Operating Instructions

TDLS GPro 500

Tunable Diode Laser Spectrometer

METTLER TOLEDO

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1 Introduction

1.1 Safety information

Read this manual and ensure that you fully understand its content before you attempt to install, use or maintain the GPro®* 500. Important safety information is highlighted in this manual as WARNINGs and CAUTIONs, which are used as follows:

WARNING

Warnings highlight specific hazards which,
if not taken into account, may result in personal injury or death.

CAUTION

Cautions highlight hazards which, if not taken into account, can result in damage to the TDL or to other equipment or property.

This manual also incorporates "be aware of" information, which is used as follows:

This highlights information which it is useful for you to be aware of (for example, specific operating conditions, and so on).

1.2 General

This manual contains information of installation, operation and maintenance of the GPro 500 TDL. A description of the GPro 500 TDL and its basic features is also included.

The GPro 500 TDL is available for use in explosive atmospheres as defined in EN 60079-14 (ATEX) or IEC 60079-10 (ATEX).
For more information on Equipment Protection Levels refer to chapter 8 (Explosion Protection) on page no 102 and Relationship of Equipment Protection Levels to ATEX Categories on page no 128.

Please read the entire manual carefully before using the GPro 500 TDL. It is a sophisticated instrument utilizing state-of-the-art electronic and laser technology. Installation and maintenance of the instrument require care and preparation and should only be attempted by competent personnel. Failure to do so may damage the instrument and void the warranty.

CAUTION

METTLER TOLEDO strongly recommends having the final installation and commissioning executed under the full supervision of a METTLER TOLEDO representative.

Do not power up the system before the wiring has been fully checked by trained personal.

It is strongly recommended to have the wiring approved by a METTLER TOLEDO Service representative.

Wrong wiring can lead to damage of the sensor head and/or the M400 transmitter.

* GPro is a registered trademark of the Mettler Toledo Group in Switzerland, India, USA, China, European Union, Japan, South Korea and Russia.

CAUTION

Do not install the probe into the process without the purging being switched on.

Without purging, optical components in the probe may be contaminated and therefore affect the GPro 500's ability to measure.

METTLER TOLEDO strongly recommends having the final installation and commissioning executed under the full supervision of a METTLER TOLEDO representative.

1.3 Safety Instructions

1.3.1 For M400 Type 3 4-wire series

☞ Before connecting the device to a supply unit make sure that its output voltage cannot exceed 30 V DC, or be less than 20 V DC. Do not use alternating current or main power supply.

WARNING

Installation of cable connections and servicing of this product require access to shock hazard voltage levels.

WARNING

Power supply and relay or open collector (OC) contacts wired to separate power source must be disconnected before servicing.

WARNING

Power supply must employ a switch or circuit breaker as the disconnecting device for the equipment.

WARNING

Electrical installation must be in accordance with the National Electrical Code and/or any oter applicable national or local codes.

☞ RELAY RESP. OC CONTROL ACTION: the M400 transmitter relays will always de-energize on loss of power, equivalent to normal state, regardless of relay state setting for powered operation. Configure any control system using these relays with fail-safe logic accordingly.

☞ PROCESS UPSETS: Because process and safety conditions may depend on consistent operation of this transmitter, provide appropriate means to maintain operation during sensor cleaning, replacement of sensor or instrument calibration.

1.3.2 Safety Instructions for installation, operation and maintenance in hazardous locations (ATEX) GPro 500 series

WARNING

Devices of these series are approved for operation in hazardous locations.

WARNING

During installation, commissioning and usage of the device, the stipulations for electrical installations (IEC EN 60079-14/IEC EN 60079-10) in hazardous areas must be observed.

WARNING

When installing the device outside the range of applicability of the 94/EC directive, the appropriate standards and regulations in the country of use must be observed.

WARNING

Manipulations of the device other than described in the instruction manual are not permitted.

The GPro 500 comes with a pre-installed cable and cable gland. Do not attempt to replace the cable as it will void the warranty and violate the ATEX classification!

WARNING

Opening the sensor head voids warranty and violates the ATEX hazardous area classifications!

WARNING

Installation may only be carried out by trained personal in accordance with the instruction manual and as per applicable standards and regulations.

– Cleaning: In hazardous locations the device may only be cleaned with damp cloth to prevent electrostatic discharge.

1.3.3 Connection to supply units

FM APPROVED

US Version:

The US version must be installed using a suitable cabling conduit system in accordance with local codes and regulations. To aid installation, the unit is supplied without an attached cable.

The terminals are suitable for single wires/flexible leads 0.2 mm^2 to 1.5 mm^2 (AWG 24–16).

WARNING

The electrical installation must be performed in accordance with National Electrical Codes of practise and/or any other applicable national or local codes.

WARNING

Wait 2 minutes before opening the enclosure after de-energizing the system.

WARNING

When fitting the enclosure cover onto the sensor head, the 8 x M5 fixing screws must be tightened to 8 Nm torque.

WARNING

For gas group A, sealing of the conduit is required at the enclosure entry. For gas groups B, C and D, no conduit sealing is required.

1.3.4 General safety precautions for installation, operation and maintenance in hazardous locations GPro 500 series

WARNING

Devices of these series are approved for operation in hazardous locations.

WARNING

During installation, commissioning and usage of the device, the stipulations for electrical installations (IEC EN 60079-14/IEC EN 60079-10) in hazardous areas must be observed.

WARNING

When installing the device outside the range of applicability of the 94/EC directive, the appropriate standards and regulations in the country of use must be observed.

WARNING

Operation of this device other than as described in this manual or the addition of non-approved modifications to the product is prohibited.

WARNING

Installation may only be carried out by trained personal in accordance with the instruction manual and as per applicable standards and regulations.

– Cleaning: In hazardous locations the device may only be cleaned with damp cloth to prevent elctrostatic discharge.

Connection to supply units

– Devices of the above mentioned series must only be connected to explosion proof power supply units (for input ratings refer to instruction manual EC-Type-Examination Certificate).

– The terminals are suitable for single wires/flexible leads 0.2 mm^2 to 1.5 mm^2 (AWG 24–16).

WARNING

The external power supply used to power the TDL sensor head should not exceed 24 V DC, with a minimum power rating of 5 watts.

Correct disposal of the unit

– When the unit is finally removed from service, observe all local environmental regulations fro proper disposal.

1.4 Introduction and Measurement principle

The GPro 500 TDL is a precision optical instrument designed for continuous in-situ or extractive gas measurement, based on tunable diode laser absorption spectroscopy (TDLS). The GPro 500 TDL provides a high performance & flexible gas measurement solution. It is supplied with a process adaptor specific optimized for the application. For in-situ applications these include standard purged probes and wafer cells, non-purged probes (with or without integrated particulate filter) & filtered wafer (W) cells. For extractive applications, a variety of extractive cells options are available..

For in-situ applications utilizing the standard purged probe or wafer cell; to ensure reliable measurement performance, it is important that there is flowing process gas at the measurement location. See chapter 2.2 (Flow conditions at measuring point) on page 28 and chapter 3.1.2 (Process side purging) page 31 for further details. (This does not apply to non-purged probes or extractive cells).

GPro 500 TDL is suitable for use in industrial environments or environments where it may be connected to a mains electrical network supplying domestic premises.

The measuring principle used is infrared single-line absorption spectroscopy, which is based on the fact that each gas has distinct absorption lines at specific wavelengths. The absorption lines are carefully selected to avoid cross interference from other (background) gases. Using direct absorption spectroscopy, a spectrum in a specific wavelength range is taken and compared with spectral reference data stored in the on-board database for any given temperature and pressure. The concentration is then calculated. Any inconsistency between reference data and measurement data will trigger an alarm. The detected light intensity varies as a function of the laser wavelength due to absorption of the targeted gas molecules in

the optical path between the laser and the detector. The laser line width is a small fraction of the absorption line width so the reproduced spectra is very accurate. The instrument stores the spectral data in its memory and once a scan is obtained a curve fitting to this data is performed yielding a measurement value. Account is also taken to the process gas temperature and pressure and these parameters are measured separately or they can be manually fixed.

The GPro 500 TDL is a gas analyzer and as such measures the FREE molecules of the specific gas of interest. It will not detect such molecules when they are bound together into larger molecular structures or when attached to particles or dissolved into droplets. This should be carefully considered when comparing measurement results with other measurement techniques.

1.4.1 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. The general impact on the measurement result in high dust load is an increased noise level. For high dust load applications, please consult your local METTLER TOLEDO representative, see "Sales and Service" on page no 130.

1.4.2 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. The manual mode with fixed temperature and pressure values is only recommended with processes where these values are constant and well known. Temperature sensor requirements: 4 – 20 mA output, either active or loop powered, with range suitable for process temperature range. The sensor must also meet the local hazardous zone requirements.

Temperature sensor accuracy requirements are: Pt100 or equivalent, +/– 0.01 °C or better, with configurable 4 – 20 mA outputs.

Rule of Thumb:
For oxygen measurements, typically a delta of 1 degree C equals 500 ppm O_2 change in reading in normal air, without compensation.

1.4.3 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. The manual mode with fixed temperature and pressure values is only recommended with processes where these values are constant and well known. Pressure sensor requirements: 4 – 20 mA output, either active or loop powered, with range suitable for the process pressure range. The sensor must also meet the local hazardous zone requirements.

Pressure sensor accuracy requirements are: +/– 1 mbar or better, with configurable 4 – 20 mA outputs.

Rule of Thumb:
For oxygen measurements, typically a delta of 50mbar equals 1% O_2 change in reading in normal air, without compensation.

Note: It is recommended that a pressure sensor referenced to absolute pressure is used to negate errors caused by atmospheric pressure variation. The pressure sensor must always be mapped to the TDL input as an absolute sensor, so if a gauge sensor is used, the nominal atmospheric pressure value will need to be added to the values entered for pressure min (4 mA) and pressure max (20 mA).

WARNING

Ensure P & T sensors are connected before applying loop power.

1.4.4 Cross interference

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

CAUTION

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.

Please consult your Mettler Toledo representative ("Sales and Service" on page no 130).

1.5 Instrument description

The GPro 500 TDL normally consists of 4 separate units: the TDL head, process adaptor, junction box and the M400 transmitter (user interface). Additionally purging gas, (suitable for the application) and 4–20mA pressure and temperature sensor inputs are required in most cases. The general installation diagrams for purged and non-purged probes, wafer cells and extractive measurements are shown on Page 18

1.5.1 System Overview

A connecting device is required between the TDL and the M400 transmitter. For ATEX applications, an existing junction box can be used, or one can be ordered as an accessory (see Appendix chapter 2.3 (Accessories) on page no 126). The 4–20 mA signals for temperature and pressure compensation are connected to the sensor's head via this junction box. The junction box also provides the connection point for the GPro 500 Ethernet interface connection.. For more information in installation in hazardous areas, please refer to chapter 8 (Explosion Protection) on page no 102.

In standard configurations the GPro 500 is connected to the M400 transmitter. This offers a flexible user interface that not only displays concentration and other measurement parameters in real-time, but can be used to configure specific analyzer parameters during commissioning and subsequent verification and calibration of the system. This avoids the requirement for using a PC at the measurement location to configure the analyzer. In addition, the M400 offers additional I/O capabilities, i.e. 4x 4…20 mA active analog outputs and 6 relays. Alternatively, if GPro 500 is supplied as an additional output version. This version provides 2 x 4…20 mA passive analog outputs directly from the sensor head and offers a full Ex-d solution. In this case a M400 transmitter is not supplied and a M400 should not be connected to the sensor head. To configure the optional direct analog outputs, it is necessary to use the MT-TDL software Suite to configure the GPro 500 during commissioning (using the Ethernet connection to the GPro 500, see item 6 on see Figure 1 (General schematic of standard purge probe (SP) shown.) on page no 19). For more information on the MT-TDL Software, please refer to chapter see 6 (Service) on page no 80.

Figure 1 General schematic of standard purge probe (SP) shown.

1 GPro 500 sensor head with insertion probe (here the 390 mm probe)
2 Purging with N_2, one inlet for the process side and one inlet and one outlet for the sensor side.
3 Process flange (DN50/PN25 or ANSI 2″/300lb)
4 Junction box (connecting device)
5 2 x 4...20 mA (pressure and temperature)
6 Ethernet connection
7 RS 485
8 M 400 T3 transmitter
9 4...20 mA output for Concentration
10 4...20 mA output for Pressure
11 4...20 mA output for Temperature
12 4...20 mA output for % Transmission
13 Relay outputs for alarm purposes.
The relays are configurable and there are 6 relays available in total.
14 Power for the M400.
15 Grounding for the TDL head.
16 External power supply. 24 V, 5 W for the sensor power head.
17 2 x 4…20 mA direct analog outputs (optional).

WARNING

When connecting the external power supply directly to the sensor head using the junction box, do not exceed the 24 V, 5 W limit required.

WARNING

When selecting the TDL sensor head external power supply, care should be taken to ensure its output does to exceed 24 V DC, and has a power output rating of 5 watts minimum.

Figure 2 GPro 500, shown with standard probe (SP)

The GPro 500 consists of the TDL head which contains the laser module with a temperature stabilized diode laser, collimating optics, the main electronics and data storage. It is housed in a coated aluminium box. The process adaptor attaches to the TDL head. Dependent on the application, this may be a purge, purge free or filter probe, in-line wafer cell or extractive cell. The TDL head has environmental protection to IP65, NEMA 4X. The GPro 500 is installed by assembling the supplied purging and then mounted onto the process flange DN50 or ANSI 2" – see (Dimensions of the DN50/PN25 flange for standard purge probe (SP) and non-purged probe (NP) on page no 19). The optical alignment is robust and reliable and does not require manual alignment. For the standard purge probe (SP) and wafer cell, purging prevents dust and other contamination from settling on the optical surfaces. For clean and static processes (for example headspace monitoring), a non-purge probe (NP) may be supplied. In this case process side purge is not required.

Figure 3 The junction box (GHG 731 from Malux) (EX-e).

The junction box is the connection point for the measurement probe, the pressure sensor, the temperature sensor, Ethernet and M400.

Figure 4 M400 transmitter Type 3

For more information refer to chapter 7.1 (M400) on page no 94 and the M400 manual.

☞ Approval for the M400 is Class 1 Div 2/Zone 2 ATEX. For installation in Zone 1 areas, see "Accessories" on page no 126 – Purging box for M400.

1.5.2 Sensor head

The combined tunable diode laser and receiver assembly is known as the TDL head. This contains the laser, optics and all the electronics for laser control, signal processing, line locking, detector electronics, data storage/retrieval, current outputs (optional), etc. The sensor head has an Ethernet interface, accessible via the junction box, for high level maintenance by the use of METTLER TOLEDO Process Analytics specific software (MT-TDL). All components of the sensor head are non-wetted and are therefore under normal conditions are never in contact with the process stream. The power required for the sensor head is 24 V, 5 W minimum. The connection between the sensor head and the process adaptor (probe, wafer or extractive cell) is a precision machined interface. Care should be taken to ensure that the metal surfaces are carefully aligned when installing the sensor head to prevent damage.

ATEX Version:

In the ATEX Version, the sensor head is supplied with a pre-configured cable already installed. Do not open the sensor head for removing, altering, or replacing the cable. The standard cable length is 5 m, but optional lengths of 15 m, 25 m and 40 m are also available. For the ATEX version, note that this cable must not be removed or changed by the user as opening the TDL blue cover will void the ATEX hazardous area certification.

WARNING
Opening the sensor head voids warranty and violates the ATEX hazardous area classifications.

US Version:

The US version must be installed using a suitable cabling conduit system in accordance with local codes and regulations. To aid installation, the unit is supplied without an attached cable. METTLER TOLEDO recommends the use of suitable cables listed as accessories in Appendix 2 (Spare Parts and Accessories) on page no 123

The terminals are suitable for single wires/flexible leads 0.2 mm^2 to 1.5 mm^2 (AWG 24–16).

WARNING
The electrical installation must be performed in accordance with National Electrical Codes of practise and/or any other applicable national or local codes.

WARNING
Wait 2 minutes before opening the enclosure after de-energizing the system.

WARNING

When fitting the enclosure cover onto the sensor head,
the 8 x M5 fixing screws must be tightened to 8 Nm torque.

WARNING

For gas group A, sealing of the conduit is required at the enclosure entry.
For gas groups B, C and D, no conduit sealing is required.

1.5.3 Insertion probes

Probes exists in several versions, including purged (SP), non-purged (NP) depending on the application. Both material of construction (windows, metals, O-rings, etc.) and insertion length can be customized to particular needs.

1.5.4 M400 type 3 transmitter

This is the GPro Series user interface. With the M400 the user can set the necessary parameters for operation, and control the alarm and I/O setup. The M400 will of course 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 4–20 mA active analog outputs.

M400 also features ISM – Intelligent Diagnostics – which provides the following features::

– **Time to Maintenance Indicator (TTM)**. Real time, dynamic prediction of when the next maintenance cycle is required for best operation. Action: Clean the optics (window, corner cube)

– **Dynamic Lifetime Indicator (DLI)**. Based on the DLI information, the transmitter tells you when it's time to replace the TDL. Action: Replace TDL (Expected lifetime >10 years)

1.6 Software

Software for the GPro 500 TDL consists of 2 programs:

- A program not visible to the user and integrated in the CPU electronics, running the micro controller on the CPU card. The program performs all necessary calculations and self-monitoring tasks.
- MT-TDL Suite: a Windows based program running on a standard PC connected through the Ethernet connection. This program enables communication with the instrument during installation, service, calibration and normal operation. See chapter 6 (Service) on page no 80 for more details.

It is only necessary to connect a PC for advanced maintenance, normal installation and service/calibration can be done via M400. Both communication ports (Ethernet and RS 485) to the M400 can be used at the same time. However, during access with a PC no changes are allowed on the M400.

1.7 Laser classification

The diode lasers used in the GPro 500 TDL operate in the near infrared (NIR). It has an output power which, according to IEC 60825-1 latest edition, classifies the GPro 500 TDL as a **Laser Class 1M** product.

WARNING

Class 1M laser product

Laser radiation – do not view directly with optical instruments

Note that the laser emits invisible light!

