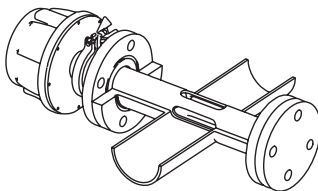


GPro 500 TDL Series Compact Spectrometer with Versatile Process Adaptions

Technical Data



GPro 500 TDL



Short description

The GPro[®] 500 TDL Series is designed for tough and challenging gas measurement applications. The series is highly suited to demanding process applications where accuracy and fast response is crucial despite a varying background gas composition and a high dust load. The range of process adaptions provides the ultimate in convenient process connection flexibility, including for the first time the ability to operate without the requirement for process purge on low particulate applications using the optional non-purge probe design. The GPro Series can be easily calibrated without interrupting the process, providing a reliable, low maintenance and flexible in situ gas measurement solution.

Outstanding features

- Interference-free in situ or extractive measurement technology
- Easy calibration without interrupting the process
- 12 month recommended verification interval
- Highly flexible process adaptions
- Different styles and insertion lengths to suit applications with all types of geometry, incl. DN50 pipes with the wafer cell
- Large selection of materials for the wetted parts
- Easy installation with either one flange, or for short pathlengths a two flange configuration, with in-line “wafer” cell, or with extractive cell
- No pre-alignment of flanges required
- Process purge-free option for clean/dry gases (application dependent)
- Approval for hazardous areas ATEX zone 1, IECEx and FM Class 1 Div 1
- Optional SIL2 compliant direct current outputs for installation without M400
- EMC conformity according to NAMUR recommendation NE 21

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Overview

Process gas analyzers are used for continuous determination of the concentration of one or more gases in a gaseous mixture. The concentration of gases in a process is decisive for the automation and optimization of processes to ensure product quality.

The fast measurement of gas concentrations directly in the process is the main advantage of in situ diode laser gas analyzers. This is because in situ analytical procedures feature physical measurements directly in the actual process. In contrast to extractive gas analysis, no sample needs to be extracted, conditioned and routed into the analyzer via a sample line. Alternatively, the GPro 500 can be installed in a bypass line with respect to process accessibility for manual intervention, in case of high process temperature, pressure and/or specific geometry of the measurement location. Flexibility of the connection to the process is key to delivering a simple to install analyzer that allows a truly representative measurement of the gas to be made at the optimum location in the process line. A variety of insertion probes or alternative in-line wafer cells make the GPro Series the ultimate in process connection convenience. An analyzer carrying out in situ measurements must always take into account changing process conditions and be able to automatically compensate for them. Therefore, accurate temperature and pressure compensation is highly recommended. Also, extreme ruggedness of the system is important since it is in direct contact with the process gas.

The GPro 500 gas analyzer offers compact, service-friendly design with simple operation and exceptional performance data. It is extremely rugged, requires little maintenance and provides high availability. The GPro 500 operates in a wide range of process temperatures and pressures and remains uninfluenced by varying concentrations of dust (particles) in the gas. These features, together with fast measurements, mean that diode laser gas analysis with the GPro 500 provides the ideal alternative to the drawbacks of established extractive gas measurement methods.

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General operation

A diode laser emits a beam of near-infrared light, which passes through the process gas and is then reflected back into the detector by an optical device that is situated at the end of the probe. The wavelength of the laser diode output is tuned to a gas specific absorption line. The laser continuously scans the absorption lines with a very high spectral resolution. For analysis, absorption, strength and line shape of the return signal is used. The influence of cross interferences from background gases is negligible, since the wavelength specific laser light is absorbed very selectively by only one specific molecule. The minimum detectable limit, the accuracy and the resolution is dependent on the probe length (optical path length), the process temperature and pressure.

Influences on the measurement**Dust load**

As long as the laser beam is able to generate a signal for the detector, the dust load of the process gases does not influence the analytical result. By amplifying the signal automatically, measurements can be carried out without any negative impact. The influence from high dust load is complex and is dependent on the optical path length (probe length), particle size and particle size distribution. At longer path lengths the optical attenuation increases rapidly. Smaller particles also have a significant impact on the optical attenuation: the smaller the particles are, the more difficult the measurement will be. For high dust load applications, please consult your local METTLER TOLEDO representative.

Temperature

The temperature influence on an absorption line must be compensated for. An external temperature sensor can be connected to the GPro 500. The signal is then used to correct the measurement results. Without temperature compensation the measurement error caused by process gas temperature changes affects the measurement substantially. Therefore, in most cases an external temperature signal is recommended.

Pressure

The process gas pressure affects the line shape of a molecular absorption line and influences the measurement results. An external pressure sensor can be connected to the GPro 500. When the correct process gas pressure is supplied, the GPro 500 uses a special algorithm to adapt the line shape and effectively compensate for the pressure influence as well as the density effect. Without compensation the measurement error caused by process gas pressure changes is substantial. Therefore, in most cases an external pressure signal is recommended.

Cross interference

Since the GPro 500 derives its signal from one or more fully-resolved molecular absorption lines, cross interference from other gases is eliminated. The GPro 500 is therefore able to measure the desired gas component very selectively.

Note:

Always take great care when choosing the measurement location. Positions where there are fewer particles, the temperature is lower or there is a more suitable process pressure, are recommended. The more optimized the measurement location is, the better the overall performance of the system will be. For advice on the optimal measurement location, please contact your local METTLER TOLEDO representative.

Solar radiation and process radiated heat.

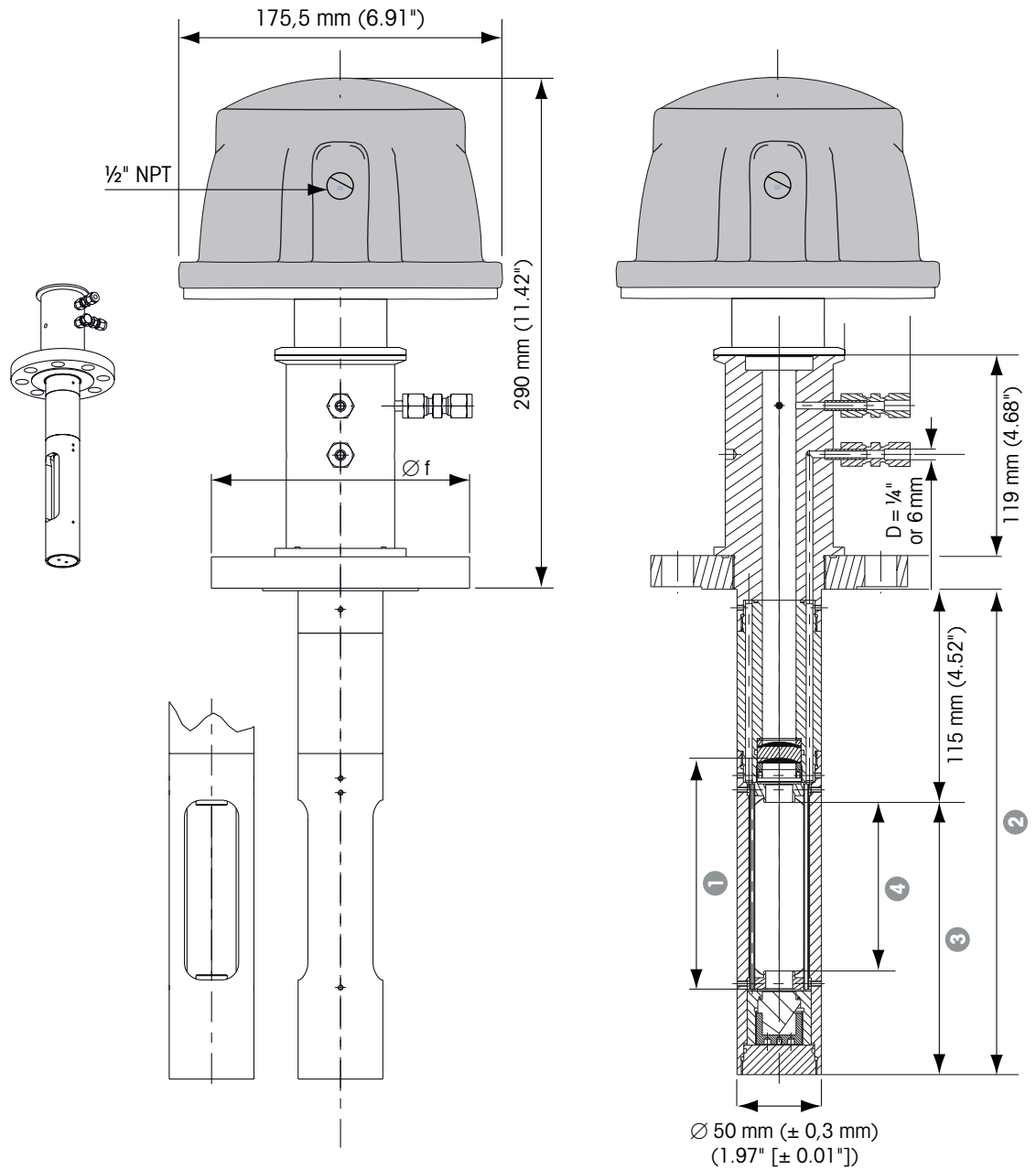
Exposure of the head of the GPro 500 to very high temperatures, for example, solar radiation and/or excessive localized heat sources (such as radiated heat from process walls or adjacent equipment) can cause internal overheating of the device. See manual for further information.

Typical applications

Industry	Safety Control	Process Control	Inertization
Chemical	•	•	•
Petrochemical	•	•	•
Refining	•	•	•
Power	–	•	–
Hazardous waste	–	•	–
Tank farms/Vapor recovery	•	–	•

Installation examples

Dimensions of the standard purged probe (SP)



Definition of the dimensions:

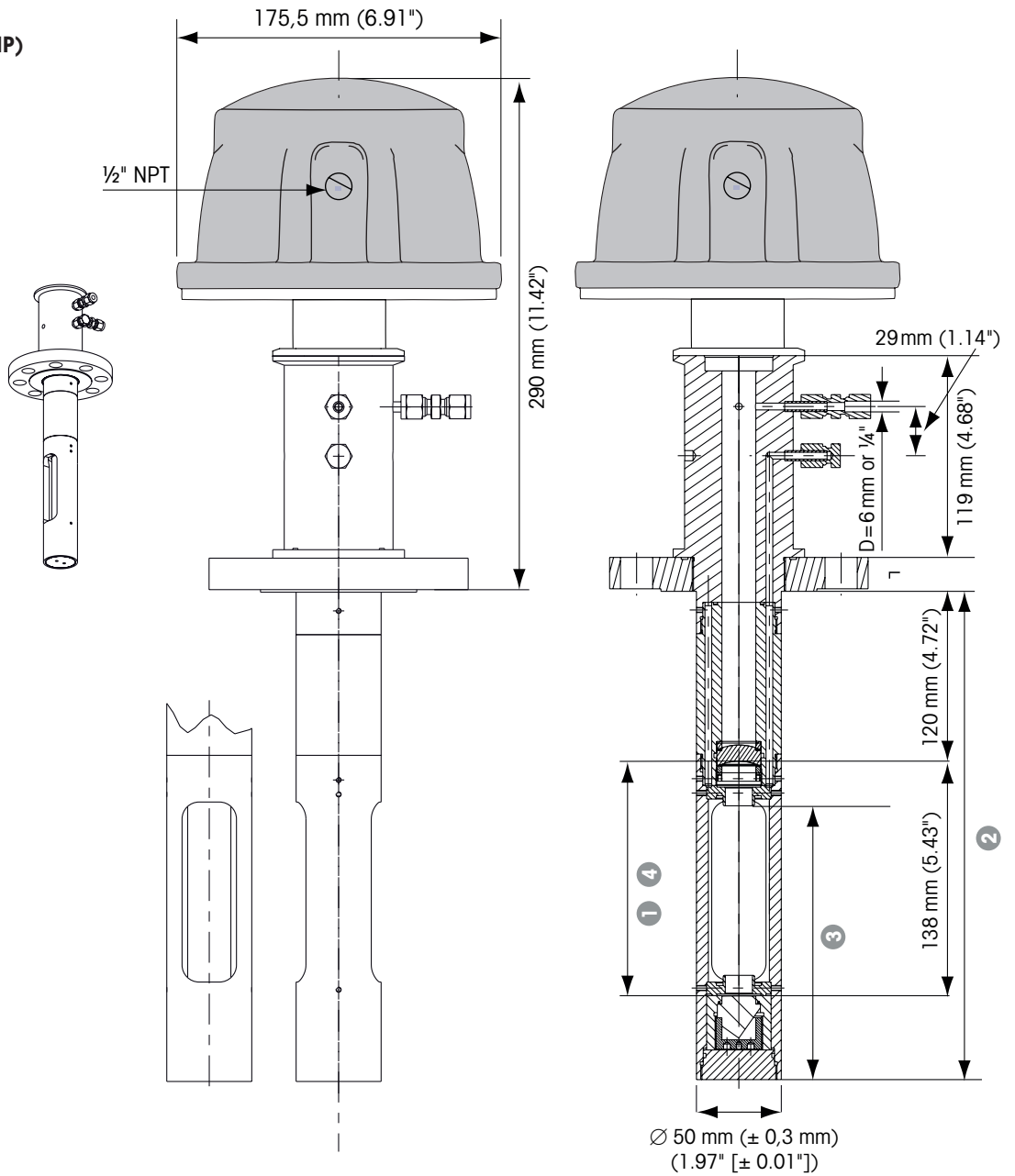
- ① **Nominal path length**, the default length when GPro 500 is delivered. It corresponds to the effective path length without purging.
- ② **Probe length**, the physical length of the probe.
- ③ **Insertion length**, the part of the probe that has to protrude into the pipe for effective purging.
- ④ **Effective path length**, when configuring the GPro 500 with the M400, the double value of the effective path length must be keyed in (2× effective path length).

