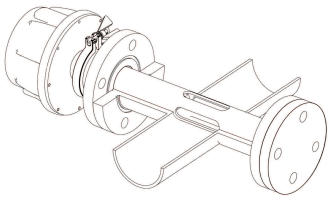
# GPro™ 500 TDL Series
# In-situ sensor convenience with the power of an analyzer

## Technical data

GPro 500 TDL



**Short description**

The GPro 500 TDL Series is designed for tough and challenging $O_2$ applications. The series is highly suited to higher demanding applications where accuracy and fast response is crucial despite a varying background gas composition and a high dust load. The GPro Series can easily be calibrated without interrupting the process,and the purging keeps the wetted parts clean to minimize maintenance.

Outstanding features are:

- Interference-free in-situ measurement technology
- Easy calibration without interrupting the process
- 12 month recommended verification interval
- Different probe insertion lengths to suit applications with all types of geometry, incl. DN100 pipes
- Large selection of materials for the wetted part
- Easy installation with either one flange or, in short path setups, a perpendicular two flange design
- No pre-alignment of flanges required etc.
- Approval for hazardous areas ATEX zone 1, IECEx and FM Class 1 Div 1
- Optional direct current outputs for installation without M400.

**Content**



METTLER TOLEDO

## 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, process temperature, pressure and/or geometry of the measurement location. 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, probe type, service-friendly design with simple operation and exceptional performance data. It is extremely rugged, requires little maintenance and provides high availability. The GPro 500 remains uninfluenced by a wide range of process temperatures and/or varying concentrations of dust (particles) in the gas. These features, together with fast measurements mean that diode laser gas analysis with the GPro 500 is a very valuabla alternative to established extractive methods.

## General operation

GPro Series is a gas analyzer employing a unique, three-line molecular absorption spectroscopy called Spectra*ID*™. 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 and 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 three discrete 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

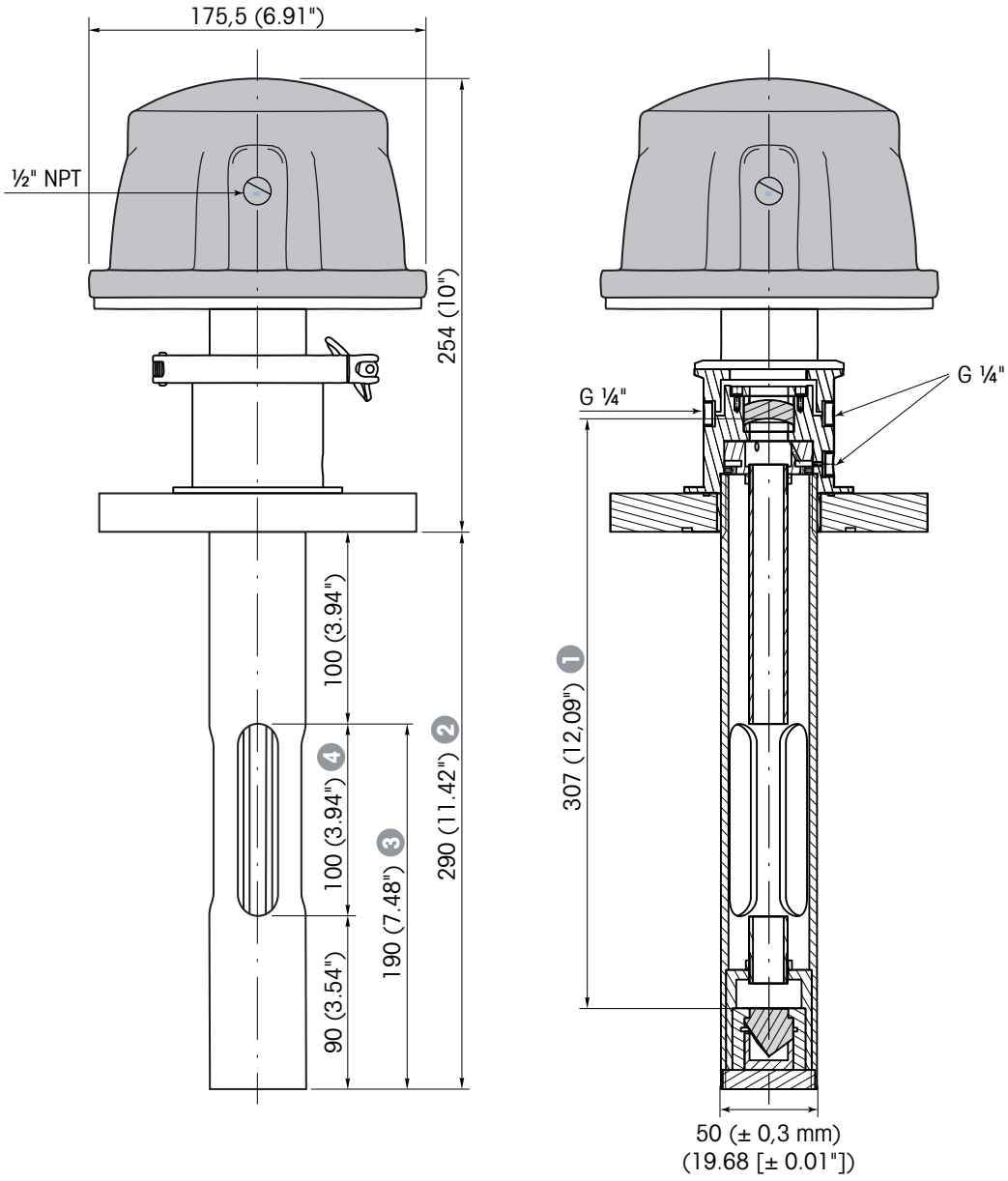
Always take great care when choosing the measurement location. Positions where there are fewer particles, the temperature is lower or there is a more suitable process pressure, are recommended. The more optimized the measurement location is, the better the overall performance of the system will be. For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