1.8 Product data

Table 1 Product data sensor head

	Size and weight	
	Dimensions	524,5 x Ø175,5 mm
	Weight	8 kg

	Material of construction	
	Steel	316L
	Optical elements	AR coated Quartz, AR coated Borosilicate
	Seals	Kalrez® 6674, Graphite compounds
	Blue cover-Aluminum	Paint finish – Chemically resistant epoxy resin coating

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

	O_2	**O_2 and temperature**	**CO (ppm)**
Optical path length	**Probes:** 200, 400 mm, 800 mm (3.94", 7.87", 15.75") **Wafer Cell:** 104 mm, 110 mm, 154 mm, 164 mm, 214 mm (4.09", 4.33", 6.06", 6.46", 8.43") **Extractive cells:** 200, 400, 800, 1 m, 10 m (7.87", 15.75", 31.49", 39.37", 393.70")		
Measurement range and standard conditions (ambient temperature and pressure, 1 m path length)	0 – 100%	1 – 100% 0 – 150 °C (32 – +302 °F)	0 – 2%
Lower Dectection Limit (in 1 meter path length at ambient standard conditions, dry gas, no dust load, in N_2 back-ground)	100 ppm-v	100 ppm-v 2 °C (35.6 °F)	1 ppm-v
Accuracy	2% of reading or 100 ppm O_2 (whichever is greater)	2% of reading or 100 ppm O_2 (whichever is greater)	2% of reading or 1 ppm (whichever is greater)
Linearity	Better than 1%	Better than 1%	Better than 1%
Resolution	< 0…01% vol O_2 (100 ppm-v)	< 0…01% vol O_2 (100 ppm-v)	1 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	O_2 in N_2 21% > 0% in < 2 sec	CO in N_2 300 ppm-v 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 0.05% O_2 (whichever is greater)	± 0.25% of reading or 5 ppm-v CO (whichever is greater)
Process pressure range	0.3 bar – 8 bar (abs)/ 4.35 psi – 116.03 psi (abs)	0.8 bar – 5 bar (abs)/ 11.63 psi – 72.52 psi (abs)*	0.8 bar – 2 bar (abs)/ 11.63 psi – 29.00 psi (abs)
Process temperature range	0 – +250 °C (+32 – +482 °F) Optional (for probe installation) 0 – +600 °C (0 – +1112 °F) with additional thermal barrier, 0 – +150 °C (+32 – +302 °F) (White cell)		
* from Firmware 6.23			

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

	CO (%)	**H_2O**	**CO_2 (%)**
Optical path length	**Probes:** 200, 400 mm, 800 mm (3.94", 7.87", 15.75") **Wafer Cell:** 104 mm, 110 mm, 154 mm, 164 mm, 214 mm (4.09", 4.33", 6.06", 6.46", 8.43") **Extractive cells:** 200, 400, 800, 1 m, 10 m (7.87", 15.75", 31.49", 39.37", 393.70")		
Measurement range and standard conditions (ambient temperature and pressure, 1 m path length)	0 – 100%	0 – 20%	0 – 100%
Lower Dectection Limit (in 1 meter path length at ambient standard conditions, dry gas, no dust load, in N_2 back-ground)	1500 ppm-v	5 ppm-v	1000 ppm-v
Accuracy	2% of reading or 1500 ppm, (whichever is greater)	2% of reading or 10 ppm, (whichever is greater)	2% of reading or 1000 ppm, (whichever is greater)
Linearity	Better than 1%	Better than 1%	Better than 1%
Resolution	1500 ppm-v	5 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)	CO in N2 1% to 0% in < 4 sec	H_2O 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 0.75%-v CO (whichever is greater)	± 0.25% of reading or 50 ppm-v H_2O (whichever is greater)	± 0.25% of reading or 5000 ppm-v CO_2 (whichever is greater)
Process pressure range	0.8 bar – 1.5 bar (abs)/ 11.63 psi – 21.75 psi (abs)	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)
Process temperature range	0 – +250 °C (+32 – +482 °F) Optional (for probe installation) 0 – +600 °C (0 – +1112 °F) with additional thermal barrier, 0 – +150 °C (+32 – +302 °F) (White cell)		

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

	CO_2 %/ CO %	**HCl (ppm)**	**H_2S (%)**
Optical path length	**Probes:** 200, 400 mm, 800 mm (3.94", 7.87", 15.75") **Wafer Cell:** 104 mm, 110 mm, 154 mm, 164 mm, 214 mm (4.09", 4.33", 6.06", 6.46", 8.43") **Extractive cells:** 200, 400, 800, 1 m, 10 m (7.87", 15.75", 31.49", 39.37", 393.70")		
Measurement range and standard conditions (ambient temperature and pressure, 1 m path length)	0 – 100% (CO_2 and CO)	0 – 1%	0 – 50%
Lower Dectection 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)	0.6 ppm-v	20 ppm-v
Accuracy	2% of reading or 1000 ppm (whichever is greater)	2% of reading or 0.6 ppm (whichever is greater)	2% of reading or 20 ppm (whichever is greater)
Linearity	Better than 1%	Better than 1%	Better than 1%
Resolution	1000 ppm-v	0.6 ppm-v	20 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	HCl in N_2 1% to 0% in < 4 sec	H_2S 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 3 ppm-v HCl (whichever is greater)	± 0.25% of reading or 100 ppm-v H_2S (whichever is greater)
Process pressure range	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)	0.8 bar – 2 bar (abs)/ 11.6 psi – 29 psi (abs)
Process temperature range	0 – +250 °C (+32 – +482 °F) Optional (for probe installation) 0 – +600 °C (0 – +1112 °F) with additional thermal barrier, 0 – +150 °C (+32 – +302 °F) (White cell)		

	Electrical inputs & outputs	
	Number of direct outputs (analog)	2 (optional)
	WARNING: Do not connect the M400 and the direct passive analog outputs at the same time.	
	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)
	Hold state	Automatic (when Ethernet port in use, during calibration): last, fixed or live
	Communication interface	RS 485 (to M400)
	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- and download
	Memory slot interface* * **Note:** For ATEX and IECEx versions the TDL head must not be opened.	SD card reader/writer for data retrieval (measurement & diagnostics), FW update (via SD card swap) and remote diagnostics (configuration file up/download) (to be accessed inside the housing). Space for data storage: 4 GB.
	Analog inputs	2 x 4...20 mA for pressure and temperature (optional: calculated values) Display on M400.
	Power supply	24 VDC, 5 W minimum

	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)
	Temperature & pressure compensation	Using analog 4 … 20 mA input signals or manually set values in M400 compensation (menu configure / measurement. Automatic plausibility check of analog inputs

	Installation	
	Warm up time	1 hour

	Instrument side purging	
	Instrument side purging (for space between TDL window and process window)	All process adaptions (SP and NP probes, wafer and extractive cells) require instrument-side purging. For oxygen applications, nitrogen with a purity >99.7% (minimum recommended) at a flow rate of about <0.5 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.

	Data logger	
	Function	Logging of all sensor data on SD card
	Interval	See chapter 6.3.3 (Data logging) on page no 87.
	Format	SPC

Table 2 Product data probe

	Size and weight	
	Probe lengths	Please see chapter 4 (Dimensions and Drawings) on page no 43.
	Weight	– 4 – 6 kg, depending on length (SP, NP, E process adaptions) – 10 – 15 kg, depending on diameter (wafer cells)

	Material of construction	
	Steel (medium-wetted)	1.4404 (comparable to 316L), 1.4571 steel, C22 Hastelloy
	Optical elements	AR coated Quartz, AR coated Borosilicate
	Seals	Kalrez® 6375, Graphite compounds
	Instrument cover (Blue)	Aluminum – Paint finish – Chemically resistant epoxy resin coating

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

	Instrument side purging	
	Process side purging – For purged (SP) and wafer (W)	For standard purged (SP) and wafer (W), 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.
	WARNING: Check valve is required (not provided with GPro 500 – see "Accessories" on page no 126).	
	Corner cube purging (for standard purged (SP) and wafer (W)	Yes, via process side purging

	Operating conditions	
	Temperature range	0… +250 °C (+ 32 … +482 °F) optional: 0… +600 °C (+ 32 … 1112 °F) with additional Thermal Barrier and graphite gaskets.
	Design Pressure (see measurement table for maximum operating pressure for specific gases)	max. pressure: 20 bar (290.1 psi) Process adaptor dependent
	Max. dust load @ nom. OPL	Application dependent
	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)

	Installation	
	Probe Flange size	DN50/PN25, DN50/PN16, DN80/PN16, ANSI 2"/300lb, ANSI 2"/150lb, ANSI 3"/150lb. See Figure 22 till Figure 27 for further details.
	Required gasket for proper flange sealing (not provided with GPro 500 – see Appendix chapter 2.3 (Accessories) on page no 126.	Dimension: 82.14 x 3.53 mm

Table 3 Product data M400

	Electrical inputs & outputs	
	Communication interface	RS 485 (to sensor head)
	Analog outputs	4 x 4...20 mA (22 mA): process temperature, pressure, % conc, % transmission (on M400)
	Relays	6 relays (on M400)
	Power supply	24 VDC or 85...250 VAC, 50/60 Hz @100 VA
	Fuse	10 A slow

	ISM diagnostics parameters	
	% Transmission	Available as a 4 … 20 mA analog output
	Window fouling	Time to Maintenance Indicator (TTM). Real time, dynamic prediction of when the next maintenance cycle is required for best operation. Action: Clean the optics (window, corner cube)
	Laser lifetime	Dynamic Lifetime Indicator (DLI). Based on the DLI information, the transmitter tells you when it's time to replace the TDL. Action: Replace TDL (Expected laser diode lifetime >10 years)

	Alarms triggers	
	Too low transmission	Min. transmission value to be set in M400 menu Config / ISM setup
	Other	All alarms (incl. SW/HW errors etc.) are listed in Chapter 8.5.1 of the M400 manual.

2 Preparations

2.1 Tools and other equipment

The following tools are necessary to install GPro 500:

- 2 pcs open-end spanners for M16 bolts
- 1 pcs Allen key 5 mm for the locking screws on flanges and Tx lid screws
- 1 pcs Allen key 3 mm for the RS 232 cover screws
- 1 pcs flat screwdriver 2.5 mm for electrical connections
- 1 pcs flat (6 mm) or cross head (No 2) screwdriver for Rx lid screws
- Adjustable wrench for purge connections

Other equipment necessary, not supplied my METTLER TOLEDO:

- Check valve
- Process side gasket (99 x 2.62 mm)

2.2 Flow conditions at measuring point

When deciding the placement of the GPro 500 TDL in the process, we recommend a minimum of 5 pipe diameters of straight duct before and 3 pipe diameters of straight duct after the point of measurement. This will lead to laminar flow conditions which is favorable for stable measurement conditions.

2.3 Measuring head placement (probe installations)

The TDL head should be easily accessible. A person should be able to stand in front of it and adjust the M16 fixing bolts using two standard spanners. There should be at least 60 cm free space measured from the flange fixed to the stack and outwards as shown below.

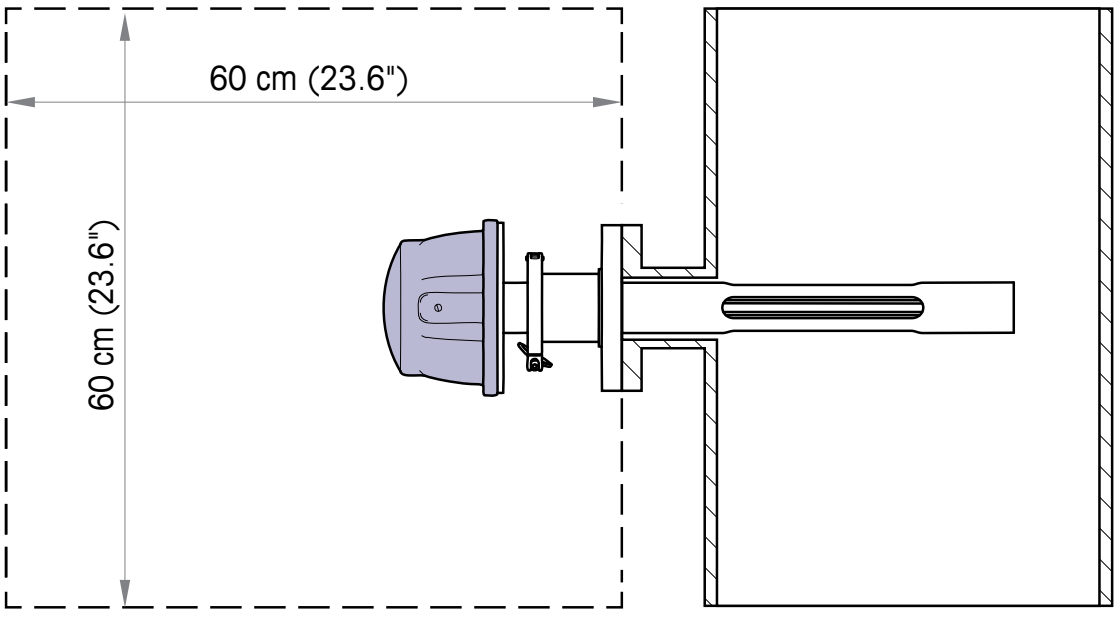


Figure 5 Minimum free space at the process flange.

US Version:

Installation in a Division 1 area requires conduit as well as cable glands approved for the area. The explosionproof probe head will need final adjustment which requires movement of the probe head. To faciliate this, you will need to provide and install an explosionproof flexible coupling (for example: Killark ECF/EKJ) in close proximity to the probe head. The coupling needs to be long enough and installed within your conduit system to minimize vibration and to faciliate final adjustment of the probe head which may include rotation by max. ±90 degrees. Please be sure to provide a coupling which is suitably long.

2.4 Flanges and stack hole requirements (Probe installations)

The probe requires one hole, at least 54 mm in diameter. Standard flange used for connection is DN50/PN25 or ANSI 2″/300 lb. The flange can either be welded directly to the process, or optionally be part of a bypass system The two flanges are shown in Dimensions of the DN50/PN25 flange for standard purge probe (SP) and non-purged probe (NP) on page no 30.

☞ When the process flange is mounted it is important that the free space in front of it is at least 60 cm to facilitate installation and maintenance. Se Minimum free space at the process flange. on page no 31.

☞ Gasket is not provided. See chapter Table 1 (Product data sensor head) on page no 24 for information on suitable gaskets.

2.5 Cables and electrical connections

The TDL and M400 are connected with a RS 485 cable. The user should verify that the cable length for the 4–20 mA analogue current output from the TDL does not influence the measurements (due to inductance etc.). If electrical connections have to be made at installation, refer to chapter 5 (Electrical Connections) on page no 67, 5M cable length statement.

ATEX Version:

WARNING

The GPro 500 comes with a pre-installed cable and cable gland.
Do not attempt to replace the cable as it will void the warranty
and violate the ATEX classification!

RS 485 cable specifications for the ATEX version: Lead area must be at least 0.5 mm^2 and the maximum length is 200 m. The specification for the Ethernet cable is CAT5.

US Version:

The FM version must be installed using a suitable cabling conduit system in accordance with local codes and regulations. To aid installation, the unit is supplied without an attached cable.

WARNING

The electrical installation must be performed in accordance with National Electrical Codes of practise and/or any other applicable national or local codes.

3 Installation and Start-up

This chapter describes the steps and measures needed to be taken during commissioning of the GPro 500.

3.1 Installation and adjustments

3.1.1 Mechanical installation

The GPro 500 is designed to be very easy to install. The optical path is aligned in the factory so the installation procedure is simply to bolt it to the process flange, mount the purging tube (6 mm or optional 1/4" tube fitting) and mount the cables.

☞ For efficient installation you must make sure that the pre-installation requirements are met prior to the visit of the Mettler-Toledo technician.

☞ For purged (SP) probes and purged wafer (W) cells, if the process is running or if the optical surfaces will be exposed to contaminates or condensates following initial installation, it is essential to connect and turn on the process purge. It is recommended to initially run the purge gas at maximum flow (typically 10 l/min) to protect the optics. This flow will be adjusted and optimized later during final measurement setup.

3.1.2 Process side purging (not applicable to non-purged probe [NP] and extractive cell [E])

Depending on the type of process adaptor supplied, there may be requirement for either one or two optical purges. These are called Instrument purge and Process purge.

Figure 7 on page 37 and Figure 9 on page 38 provides further details on the purge requirements for the standard purge (SP) probe together with the typical configuration of the required external flowmeters (rota meters) used to supply and control the purge gas flow.

Purge and non purge Probes without filter.

If installing an SP or NP probe without filter, ensure that the holes/slots are facing the process (verify that the flat gasket between the probe and the sensor head is well installed) and ensure the flange gasket is in place.

Non-purged with filter

Prior to inserting an NP probe with an installed filter, mark the position/angle of the DUST SHIELD on the flange. When installing the probe, ensure that the DUST SHIELD is facing the process in coming flow and ensure the flange gasket is in place.

Instrument Purge

The GPro 500 TDL head attaches to the process adaptor via a precision mechanical interface. Between the optical window of the TDL head and the adaptor's process window, there is a small cavity. This cavity forms part of the optical path of the analyzer and therefore it is important that there are no traces of the gas to be measured, i.e. O_2 or H_2O or other, in this space, otherwise this will add to the measurement concentration. The instrument purge is therefore used to flush this space. In addition, in the unlikely event of a breakage of the process window, the purge will flush process gas away from the cavity.

Typical purge gas flow for instrument purge is < 1 l/min

Note: All current process adaptor types require instrument purge.

Process Purge

For standard purged (SP) probes and purged in-line wafer (W) cells, in addition to the instrument purge described above, these also utilize a process purge to protect the optical windows from direct contact with process gas. The process purge flow is adjusted during commissioning to provide sufficient flow to provide this protection and to set the optical path length through the probe.

Note. Process purge is critical for the protection of the process wetted optical components and for correct operation of the analyzer and therefore must be running at all times.

For oxygen applications nitrogen purge is required, or alternatively another clean, non-explosive, non-corrosive and dry O_2 free gas. For other gas measurements, instrument grade air is normally recommended. The GPro 500 standard purged probes (SP) and purged wafer cells (W) are designed to consume as little purge gas as possible while still keeping the process optical surfaces clean.

When bulk plant nitrogen (or instrument air for non O_2 measurements) is not available gas cylinders can alternatively be be used. The purge consumption during normal operation is less than 1 l/min. which means that if you have ten bottles with 3300 Std Liters (Liters of gas when at "standard" room temperature and pressure) filled to 2500 psi (172 bar), which is typically large bottles, they will last at least 3 weeks. Process purge gas consumption rarely exceeds 5 l/min.

The purging of the probe optics is essential to avoid contamination of the probe optics during process operation. After installation ensure that purging is operating before you start the process. The details are described in chapter 3 of the operating instructions.

WARNING

Always start purging at maximum flow before starting the process.

WARNING

Purging must always be switched on in order
to avoid dust and/or condensate deposition onto the optical surfaces.

Another alternative is to use a nitrogen generator (for O_2 applications) local compressed air supply (for CO and H_2O applications), as long as it is oil free and non condensing and meets the quality requirements laid out in ISO 8573.1, class 2–3, for instrument air.

The purging is attached to the 6 mm (optional 1/4") Tube Fitting. The purge gas then exits in front of the first window and in front of the corner cube at the end of the probe see Figure 6 (Optimizing the purge flow) on page no 36.

WARNING

The purge gas inlet for the process side must have a check valve to
avoid contamination of the purging system from process gas.

WARNING

Always start purging at maximum flow before starting the process.

WARNING

Purging must always be switched on in order
to avoid dust deposition onto the optical surfaces.

WARNING

Do not remove and/or disassemble the purge gas inlet for processes (2). If disassembled, the PED pressure certificate is void.

WARNING

Do not connect instrument and process side purging in series, otherwise when disassembling the sensor heat the probe purging will stop.

3.1.3 Adjusting the purging flow (for standard purged [SP] and in-line wafer [W] cells)

The flow rate of the purging will affect the effective path length and consequently the measurement value. Therefore the following procedure should be used. Start with a very high flow rate and gradually decrease it. The measurement value will then start at a low value and increase with decreasing purge flow. At some point it will level out and stay constant for a while and then again start increasing. Choose a purge flow in the middle of the constant region.

CAUTION

If the process flow rate remains constant this will be a good purge flow but the effective path length will always be a function of the process flow rate so be observant on this.

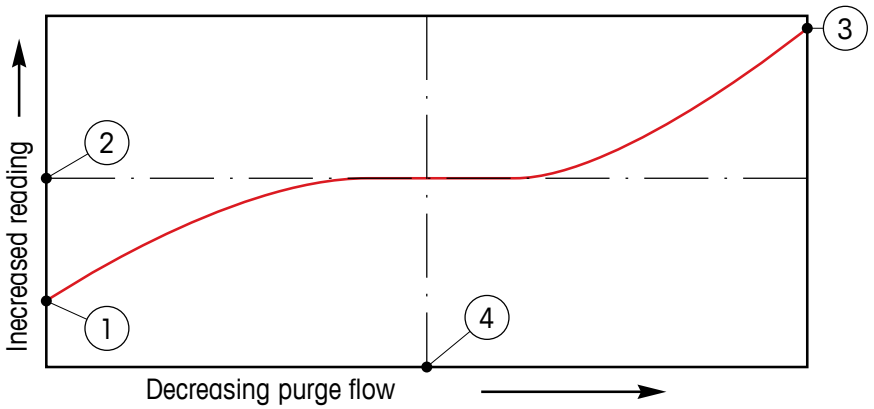


Figure 6 Optimizing the purge flow

On the x-axis there is purge flow and on the y-axis there is the instrument concentration reading.

1 Concentration reading with high purge flow. The path length is now shorter than the effective path length since the purge tubes is completely filled with purging gas and some of the purging gas is flowing into the measurement path.

2 Concentration reading with optimized purge flow. The path length is now equal to the effective path length since the purge tubes are completely filled with purge gas. See the illustration below.

3 Concentration reading with no purge flow. The path length is now equal to the nominal path length since the probe is completely filled with process gas.

4 The optimized purge flow.

3.1.4 Signal Optimization

When in installation mode, the current value of % transmission and the noise signal level (NSL) will be displayed for 5 minutes on the M400 transmitter display, before automatically returning to measurement mode. These two diagnostics values aid in optimizing the laser signal quality. This is accomplished by loosening the securing clamp and slowing rotating the blue TDL head. Continue to rotate the head until the NSL value is less than 40 and the transmission value is above 70%. Finally fully tighten the clamp and confirm the values are still acceptable. (See "TDL Installation" on page no 41 for further details).

WARNING

The GPro 500, when fitted with the standard purged (SP) probe, can not operate in process conditions where process gas stream velocity is typically <1 m/s. This would make the effective path length (see "Dimensions and Drawings" on page no 43) too variable.

For applications with sample flows <1 m/s, an in-line wafer cell option is available. For static processes where the process gas is clean and dry (non-condensing), for example; tank head space measurement, a non-purge probe option is available.