Note:

- The exact dimensions may vary depending on the configuration.

Installation examples

Dimensions of the non-purged probe (NP) with optional filter



Definition of the dimensions:

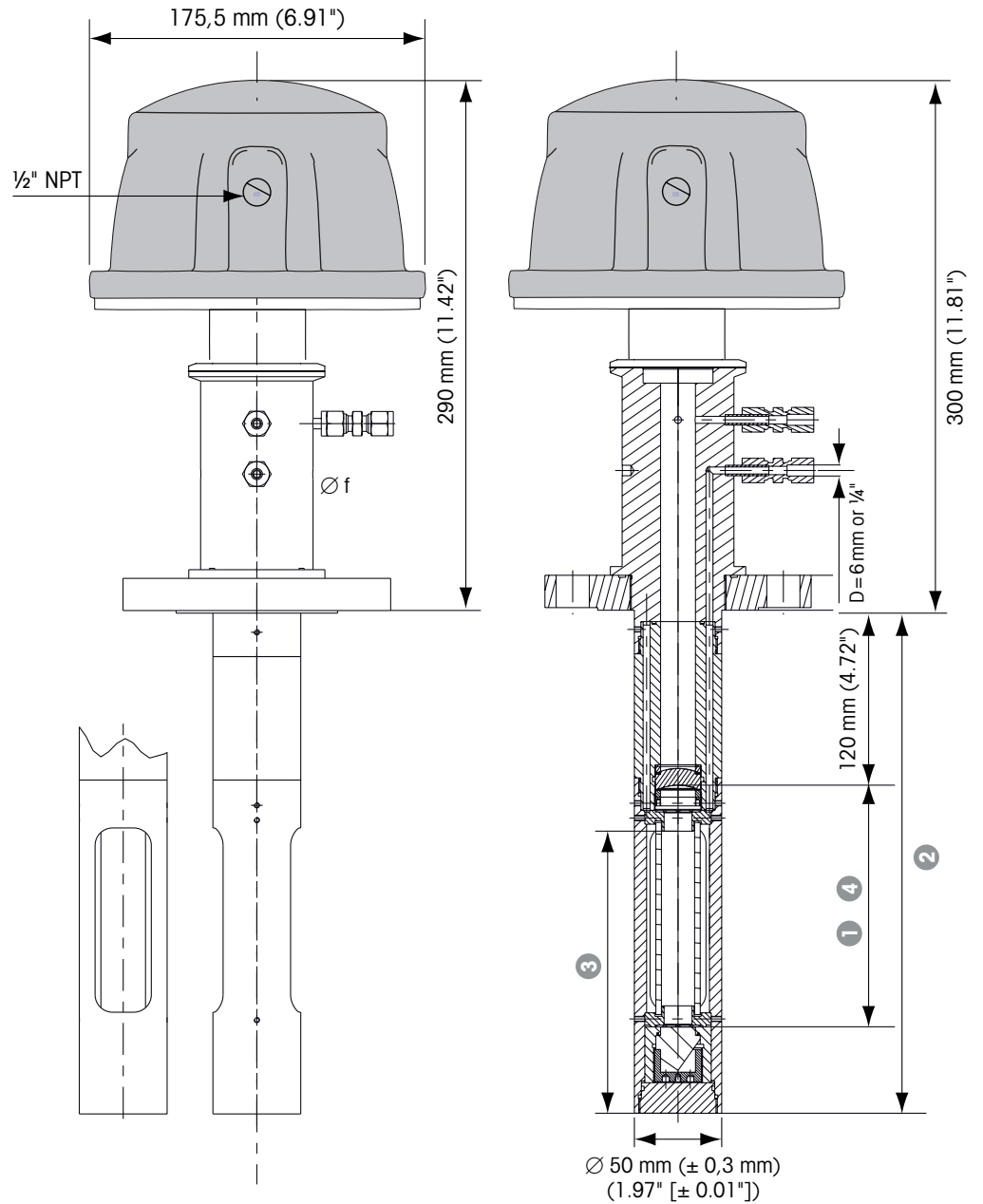
- ① **Nominal path length**, the default length when GPro 500 is delivered. It corresponds to the effective path length without purging.
- ② **Probe length**, the physical length of the probe.
- ③ **Insertion length**, the part of the probe that has to protrude into the pipe for effective purging.
- ④ **Effective path length**, when configuring the GPro 500 with the M400, the double value of the effective path length must be keyed in (2× effective path length).

Note:

- When using the PTFE filter, the maximum process gas temperature is 302 °F (150 °C).
- Metal filters available: 3 µm, 40 µm, 100 µm, 200 µm.

Installation examples

Dimensions of the non-purged probe (B) with blow-back filter



Definition of the dimensions:

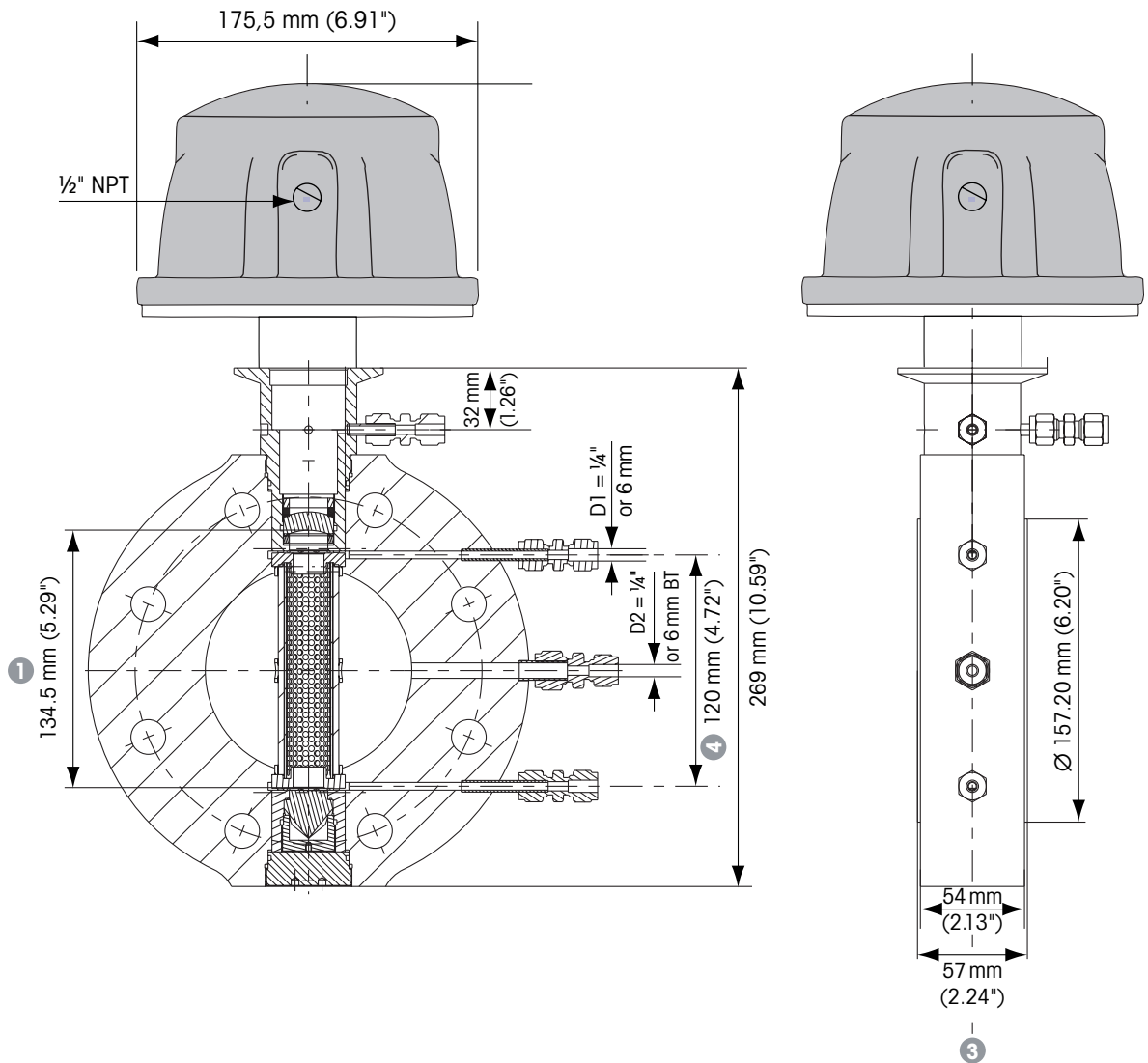
- ① **Nominal path length**, the default length when GPro 500 is delivered.
It corresponds to the effective path length without purging.
- ② **Probe length**, the physical length of the probe.
- ③ **Insertion length**, the part of the probe that has to protrude into the pipe for effective purging.
- ④ **Effective path length**, when configuring the GPro 500 with the M400, the double value of the effective path length must be keyed in (2× effective path length).

Note:

- When using the PTFE filter, the maximum process gas temperature is 302 °F (150 °C).
- Metal filters available: 3 µm, 40 µm, 100 µm, 200 µm.