## Typical applications

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

## Installation examples

**Dimensions of the 290 mm probe**

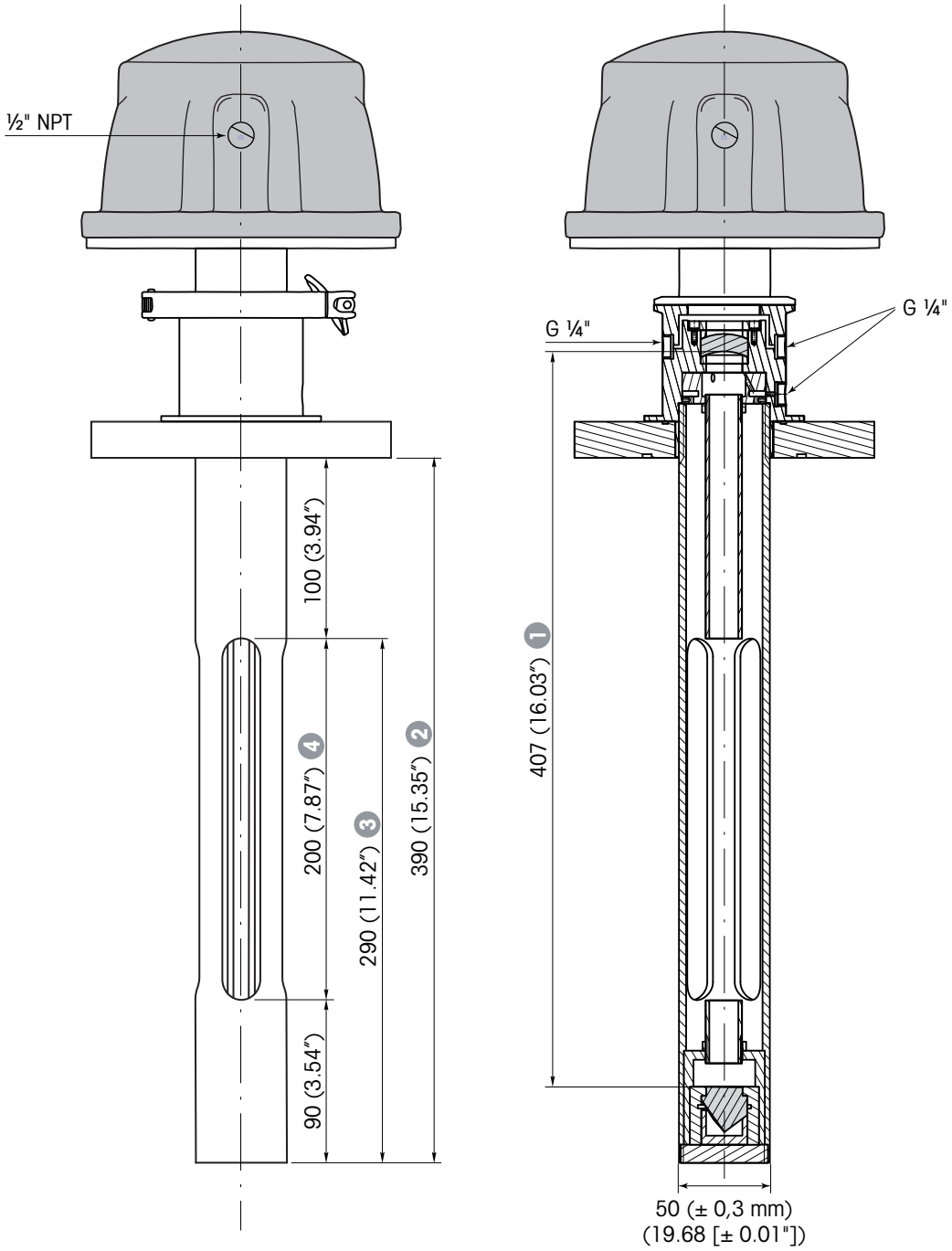



**Definition of the lengths:**

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,** 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).