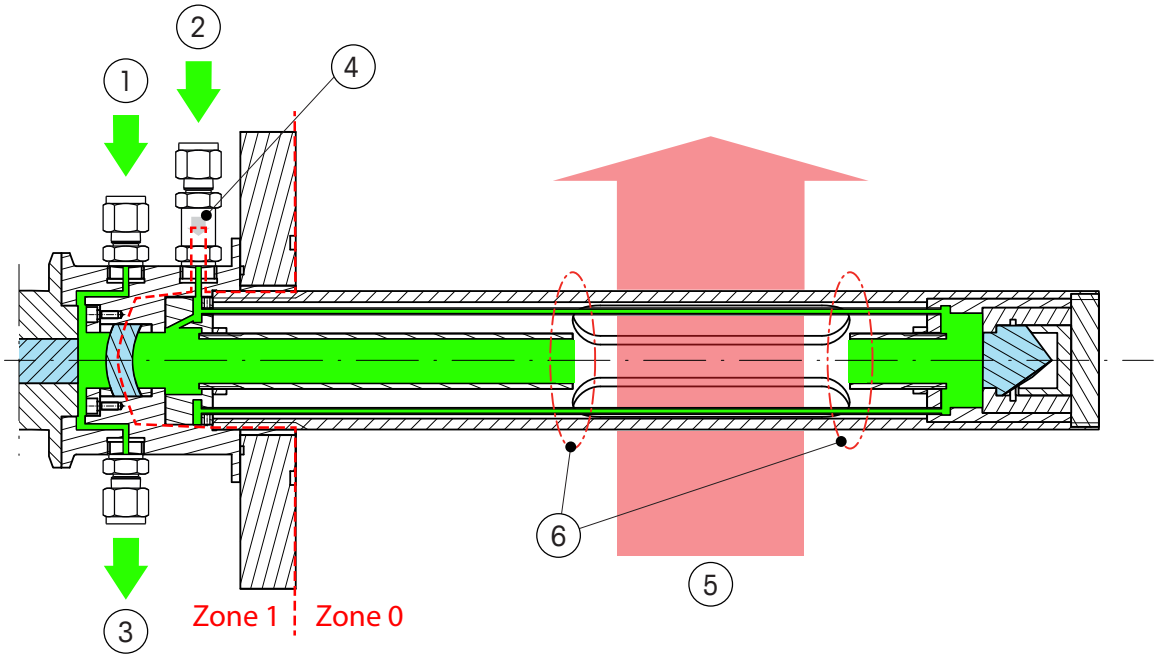


Figure 7 Purging configuration for standard purged probe (SP)

1 Purge gas inlet for instrument side (6 mm Tube Fitting for DIN, ¼" for ANSI versions)
2 Purge gas inlet for process side (must have a check valve to be supplied by the user)
3 Purge gas outlet for instrument side (6 mm Tube Fitting for DIN, ¼" for ANSI versions)
4 Mandatory check valve (to be supplied by the user)
5 Process gas flow
6 Cut-off zone: region that defines the boundaries of the effective path length. See "Adjusting the purging flow (for standard purged [SP] and in-line wafer [W] cells)" on page no 36.

≠

The process side purge connection is fitted with a seal between the fitting and the purge housing to conform to the pressurized equipment directive (PED). To ensure the integrity of this seal and to prevent damage when connecting the purge tube to the fitting, a back spanner (wrench) must be used to securely hold the fitting body as the purge pipe nut is tightened, as illustrated in Figure 8 below.

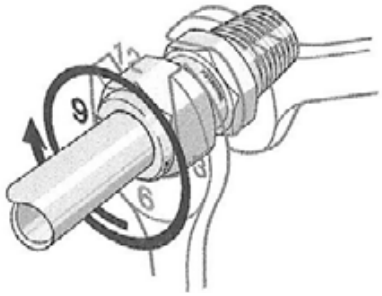


Figure 8 Connecting purge pipe to process side purge fitting.

WARNING

Do not remove and/or disassemble the purge gas inlet for process (2). If disassembled, the PED pressure certificate is void.

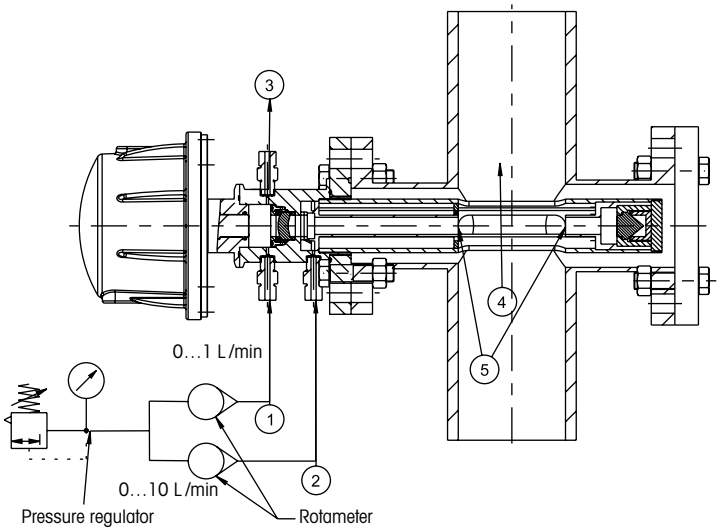


Figure 9 Purge gas rotameter connections for standard purge (SP) probe

1 Purge gas inlet for instrument side (6 mm or ¼" tube fitting).
2 Purge gas inlet for process side (must have a check valve).
3 Purge gas outlet for instrument side (6 mm or ¼" tube fitting).
4 Process gas flow.
5 Region that defines the boundaries of the effective path length.

WARNING

Always start purging at maximum flow before starting the process.

WARNING

Purging must always be switched on in order to avoid dust deposition onto the optical surfaces.

WARNING

Do not remove and/or disassemble the purge gas inlet for processes (2). If disassembled, the PED pressure certificate is void.

WARNING

Do not connect instrument and process side purging in series, otherwise when disassembling the sensor heat the probe purging will stop.

WARNING

Instrument side purging must be sufficient in order to maintain the temperature of the sensor head below the maximum acceptable limit of < 55 °C (< 130 °F).

WARNING

When the process gas stream is on, the instrument side purging must always be on in order to avoid possibility of ingress of process gas stream into the sensor head in the unlikely event of a TDL sensor head window failure.

3.1.5 Solar radiation and process radiated heat.

Exposure of the TDL head to very high temperatures, for example, solar radiation and/or excessive localised heat sources (such as radiated heat from process walls or adjacent equipment) can cause internal overheating of the device. It is therefore important under these circumstances that adequate protection is provided, either in the form of a solar shield/roof for solar protection, or a suitable heat shield in the case of excessive radiated heat from nearby processes or equipment. If the TDL is exposed to excessive heat for prolonged periods, under these extreme circumstances the measurement may be withdrawn and the TDL will display a laser source error message. If this should occur, the device should be allowed to cool to its normal operating temperature range and suitable remedial measures made to prevent further overheating occurring. Should the sensor head be exposed to excessive high temperatures beyond the specification, the laser may shutdown, and a laser source error message may be indicated. If this should occur, power should be disconnected and the sensor head allowed to cool before restarting the device.

Note: The solar shield/roof should not enclose the TDL head, as a free flow of air should be allowed to circulate at all times.

3.2 Alignment

The GPro 500 is carefully aligned when it leaves the factory and normally doesn't require any alignment during normal use. If misalignment is suspected you need to contact Mettler Toledo or you local supplier (see Sales and Service on page no 130) and send the GPro 500 back to the factory for re-alignment.

When the GPro 500 sensor head is removed from the probe (or from the thermal barrier should this be installed), for example for verification and/or inspection, it is not necessary to realign it when mounting it back onto the probe (or heat barrier). However, we should recommend to turn the head until the maximum transmission is reached. Consult the M400 manual on how to see the live transmission value on its display.

3.2.1 Signal Optimization

Note that when in installation mode, the current value of % transmission and the noise signal level (NSL) will be displayed for 5 minutes on the M400 transmitter display, before automatically returning to measurement mode. These two diagnostics values aid in optimizing the laser signal quality. This is accomplished by loosening the securing clamp and slowing rotating the blue TDL head. Continue to rotate the head until the NSL value is less than 40 and the transmission value is above 70%. Finally fully tighten the clamp and confirm the values are still acceptable. (See "TDL Installation" on page no 41 for further details).

WARNING

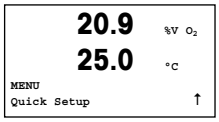
The purge gas for the thermal barrier must always be turned on when the process is running in order to protect the sensor head from permanent damage.

WARNING

The failure of the instrument side and thermal barrier purging system must trigger an alarm. This alarm has to be implemented in th DCS ny the user.

3.3 Installation & Commissioning

General Setup (applies for all parameters)
(PATH: Menu/Quick Setup)



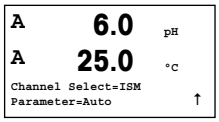
While in Measurement mode press the [MENU] key to bring up the Menu selection. Select QUICK SETUP and press the [ENTER] key.

Display Convention:

1st line on display → a	3rd line on display → c
2nd line on display → b	4th line on display → d

Select the units of measurement for a and b. Only lines a and b can be configured in Quick Setup. Go to the Configuration Menu to configure lines c and d.

Channel Selection



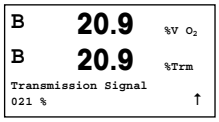
Please select the type of Sensor:
Analog: For conventional analog sensors (will be displayed on channel "A").
ISM: For ISM sensors (will be displayed on channel "B").

Please select the parameter requirement:
The choice of parameter depends on the level of transmitter. If an ISM sensor is selected, the setting "Auto" means, all possible ISM sensors will be recognized and accepted. If a special parameter is chosen, only this parameter will be recognized and accepted on the transmitter.

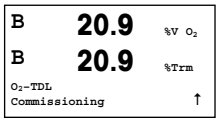
Calibration
The GPro 500 is calibrated at the factory and does not require calibration at installation & Startup.

TDL Installation
(path: Quick Setup/TDL/Installation)

While in measurement mode press the key [MENU] . Press the ▲ or ▼ key to select the TDL and then the Installation menu item.



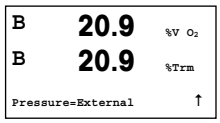
In this mode, the current value of % transmission and the noise signal level (NSL) will be displayed for 5 minutes before automatically returning to measurement mode. These two diagnostics values aid in optimizing the laser signal quality. This is accomplished by loosening the securing clamp and slowing rotating the blue TDL head. Continue to rotate the head until the NSL value is less than 40 and the transmission value is above 70%. Finally fully tighten the clamp and confirm the values are still acceptable. In this position, and secure the blue sensor head into position and tighten the clamp.



TDL Commissioning (path: Quick Setup/TDL/Commissioning)
While in measurement mode press the key [MENU] . Press the ▲ or ▼ key to select the TDL and then the Commissioning menu item.

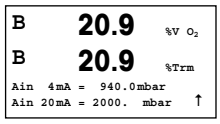
First, select the type of pressure compensation selected:
– External: current external pressure value coming from a pressure transducer of 4.. 20 mA analog output
– Fixed: pressure compensation uses a fixed value to be set manually.
Note: if this pressure compensation mode is selected, a considerable gas concentration measurement error resulting from a non- realistic pressure value can

take place.



If External compensation is selected, then the minimum (4 mA) and maximum (20 mA) analog output signals from the pressure transducer must be mapped to the corresponding Analog input of the TDL. Key in the minimum and maximum values of the pressure in the following units:

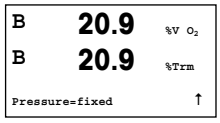
– hPa – mmHg – mbar
– psi – kPa



In general, METTLER TOLEDO recommends the use of absolute pressure transducers for more accurate signal compensation over a broad pressure range.

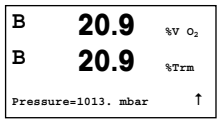
If, however, small pressure variations around atmospheric pressure are to be expected, relative pressure sensors will produce better results; but the variations of the underlying barometric pressure will be ignored.

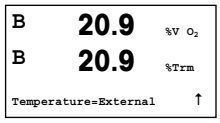
For relative pressure sensors, the minimum and maximum values must be mapped so that the TDL can interpret the analog pressure signal as "absolute", i.e. a fixed barometric pressure of 1013 mbar (for example) has to be added to the mapped values.



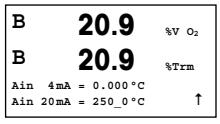
If Fixed compensation is selected, the fixed pressure value with which the measurement signal will be calculated has to be keyed in manually. For the fixed pressure, the following units can be used:

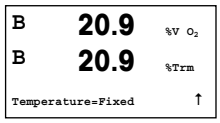
– hPa – mmHg – mbar
– psi – kPa



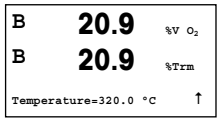


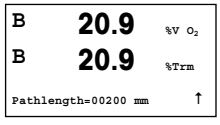
If External compensation is selected, then the minimum (4 mA) and maximum (20 mA) analog output signals from the temperature transducer must be mapped to the corresponding Analog input of the TDL. Key in the minimum and maximum values of the temperature in °C.





If Fixed compensation is selected, the fixed temperature value with which the measurement signal will be calculated has to be keyed in manually. For the fixed temperature, only °C can be used.





Last, select the initial optical path length corresponding to the probe length installed:
Please see Table 4 (Installation examples) on page no 62 for details of the applicable OPL value for the process adaptor type being installed.

This initial value is valid when instrument purging on the instrument and on the process side is running. Depending on the process conditions and after the optimum of the process purging flow has been found (see next chapter), this value may have to be slightly adapted.

4 Dimensions and Drawings

4.1 Standard purged probe (SP)

The GPro 500 is available with 3 different probe lengths. It can also be supplied with various flange sizes to suit the installation (see page 44 for flange dimensions). This will increase the number of available applications where the GPro 500 will fit smoothly. The dimensions of the TDL heads as well as of the flanges and the thermal barrier are shown below.

There are four different lengths that should be observed. The most relevant from the standpoint of measuring performance is the **Effective path length**.

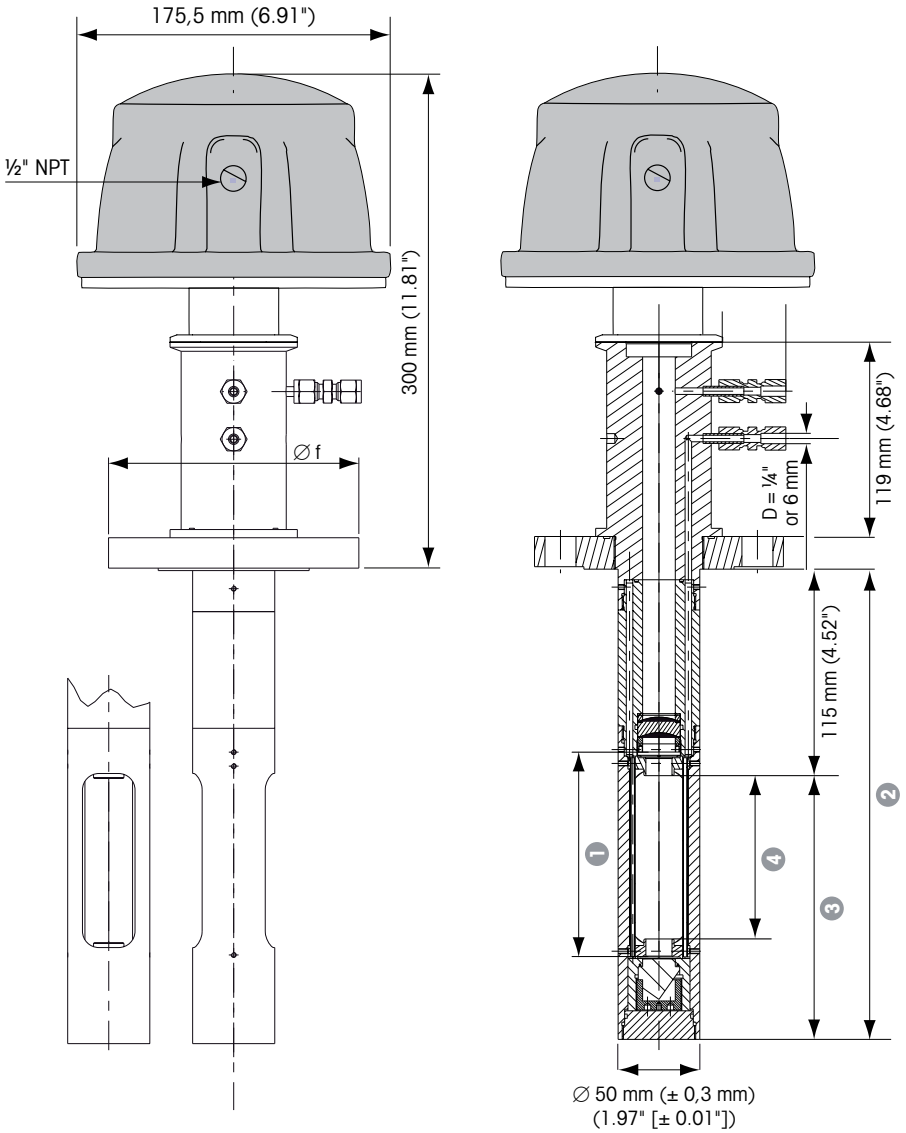


Figure 10 Dimensions of the standard probe (SP)

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 (2x effective path length).

Probes, wafer and cell dimensions					
Standard purged probe (SP)	**OPL**	**Dimension ❶**	**Dimension ❷**	**Dimension ❸**	**Dimension ❹**
Standard purged (SP)	200 mm (7.9")	138 mm (5.4")	288 mm (11.3")	161.5 mm (6.4")	100 mm (3.9")
Standard purged (SP)	400 mm (15.7")	238 mm (9.4")	388 mm (15.3")	261.5 mm (10.3")	200 mm (7.9")
Standard purged (SP)	800 mm (31.5")	438 mm (17.2")	588 mm (23.1")	461.5 mm (18.2")	400 mm (15.7")

* **Note:** Dimension ❷ in above table applies for standard 100 mm stand-off. For total probe length dimensions for other stand-off lengths, please refer to product configurator.

4.2 Non-purged probe (NP) with filter

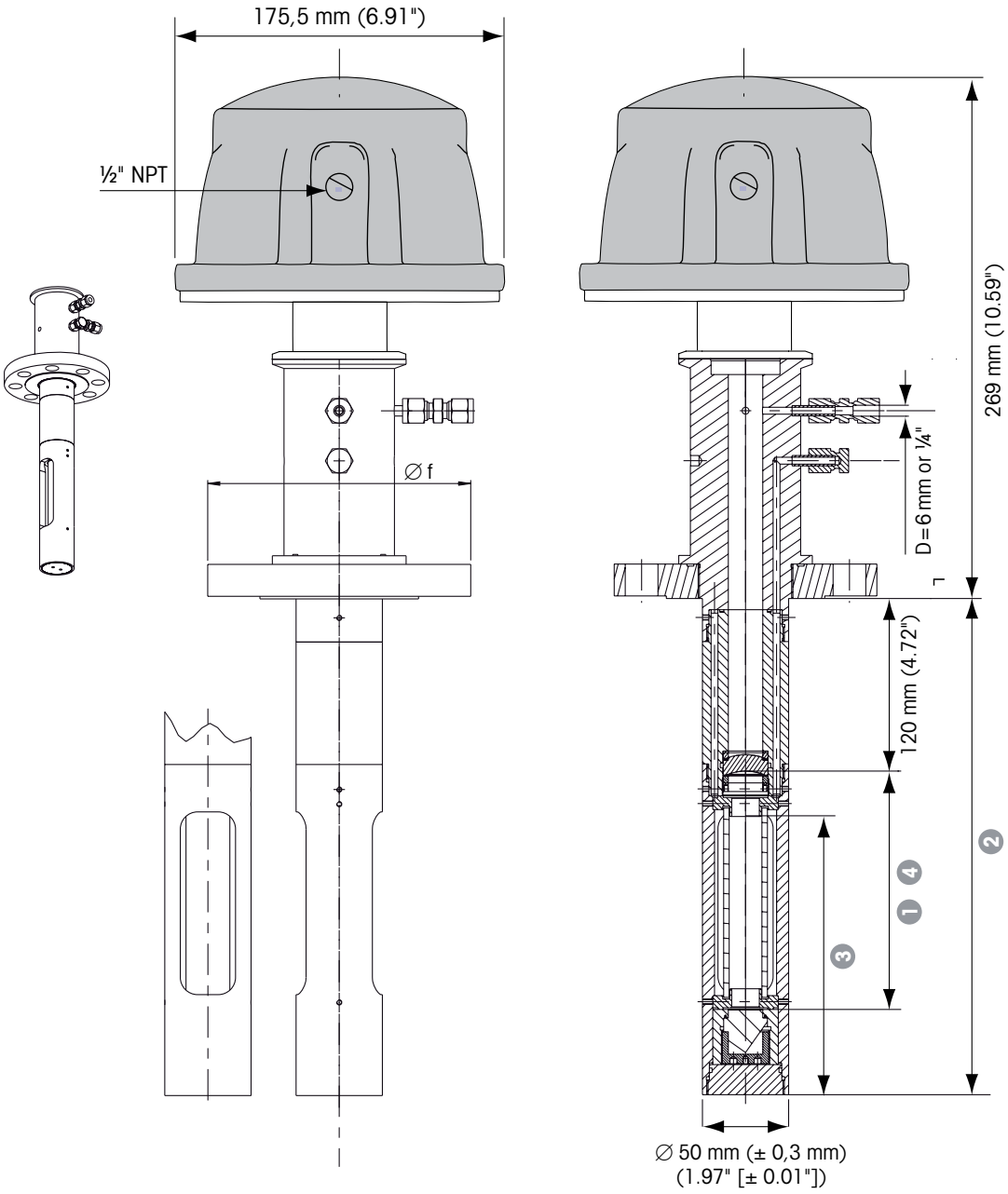


Figure 11 Dimensions of the non-purged probe (NP) with filter.