Installation examples

Dimensions of the wafer (W) with optional filter



Definition of the dimensions:

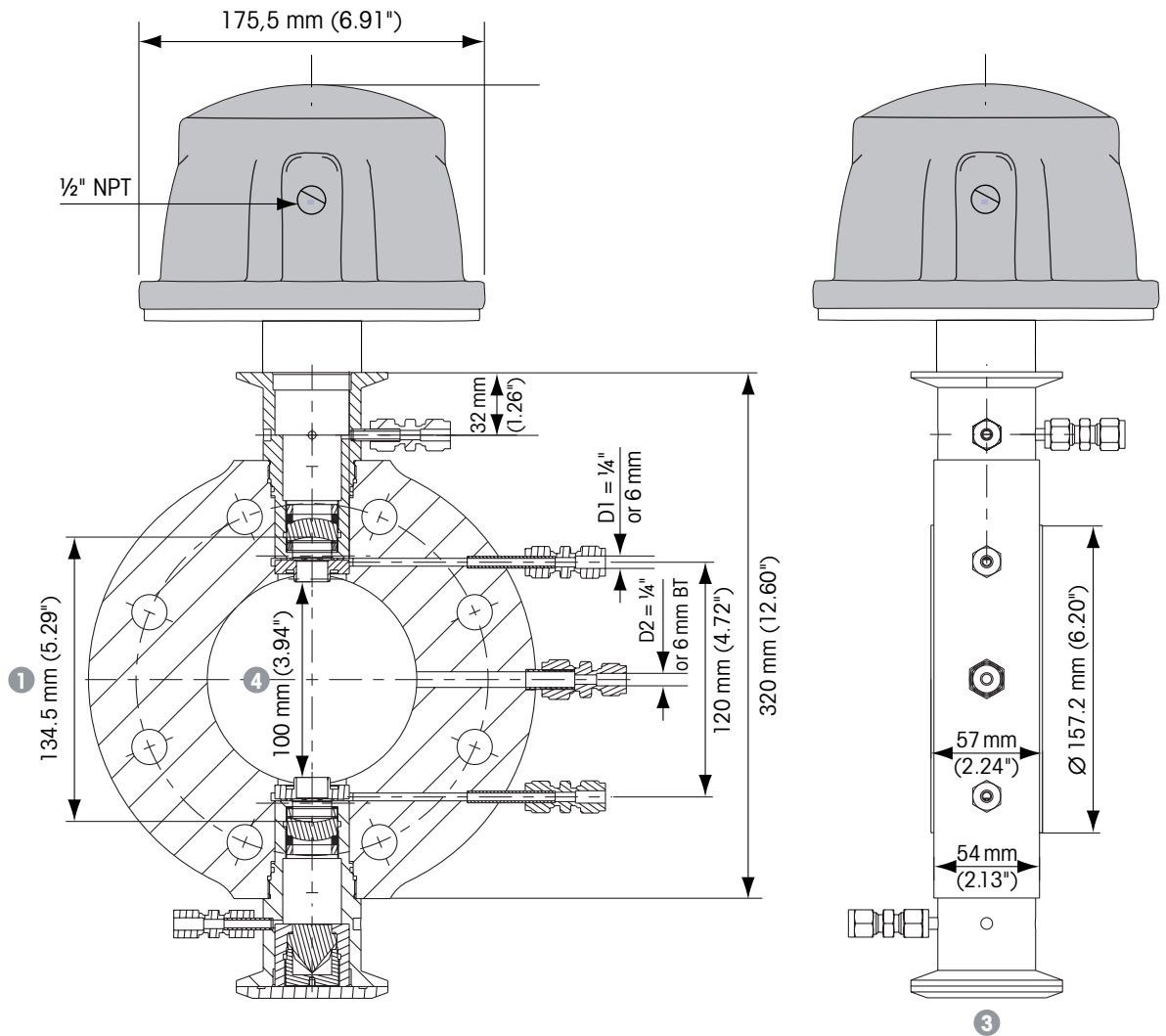
- ① **Nominal path length**, the default length when GPro 500 is delivered. It corresponds to the effective path length without purging.
- ③ **Insertion length**, wafer thickness (distance between pipe flanges).
- ④ **Effective path length**, when configuring the GPro 500 with the M400, the double value of the effective path length must be keyed in (2× effective path length).

Note:

- Filters only available on DN100/4" wafers.
- When using the PTFE filter, the maximum process gas temperature is 302 °F (150 °C).
- Metal filters available: 3 µm, 40 µm, 100 µm, 200 µm.

Installation examples

Dimensions of the Wafer (W) Dual Window

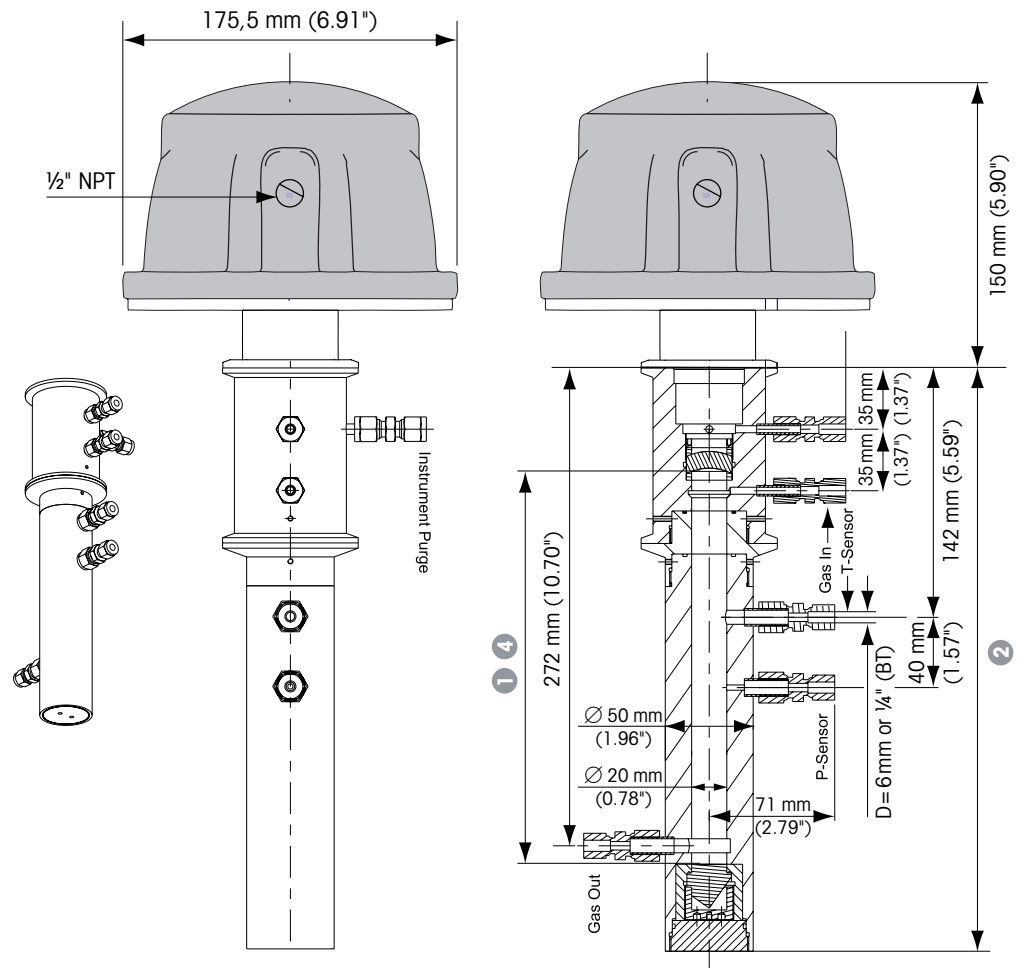


Definition of the dimensions:

- ① **Nominal path length**, the default length when GPro 500 is delivered. It corresponds to the effective path length without purging.
- ③ **Insertion length**, wafer thickness (distance between pipe flanges).
- ④ **Effective path length**, when configuring the GPro 500 with the M400, the double value of the effective path length must be keyed in (2× effective path length).

Installation examples

Dimensions of the extractive cell (E)

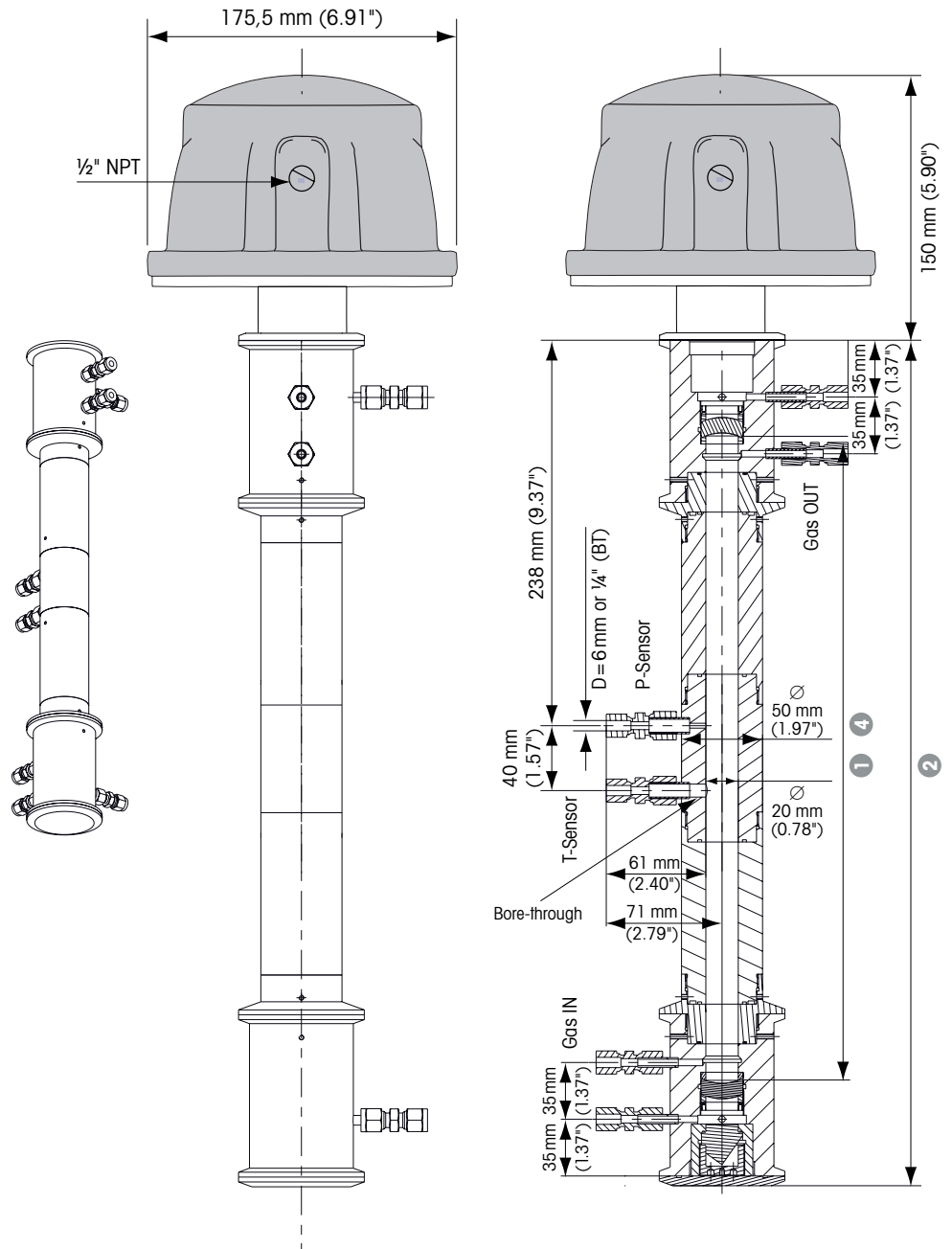


Definition of the dimensions:

- ① **Nominal path length**, the default length when GPro 500 is delivered. It corresponds to the effective path length without purging.
- ② **Probe length**, the physical length of the probe.
- ④ **Effective path length**, when configuring the GPro 500 with the M400, the double value of the effective path length must be keyed in (2× effective path length).