## Installation examples

### Dimensions of the 390 mm probe

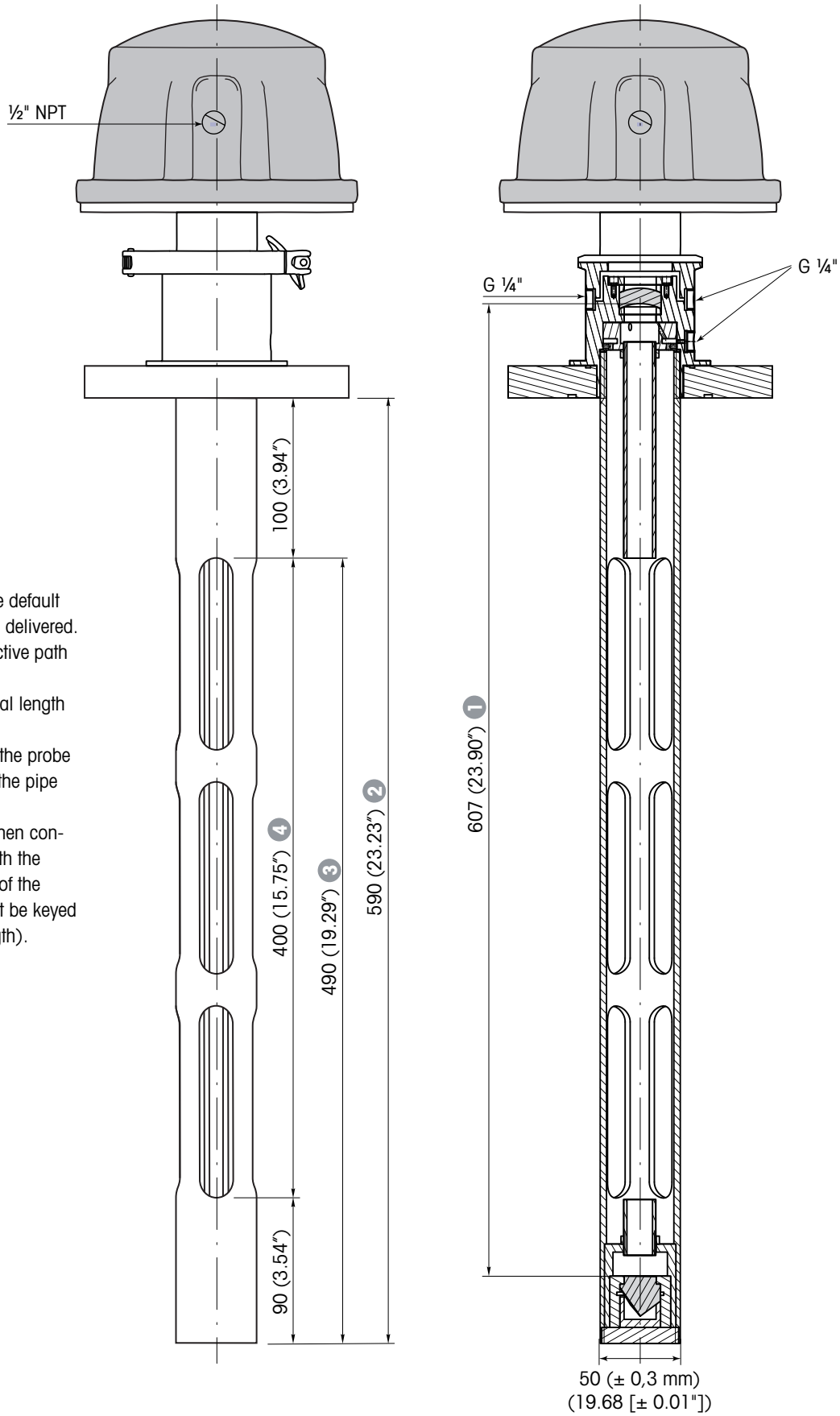



**Definition of the lengths:**

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,** 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).

## Installation examples

**Dimensions of the 590 mm probe**




**Definition of the lengths:**

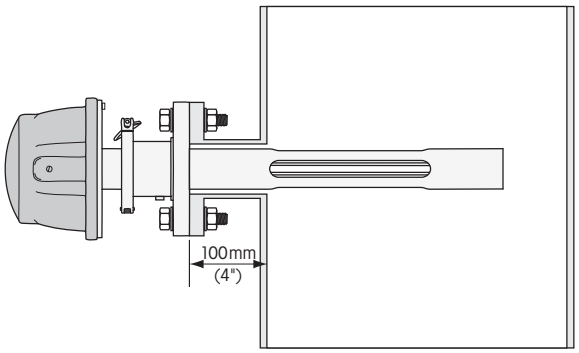
1. **Nominal path length,** the default length when GPro 500 is delivered. It corresponds to the effective path length without purging.
2. **Probe length,** the physical length of the probe.
3. **Insertion length,** part of the probe that has to protrude into the pipe for effective purging.
4. **Effective 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).