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 (2x effective path length).

Probes, wafer and cell dimensions					
Non-purged probe (NP) with filter	**OPL**	**Dimension ❶**	**Dimension ❷**	**Dimension ❸**	**Dimension ❹**
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")

* **Note:** Dimension ❷ in above table applies for standard 100 mm stand-off. For total probe length dimensions for other stand-off lengths, please refer to product configurator.

4.3 Non-purged probe (B) with Blow-Back

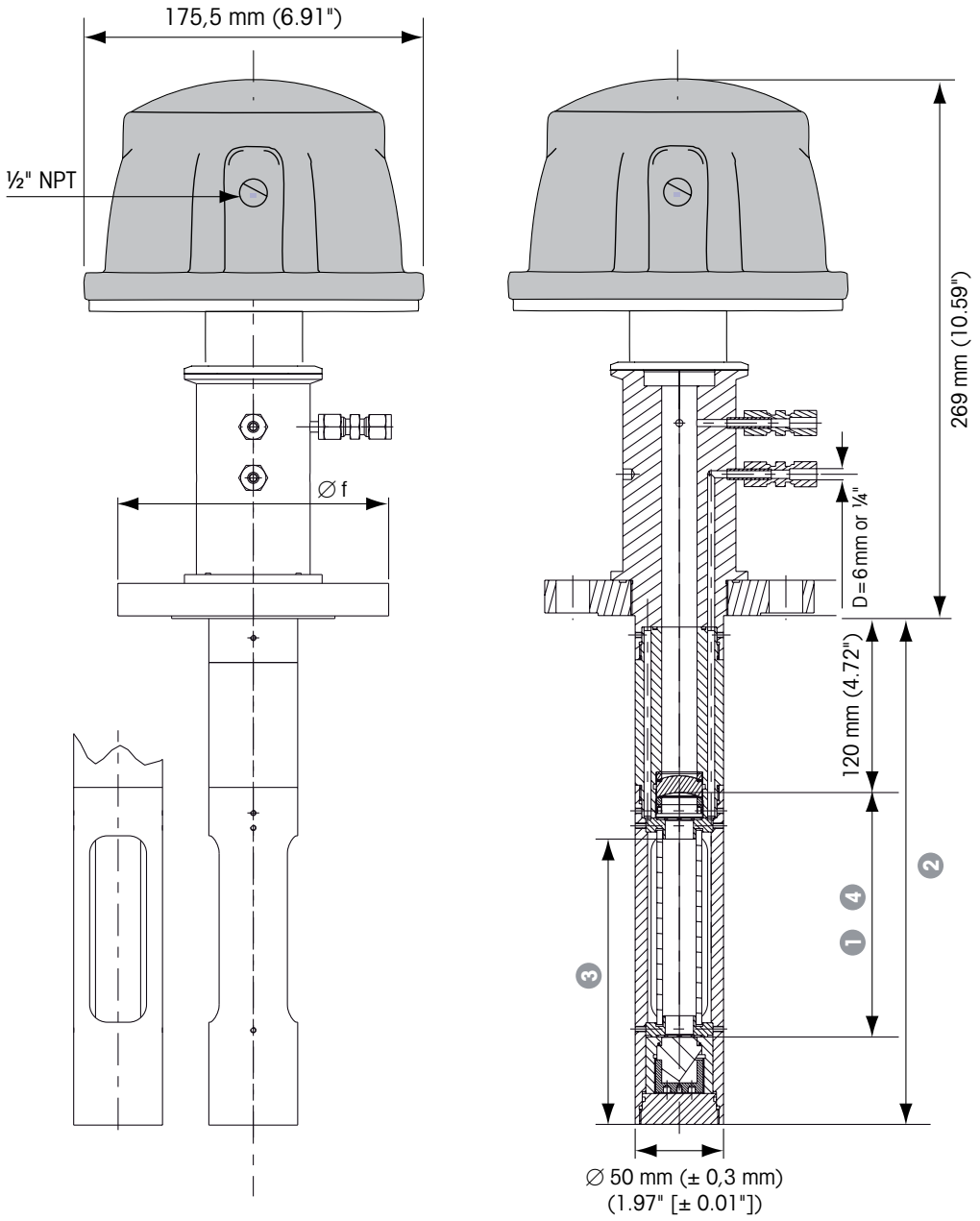


Figure 12 Dimensions of the non-purged probe (B) with Block-Back.

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 (2x effective path length).

Probes, wafer and cell dimensions					
Non-purged probe (NP) with blow-back	**OPL**	**Dimension ❶**	**Dimension ❷**	**Dimension ❸**	**Dimension ❹**
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")	138 mm (5.4")
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")	238 mm (9.4")
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")	438 mm (17.2")

*** Note:** Dimension ❷ in above table applies for standard 100 mm stand-off. For total probe length dimensions for other stand-off lengths, please refer to product configurator.

4.4 Configuring Blow-back function

When using the non-Purge probe with blow-back (NB), a suitable N2 or instrument air supply can be connected to the probe blow-back port. A suitable solenoid valve can then be connected to the M400 Transmitter, relay 1 connections (as detailed below) to initiate blow-back on a timed basis.

This is configured through the M400 interface:
Menu/Configure/Alarm/clean

Select clean and relay #1.
Press ENTER.
Select clean interval (period between cleaning cycles) and clean time (how long the solenoid valve is activated).
Press ENTER.
Select relay normal or inverted mode and finally save settings.

Blow-back will now be initiated automatically at the configured schedule.

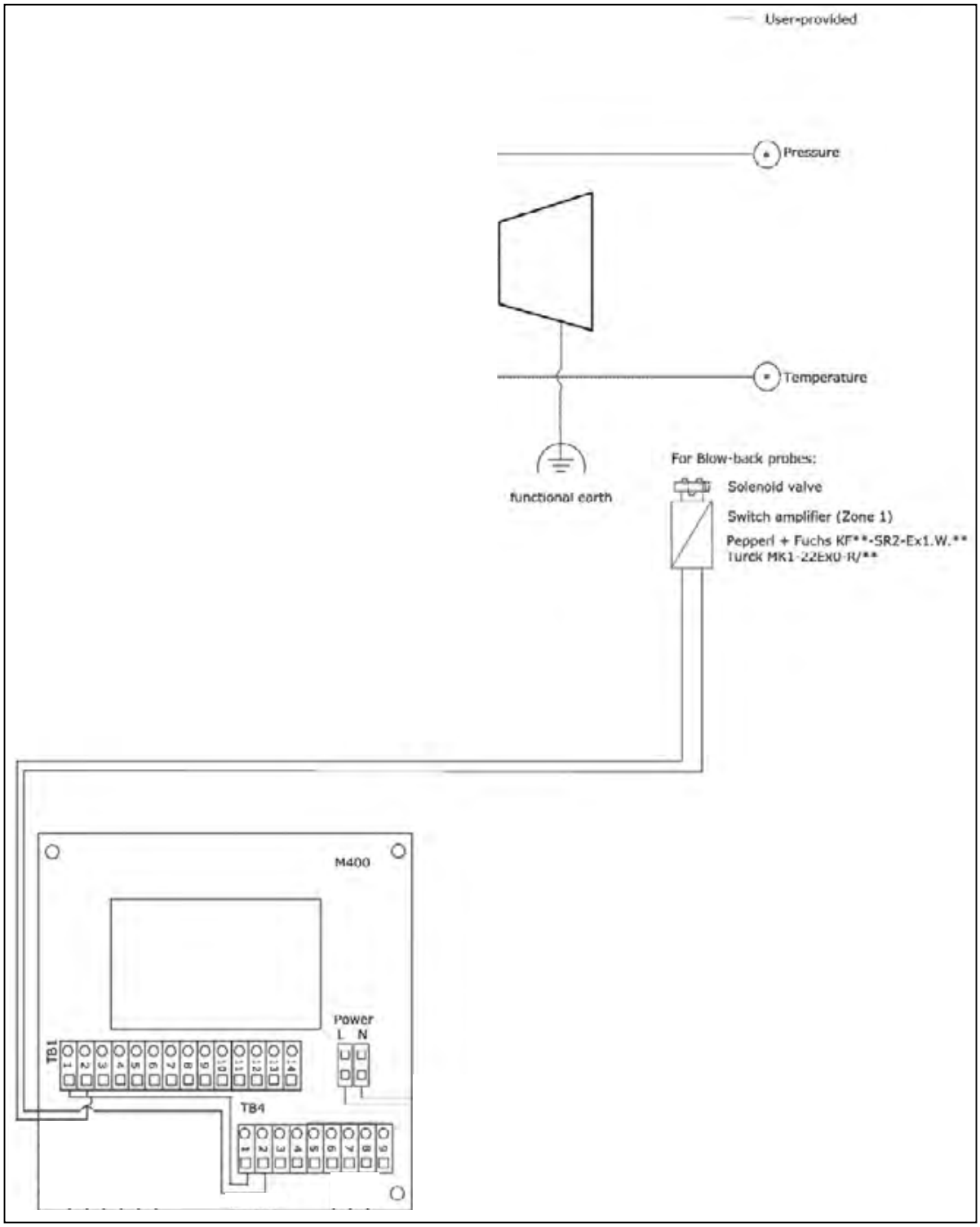


Figure 13 B probe with blow-back using M400 (DC solenoid valve).

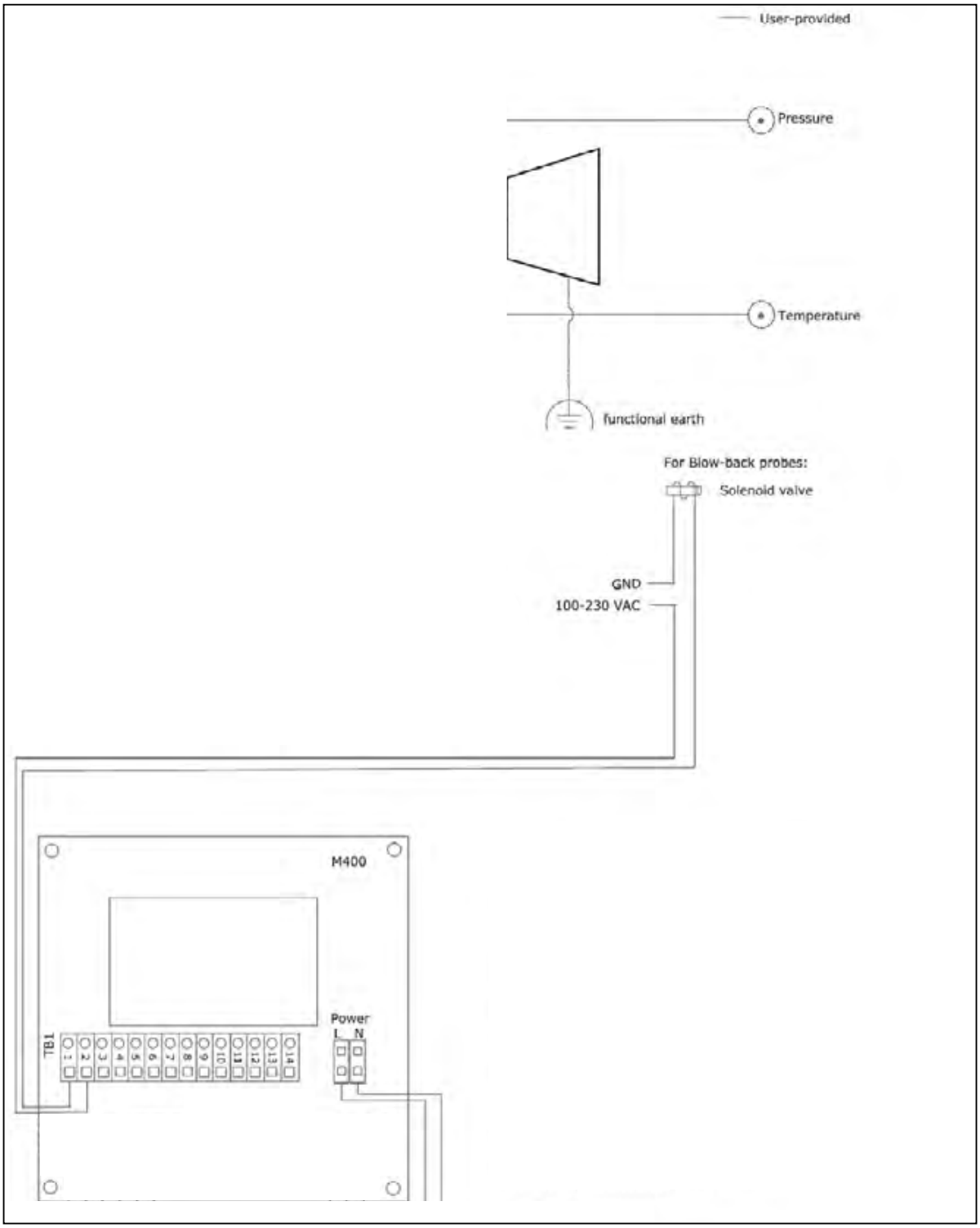


Figure 14 B probe with blow-back using M400 (AC solenoid valve).

4.5 Wafer (W)

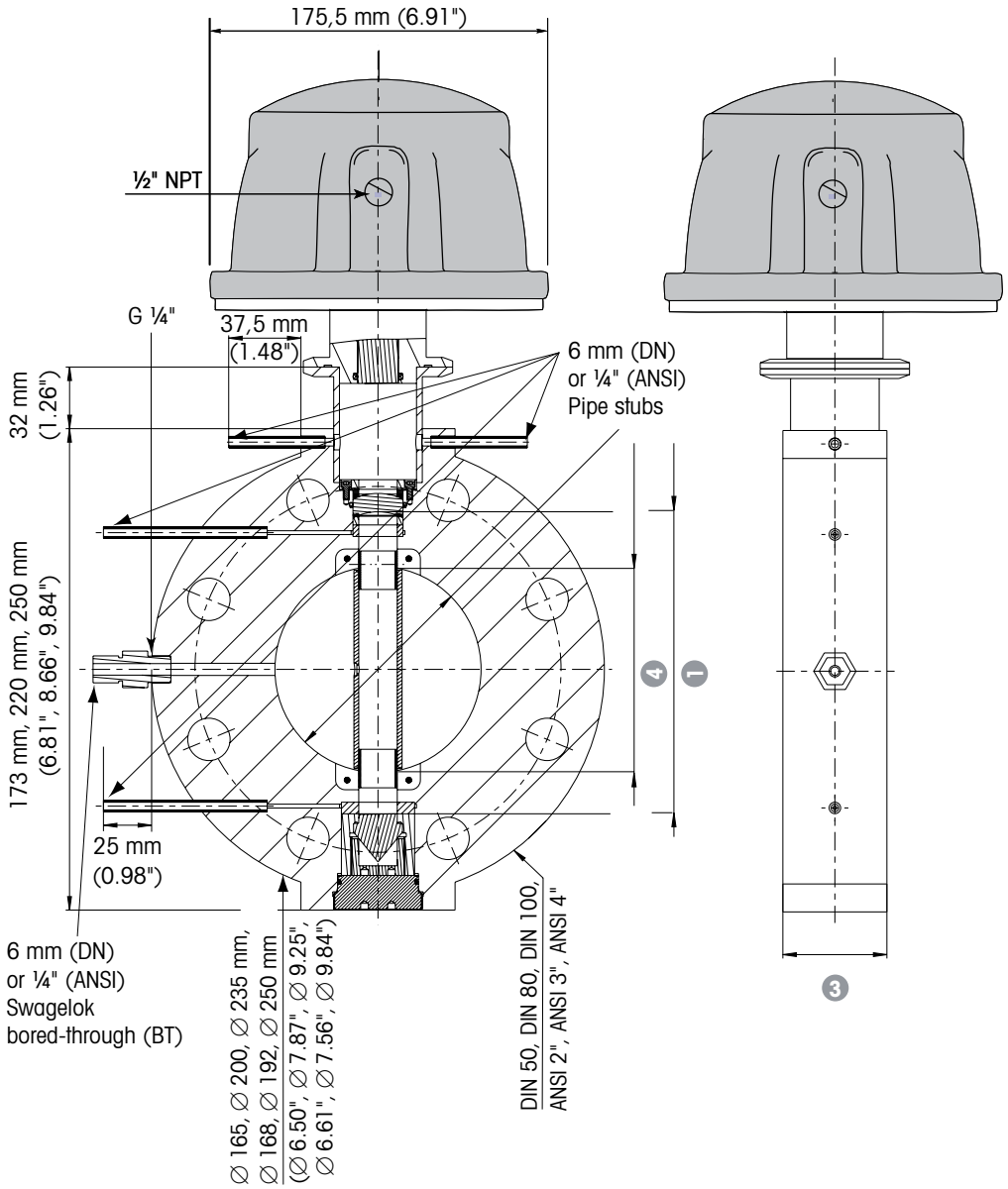


Figure 15 Dimensions of the wafer (W).

Definition of the lengths:

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

Probes, wafer and cell dimensions					
Wafer (W)	**OPL**	**Dimension ❶**	**Dimension ❷**	**Dimension ❸**	**Dimension ❹**
DN 50 wafer (W)	110 mm (4.33")	79 mm (3.11")	n.a.	54 mm (2.13")	55 mm (2.17")
DN 80 wafer (W)	164 mm (6.46")	121 mm (4.76")	n.a.	54 mm (2.13")	82 mm (3.29")
DN 100 wafer (W)	214 mm (8.43")	157 mm (6.18")	n.a.	54 mm (2.13")	107 mm (4.21")
ANSI 2" wafer (W)	104 mm (4.09")	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)	214 mm (8.43")	157 mm (6.18")	n.a.	54 mm (2.13")	107 mm (4.21")

*** Note:** Dimension ❷ in above table applies for standard 100 mm stand-off. For total probe length dimensions for other stand-off lengths, please refer to product configurator.

4.6 Extractive cell (E)

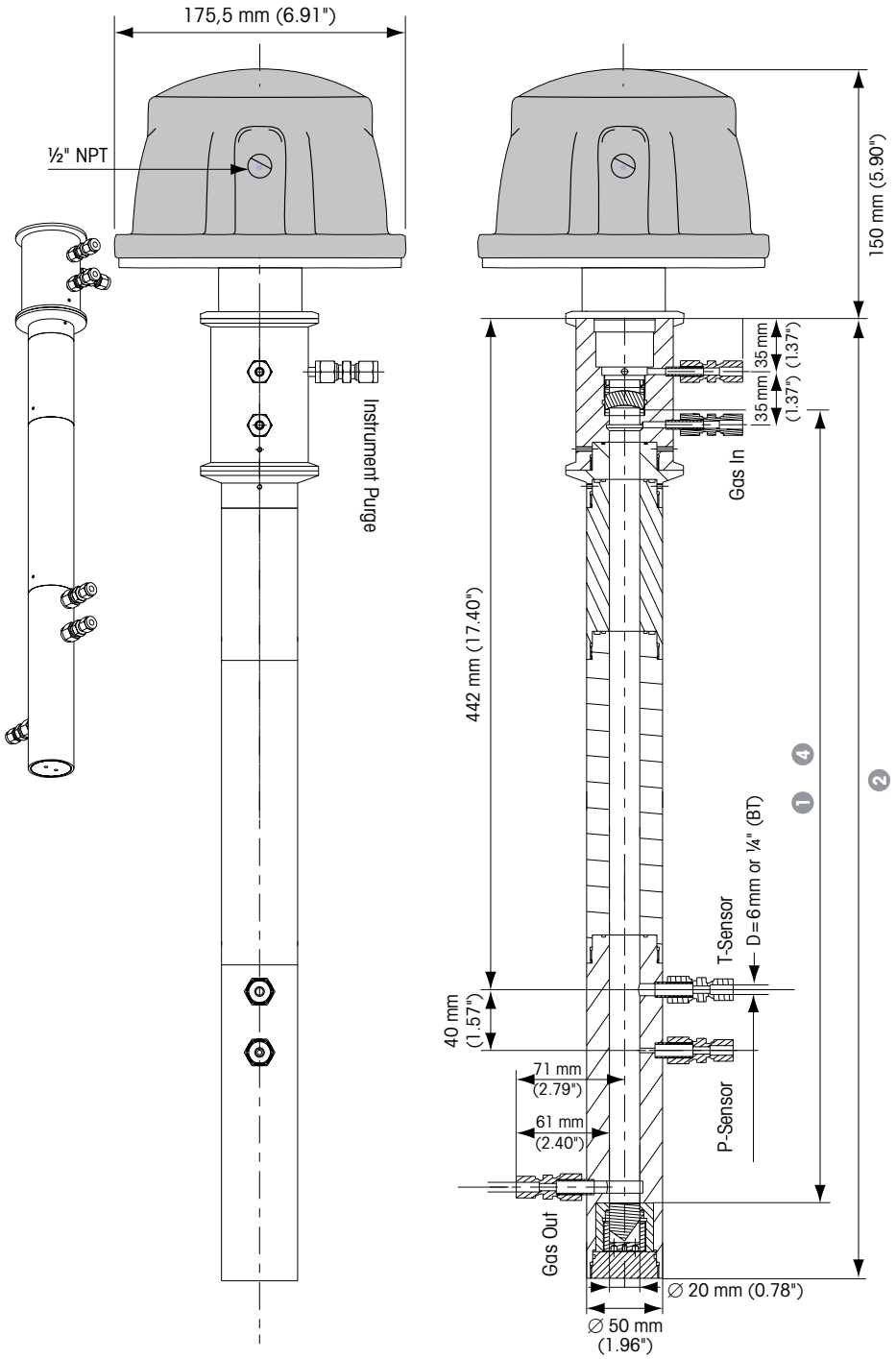


Figure 16 Dimensions of the extractive cell (E).