Installation examples

Dimensions of the extractive cell dual window (DW)

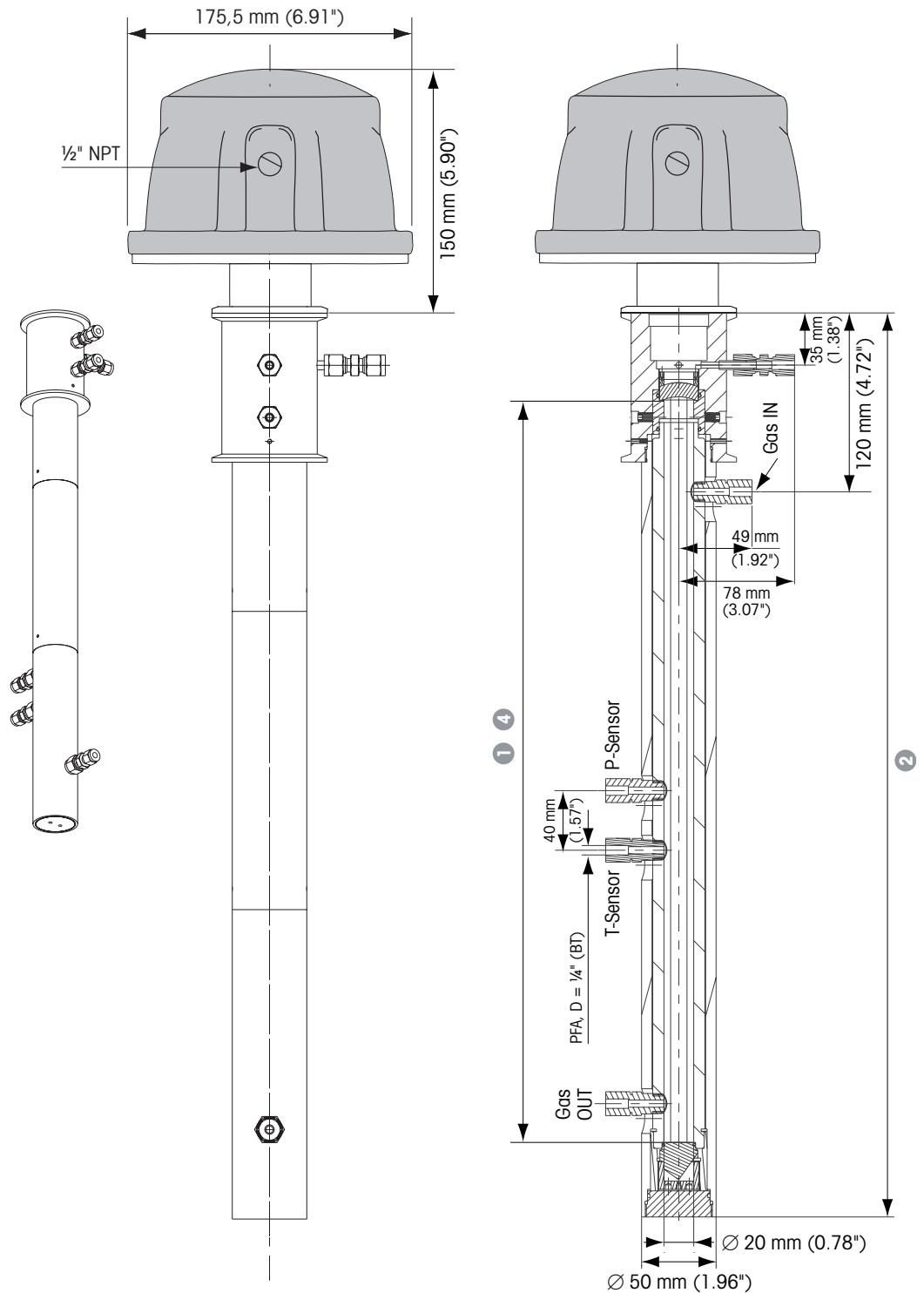


Definition of the dimensions:

- ① **Nominal path length**, the default length when GPro 500 is delivered. It corresponds to the effective path length without purging.
- ② **Probe length**, the physical length of the probe.
- ④ **Effective path length**, when configuring the GPro 500 with the M400, the double value of the effective path length must be keyed in (2× effective path length).

Installation examples

Dimensions of the extractive cell (E) PFA

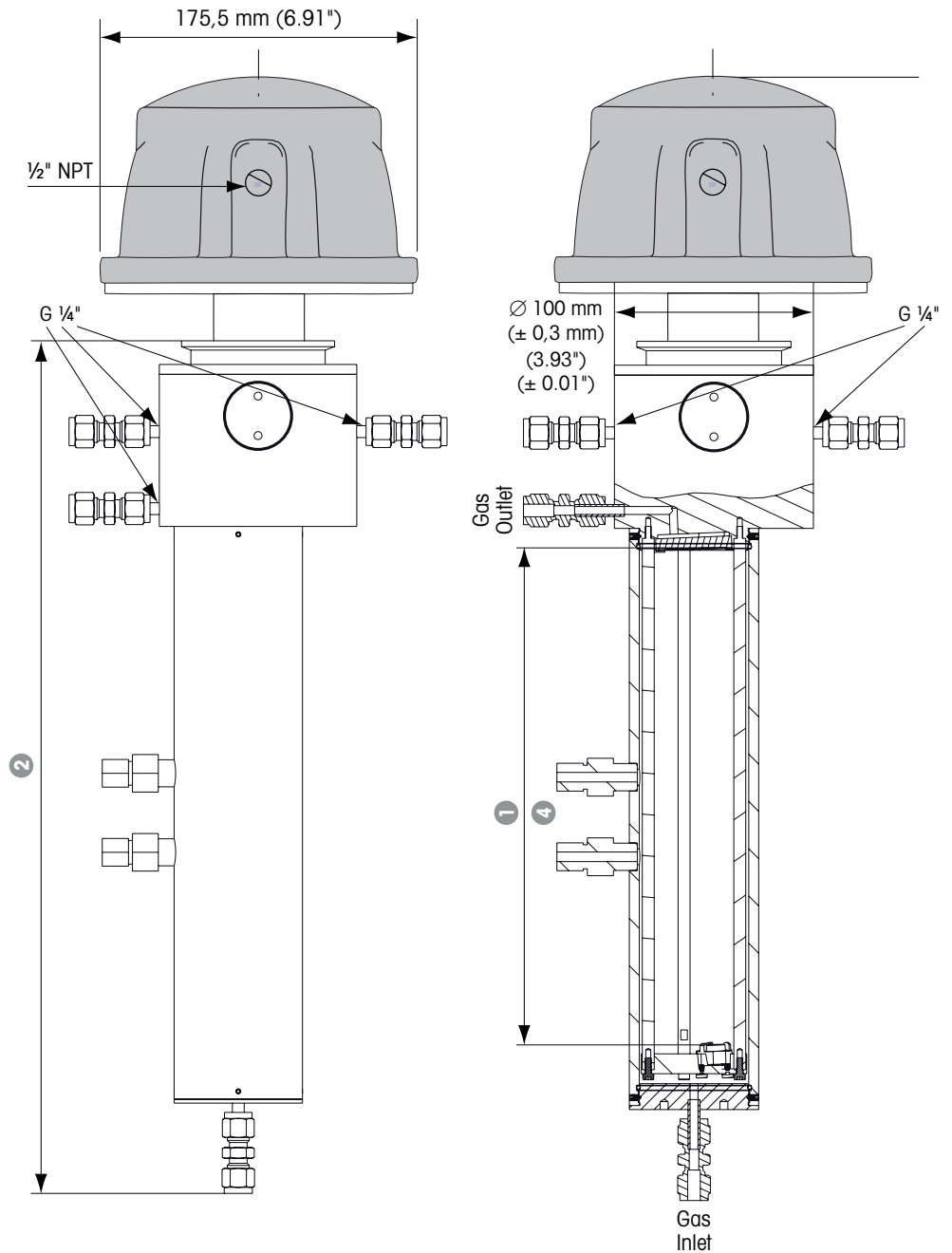


Definition of the dimensions:

- ① **Nominal path length**, the default length when GPro 500 is delivered.
It corresponds to the effective path length without purging.
- ② **Probe length**, the physical length of the probe.
- ④ **Effective path length**, when configuring the GPro 500 with the M400, the double value of the effective path length must be keyed in (2× effective path length).

Installation examples

Dimensions
of the extractive (E) white cell



Definition of the dimensions:

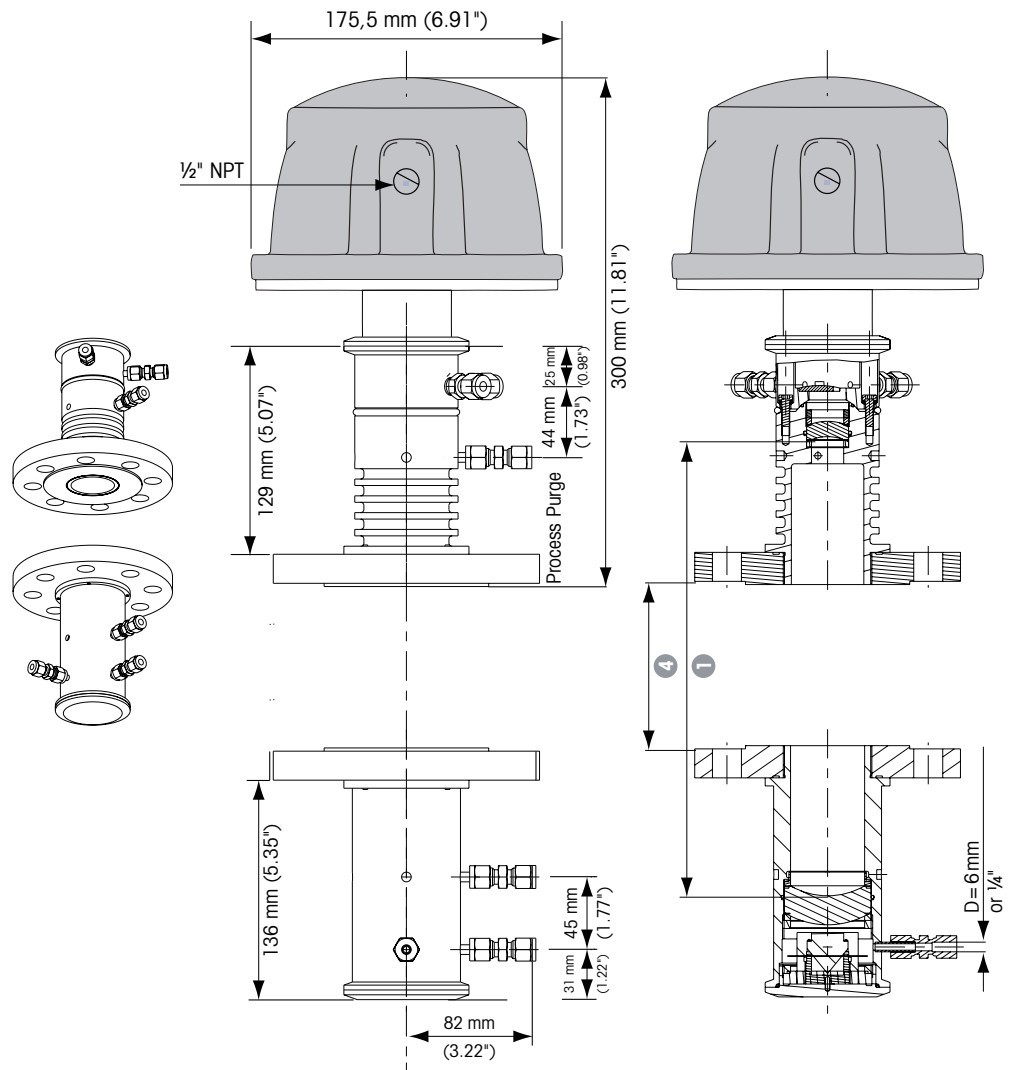
- ① **Nominal path length**, the default length when GPro 500 is delivered.
It corresponds to the effective path length without purging.
- ② **Probe length**, the physical length of the probe.
- ④ **Effective path length**, when configuring the GPro 500 with the M400, the double value of the effective path length must be keyed in (2× effective path length).

Note:

- For oxygen measurement only.