## Installation examples

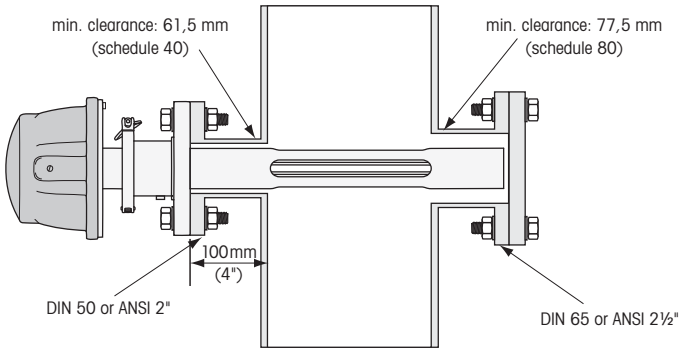
### Required flanges for some typical configurations

| ❶ Nominal path length | ❷ Probe length | ❸ Insertion length | ❹ Effective path length * | Pipe size DN/SPS | Number of flanges |
|---|---|---|---|---|---|
| 307 mm/12.09" | 290 mm/11.42" | 190 mm/7.48" | 100 mm/3.94" | 100 mm/3.94" | 2 |
| 307 mm/12.09" | 290 mm/11.42" | 190 mm/7.48" | 100 mm/3.94" | 150 mm/5.91" | 2 |
| 307 mm/12.09" | 290 mm/11.42" | 190 mm/7.48" | 100 mm/3.94" | 200 mm/7.87" | 1 |
| 407 mm/16.02" | 390 mm/15.35" | 290 mm/11.42" | 200 mm/7.87" | 200 mm/7.87" | 2 |
| 407 mm/16.02" | 390 mm/15.35" | 290 mm/11.42" | 200 mm/7.87" | 250 mm/9.84" | 2 |
| 407 mm/16.02" | 390 mm/15.35" | 290 mm/11.42" | 200 mm/7.87" | 300 mm/11.81" | 1 |
| 607 mm/23.09" | 590 mm/23.23" | 490 mm/19.29" | 400 mm/15.75" | 300 mm/11.81" | 2 |
| 607 mm/23.09" | 590 mm/23.23" | 490 mm/19.29" | 400 mm/15.75" | 400 mm/15.75" | 2 |
| 607 mm/23.09" | 590 mm/23.23" | 490 mm/19.29" | 400 mm/15.75" | 500 mm/19.69" | 2 |
| 607 mm/23.09" | 590 mm/23.23" | 490 mm/19.29" | 400 mm/15.75" | 600 mm/23.62" | 1 |

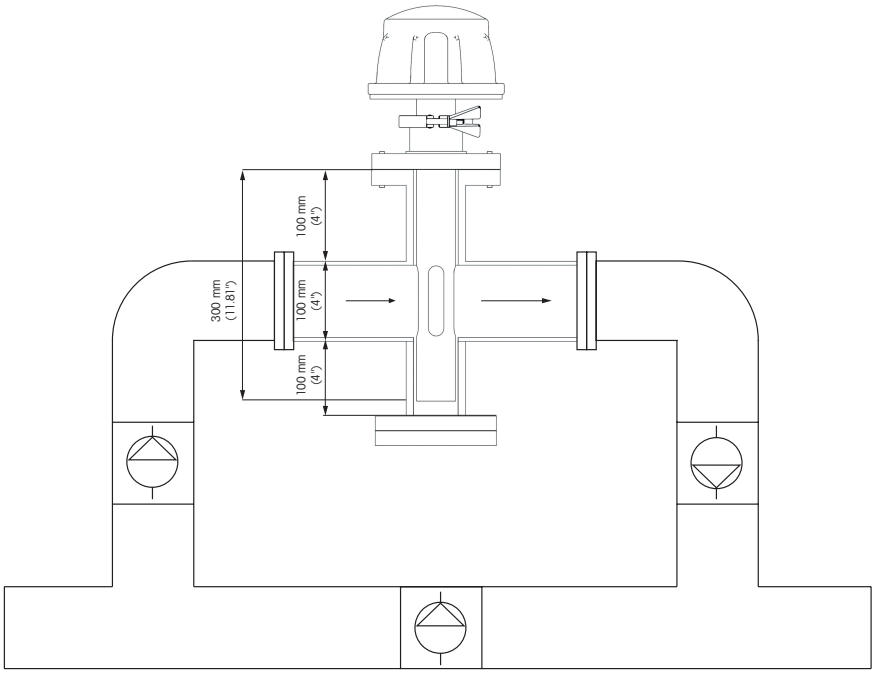
* When configuring the GPro 500 with the M400, the double value of the effective path length must be keyed in (2× effective path length).