Definition of the lengths:

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

Probes, wafer and cell dimensions					
Extractive cell (E)	**OPL**	**Dimension ❶**	**Dimension ❷**	**Dimension ❸**	**Dimension ❹**
Extractive cell (E)	200 mm (7.9")	125 mm (4.92")	232 mm (9.13")	N.A N.A	125 mm (4.92")
Extractive cell (E)	400 mm (15.7")	225 mm (8.86")	332 mm (13.07")	N.A N.A	225 mm (8.86")
Extractive cell (E)	800 mm (31.5")	425 mm (16.73")	532 mm (20.94")	N.A N.A	425 mm (16.73")
Extractive cell (E)	1000 mm (39.4")	525 mm (20.67")	632 mm (24.88")	N.A N.A	525 mm (20.67")

*** Note:** Dimension ❷ in above table applies for standard 100 mm stand-off. For total probe length dimensions for other stand-off lengths, please refer to product configurator.

4.7 Extractive Probe Dual Window

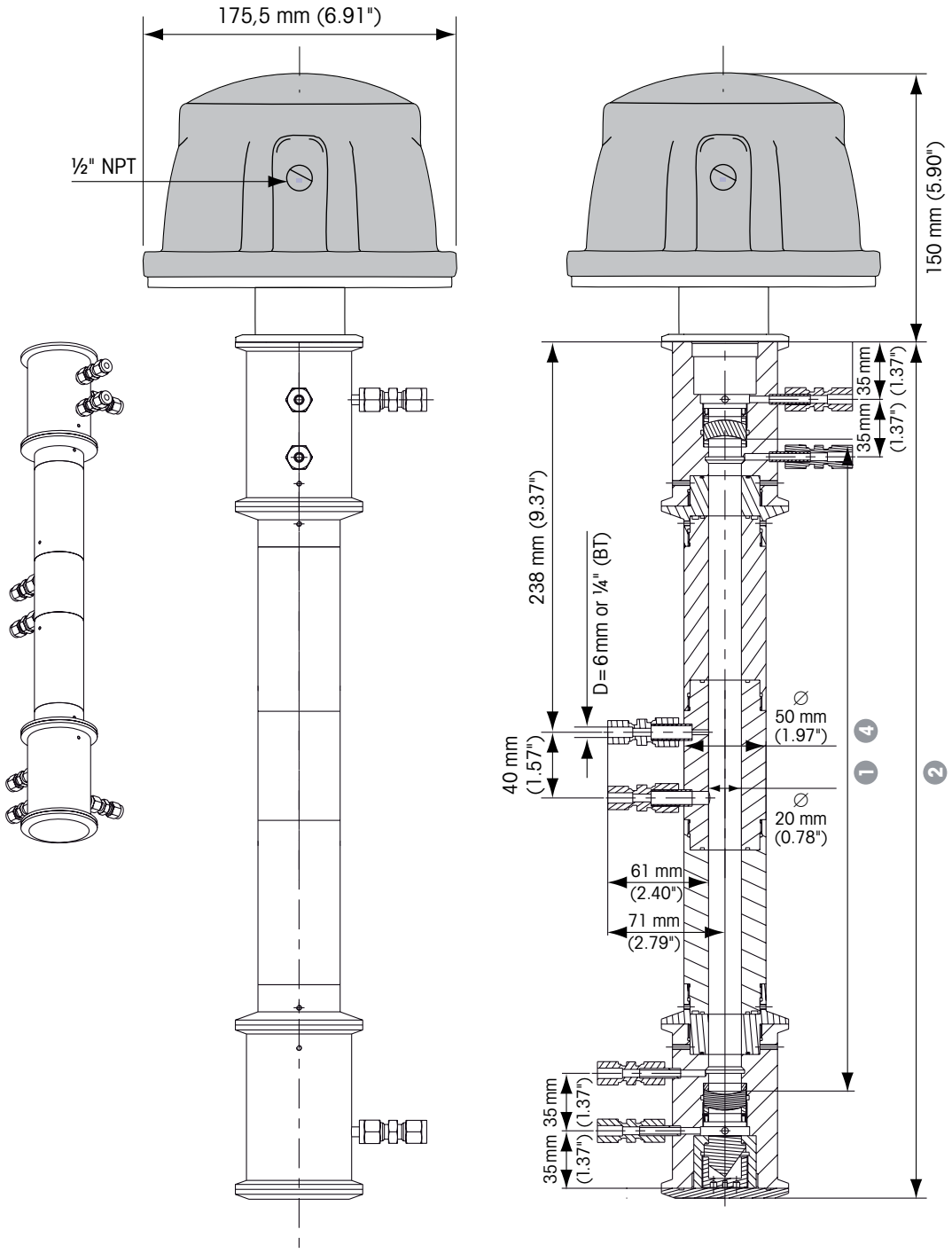


Figure 17 Dimensions of the extractive dual window.

Definition of the lengths:

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

Probes, wafer and cell dimensions					
Extractive cell Dual Window (E)	**OPL**	**Dimension ❶**	**Dimension ❷**	**Dimension ❸**	**Dimension ❹**
Extractive cell Dual Window(E)	400 mm (15.7")	200 mm (7.9")	321 mm (12.6")	N.A 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 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 N.A	(500 mm (19.7")

*** Note:** Dimension ❷ in above table applies for standard 100 mm stand-off. For total probe length dimensions for other stand-off lengths, please refer to product configurator.

4.8 Extractive Cell PFA

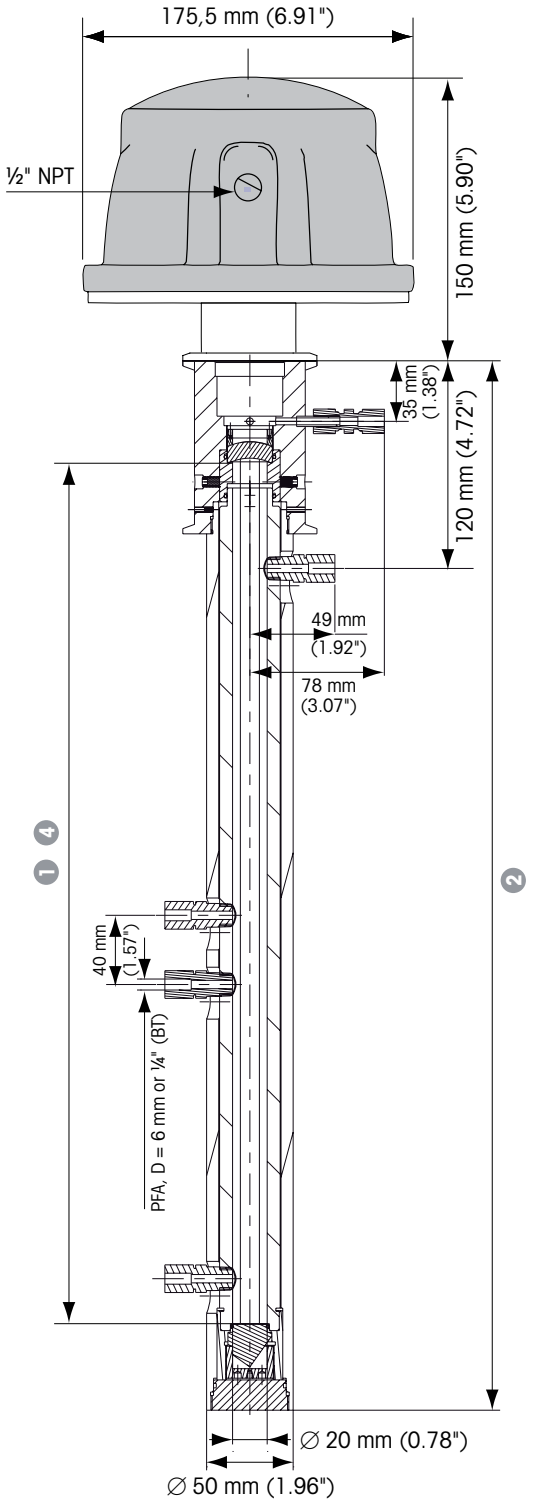


Figure 18 Dimensions of the extractive cell PFA.

Definition of the lengths:

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

Probes, wafer and cell dimensions					
Extractive Cell PFA	**OPL**	**Dimension ❶**	**Dimension ❷**	**Dimension ❸**	**Dimension ❹**
Extractive cell (E) PFA	1000 mm (39.4")	500 mm (19.7")	606.5 mm (23.9")	N.A N.A	500 mm (19.7")

*** Note:** Dimension ❷ in above table applies for standard 100 mm stand-off. For total probe length dimensions for other stand-off lengths, please refer to product configurator.

4.9 Extractive White Cell

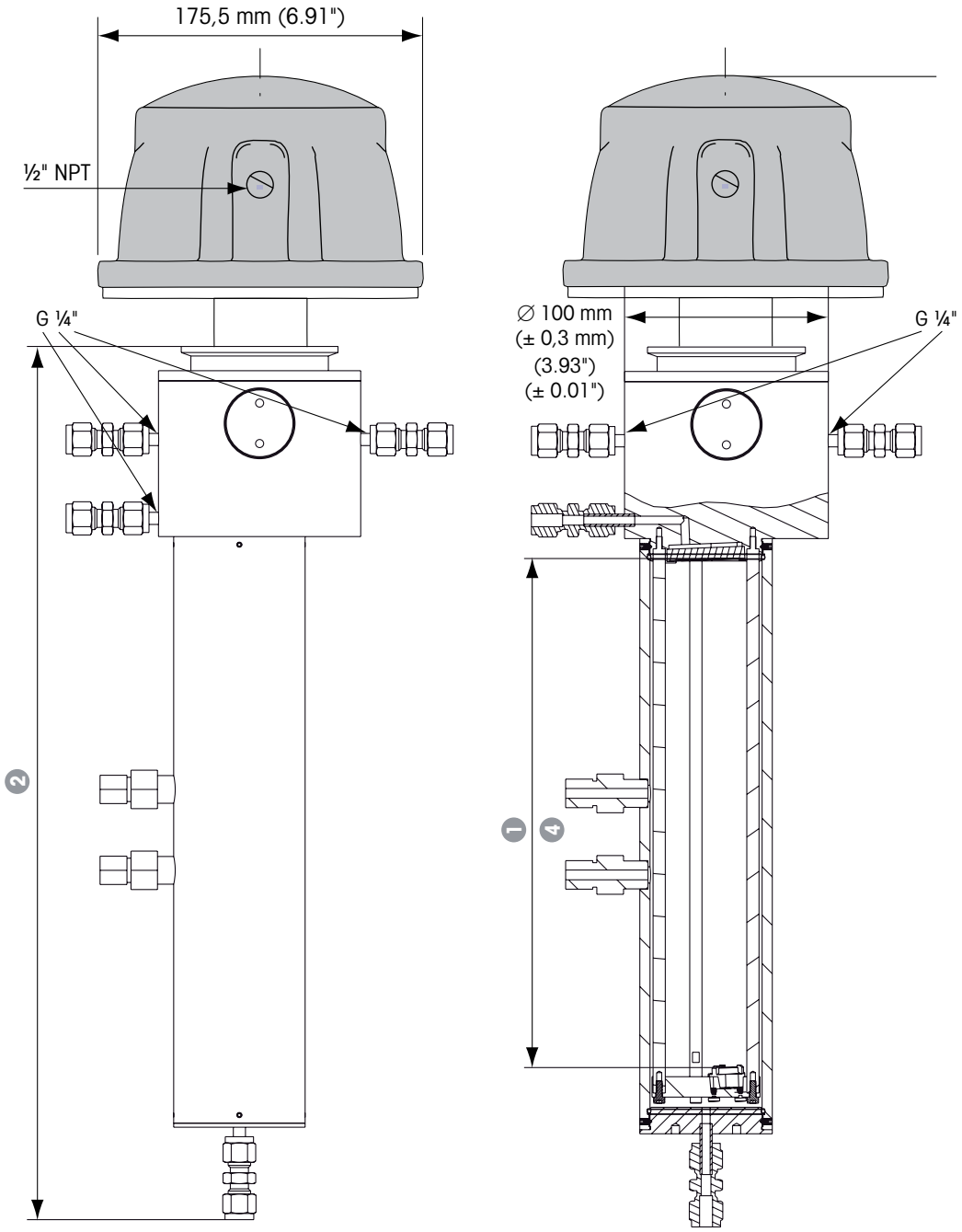


Figure 19 Dimensions of the extractive white cell.

Definition of the lengths:

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

Probes, wafer and cell dimensions					
Extractive White Cell	**OPL**	**Dimension ❶**	**Dimension ❷**	**Dimension ❸**	**Dimension ❹**
Extractive white cell (E)	10000 mm (393.7")	250 mm (9.8")	432 mm (17.0")	N.A N.A	250 mm (9.8")

*** Note:** Dimension ❷ in above table applies for standard 100 mm stand-off. For total probe length dimensions for other stand-off lengths, please refer to product configurator.

Extractive White Cell			
Internal Volume	**OPL**	**Diameter**	**Approx. Volume**
	200 mm (7.9")	25 mm (1.0")	98 ml
	400 mm (15.7")	25 mm (1.0")	196 ml
	800 mm (31.5")	25 mm (1.0")	393 ml
	1000 (39.4")	25 mm (1.0")	491 ml

Extractive White Cell			
Internal Volume	**OPL**	**Diameter**	**Approx. Volume**
	200 mm (7.9")	20 mm (0.8")	63 ml
	400 mm (15.7")	20 mm (0.8")	126 ml
	800 mm (31.5")	20 mm (0.8")	251 ml
	1000 (39.4")	20 mm (0.8")	314 ml

Extractive (PFA)			
Internal Volume	**OPL**	**Diameter**	**Approx. Volume**
	200 mm (7.9")	20 mm (0.8")	63 ml
	400 mm (15.7")	20 mm (0.8")	126 ml
	800 mm (31.5")	20 mm (0.8")	251 ml
	1000 (39.4")	20 mm (0.8")	314 ml

White Cell			
Internal Volume	**OPL**	**Diameter**	**Approx. Volume**
	260 mm (10.2")	55 mm (2.2")	618 ml

Table 4 Installation examples

Required flanges for some typical standard probe (SP) configurations (100 mm stand-off)					
❶ Nominal path length	❷ Probe length	❸ Insertion length	❹ 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 (23 effective path length).

4.10 Standard purged (SP) or non-purge (NP) probe configuration with single flange or dual flange.

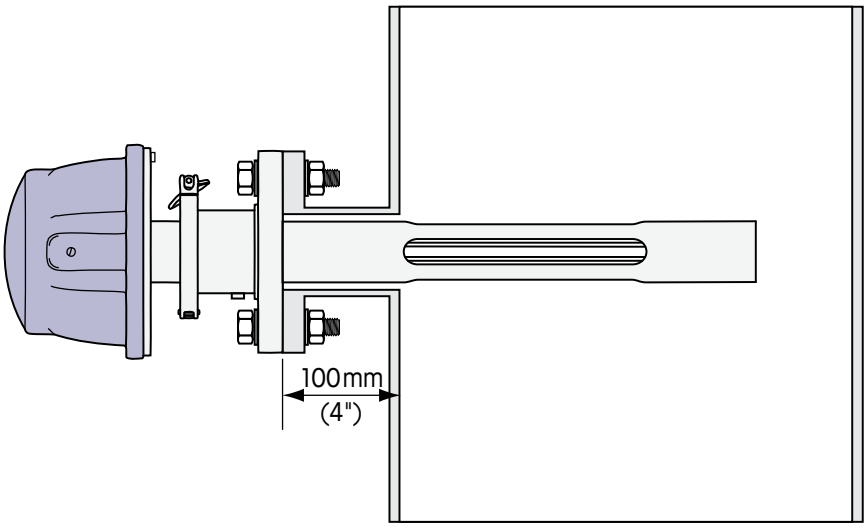


Figure 20 One flange configuration

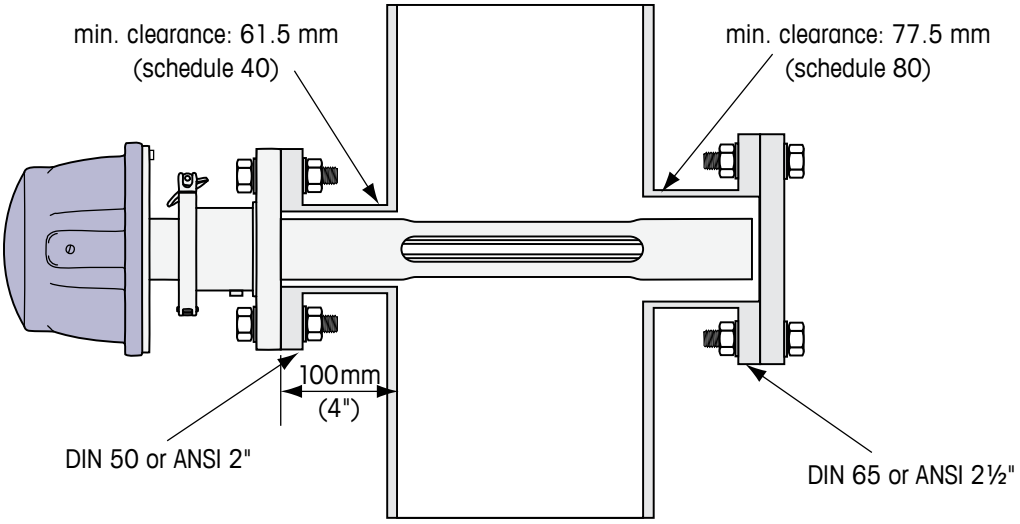


Figure 21 Two flange configuration

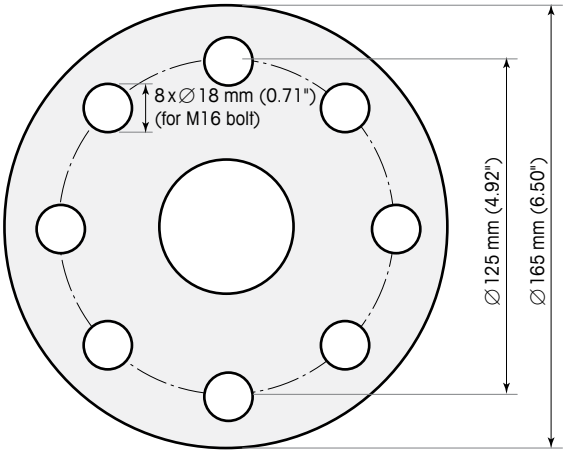


Figure 22 Dimensions of the DN50/PN25 flange for standard purge probe (SP) and non-purged probe (NP)

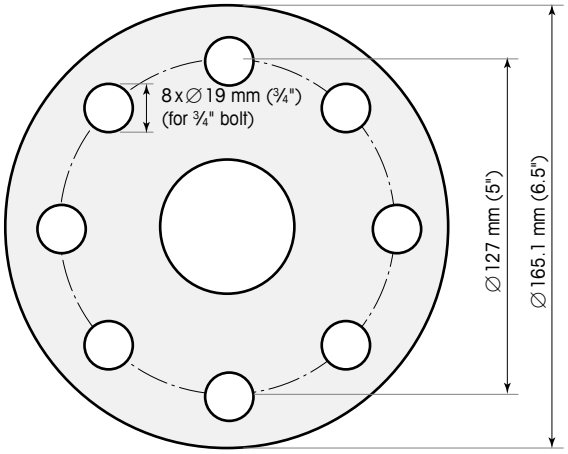


Figure 23 Dimensions of the ANSI 2"/300lb flange for standard purge probe (SP) and non-purged probe (NP)

