA range < ±0.10 mA over 0 to 1 mA range
Analog output configuration	Linear, Bi-linear, Logarithmic, Autoranging
Load	max. 500 Ω
Display	Backlit LCD, 4 lines
Running capacity	Ca. 4 days
Keypad	5 tactile feedback keys
Languages	8 (english, german, french, italian, spanish, portuguese, russian and japanese)
PID process controller	Pulse length, pulse frequency or analog control
Cycle time	Ca. 1 sec.
Hold input/Alarm contact	Yes/Yes (alarm delay 0 to 999 s)
Connection terminal	Detachable screw terminals
Relays	- 2-SPDT mechanical rated at 250 VAC, 3 Amps - 2-SPST mechanical rated at 250 VAC, 3 Amps - 2-Reed rated at 250 VAC or DC, 0.5 Amp switching
Digital input	2 with switching limits 0.00 VDC to 1.00 VDC inactive 2.30 VDC to 30.00 VDC active
Analog input	4 to 20 mA (for M400 oxygen transmitter with ISM sensor)
Port	USB, Type B connector
Alarm relay delay	0 - 999 s
Mains fuse	1.0 A slow Blow type FC

**Environmental specifications**

Storage temperature	-40 to 70 °C (-40 to 158 °F)
Ambient temperature operating range	-10 to 50 °C (14 to 122 °F)

Environmental specifications (cont.)

Relative humidity	0 to 95%
Emissions	According to EN55011 Class A
Certificate	CE
Material	ABS/polycarbonate
Hazardous areas	Type 1, Type 2, Type 3: cFMus Class I Division 2, ATEX Zone 2 Type 1 Cond Ind: cFMus Class I Division 2*, ATEX Zone 2*

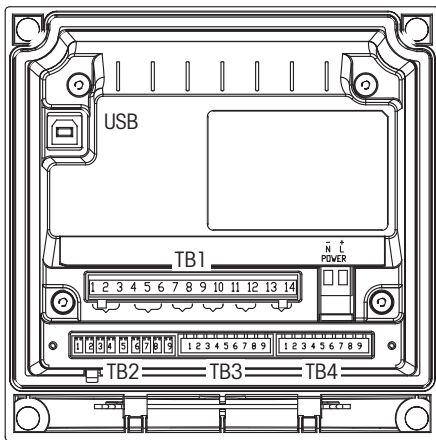
\* In Preparation

Mechanical specifications

Dimensions	Housing (H×W×D)*	144×144×116 mm
	Front bezel (H×W)*	150×150 mm
	Max. D – panel mounted	87 mm
Weight	0.95 kg (2 lb)	
Insulation/Rating	IP65	

\* H = Height, W = Width, D = Depth

Connector pin definitions



TB1

Pin	Definition
1	NO1
2	COM1
3	NC1
4	NO2
5	COM2
6	NC2
7	COM5
8	NC5
9	COM6
10	NO6
11	NO3
12	COM3
13	NO4
14	COM4

1/2 DIN housing (Wall mount)

TB2	
Pin	Definition
1	AO1+
2	AO1-/AO2-
3	AO2+
4	AO3+
5	AO3-/AO4-
6	AO4+
7	DI1+
8	DI1-/DI2-
9	DI2+

TB3 pin definitions

Conventional sensor

M400 pH transmitter

Pin	Definition
1	Glass
2	not used
3	Reference
4	Solution GND/Shield
5	not used
6	RTD ref/GND
7	RTD sense
8	RTD
9	+5V

M400 ISFET (pH) transmitter

Pin	Definition
1	FET
2	not used
3	Reference
4	Shield/GND
5	not used
6	RTD ref/GND
7	not used
8	RTD
9	+5V DC

M400 Oxygen transmitter

Pin	Definition
1	not used
2	Anode
3	not used
4	Shield/GND
5	Cathode
6	GND/NTC
7	not used
8	NTC
9	+5V

Connector pin definitions (cont.)

M400 Conductivity (2-e/4-e) transmitter	
Pin	
1	Cnd inner1
2	Cnd outer1
3	Cnd inner2
4	Cnd outer2/shield
5	not used
6	RTD ref/GND
7	RTD sense
8	RTD
9	+5V

M400 Conductivity (inductive) transmitter	
Pin	
1	Receive hi
2	Receive lo
3	Shield/GND
4	Send lo
5	Send hi
6	RTD ref/GND
7	RTD sense
8	RTD
9	+5V

M400 Dissolved Carbon Dioxide transm.	
Pin	
1	Glass
2	not used
3	Reference
4	Shield/GND
5	not used
6	RTD ref/GND
7	not used
8	RTD
9	+5V

TB4 pin definitions

Analog input\*

Pin	
1	+Input of 4/20 mA signal
2	not used
3	not used
4	- Input of 4/20 mA signal
5	not used
6	not used
7	not used
8	not used
9	not used

ISM sensor (except optical oxygen)

Pin	
1	not used
2	not used
3	Cable core
4	Shield
5	not used
6	not used
7	not used
8	not used
9	not used

ISM optical oxygen sensor

Pin	
1	24 V DC
2	GND 24 V DC
3	not used
4	Shield/GND (5V DC)
5	not used
6	not used
7	RS 485-
8	RS 485+
9	+5V

\* Note:  
Jumper 3 to 4 has to be installed. 50 Ohm resistor has to be installed between 1 and 4.

Ordering information

Transmitter	Order no.
M400 Type 1, 1-channel multi-parameter	52 121 348
M400 Type 1 Cond Ind, 1-channel multi-parameter	52 121 495
M400 Type 2, 1-channel multi-parameter	52 121 349
M400 Type 3, 1-channel multi-parameter	52 121 350

Parameter guide M400

Parameter	Type 1		Type 1 Cond Ind		Type 2		Type 3	
	Analog	ISM	Analog	ISM	Analog	ISM	Analog	ISM
pH/ORP	•	•	-	•	•	•	•	•
pH ISFET	•	-	-	-	•	-	•	-
Conductivity 2-e	•	-	-	-	•	-	•	-
Conductivity 4-e	•	•	-	•	•	•	•	•
Conductivity inductive	-	-	•	-	-	-	-	-
Amp. DO ppm/ppb/trace	-	-	-	-	•/-/-	•/-/-	•/•/-	•/•/•
Amp. O <sub>2</sub> gas ppm/ppb/trace	-	-	-	-	•/-/-	•/-/-	•/•/-	•/•/•
DO optical ppm/ppb	-	-	-	-	-	•/-	-	•/•
Dissolved Carbon Dioxide	-	-	-	-	-	-	•	-

Accessories	Order no.
Pipe mount kit	52 500 212
Panel mount kit	52 500 213
Protective hood	52 500 214
Terminal blocks for M300, M400	52 121 504

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