Installation examples

Dimensions
of the cross pipe



Definition of the dimensions:

- ① **Nominal path length**, the default length when GPro 500 is delivered (configuration dependent). It corresponds to the effective path length without purging.
- ④ **Effective path length**, when configuring the GPro 500 with the M400, the double value of the effective path length must be keyed in (2× effective path length).

Installation examples

Probes dimensions

Standard purged probe (SP)	OPL	Dimension ①	Dimension ②*	Dimension ③	Dimension ④
Standard purged (SP)	200 mm (7.9")	138 mm (5.4")	288 mm (11.3")	161.5 mm (6.4")	138 mm (5.3")
Standard purged (SP)	400 mm (15.7")	238 mm (9.4")	388 mm (15.3")	261.5 mm (10.3")	238 mm (9.4")
Standard purged (SP)	800 mm (31.5")	438 mm (17.2")	588 mm (23.1")	461.5 mm (18.2")	438 mm (17.2")

Non-purged probe (NP) with filter	OPL	Dimension ①	Dimension ②*	Dimension ③	Dimension ④
Non-purged probe (NP)	200 mm (7.9")	138 mm (5.4")	288 mm (11.3")	161.5 mm (6.4")	138 mm (5.4")
Non-purged probe (NP)	400 mm (15.7")	238 mm (9.4")	388 mm (15.3")	261.5 mm (10.3")	238 mm (9.4")
Non-purged probe (NP)	800 mm (31.5")	438 mm (17.2")	588 mm (23.1")	461.5 mm (18.2")	438 mm (17.2")

Non-purged probe (NP) with blow-back	OPL	Dimension ①	Dimension ②*	Dimension ③	Dimension ④
Non-purged filter probe with blow-back (NB)	200 mm (7.9")	138 mm (5.4")	288 mm (11.3")	161.5 mm (6.4")	100 mm (3.9")
Non-purged filter probe with blow-back (NB)	400 mm (15.7")	238 mm (9.4")	388 mm (15.3")	261.5 mm (10.3")	200 mm (7.9")
Non-purged filter probe with blow-back (NB)	800 mm (31.5")	438 mm (17.2")	588 mm (23.1")	461.5 mm (18.2")	400 mm (15.7")

* **Note:** Dimension ② in above table applies for standard 100 mm stand-off and for probes with 20 mm flange thickness. For total probe length dimensions for other stand-off lengths, please refer to product configurator.

Installation examples

Wafer dimensions

Wafer (W) without filter	OPL	Dimension ①	Dimension ②	Dimension ③	Dimension ④
DN 50 wafer (W)	100 mm (3.94")	79 mm (3.11")	n.a.	54 mm (2.13")	55 mm (2.17")
DN 80 wafer (W)	154 mm (6.06")	121 mm (4.76")	n.a.	54 mm (2.13")	82 mm (3.29")
DN 100 wafer (W)	200 mm (7.87")	157 mm (6.18")	n.a.	54 mm (2.13")	107 mm (4.21")
ANSI 2" wafer (W)	100 mm (3.94")	77 mm (3.03")	n.a.	54 mm (2.13")	52 mm (2.05")
ANSI 3" wafer (W)	154 mm (6.06")	99 mm (3.90")	n.a.	54 mm (2.13")	77 mm (3.03")
ANSI 4" wafer (W)	200 mm (7.87")	157 mm (6.18")	n.a.	54 mm (2.13")	102 mm (4.06")

Wafer (W) with filter	OPL	Dimension ①*	Dimension ②	Dimension ③	Dimension ④
DN 80 wafer (W)	222 mm (8.74")	111 mm (4.37")	n.a.	54 mm (2.13")	82 mm (3.29")
DN 100 wafer (W)	268 mm (10.55")	134 mm (5.27")	n.a.	54 mm (2.13")	107 mm (4.21")
ANSI 3" wafer (W)	222 mm (8.74")	111 mm (4.37")	n.a.	54 mm (2.13")	77 mm (3.03")
ANSI 4" wafer (W)	268 mm (10.55")	134 mm (5.27")	n.a.	54 mm (2.13")	107 mm (4.21")

* **Note:** For DN 80 (3") and DN 100 (4") wafer with filter, please use dimension ① as effective path length.

Wafer Dual Window (DW) without filter	OPL	Dimension ①	Dimension ②	Dimension ③	Dimension ④
DN 50 wafer (W)	100 mm (3.94")	94 mm (3.70")	n.a.	54 mm (2.13")	55 mm (2.17")
DN 80 wafer (W)	154 mm (6.06")	121 mm (4.76")	n.a.	54 mm (2.13")	82 mm (3.29")
DN 100 wafer (W)	200 mm (7.87")	144 mm (5.67")	n.a.	54 mm (2.13")	107 mm (4.21")
ANSI 2" wafer (W)	100 mm (3.94")	94 mm (3.70")	n.a.	54 mm (2.13")	52 mm (2.05")
ANSI 3" wafer (W)	154 mm (6.06")	121 mm (4.76")	n.a.	54 mm (2.13")	77 mm (3.03")
ANSI 4" wafer (W)	200 mm (7.87")	144 mm (5.67")	n.a.	54 mm (2.13")	107 mm (4.21")

Wafer Dual Window (DW) with filter	OPL	Dimension ①*	Dimension ②	Dimension ③	Dimension ④
DN 80 wafer (W)	242 mm (9.53")	121 mm (4.76")	n.a.	54 mm (2.13")	82 mm (3.29")
DN 100 wafer (W)	288 mm (11.34")	144 mm (5.67")	n.a.	54 mm (2.13")	107 mm (4.21")
ANSI 3" wafer (W)	242 mm (9.53")	121 mm (4.76")	n.a.	54 mm (2.13")	77 mm (3.03")
ANSI 4" wafer (W)	288 mm (11.34")	144 mm (5.67")	n.a.	54 mm (2.13")	107 mm (4.21")

* **Note:** For DN 80 (3") and DN 100 (4") wafer with filter, please use dimension ① as effective path length.

Installation examples

Cell dimensions

Extractive cell (E)	OPL	Dimension ①	Dimension ②*	Dimension ③	Dimension ④
Extractive cell (E)	200 mm (7.9")	125 mm (4.92")	232 mm (9.13")	n.a.	125 mm (4.92")
Extractive cell (E)	400 mm (15.7")	225 mm (8.86")	332 mm (13.07")	n.a.	225 mm (8.86")
Extractive cell (E)	800 mm (31.5")	425 mm (16.73")	532 mm (20.94")	n.a.	425 mm (16.73")
Extractive cell (E)	1000 mm (39.4")	525 mm (20.67")	632 mm (24.88")	n.a.	525 mm (20.67")

Extractive cell Dual Window (E)	OPL	Dimension ①	Dimension ②*	Dimension ③	Dimension ④
Extractive cell Dual Window(E)	400 mm (15.7")	200 mm (7.9")	321 mm (12.6")	n.a.	200 mm (7.9")
Extractive cell Dual Window(E)	800 mm (31.5")	400 mm (15.7")	521 mm (20.5")	n.a.	400 mm (15.7")
Extractive cell Dual Window(E)	1000 mm (39.4")	500 mm (19.7")	621 mm (24.4")	n.a.	500 mm (19.7")

Extractive Cell PFA	OPL	Dimension ①	Dimension ②*	Dimension ③	Dimension ④
Extractive cell (E) PFA	1000 mm (39.4")	500 mm (19.7")	606.5 mm (23.9")	n.a.	500 mm (19.7")

Extractive White Cell	OPL	Dimension ①	Dimension ②*	Dimension ③	Dimension ④
Extractive white cell (E)	10000 mm (393.7")	250 mm (9.8")	432 mm (17.0")	n.a.	250 mm (9.8")

* **Note:** Dimension ② in above tables apply for standard 100 mm stand-off and for probes with 20 mm flange thickness.
For total probe length dimensions for other stand-off lengths, please refer to product configurator.

Cross-Pipe Dimensions	OPL	Dimension ①	Dimension ②	Dimension ③	Dimension ④
Cross-Pipe (C)	2000–6000 mm (78.74"–236.22")	2000–6000 mm (78.74"–236.22")	n.a.	n.a.	Dimension ①–300 mm (11.81")

Sampling and conditioning system (SCS) Design requirements

- Sampled gases must be dry and dust-free. Flow can be user-defined.
- Heat tracing of the cell up to the maximum design temperature is allowed, but maximum spectrometer ambient temperature is 55 °C (131 °F).

	Internal volume	OPL (Optical path length)	Maximum design pressure	Maximum design temperature
Extractive cell (E)	39	200	10 bar a	250 °C/482 °F
Extractive cell (E)	71	400	10 bar a	250 °C/482 °F
Extractive cell (E)	134	800	10 bar a	250 °C/482 °F
Extractive cell (E)	165	1000	10 bar a	250 °C/482 °F
Extractive cell Dual Window (DW)	31	200	10 bar a	250 °C/482 °F
Extractive cell Dual Window (DW)	63	400	10 bar a	250 °C/482 °F
Extractive cell Dual Window (DW)	126	800	10 bar a	250 °C/482 °F
Extractive cell Dual Window (DW)	157	1000	10 bar a	250 °C/482 °F
Extractive cell (E) PFA	157	1000	5 bar a	150 °C/302 °F
Extractive white cell (E)	618	5000	10 bar a	150 °C/302 °F

Installation examples

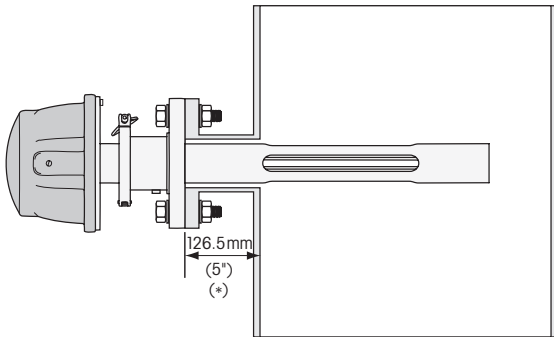
Required flanges for some typical standard probe (SP) configurations (100 mm stand-off)

① Nominal path length	② Probe length	③ Insertion length	④ Effective path length *	Pipe size DN/SPS	Number of flanges
138 mm (5.4")	288 mm (11.3")	161.5 mm (6.4")	100 mm (3.9")	100 mm (3.94")	2
138 mm (5.4")	288 mm (11.3")	161.5 mm (6.4")	100 mm (3.9")	150 mm (5.91")	2
138 mm (5.4")	288 mm (11.3")	161.5 mm (6.4")	100 mm (3.9")	200 mm (7.87")	1
238 mm (9.4")	388 mm (15.3")	261.5 mm (10.3")	200 mm (7.9")	200 mm (7.87")	2
238 mm (9.4")	388 mm (15.3")	261.5 mm (10.3")	200 mm (7.9")	250 mm (9.84")	2
238 mm (9.4")	388 mm (15.3")	261.5 mm (10.3")	200 mm (7.9")	300 mm (11.81")	1
438 mm (17.2")	588 mm (23.1")	461.5 mm (18.2")	400 mm (15.7")	300 mm (11.81")	2
438 mm (17.2")	588 mm (23.1")	461.5 mm (18.2")	400 mm (15.7")	400 mm (15.75")	2
438 mm (17.2")	588 mm (23.1")	461.5 mm (18.2")	400 mm (15.7")	500 mm (19.69")	1
438 mm (17.2")	588 mm (23.1")	461.5 mm (18.2")	400 mm (15.7")	600 mm (23.62")	1

* When configuring the GPro 500 with the M400, the double value of the effective path length must be keyed in (2× effective path length).