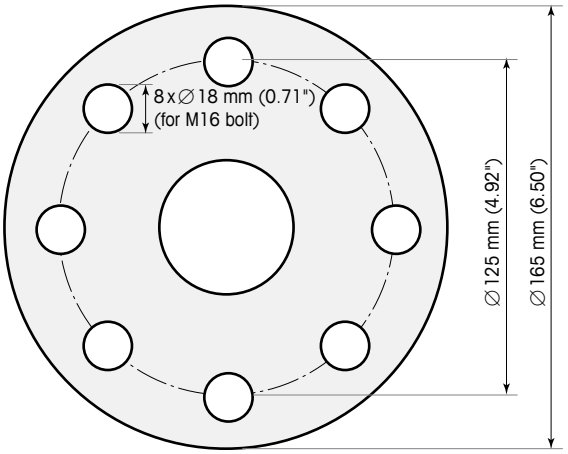


Figure 24 Dimensions of the DN50/PN16 flange for standard purge probe (SP) and non-purge probe (NP)

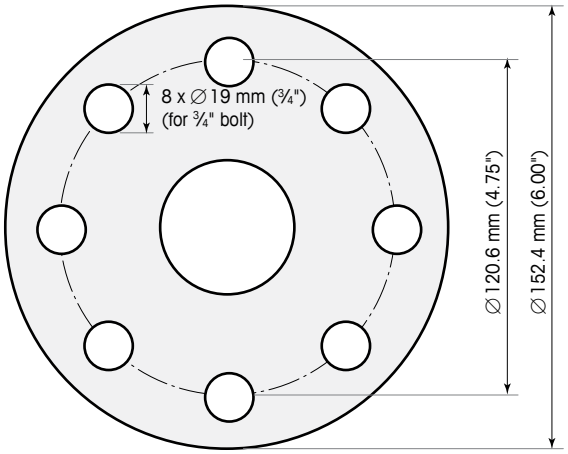


Figure 25 Dimensions of the ANSI 2"/150lb flange for standard purge probe (SP) and non-purge probe (NP)

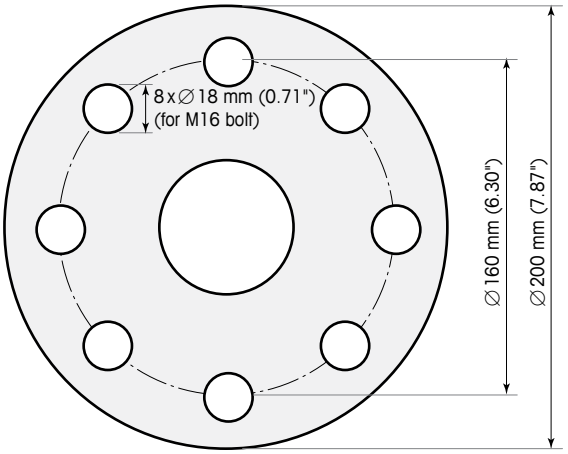


Figure 26 Dimensions of the DN80/PN16 flange for standard purge probe (SP) and non-purge probe (NP)

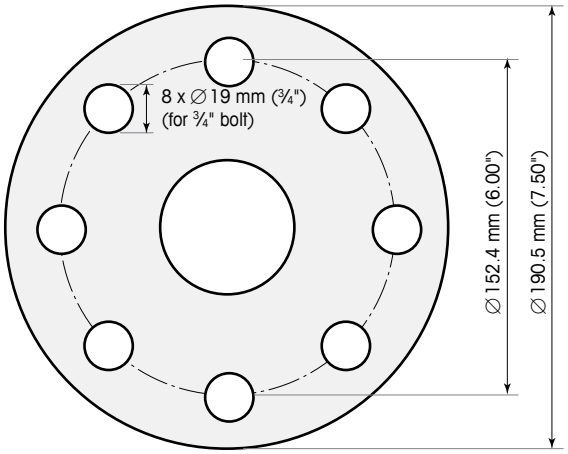


Figure 27 Dimensions of the ANSI 3″/150lb flange for standard purge probe (SP) and non-purge probe (NP)

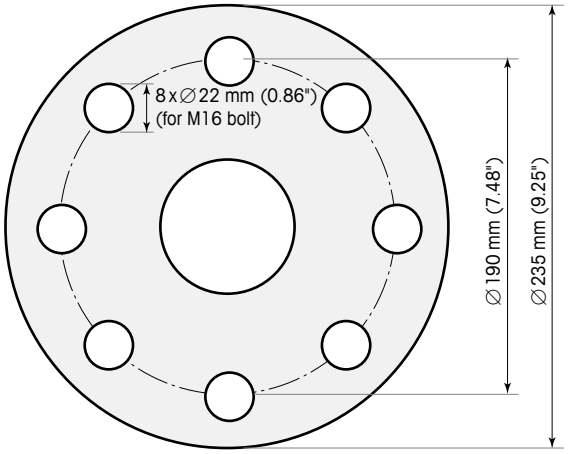


Figure 28 Dimensions of the RF DN100/PN25 flange for standard purge probe (SP) and non-purge probe (NP)

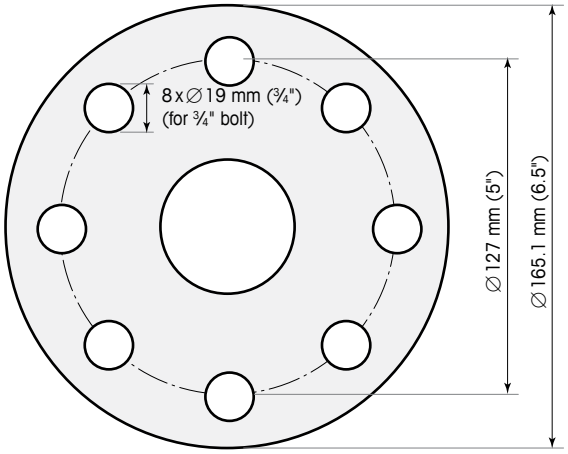
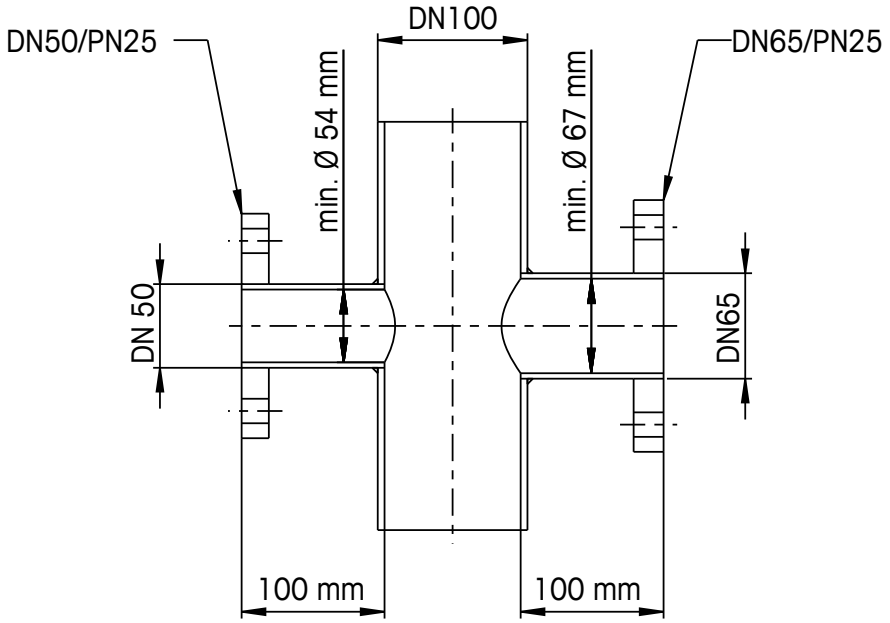


Figure 29 Dimensions of the RF ANSI 4"/300 lb flange for standard purge probe (SP) and non-purge probe (NP)

4.11 Welded flange dimensions for standard purged (SP) and non-purged (NP) and blow-back (B) probes

DIN



For installations where the pipe diameter is not sufficient to accommodate the full probe length, a secondary "blind" flange is required 180° opposite to the entry flange. Fig. 19 shows typical dimensions for such a spool piece suitable for typical DIN 100 or 4" pipe diameters.

Note: It is important that the opposing "blind" flange has a larger diameter (as shown). This will accommodated any minor misalignment of the two flanges and allow the probe sufficient clearance across the pipe. Under no circumstances should the probe body be in contact with either flange internal wall or the welds. This could distort the probe body, affecting the laser beam integrity.

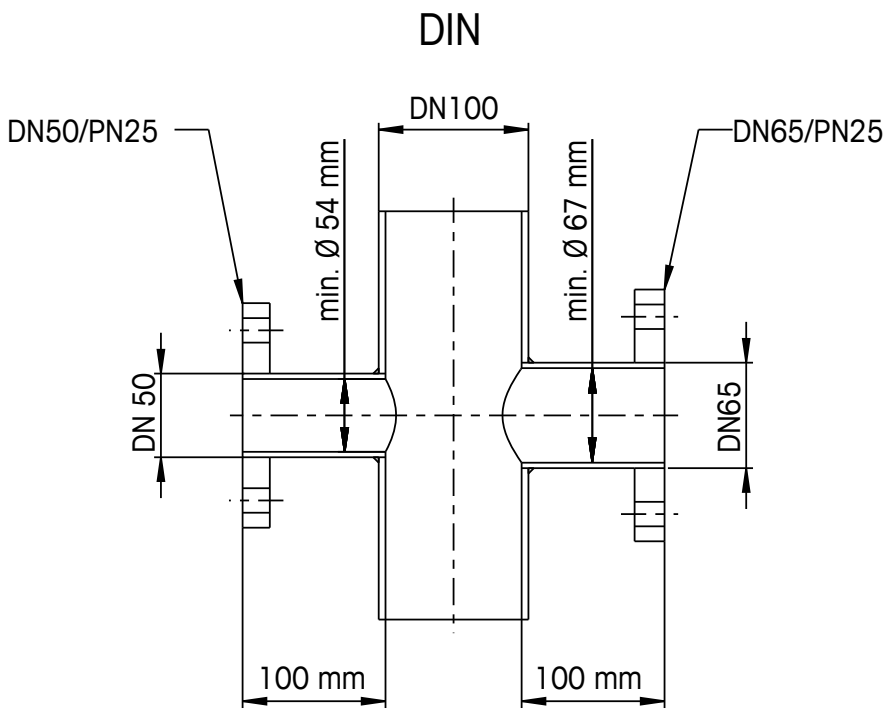


Figure 30 Recommended welded flange dimensions (for standard (SP) and non-purged (NP) and blow-back (B) probe installations)

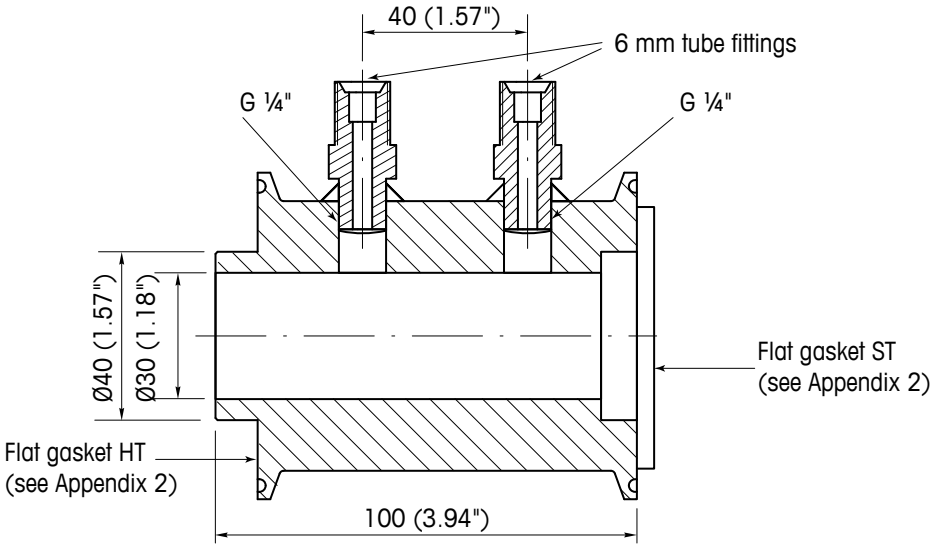


Figure 31 Dimensions of the thermal barrier.

5 Electrical Connections

ATEX Version:

Most of the electrical connections are terminated at the junction box. All potentials are floating and none of them should be grounded to the box. This applies to all connection tables.

WARNING

Ensure that the electrical installation of the TDL conforms to all applicable local and national electrical safety requirements.

WARNING

Obey the safety instructions given below when you install the TDL; if you do not, the TDL certification may be invalidated, the TDL may not operate correctly, or it may be damaged.

WARNING

Isolate mains power before commencing installation.

WARNING

Make sure that power is disconnected or switched off before connecting any cable.

US Version:

The US version must be installed using a suitable cabling conduit system in accordance with local codes and regulations. To aid installation, the unit is supplied without an attached cable.

The terminals are suitable for single wires/flexible leads 0.2 mm^2 to 1.5 mm^2 (AWG 16–24).

WARNING

The electrical installation must be performed in accordance with National Electrical Codes of practise and/or any other applicable national or local codes.

WARNING

Wait 2 minutes before opening the enclosure after de-energizing the system.

WARNING

When fitting the enclosure cover onto the sensor head, the 8 x M5 fixing screws must be tightened to 8 Nm torque.

WARNING

For gas group A, sealing of the conduit is required at the enclosure entry. For gas groups B, C and D, no conduit sealing is required.

Power supply ot the GPro 500 and M400

The GPro 500 and the M400 have to be powered separately:

- GPro 500: 24 VDC, 5 W minimum
- M400 transmitter: 20–30 V DC or 100–240 V AC

WARNING

Always check the complete wiring between the M400 transmitter, the GPro 500 sensor head, junction box (if applicable) and external temperature and pressure sensors before switching on the sensor.

WARNING

Always check all the electrical and grounding connections before switching on the power.

5.1 Electrical Safety and Grounding

The GPro 500 does not incorporate an integral on/off switch. You must provide a means of externally isolating the electrical supply from the GPro 500: use a suitable switch or circuit breaker located close to the GPro 500, clearly marked as the disconnecting device for the GPro 500.

- The electrical supply circuit must incorporate a suitable fuse or over-current protection device, set to or rated at no more than 10 A.
- The GPro 500 must be connected to an external protective earthing system via one of the screws for the lid to the sensor head (see Figure 32 on page no 70).
- Ensure that your electrical supply can provide the necessary maximum power consumption. Refer to "Product data" on page no 24.
- Equipment connected to the mA input, mA output, RS 485 and Ethernet must be separated from mains voltages by at least reinforced insulation.
- Ensure that the cables that you connect to the GPro 500 are routed so that they do not present a trip hazard.
- All signal and electrical supply cables must be rated for temperatures of 70 °C or higher. When you carry out insulation testing, disconnect all cables from the GPro 500.

Power supply ot the GPro 500 and M400

The GPro 500 and the M400 have to be powered separately:

- GPro 500: 24 VDC, 5 W minimum
- M400 transmitter: 20–30 V DC or 100–240 V AC

WARNING

Always check all the electrical and grounding connections before switching on the power.

Instrument Protective Grounding

WARNING

It is important that the protective ground connection provided at the analyzer enclosure is connected to a suitable instrument grounding (earthing) point at the site of installation.

The GPro 500 is supplied with both internal and external protective grounding (earth) connections. The external protective grounding connection is clearly labelled and consists of an M6 x12mm screw located on the flange of the instrument cover. The internal protective grounding connections are located inside the instrument enclosure and are used for connection of the cable outer screen. See drawing "Protective Grounding." on page no 70 for location of protective ground connections.

ATEX Protective Grounding

Note: The European ATEX certified version is supplied pre-wired with the internal grounding connection already terminated to the cable outer screen.

IMPORTANT: The instrument cover MUST NOT be opened under any circumstances, as this will invalidate the safety certification.

For the external protective grounding a suitable grounding cable should be appropriately terminated and attached to the M6 x12mm protective ground connection. The other end of the cable should be terminated at a suitable instrumentation grounding point at the installation site.

FM Protective Grounding

The FM certified version is supplied without an attached cable. When installing the multicore cable, the cable screen should be appropriately terminated at one of the two internal protective grounding points, using the supplied M4 x 6mm screw.

For the external protective grounding a suitable grounding cable should be appropriately terminated and attached to the M6 x12mm protective ground connection. The other end of the cable should be terminated at a suitable instrumentation grounding point at the installation site.

Grounding cable needs to be in accordance with the NEC regulations.

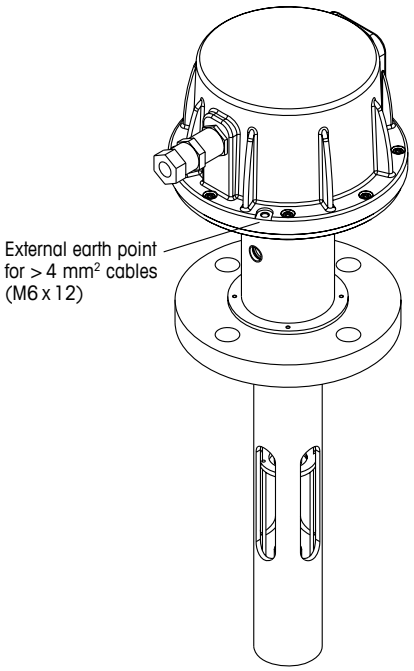


Figure 32 External earth point. Standard probe (SP) process adaptor shown.

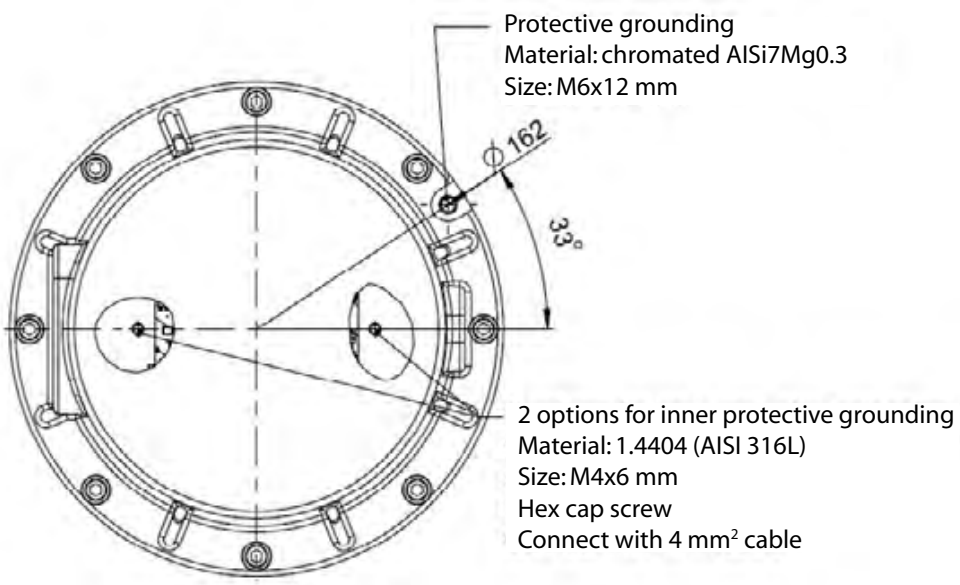


Figure 33 Protective Grounding.

5.2 Sensor head connections

ATEX Version:

In the ATEX Version, the sensor head is supplied with a pre-configured cable already installed. Do not open the sensor head for removing, altering, or replacing the cable.

The junction box is the interface between the GPro 500 and the M400 and also the Ethernet. Any suitable junction box approved for the hazardous area can be used. The GPro 500 can be supplied with the optional accessory GHG 731.11 which is a suitable junction box supplied by Malux. The dimensions of this is shown below:

WARNING

Opening the sensor head voids the warranty and violates the ATEX certification.