One flange configuration



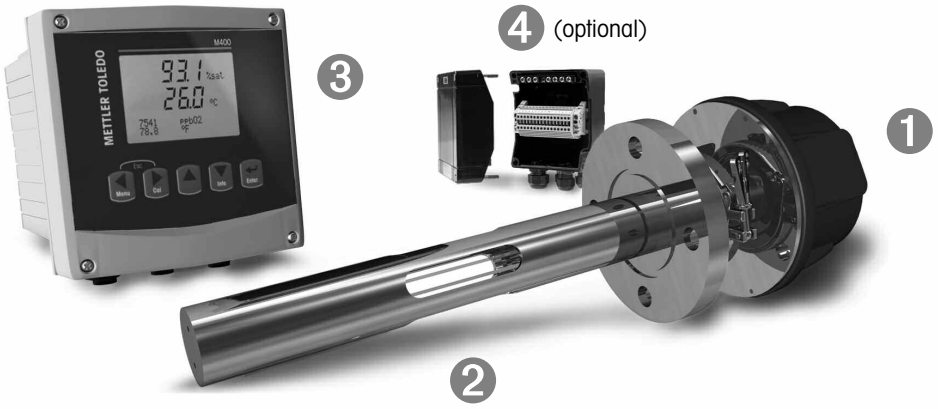

Two flange configuration




Example of by-pass configuration.

## System overview

**The GPro Series consists of four main components:**




### ❶ 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 is non-wetted and never gets in contact with the process. If this feature has been selected when purchasing the analyzer, the GPro 500 can also provide 2x 4…20 mA passive analog outputs directly from the sensor head.

### ❷ Insertion probe

The probe exists in several standard versions where both material of construction and insertion length can be customized to particular needs.

**Material of construction**

| | |
|---|---|
| Metallic Parts | 1.4404 (comparable to 316L), Hastelloy C22 |
| Glass, Optics | AR coated Quartz, AR coated Borosilicate |
| O-rings, Gaskets | Kalrez® 6375, Graphite |

**Probe lengths**

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

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

### ❸ M400 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.

### ❹ 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.

## Technical specifications

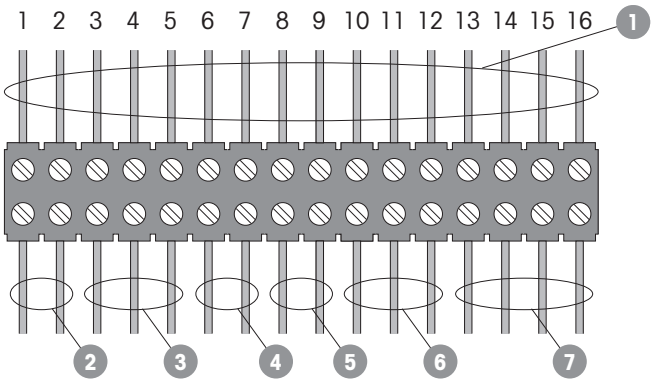
| Measurement | |
|---|---|
| Effective path length (EPL) | 100, 200, and 400 mm (3.94", 7.87", and 15.75")<br>When configuring the GPro 500 with the M400, the double value of the effective path length must be keyed in (2 × effective path length). |
| Detection limit | 0.01 % Vol (100 ppm-v) with 1 m path length and ambient standard conditions (no dust load, dry gas, $O_2$ in $N_2$) |
| Display units | ppm-v, % Vol $O_2$ |
| Accuracy | 2 % of reading or 100 ppm, whichever is bigger |
| Linearity | Better than 1% |
| Resolution | <0.01% Vol $O_2$ (100 ppm-v) |
| Drift | Negligible (<2 % of measuring range between maintenance intervals) |
| Sampling rate | 1 s |
| Response time ($T_{90}$) | $O_2$ in $N_2$ 21% → 0 % in <2 s |
| Repeatability | ±0.25 % of reading or 0.05 % $O_2$, whichever is greater |

| Electrical inputs & outputs | |
|---|---|
| Communication interface | RS485 (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 to20 mA range<br>Offset error <±0.004 mA (zero scale)<br>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, 0.2 A, >5 W |
| Fuse | 1 A slow blow type FC |