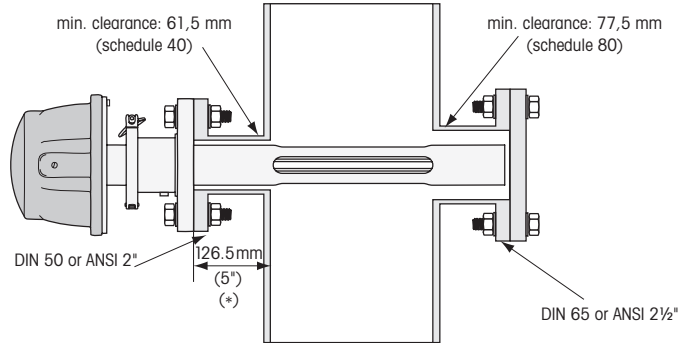
Installation examples (SP probe)

One and two flange configuration



One flange configuration

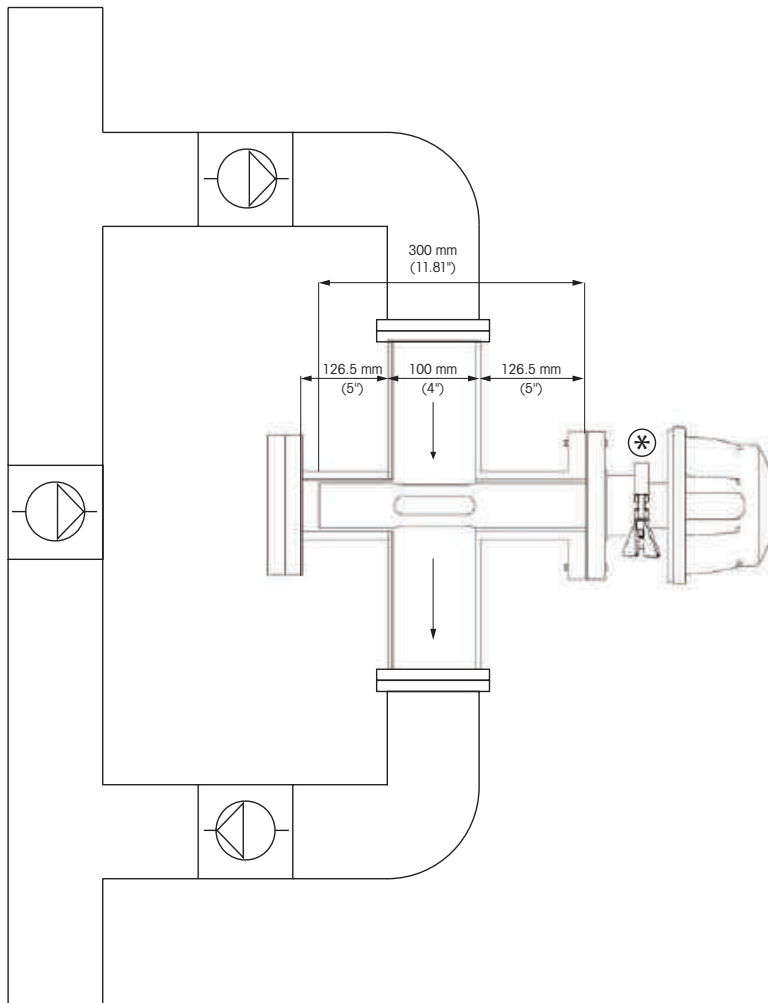
Default* stand-off for standard probe (SP).
Other stand-off distances available:
200 mm (8") and 300 mm (12").



Two flange configuration

Default* stand-off for standard probe (SP).
Other stand-off distances available:
200 mm (8") and 300 mm (12").

By-pass configuration (SP probe)



Example of typical by-pass configuration.

* Default stand-off length shown.

System overview

The GPro Series consists of four main components:



1 Sensor head

The combined transmitter and receiver unit is called the sensor head. This part contains the laser, optics and all the electronics for laser control, signal processing, line locking, detector electronics, etc. The sensor head has an Ethernet interface for high level maintenance by the use of METTLER TOLEDO Process Analytics specific software. All parts of the sensor head are non-wetted and are never in contact with the process. If this feature has been selected when purchasing the analyzer, the GPro 500 can also provide $2 \times 4 \dots 20$ mA passive analog outputs directly from the sensor head (SIL2).

2 Process adaption

The probe exists in several standard versions where both material of construction and insertion length can be customized to particular needs. The wafer is available in a variety of sizes, to suit pipes sizes of DN50, DN80, DN100 or ANSI 2", ANSI 3" or ANSI 4".

3 M400 G2 type 3 transmitter

The M400 is the GPro 500 user interface. Using the M400, the user can set the necessary parameters for operation, and control the alarm and I/O setup. The M400 will also display the measured gas concentration, the process temperature and pressure as well as the transmission (signal quality/strength). It features class 1 Div 2 FM approval (ATEX zone 2) and four active 4–20 mA analog outputs.

4 Junction box

A junction box is required between the sensor head and the M400. An existing junction box can be used, or one can be ordered as an accessory. The 4–20 mA signals for temperature and pressure compensation are connected to the sensor's head through the junction box. The Ethernet interface can be accessed through the junction box as well.

System overview

Material of construction for process adaption

Wetted Parts	1.4404 (comparable to 316L), 1.4571, Hastelloy C22, PFA
Glass, Optics	AR coated Quartz, AR coated Borosilicate, Sapphire
O-rings, Gaskets	Kalrez® 6375, Kalrez® (FDA) 6230, 6380 (Spectrum), 0090 (RGN), Graphite, PFA-O-Seal PTFE

Probe lengths. Standard purged (SP)

290 mm / 11.42"
 390 mm / 15.35"
 590 mm / 23.23"

Probe lengths. Non-purge probes (NP)

290 mm / 11.42"
 390 mm / 15.35"
 590 mm / 23.23"

Probe lengths. Non-purged filter probe with blow-back (NB)

290 mm / 11.42"
 390 mm / 15.35"
 590 mm / 23.23"

Probe lengths. Non-purged probes (NP) with filter

290 mm / 11.42"
 390 mm / 15.35"
 590 mm / 23.23"

Wafer sizes (to fit pipe diameter)

DN 50, 80 or 100; PN16/PN40
 ANSI 2", 3" or 4"; 150 lbs

Other materials of construction as well as different probe lengths are available upon request.

Measurement (All measurement specifications with reference to standard conditions T & P with no dust or particulates)

	O ₂	CO (ppm)	CO (%)
Optical path length	<ul style="list-style-type: none"> Optical path length (OPL) can vary between 100 mm and 10 m depending on the selected process adaption (see "Installation examples" on page 15). The OPL can be multiplied by 2 (MR2) or 3 (MR3) when using the multi-reflection cell (MR). 		
Measurement range and standard conditions (ambient temperature and pressure, 1 m path length)	0 – 100 %	0 – 2 %	0 – 100 %
Lower Deflection Limit (in 1 meter path length at ambient standard conditions, dry gas, no dust load, in N ₂ back-ground)	100 ppm-v	1 ppm-v	1500 ppm-v
Accuracy	1 % of reading or 100 ppm O ₂ (whichever is greater)	2 % of reading or 1 ppm (whichever is greater)	2 % of reading or 1500 ppm, (whichever is greater)
Linearity	Better than 1 %	Better than 1 %	Better than 1 %
Resolution	<0.01 % vol O ₂ (100 ppm-v)	1 ppm-v	1500 ppm-v
Drift	Negligible (<2 % of measurement range between maintenance intervals)	Negligible (<2 % of measurement range between maintenance intervals)	Negligible (<2 % of measurement range between maintenance intervals)
Sampling rate	1 second	1 second	1 second
Response Time (T90)	O ₂ in N ₂ 21 % > 0 % in <2 sec	CO in N ₂ 300 ppm-v to 0 % in <4 sec	CO in N ₂ 1 % to 0 % in <4 sec
Warm up time	Typically <1 hour	Typically <1 hour	Typically <1 hour
Repeatability	±0.25 % of reading or 0.05 % O ₂ (whichever is greater)	±0.25 % of reading or 5 ppm-v CO (whichever is greater)	±0.25 % of reading or 0.75 %-v CO (whichever is greater)
Process pressure range	0.1 bar – 10 bar (abs) / 4.35 psi – 145.03 psi (abs)*	0.8 bar – 2 bar (abs) / 11.63 psi – 29.00 psi (abs)	0.8 bar – 1.5 bar (abs) / 11.63 psi – 21.75 psi (abs)
Process temperature range	0 to +250 °C (+32 to +482 °F) Standard 0 to +600 °C (0 to +1112 °F) with built in thermal barrier, 0 to +150 °C (+32 to +302 °F) (White cell, PFA, PTFE filter)		
* from Firmware 6.23 or higher			

Measurement (All measurement specifications with reference to standard conditions T & P with no dust or particulates)

	H ₂ O	H ₂ O ppm	CO ₂ (%)
Optical path length	<ul style="list-style-type: none"> Optical path length (OPL) can vary between 100 mm and 10 m depending on the selected process adaptation (see "Installation examples" on page 15). The OPL can be multiplied by 2 (MR2) or 3 (MR3) when using the multi-reflection cell (MR). 		
Measurement range and standard conditions (ambient temperature and pressure, 1 m path length)	0–20%	0–1%	0–100%
Lower Detection Limit (in 1 meter path length at ambient standard conditions, dry gas, no dust load, in N ₂ back-ground)	5 ppm-v	1 ppm-v	1000 ppm-v
Accuracy	2% of reading or 10 ppm, (whichever is greater)	2% of reading or 1 ppm, (whichever is greater)	2% of reading or 1000 ppm, (whichever is greater)
Linearity	Better than 1%	Better than 1%	Better than 1%
Resolution	5 ppm-v	1 ppm-v	1000 ppm-v
Drift	Negligible (<2% of measurement range between maintenance intervals)	Negligible (<2% of measurement range between maintenance intervals)	Negligible (<2% of measurement range between maintenance intervals)
Sampling rate	1 second	1 second	1 second
Response Time (T90)	H ₂ O in N ₂ 1% to 0% in <4 sec	H ₂ O in N ₂ 1% to 0% in <4 sec	CO ₂ in N ₂ 1% to 0% in <4 sec
Warm up time	Typically <1 hour	Typically <1 hour	Typically <1 hour
Repeatability	±0.25% of reading or 50 ppm-v H ₂ O (whichever is greater)	±0.25% of reading or 10 ppm-v H ₂ O (whichever is greater)	±0.25% of reading or 5000 ppm-v CO ₂ (whichever is greater)
Process pressure range	0.8 bar–2 bar (abs) / 11.63 psi–29.00 psi (abs)	0.8 bar–5 bar (abs) / 11.63 psi–72.50 psi (abs)	0.8 bar–2 bar (abs) / 11.63 psi–29.00 psi (abs)
Process temperature range	0 to +250 °C (+32 to +482 °F) Standard 0 to +600 °C (0 to +1112 °F) with built in thermal barrier, 0 to +150 °C (+32 to +302 °F) (White cell, PFA, PTFE filter)		

Measurement (All measurement specifications with reference to standard conditions T & P with no dust or particulates)