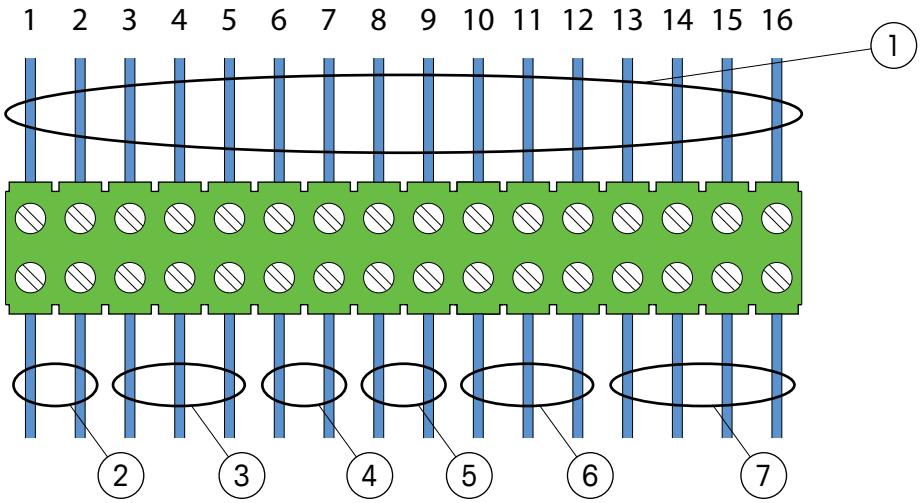


Figure 34 Connections in the junction box

1 Connections to the GPro 500 – Cable numbers below.
2 Power to the GPro 500 from an external 24 V, 5 W minimum source
3 RS 485 from the M400
4 4...20 mA from temperature sensor
5 4...20 mA from pressure sensor
6 Direct analog output (2x 4…20 mA) (optional)
7 Ethernet

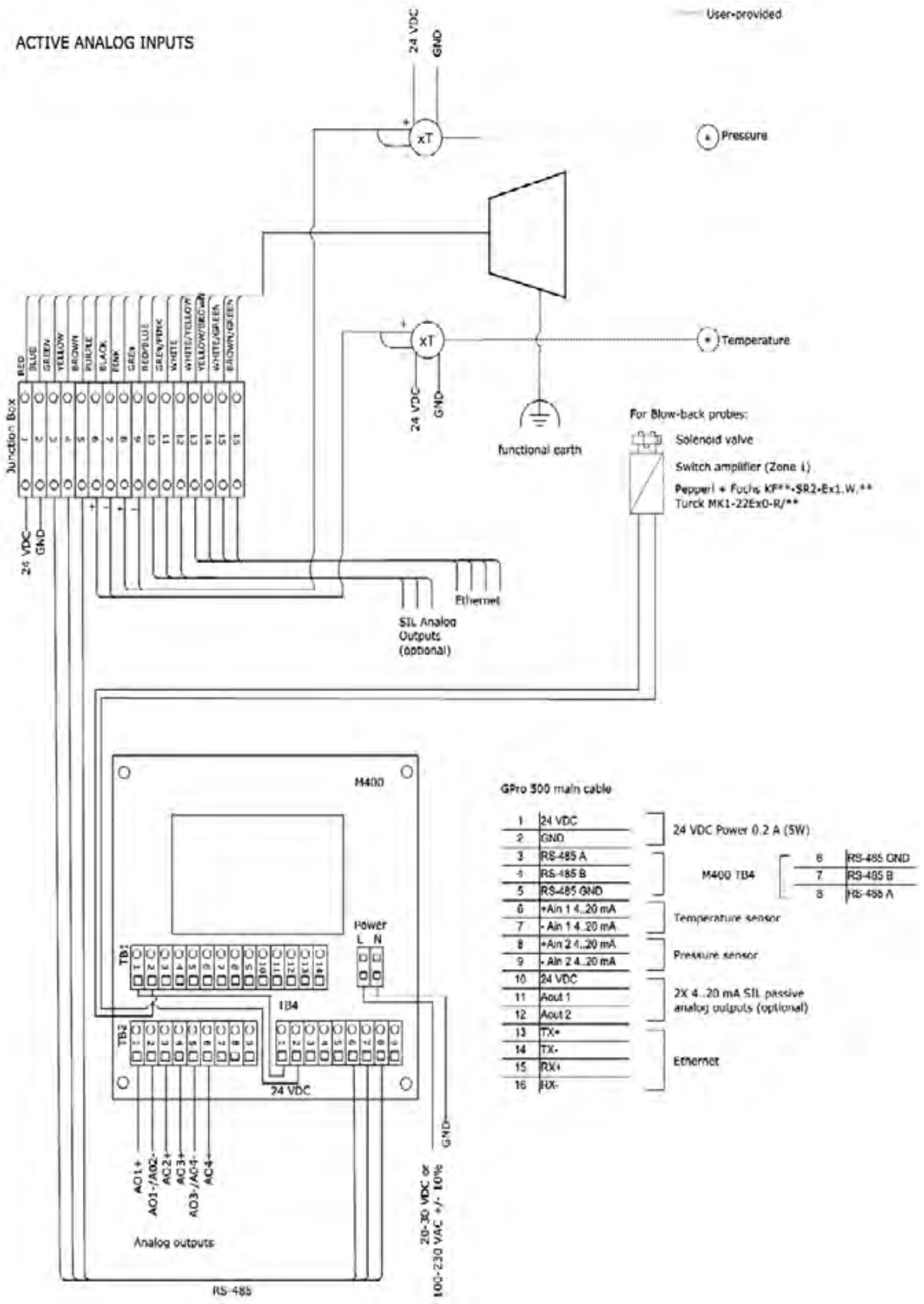


Figure 35 Wiring diagram with active analog inputs.

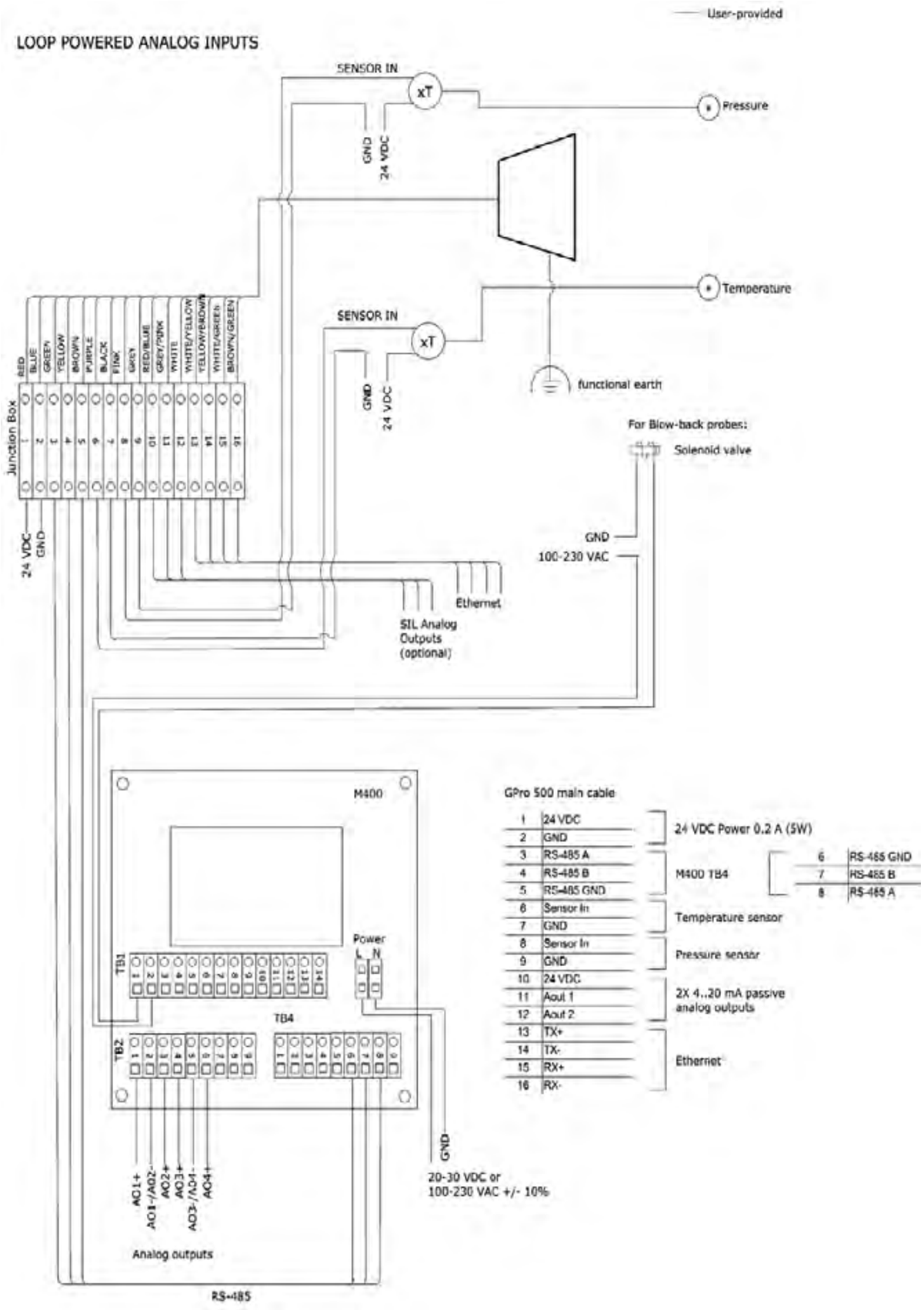


Figure 36 Wiring diagram with loop-powered analog inputs.

Table 5 GPro 500 cables

Signal	Description	Cable no.	Color
Power + 24 V	Power 24V, 5W	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	SIL direct anolog output (2x 4…20 mA) (optional)	10	Red/Blue
Out 1		11	Grey/Pink
Out 2		12	White
TX+	Ethernet interface for communication with PC	13	White/Yellow
TX–		14	Yellow/Brown
RX+		15	White/Green
RX–		16	Brown/Green

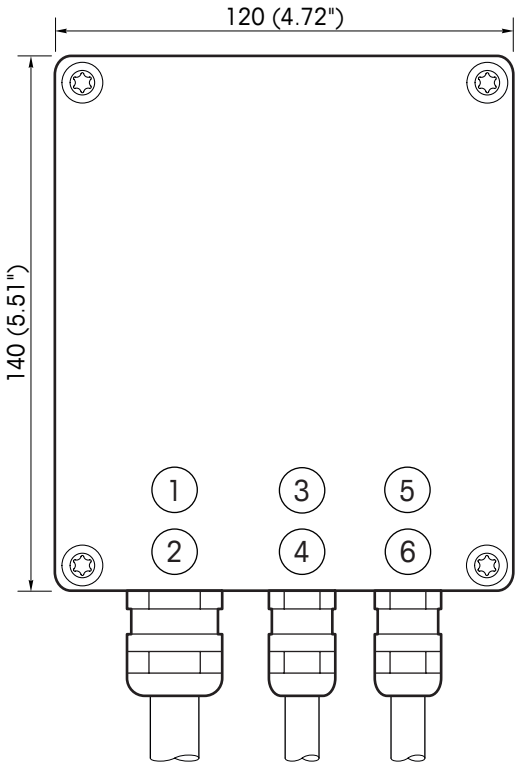


Figure 37 The junction box GHG 731.11 (EX-e)

1 Connection for the TDL
2 Connection for external power supply
3 Ethernet connection
4 Connection for temperature sensor (4...20 mA)
5 Connection for pressure sensor (4...20 mA)
6 Connection for M400 (RS 485)

The connection are done to the same number in the GPro 500 and in the junction box except for the Ethernet cable. This cable has to be equipped with an Ethernet connector in the GPro 500 side and screwed to the appropriate screw connectors in the junction box. The connection diagram is shown below.

US Version:

The US version must be installed using a suitable cabling conduit system in accordance with local codes and regulations. To aid installation, the unit is supplied without an attached cable. For suitable cables (for example Lapp UNITRONIC FD CP [TP] plus) please see Appendix 2, chapter 2.3 (Accessories) on page no 126.

The terminals are suitable for single wires/flexible leads 0.2 mm^2 to 1.5 mm^2 (AWG 24–16).

WARNING

The electrical installation must be performed in accordance with National Electrical Codes of practise and/or any other applicable national or local codes

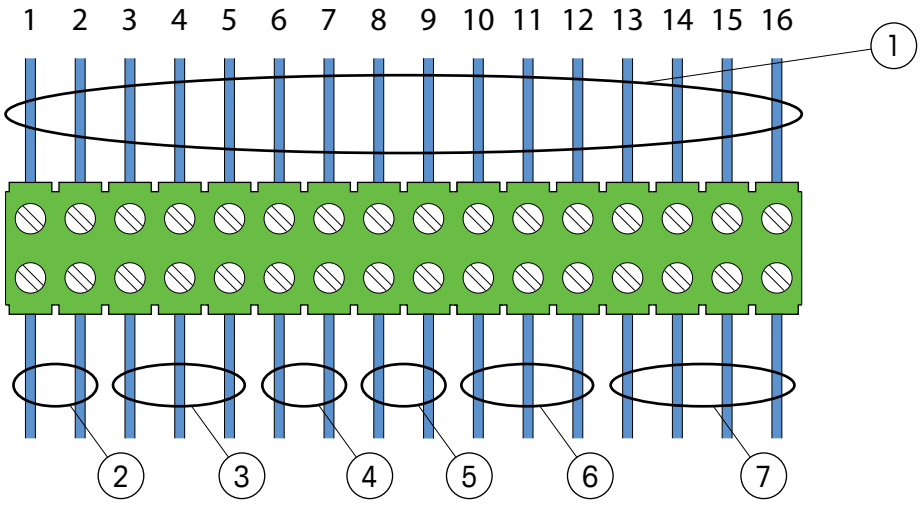


Figure 38 Connections in the junction box

1 Connections to the GPro 500 – Cable numbers below.
2 Power to the GPro 500 from an external 24 V, 5 W minimum source
3 RS 485 from the M400
4 4...20 mA from temperature sensor
5 4...20 mA from pressure sensor
6 SIL2 direct analog output (2x 4…20 mA) (optional)
7 Ethernet

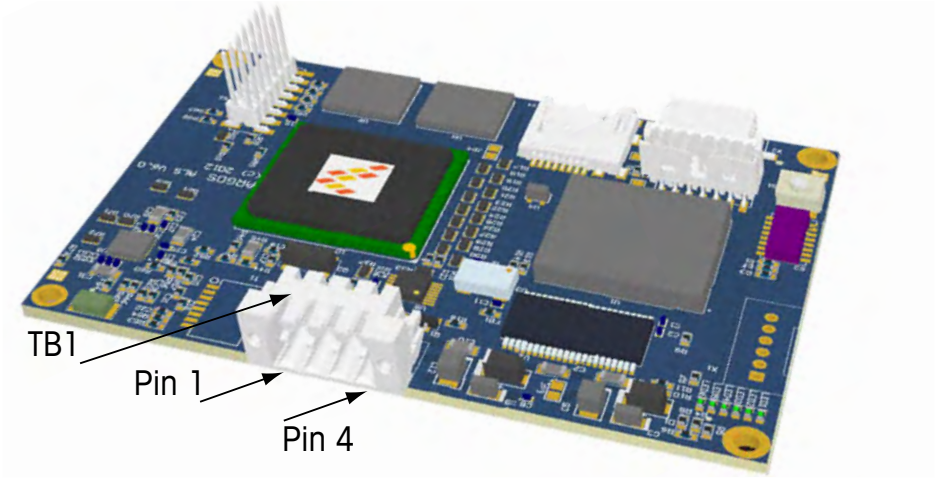


Figure 39 Connections on motherboard in the sensor head

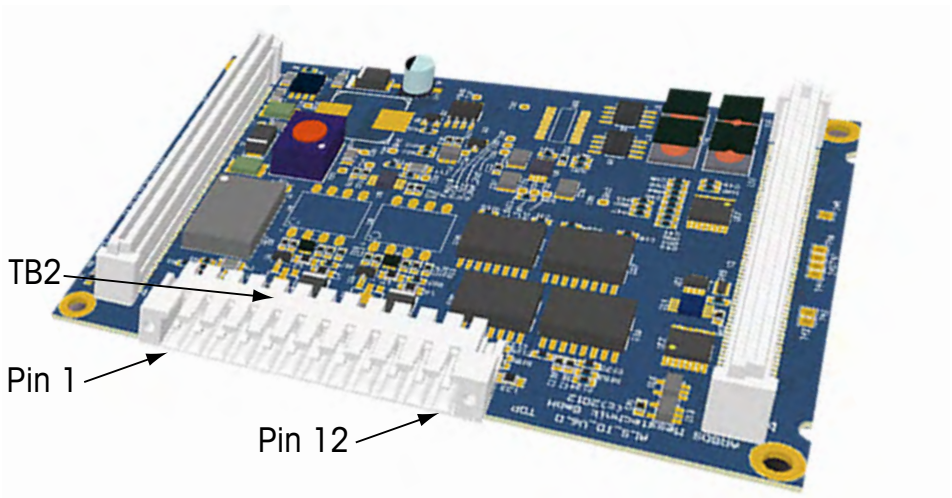


Figure 40 Connections on IO board in the sensor head

Table 6 GPro 500 cables

Signal	Description	Cable no. Junction Box	Color	TB1 Pin no	TB2 Pin no
Power +24 V	Power 24 V, 5 W	1	Red		1
GND (Power)		2	Blue		2
RS 485 A	Interface M400 (RS 485)	3	Green		3
RS 485 B		4	Yellow		4
RS 485 GND		5	Brown		5
4...20 mA pos	Current input temperature	6	Purple		6
4...20 mA neg		7	Black		7
4...20 mA pos	Current input pressure	8	Pink		8
4...20 mA neg		9	Grey		9
+24 V	Direct anolog output (2x 4…20 mA) (optional)	10	Red/Blue		10
Out 1		11	Grey/Pink		11
Out 2		12	White		12
TX+	Ethernet interface for communication with PC	13	White/Yellow	1	
TX–		14	Yellow/Brown	2	
RX+		15	White/Green	3	
RX–		16	Brown/Green	4	

For all versions.

WARNING

All openings have to be closed with certified cable glands or blocking plugs of the same degree of certification as the GPro 500.

WARNING

It is essential that you observe all provided information and warnings. The system must be closed and grounded before switching on the system.

For version with optional direct analog outputs.

WARNING

Do not connect the M400 and the direct passive analog outputs at the same time.

5.3 M400 connections

WARNING

AC Power for EX versions may only be connected via a suitably certified Purge Control Unit.

The power cable is attached inside the M400. It shall be a two core cable with Line/Live (L), Neutral (N) conductors.

The power cable connection terminals are suitable for solid or stranded conductors 0.205 to 2.5 mm^2 (24 to 13 AWG).

Connect your mains electrical supply cable as follows:

1 Pass your mains electrical supply cable through a suitable cable-gland fitted to the base of the power/interface compartment.

2 Connect the wires in the supply cable to the appropriate electrical supply terminals in the M400 as follows and as shown in Figure 41 (Cable connections in M400) on page no 78.

Table 7 Mains power supply terminals

Signal	Terminal on mains power supply
Live	L
Neutral	N

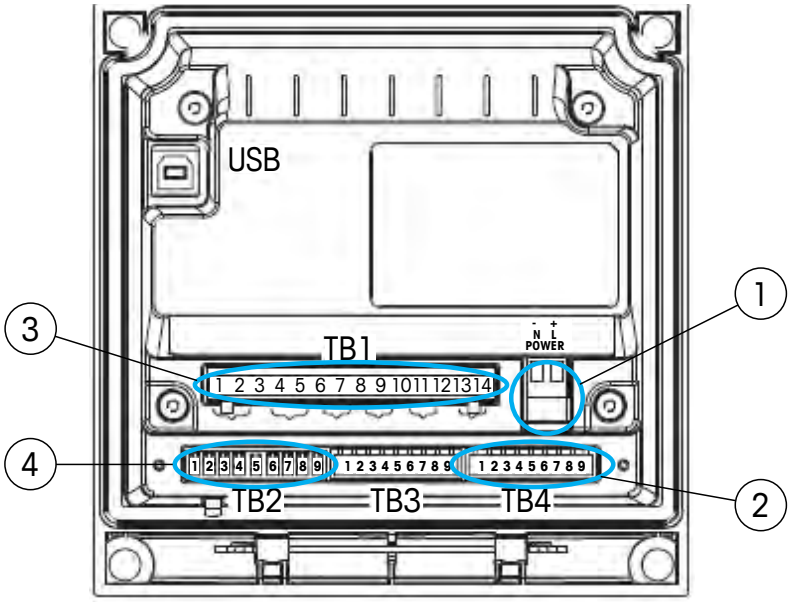


Figure 41 Cable connections in M400

1 Connection terminal for the power cable

2 TB4 – connection terminal for the GPro 500

3 TB1 – connection terminal for the relays. These can be configured with the M400.

4 TB2 connection terminals for external 4–20mA outputs

Table 8 RS 485 connection of GPro 500 to M400 terminal TB4

Pin no.	Description
1	
2	
3	
4	
5	
6	GND
7	RS 485B
8	RS 485A
9	

Table 9 M400 terminal TB1 relay connections

Pin no.	Description
1	NO1
2	COM1
3	INC1
4	NO2
5	COM2
6	NC2
7	COM5
8	NC5
9	COM6
10	NC6
11	NO3
12	COM3
13	NO4
14	COM4

Table 10 M400 4–20mA Output connections

Pin no.	Description
1	AO1+
2	AO1–/AO2–
3	AO2+
4	AO3+
5	AO3–/AO4–
6	AO4+
7	DI1+
8	DI1–/DI2–
9	DI2+

6 Service

6.1 Connecting a PC

The MT-TDL software is the GPro 500 service tool. With this software all parameters can be access and all possible settings can be modified. To run it you need to connect a PC, with the software installed, to the Ethernet port in the junction box as illustrated below.