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

| | |
|---|---|
| **Operating conditions** | |
| Temperature range process | 0…+250 °C (+32…+482 °F)<br>optional: 0…+600 °C (+32…1112 °F) with additional Thermal Barrier |
| Ambient temperature range | −20…+55 °C (−4…+131 °F) during operation;<br>−40…+70 °C (−40…+158 °F) during transport and storage (<95 % non-condensing humidity) |
| Pressure | Measuring: 0.8 bar−5 bar (abs)/11.6 psi−72.52 psi (abs)<br>Design: 25 bar (abs)/362.6 psi (abs) |
| 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 |
| **Installation** | |
| Flange size | DN50/PN25 or ANSI 2"/300 lbs |
| Warm up time | Typically < 1 minute |
| **Purging** | |
| Process side purging | Nitrogen, >99.7 % purity (minimum recommended), 0.5…5 L/min (any other "$O_2$ free" clean and dry gas can be used, the purity requirements are: conform to standard set by ISO 8573.1, class 2–3, analog to instrument air) |
| Instrument side purging | Yes, flow <0.5 L/min |
| 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) |
| **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 Chapt 8.5.1 of manual M400 |
| **Mechanical specifications** | |
| Insertion length | 190−490 mm/7.48"−19.29" |
| Total length | 530−900 mm/20.87"−35.43", depending on probe length |
| Weight | 12−14 kg/26−30 lbs, depending on probe length |
| Insulation/rating | IP65/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,<br>ATEX II 1/2G – Ex op is/[op is T6 Ga] d IIC T6 Ga/Gb,<br>ATEX II 1/2D – Ex op is/[op is T86°C Da] t b III C T86°C Da/Db,<br>IECEx, FM, CE, PED, IP 65, NEMA 4X |

## Signal cable connections

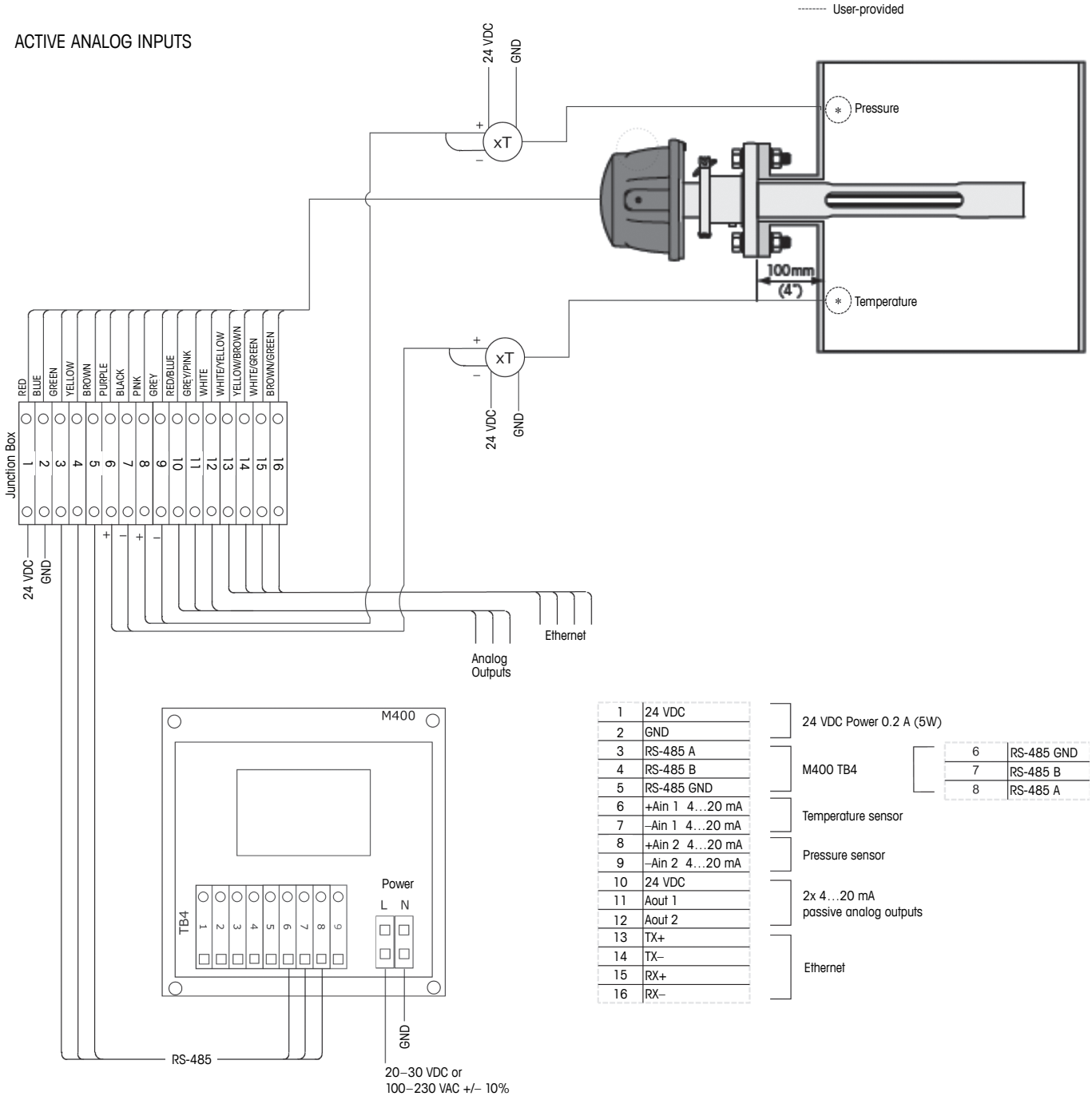



Connections in the junction box

1. Connections to the GPro 500 – Cable numbers below
2. Power from an external source or optionally from the M400
3. RS485 from the M400
4. 4 … 20 mA from temperature sensor
5. 4 … 20 mA from pressure sensor
6. 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 |
| RS485 A | Interface M400 (RS485) | 3 | Green |
| RS485 B | | 4 | Yellow |
| RS485 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)