	CO ₂ %/CO %	CO ppm/CH ₄ %	HCl (ppm)
Optical path length	<ul style="list-style-type: none"> Optical path length (OPL) can vary between 100 mm and 10 m depending on the selected process adaptation (see "Installation examples" on page 15). The OPL can be multiplied by 2 (MR2) or 3 (MR3) when using the multi-reflection cell (MR). 		
Measurement range and standard conditions (ambient temperature and pressure, 1 m path length)	0–100% (CO ₂ and CO)	0–2% (CO) 0–10% (CH ₄)	0–3%
Lower Detection Limit (in 1 meter path length at ambient standard conditions, dry gas, no dust load, in N ₂ back-ground)	1000 ppm-v (CO ₂) 1500 ppm-v (CO)	0–200 °C: 1 ppm-v CO, 5 ppm-v CH ₄ 200–600 °C: 5 ppm-v (CO), 25 ppm-v (CH ₄)	0.6 ppm-v
Accuracy	2% of reading or 1000 ppm (whichever is greater)	2% of reading or 1 ppm (CO) / 25 ppm-v (CH ₄) (whichever is greater)	2% of reading or 0.6 ppm (whichever is greater)
Linearity	Better than 1%	Better than 1%	Better than 1%
Resolution	1000 ppm-v	1 ppm-v (CO) 3 ppm-v (CH ₄)	0.6 ppm-v
Drift	Negligible (<2% of measurement range between maintenance intervals)	Negligible (<2% of measurement range between maintenance intervals)	Negligible (<2% of measurement range between maintenance intervals)
Sampling rate	1 second	1 second	1 second
Response Time (T90)	CO ₂ in N ₂ 1% to 0% in <4 sec	CO/CH ₄ in N ₂ 2% to 0% in <4 sec	HCl in N ₂ 1% to 0% in <4 sec
Warm up time	Typically <1 hour	Typically <1 hour	Typically <1 hour
Repeatability	±0.25% of reading or 5000 ppm-v CO ₂ or CO (whichever is greater)	±0.25% of reading or 5 ppm-v CO/500 ppm-v CH ₄ (whichever is greater)	±0.25% of reading or 3 ppm-v HCl (whichever is greater)
Process pressure range	0.8 bar–2 bar (abs) / 11.63 psi–29.00 psi (abs)	0.8 bar–2 bar (abs) / 11.63 psi–29.00 psi (abs)	0.8 bar–3 bar (abs) / 11.6 psi–43.5 psi (abs)
Process temperature range	0 to +250 °C (+32 to +482 °F) Standard 0 to +600 °C (0 to +1112 °F) with additional thermal barrier, 0 to +150 °C (+32 to +302 °F) (White cell, PFA, PTFE filter)		

Measurement (All measurement specifications with reference to standard conditions T & P with no dust or particulates)

	H ₂ S (%)	CH ₄ ppm	NH ₃ ppm
Optical path length	<ul style="list-style-type: none"> Optical path length (OPL) can vary between 100 mm and 10 m depending on the selected process adaptation (see "Installation examples" on page 15). The OPL can be multiplied by 2 (MR2) or 3 (MR3) when using the multi-reflection cell (MR). 		
Measurement range and standard conditions (ambient temperature and pressure, 1 m path length)	0–50%	0–1%	0–1%
Lower Detection Limit (in 1 meter path length at ambient standard conditions, dry gas, no dust load, in N ₂ back-ground)	20 ppm-v	1 ppm-v	1 ppm-v
Accuracy	2% of reading or 20 ppm (whichever is greater)	2% or 1 ppm (whichever is greater)	2% or 1 ppm (whichever is greater)
Linearity	Better than 1%	Better than 1%	Better than 1%
Resolution	20 ppm-v	1 ppm	1 ppm
Drift	Negligible (<2% of measurement range between maintenance intervals)	Negligible (<2% of measurement range between maintenance intervals)	Negligible (<2% of measurement range between maintenance intervals)
Sampling rate	1 second	1 second	1 second
Response Time (T90)	H ₂ S in N ₂ 1% to 0% in <4 sec	CH ₄ in N ₂ 1% to 0% in <4 sec	NH ₃ in N ₂ 1% to 0% in <4 sec
Warm up time	Typically <1 hour	Typically <1 hour	Typically <1 hour
Repeatability	±0.25% of reading or 100 ppm-v H ₂ S (whichever is greater)	±0.25% of reading or 5 ppm-v CH ₄ (whichever is greater)	±0.25% of reading or 5 ppm-v NH ₃ (whichever is greater)
Process pressure range	0.8 bar–2 bar (abs) / 11.6 psi–29 psi (abs)	0.8 bar–3 bar (abs) / 11.63 psi–43.5 psi (abs)	0.8 bar–3 bar (abs) / 11.63 psi–43.5 psi (abs)
Process temperature range	0 to +250 °C (+32 to +482 °F) Standard 0 to +600 °C (0 to +1112 °F) with additional thermal barrier, 0 to +150 °C (+32 to +302 °F) (White cell, PFA, PTFE filter)		

Technical specifications

Electrical inputs & outputs

Communication interface	RS 485 (to transmitter) or direct current outputs (optional)
Service interface	Ethernet (to PC) as direct service interface for FW updates (not using the M400 transmitter), for off-line diagnostics and configuration database up/download
Memory slot interface	SD card reader/writer for data retrieval (measurement & diagnostics), FW update and remote diagnostics (configuration file up/download) (to be accessed using Ethernet port). Space for data storage: 4 GB.
Analog outputs (on M400)	4 × 4–20 mA (22 mA): process temperature, pressure, % conc, % transmission
Number of direct analog outputs	2 (optional)
Current outputs	Passive 4...20 mA outputs, galvanically isolated, alarms to 3.6 mA or 22 mA conform to NAMUR NE43 guidelines
Measurement error through analog outputs	Non-linearity <±0.002 mA over the 1 to 20 mA range Offset error <±0.004 mA (zero scale) Gain error <±0.04 mA (full scale)
Analog output configuration	Linear
Load	Max 500 Ohms
Hold mode input	Yes, via Ethernet (using the MT-TDL suite)
Analog inputs	2 × 4–20 mA (passive) for pressure and temperature (optional: fixed values)
Display	On M400, see M400 technical datasheet
Relays	4 relays (on M400)
Power supply	24 VDC, ± 10% , 5–60 W
Fuse	2 A slow blow type FC

Calibration

Calibration (factory)	Full calibration
Calibration (user)	One-point and process calibration

Operating conditions

Ambient temperature range	–20 ... +55 °C (–4 ... +131 °F) during operation; –40 ... +70 °C (–40 ... +158 °F) during transport and storage (<95% non-condensing humidity)
Maximum design (non- operating) Pressure	Design: 25 bar (abs)/362.6 psi (abs); extractive cells: 10 bar (abs) (PFA version: 5 bar [abs]) Probes with DN 100 flanges: 10 bar
Max. dust load @ nom. EPL	Application dependent
Temperature & pressure compensation	Using analog 4 ... 20 mA input signals or manually set values in M400 (menu configure/measurement). Automatic plausibility check of analog inputs

Purging

Process side purging (standard probes [SP]) and wafer cells	For standard purged (SP) and wafer cells, a process side purge is normally required. For oxygen applications, nitrogen with a purity >99.7% (minimum recommended) at a flow rate of between 0.5 and 10 L/min (application dependent) is required. For other gas applications, instrument grade air can be used instead of nitrogen. All purge gases should be clean/dry and conform to standard ISO 8573.1. class 2 3, for instrument air quality.
Instrument side purging	Yes, flow <0.5 L/min (all process adaptations)
Corner cube purging	Yes, via process side purging

ISM

ISM® diagnostics parameters	% Transmission (available as a 4 ... 20 mA analog output) Window fouling (→ TTM: Time to Maintenance) Laser lifetime (→ DLI: Dynamic Lifetime Indicator)
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Alarms

Alarm triggers	Too low transmission (min. transmission value to be set in M400 menu Config/ISM setup) All alarms (incl SW/HW errors etc) listed into Chapter 8.5.1 of manual M400
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Mechanical specifications

Insertion length	see installation examples
Weight	12 – 14 kg/26 – 30 lbs, depending on configuration
Insulation / rating	IP 65/NEMA Type 4X

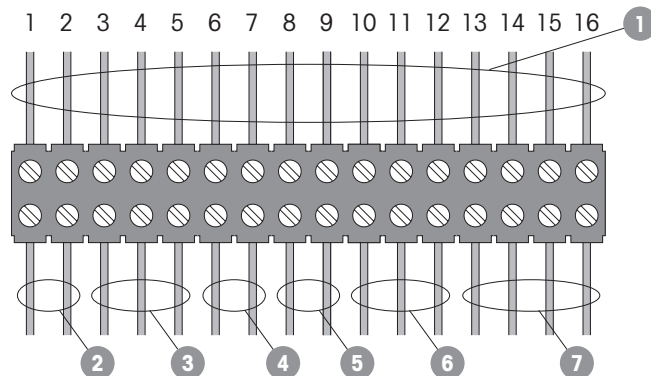
Data logger

Function	Logging of all sensor data on SD card
Interval	Freely selectable using the METTLER TOLEDO TDL software (on documentation CD)
Format	SPC

Certificates

	Quality certificate (final inspection), Material certificate 3.1, EX II 1/2G – Ex op is/[op is T6 Ga] d IIC T6 Ga/Gb, EX II 1/2D – Ex op is/[op is T86°C Da] tb IIIC T80°C Da/Db, IECEx IBE 15.0013 X CI I, Div 1, Grp A, B, C, D, T6 CI II, III, Div 1, Grp E, F, G, T6 FM, CE, PED, IP 65, NEMA 4X
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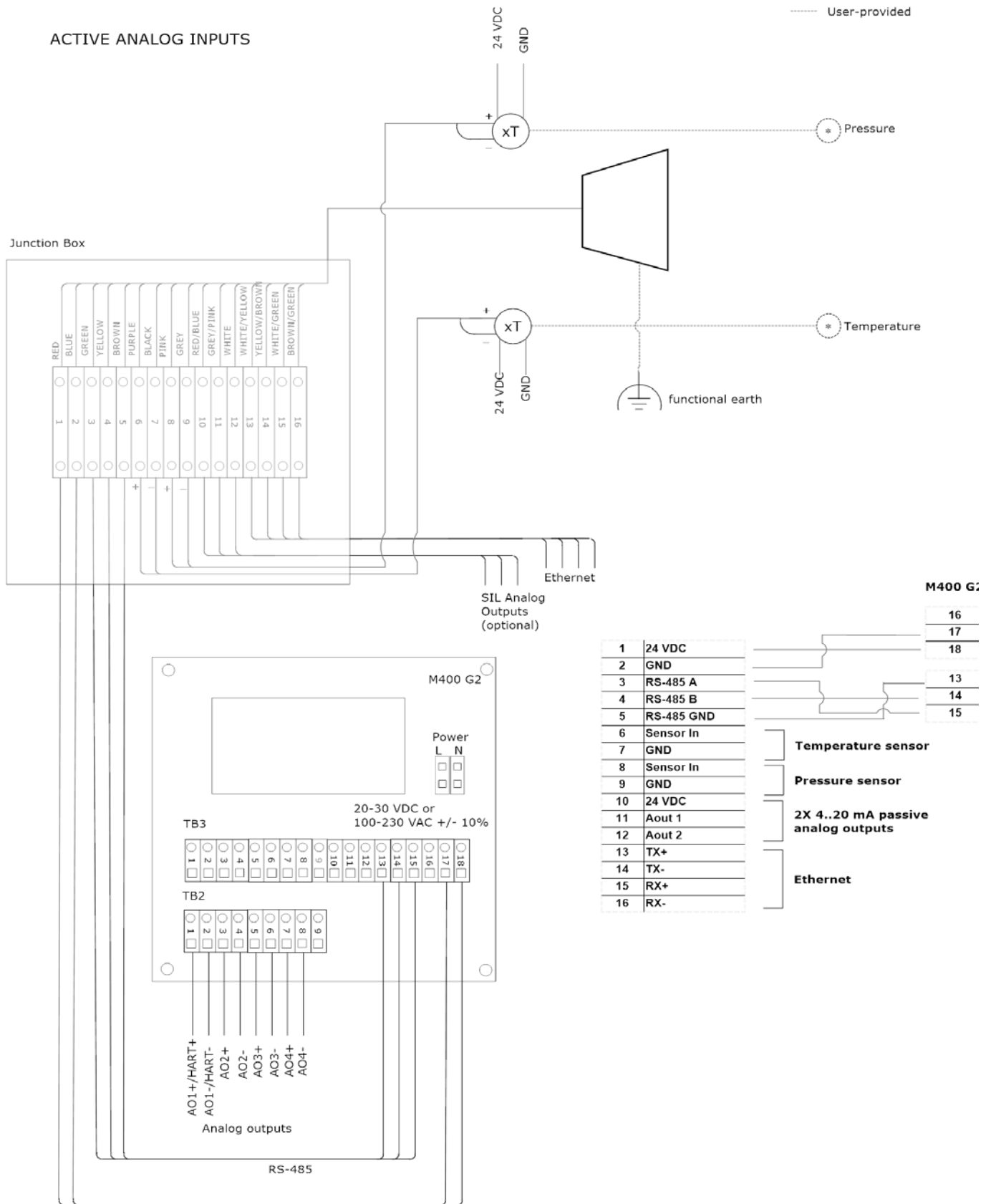
Signal cable connections