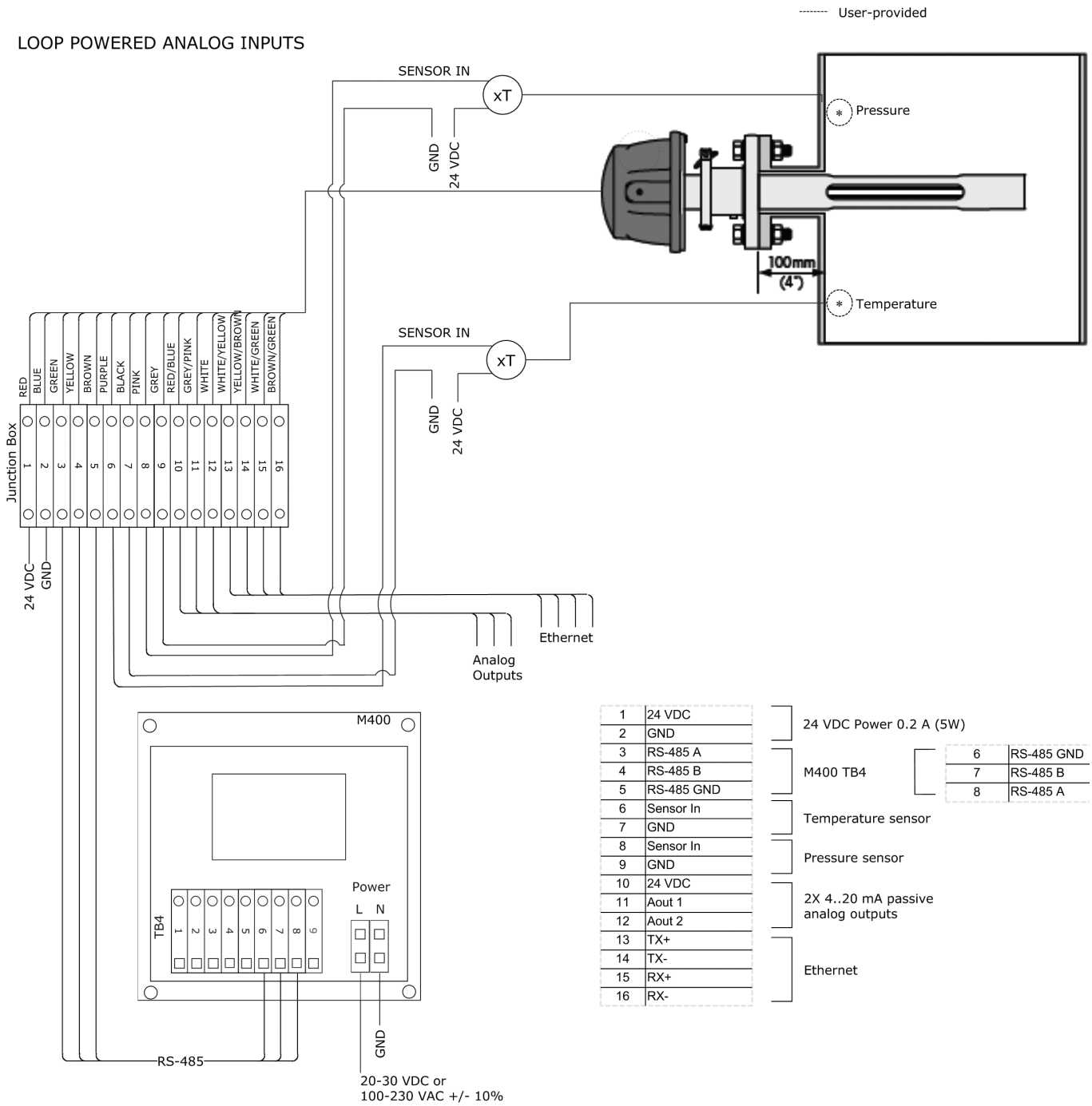



| | | | |
|---|---|---|---|
| 1 | 24 VDC | | 24 VDC Power 0.2 A (5W) |
| 2 | GND | | |
| 3 | RS-485 A | | M400 TB4 |
| 4 | RS-485 B | | |
| 5 | RS-485 GND | | |
| 6 | +Ain 1 4…20 mA | | Temperature sensor |
| 7 | –Ain 1 4…20 mA | | |
| 8 | +Ain 2 4…20 mA | | Pressure sensor |
| 9 | –Ain 2 4…20 mA | | |
| 10 | 24 VDC | | 2x 4…20 mA passive analog outputs |
| 11 | Aout 1 | | |
| 12 | Aout 2 | | |
| 13 | TX+ | | Ethernet |
| 14 | TX– | | |
| 15 | RX+ | | |
| 16 | RX– | | |

| | |
|---|---|
| 6 | RS-485 GND |
| 7 | RS-485 B |
| 8 | RS-485 A |

Wiring diagram with active analog outputs (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 product key

| Gas Analyzer GPro™ 500 – | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | – | Y | Y |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| * Other configurations upon request | | | | | | | | | | | | | | | | | | | | | |
| **Hazardous Area Approvals** | | | | | | | | | | | | | | | | | | | | | |
| ATEX Ex d, IECEx | A | T | | | | | | | | | | | | | | | | | | | |
| FM Class 1 Div 1 | U | S | | | | | | | | | | | | | | | | | | | |
| **Process Windows*** | | | | | | | | | | | | | | | | | | | | | |
| Standard (AR-coated Borosilicate) | | | B | | | | | | | | | | | | | | | | | | |
| High temperature (AR-coated Quartz) | | | Q | | | | | | | | | | | | | | | | | | |
| **Process O-rings*** | | | | | | | | | | | | | | | | | | | | | |
| Standard (Kalrez) | | | | K | A | | | | | | | | | | | | | | | | |
| High temperature (Graphite) | | | | G | R | | | | | | | | | | | | | | | | |
| **Wetted Materials*** | | | | | | | | | | | | | | | | | | | | | |
| 1.4404 (comparable to 316L) | | | | | | 4 | 4 | 0 | 4 | | | | | | | | | | | | |
| Hastelloy | | | | | | C | 2 | 2 | – | | | | | | | | | | | | |
| **Probe length*** | | | | | | | | | | | | | | | | | | | | | |
| 290 mm/11.42" | | | | | | | | | | 2 | 9 | 0 | – | | | | | | | | |
| 390 mm/15.35" | | | | | | | | | | 3 | 9 | 0 | – | | | | | | | | |
| 590 mm/23.23" | | | | | | | | | | 5 | 9 | 0 | – | | | | | | | | |
| **Process connection*** | | | | | | | | | | | | | | | | | | | | | |
| ANSI 2"/300 lbs | | | | | | | | | | | | | | A | 0 | 3 | | | | | |
| DIN DN50/PN25 | | | | | | | | | | | | | | D | 1 | 2 | | | | | |
| **Thermal Barrier*** | | | | | | | | | | | | | | | | | | | | | |
| No thermal barrier (for temperatures up to 250°C/482°F) | | | | | | | | | | | | | | | | | S | T | | | |
| With thermal barrier (for temperatures up to 600°C/1112°F) | | | | | | | | | | | | | | | | | H | T | | | |
| **Gas to measure** | | | | | | | | | | | | | | | | | | | | | |
| Oxygen | | | | | | | | | | | | | | | | | | | | A | |
| **Interface** | | | | | | | | | | | | | | | | | | | | | |
| RS 485 (for M400) | | | | | | | | | | | | | | | | | | | | | X |
| RS 485 and direct analog outputs | | | | | | | | | | | | | | | | | | | | | A |

## Ordering information

| Accessories | Order no. |
|---|---|
| Thermal barrier | 30 034 138 |
| Junction box | 30 034 149 |
| Purging box for M400 Ex d | 30 034 148 |
| $O_2$ Calibration kit | 30 034 139 |
| Gasket for process flange | To be provided by the user (82.14 × 3.53 mm) |
| Check valve | To be provided by the user |

| Spare parts | Order no. | Spare parts | Order no. |
|---|---|---|---|
| Window Module Q GR 4404 D12 | 30 032 364 | $O_2$ Corner Cube Module B 4404 | 30 038 091 |
| Window Module Q GR 4404 A03 | 30 032 365 | $O_2$ Corner Cube Module Q 4404 | 30 038 092 |
| Window Module B KA 4404 D12 | 30 032 366 | $O_2$ Corner Cube Module B C22 | on request |
| Window Module B KA 4404 A03 | 30 032 367 | $O_2$ Corner Cube Module Q C22 | on request |
| Window Module Q GR C22 D12 | on request | Kit Flat gasket ST | 30 080 914 |
| Window Module Q GR C22 A03 | on request | Kit Flat gasket HT (Graphite) | 30 080 915 |
| Window Module B KA C22 D12 | on request | Cable GPro 500 ATEX, FM 5 m | 30 077 735 |
| Window Module B KA C22 A03 | on request | Cable GPro 500 ATEX, FM 15 m | 30 077 736 |
| | | Cable GPro 500 ATEX, FM 25 m | 30 077 737 |

## METTLER TOLEDO Market Organizations

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