**Connections in the junction box**

- ① Connections to the GPro 500 – cable numbers below
- ② Power from an external source or optionally from the M400
- ③ RS 485 from the M400
- ④ 4 ... 20 mA from temperature sensor
- ⑤ 4 ... 20 mA from pressure sensor
- ⑥ SIL2 direct analog outputs (optional)
- ⑦ Ethernet

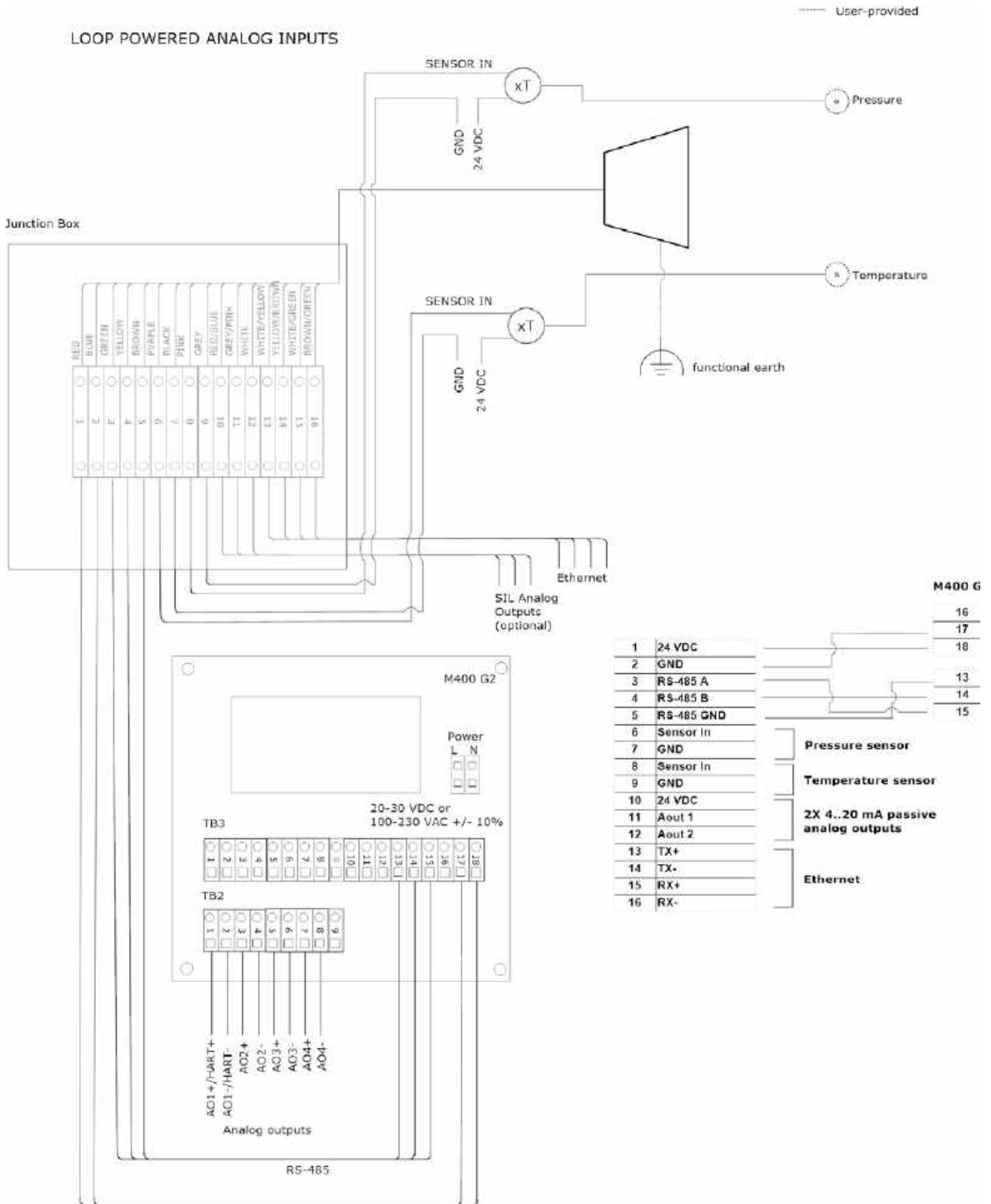
Signal	Description	Cable no.	Color
Power +24 V	Power 24 V, 5 W	1	Red
GND (Power)		2	Blue
RS 485 A	Interface M400 (RS 485)	3	Green
RS 485 B		4	Yellow
RS 485 GND		5	Brown
4 ... 20 mA pos	Current input temperature	6	Purple
4 ... 20 mA neg		7	Black
4 ... 20 mA pos	Current input pressure	8	Pink
4 ... 20 mA neg		9	Grey
+ 24 V	Passive analog outputs	10	Red/blue
Out 1		11	Grey/pink
Out 2		12	White
TX+	Ethernet	13	White/yellow
TX-		14	Yellow/brown
RX+		15	White/green
RX-		16	Brown/green

Active analog inputs (ATEX and US version)



Wiring diagram with active analog inputs (ATEX and US version).

Loop-powered analog inputs (ATEX and US version)



Wiring diagram with loop-powered analog inputs (ATEX and US version).

Gas analyzer GPro 500 product key

Gas Analyzer	GPro 500	A	T	A	O	P	B	K	S	O	2	O	P	D	1	X	S	_	_	/	A	X
30 027 126*, 30 538 717**	GPro 500	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	/	Y	Y
Hazardous area approvals																						
ATEX/IECEX Ex d		A	T																			
FM Class 1 Div 1		U	S																			
Gases																						
Oxygen				A	O																	
CO				C	O																	
H ₂ O				H	O																	
H ₂ O ppm				H	1																	
CO ₂ %				C	2																	
CO %				C	1																	
CO % + CO ₂ %				C	C																	
CO ppm + CH ₄ %				C	M																	
H ₂ S				S	1																	
HCl ppm				L	O																	
CH ₄ ppm				M	O																	
NH ₃ ppm				N	O																	
Process interfaces																						
Standard Probe purged (SP)						P																
Non-purged Filter Probe (NP)						F																
Non-purged Filter Probe with Blow-back (BP)						B																
Wafer (W)						W																
Extractive Cell (E)						E																
Cross-pipe Folded Path (C)						C																
Process optics***																						
Borosilicate						B																
Quartz						Q																
Sapphire						S																
Dual Window Borosilicate						C																
Dual Window Quartz						R																
Dual Window Sapphire						T																
Process sealings***																						
Kalrez® 6375							K															
Graphite							G															
Kalrez® (FDA grade) 6230							F															
Kalrez® 6380							S															
Kalrez® 0090							R															
PFA-coated FEP							P															
Wetted materials***																						
1.4404 (equivalent to 316L)								S	O													
Hastelloy C22								C	O													
Optical path probes and extractive cell***																						
200 mm (7.9")										2	0											
400 mm (15.7")										4	0											
800 mm (31.5")										8	0											
1 m (3.3 ft)										0	1											
2 m (6.6 ft)										0	2											
3 m (9.8 ft)										0	3											
4 m (13.1 ft)										0	4											

Gas Analyzer	GPro 500	A	T	A	O	P	B	K	S	O	2	O	P	D	1	X	S	_	_	/	A	X
30 027 126*, 30 538 717**	GPro 500	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	/	Y	Y
5 m (16.4 ft)											0	5										
6 m (19.7 ft)											0	6										
10 m (32.8 ft)											1	0										
None											X	X										
Process connections***																						
DN50/PN25														P	D							
ANSI 2" / 300 lbs														P	A							
DN50/PN 16														L	D							
ANSI 2" / 150 lbs														L	A							
DIN 80/PN 16														G	D							
ANSI 3" / 150 lbs														G	A							
DIN100/PN25														N	D							
ANSI 4" / 300 lbs														N	A							
ANSI 4" / 150 lbs														M	A							
DN50/PN 16 and 40														W	1							
DN80/PN 16 and 40														W	2							
DN 100/PN 16														W	3							
ANSI 2" / 150 lbs														W	4							
ANSI 3" / 150 lbs														W	5							
ANSI 4" / 150 lbs														W	6							
Swagelok 6 mm														E	M							
Swagelok ¼"														E	I							
Wall thickness***																						
100 mm																					1	
200 mm																						2
300 mm																						3
None																						X
Filters***																						
Filter A – 40 µm																						A
Filter B – 100 µm																						B
Filter C – 200 µm																						C
Filter D – 3 µm																						D
Filter PTFE Membrane																						E
No Filter																						X
Add-on modules***																						
None																						X
With Thermal Barrier (up to 600 °C)																						H
2-fold Multireflection Cell																						2
3-fold Multireflection Cell																						3
Cable																						
5 m (16.4 ft)																						A
15 m (49.2 ft)																						B
25 m (82.0 ft)																						C
40 m (131.2 ft)																						D
None																						X
Communication interfaces																						
RS485 (for M400)																						X
RS485 and Direct Analog																						A

* 6 weeks delivery time. ** 3 weeks delivery time. *** Other configurations upon request.

Ordering information

Spare parts	Order number
Kit Flat gasket ST	30 080 914
Kit Flat gasket HT (Graphite)	30 080 915
Spares Kit FM spectrometer	30 252 641
Sunk-in screws set (20 pc) 1.4404	30 297 253
Sunk-in screws set (5 pc) Hastelloy C22	30 297 255

Accessories	Order number
Thermal barrier	30 034 138
Junction box	30 034 149
Purging box for M400 Ex d	30 034 148
O2 Calibration Kit GPro OPL 200, 6 mm	30 034 139
O2 Calibration Kit GPro OPL 200, ¼ inch	30 445 252
O2 Calibration Kit GPro OPL 400, 6 mm	30 445 253
O2 Calibration Kit GPro OPL 400, ¼ inch	30 445 254
Calibration kit	30 034 139
Check valve	To be provided by the user
Cable GPro 500 ATEX, FM 5 m	30 077 735
Cable GPro 500 ATEX, FM 15 m	30 077 736
Cable GPro 500 ATEX, FM 25 m	30 077 737
Cable GPro 500 ATEX, FM 40 m	30 422 256
GPro 500 cross-pipe installation positioning kit	30 392 869
GPro 500 cross-pipe verification kit	30 428 120
M400, Type 3	30 374 113
M400 Pipe mount kit	30 300 480
M400 Panel mount kit	30 300 481
M400 Protective hood	30 073 328
GPro Pin Spanner	30 129 726
Tri-Clamp 2.5" high pressure	30 297 256

**Corner cube module O-ring set
for Standard Temperature (ST):**

Kalrez® 6375	30 428 051
Kalrez® 6230 (FDA grade)	30 428 052
Kalrez® 6380	30 468 293
Kalrez® 0090	30 468 294
EPDM	30 468 295

Filter O-ring set for all metal filters (A, B, C, D)

Kalrez® 6375	30 428 053
Kalrez® 6230 (FDA grade)	30 428 054
Kalrez® 6380	30 468 296
Kalrez® 0090	30 468 297
EPDM	30 468 298
Graphite	30 428 055

For addresses of METTLER TOLEDO
Market Organizations please go to:
www.mt.com/pro-MOs



Management System
certified according to
ISO 9001 / ISO 14001



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Mettler-Toledo GmbH, Process Analytics
Im Hackacker 15, CH-8902 Urdorf, Switzerland
Phone + 41 44 729 62 11, Fax +41 44 729 66 36

www.mt.com/pro