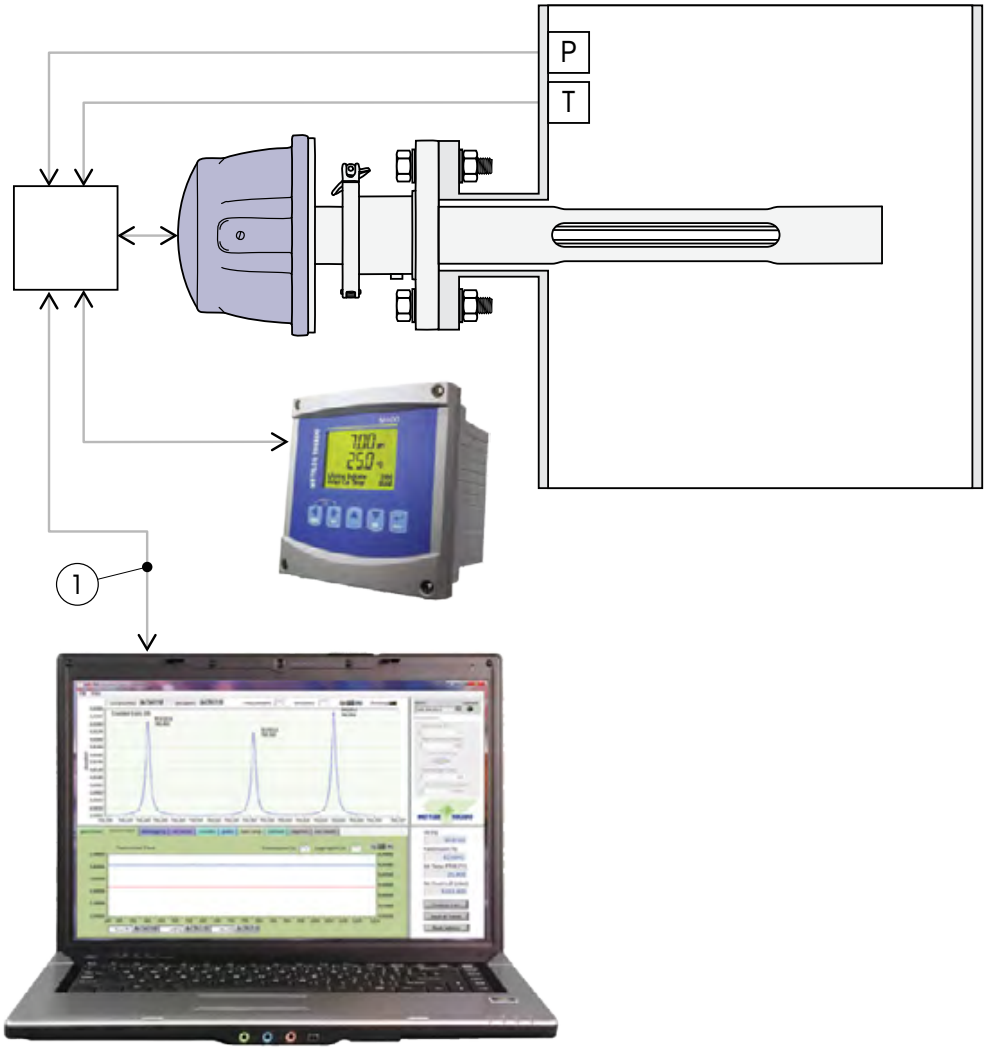


Figure 42 Connecting a PC. Standard probe (SP) process adaptor shown

1 Ethernet connection

When accessing the MT-TDL with a PC it is important to make sure that no work is performed at the same time via the M400.

WARNING

When accessing the GPro 500 using the MT-TDL software, work using the laptop or PC must comply with the restrictions in place for working in hazardous areas.

6.2 Setting up your PC to connect to the GPro 500 using the MT-TDL Software

☞ This instruction applies to Windows XP users only. If you are using Windows 7 your system will automatically use the correct IP address.

Open the **Control Panel** and double click **Network Connections**

Figure 43 Network connections

Double click **Local Area Connection**

Figure 44 Local area connections

Choose **Internet Protocol (TCP/IP)** and then **Properties**

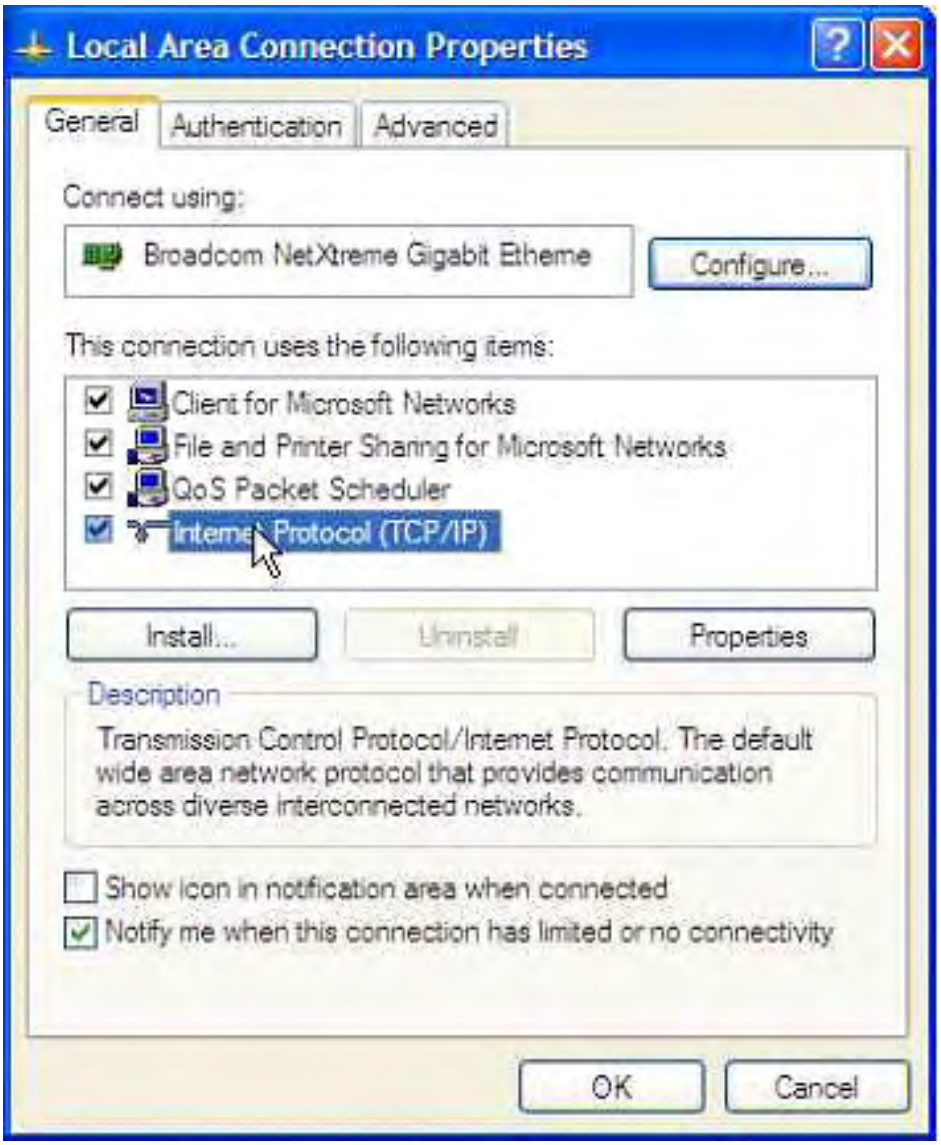


Figure 45 Local area connection properties

Select **Use the following** address and type in an IP number of the same series as the IP number of your GPro 500 unit (this number is given on the calibration certificate).

☞ If your GPro 500 has IP number 192.168.2.16 the computer IP address can be set to 192.168.2.1.

If not already set choose **Subnet** [255.255.0.0]

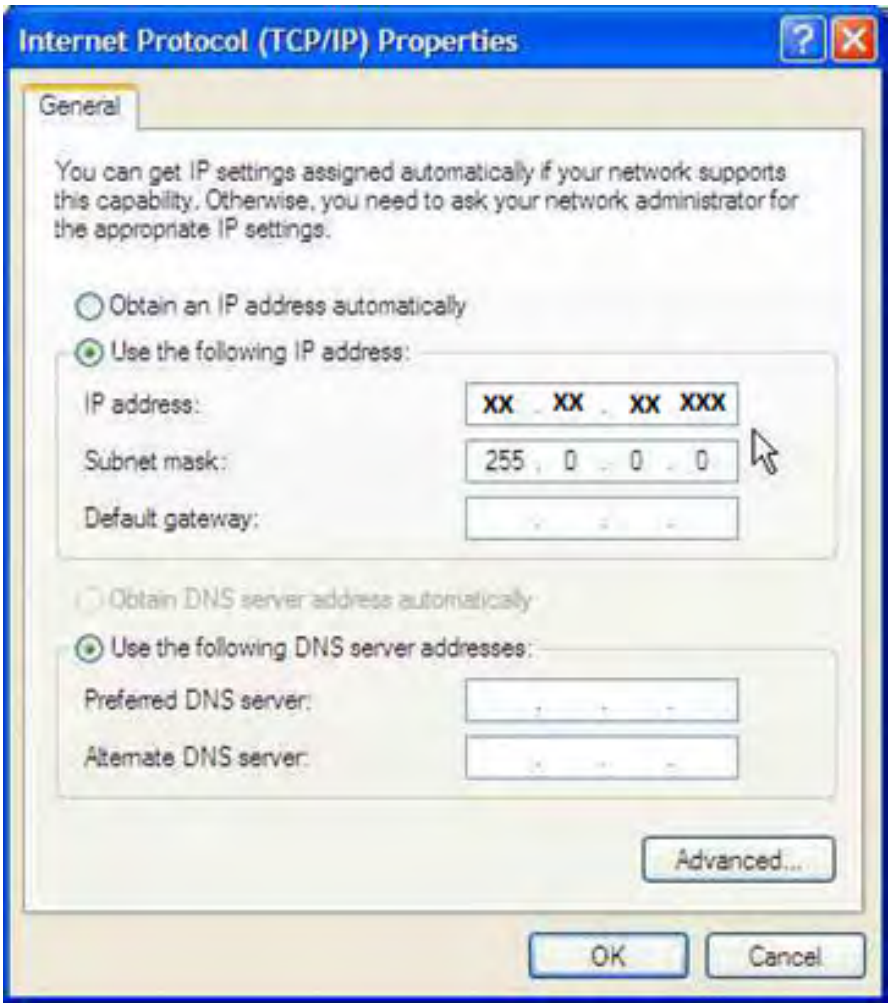


Figure 46 Internet protocol (TCP/IP) properties

Close all windows and start up the MT-TDL software.

☞ It is recommended to use an Ethernet hub between the PC or laptop and the TDL head. If port conflicts occur, disable manually all local connections and start the MT-TDL software.

6.3 The MT-TDL software

The most important function of the MT-TDL software from a service standpoint is the log capabilities. When connected to the GPro 500 with your PC it is possible to start a log of selected parameters for a defined period of time. One can then disconnect the PC from GPro 500 and with the log data stored on the SD-card it can easily be access at a later time. A log folder is created on the SD-card and the files within this folder can either be sent to trained staff at Mettler Toledo for further investigation or it can be viewed locally on your PC with the MT TDL log viewer. Files are stored in date stamped folders, one folder for each day.

The software has three access levels but the normal user will only use the first one (Normal). The remaining two access levels are restricted for use by METTLER TOLEDO personnel. You can perform the following tasks under the Normal access level:

1 Concentration trend – Here you can follow the concentration value in the lower plot.
2 Transmission trend – Here you can follow the optical transmission value in the lower plot.
3 Data logging
4 Ext sensor
5 Analog output (Note: only available if connected to a TDL with this option)

Through different menus the necessary installation parameters may be set. After setting the necessary parameters the PC is no longer needed. The GPro 500 has all the parameters stored in the internal memory. The PC can therefore be disconnected and the GPro 500 can be turned off and on without resetting the parameters.

Once the program starts the user is presented with a screen like the one in the illustration below. It consists of an upper part and a lower part. In the upper screen a plot of the signal processed absorption lines and the model absorption lines are shown. The version of the service program is also shown to the right (in the example here) as is also the IP number of the GPro 500.

The content in the lower part is specific to the function the user chooses – concentration trend, transmission trend, etc. The following paragraphs will discuss their content.

6.3.1 The ppm trend

In this screen the user can monitor the measured concentration value over time: The present values of concentration, transmission, temperature and pressure in the process are shown to the right.

Figure 47 The ppm trend

Here follows a descriptions of some of the settings for this screen. Note that settings 3 through 16 are visible on all the different screens.

1 Scan no
2 Unit for the concentration
3 Version of the software
4 IP number of the GPro 500
5 The fixed value for the temperature
6 The fixed value for the pressure
7 Toggle between fixed and measured values for temperature and pressure
8 The effective path length
9 Setpoint for calibration
10 Actual O_2 concentration
11 Actual transmission
12 External temperature reading
13 External pressure reading
14 Alarm
15 Reset all trends

6.3.2 The transmission trend

In this screen the user can monitor the optical transmission level in the measurement path over time: The present values of concentration, transmission, temperature and pressure in the process are shown to the right.

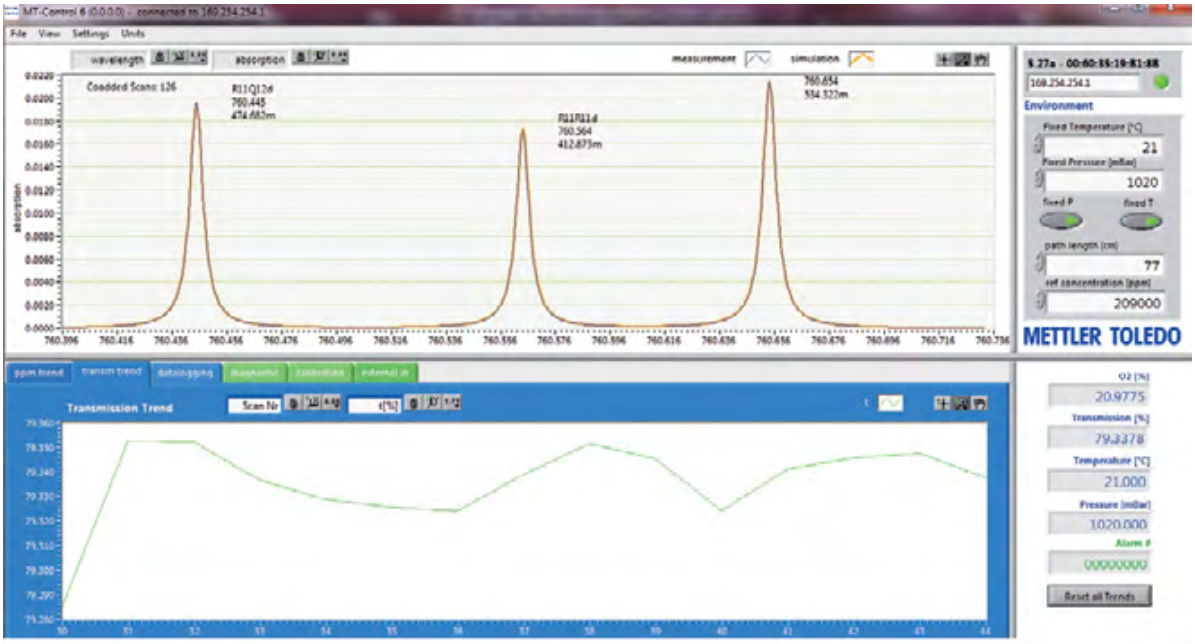


Figure 48 The transmission trend

6.3.3 Data logging

This screen is used to administer the data logging capabilities of the software.

Figure 49 Data logging

By changing the "SPC Interval(s)" to 1 sec. or more the log will start. By setting the log interval to 1 sec. the system will store a log record every one second. Each log record is 8 kb, the total space available is 80% of 4GB (3.2GB). When the available space is used up the system will automatically replace the oldest log record. By changing the "SPC Interval(s)" back to 0 sec. the log will stop. By pushing the button "Get Files" you will download the entire log file to your PC. The log can later be viewed/analyzed by using the MT-TDL Viewer.

6.3.4 External sensors

When using external inputs for Temperature and Pressure, the inputs have to be configured according to the customer specifications. This is done in this screen.

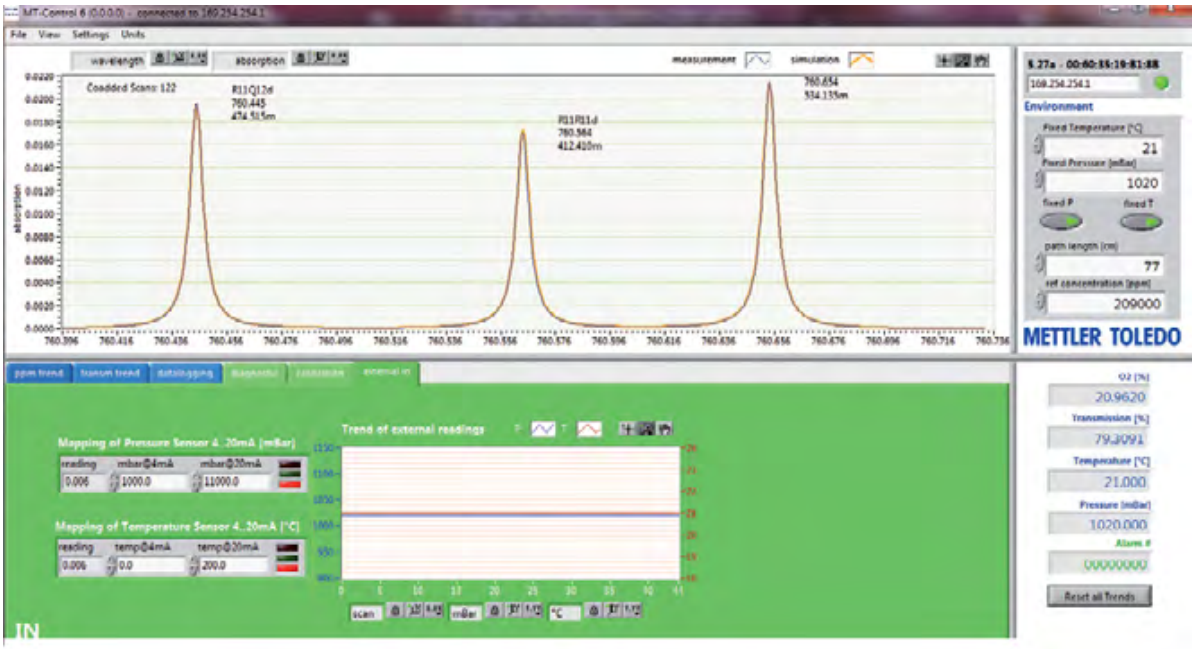


Figure 50 External sensors

6.3.5 Diagnostic

On this tab, several ISM related data is available. ISM (Intelligent Sensor Management) is METTLER TOLEDO's concept for proactive, real-time sensor health monitoring. The ISM relevant data for the GPro 500 contain the following:

- DLI (Dynamic Lifetime Indicator): The DLI indicates in days the expected laser diode remaining lifetime, based on current usage. This value is read-only and is a general indication of the analyzer's recommended duration until complete replacement. When the DLI reaches zero, the analyzer will continue to measure but the alarm will appear in the M400 transmitter.
- TTM (Time to Maintenance): The TTM is evaluating in real-time the remaining time until the minimum recommended transmission value of 10% is reached. This evaluation is based on the current rate of transmission loss under the present process conditions. When the TTM reached zero, cleaning of the optics or even replacement of optics parts is recommended.
- T-max extern: this is the maximum temperature at which the GPro 500 process adaption has been exposed to from the process gas stream.
- Operating hours: the service time of the GPro 500 in hours.
- Create Diagnostic file: use this button for troubleshooting the unit. When the butten "Create diagnostic file" is pressed, a ZIP compressed file is created after 15 seconds on the desktop. The ZIP file contains:
  - the log file (equivalent to clicking on the "Get logfile" button).
  - 10 spc files containing the full spectral data of the last 10 seconds in service.
  - the ppm trend values
  - the % trend values
  - the calibration history file

The data ZIP file cannot be opened by the user. Please send the ZIP file to your METTLER TOLEDO representative for further analysis..

Figure 51 Diagnostic

6.3.6 Calibration data

The calibration tab shows a summary of all successfully executed calibrations on the unit.

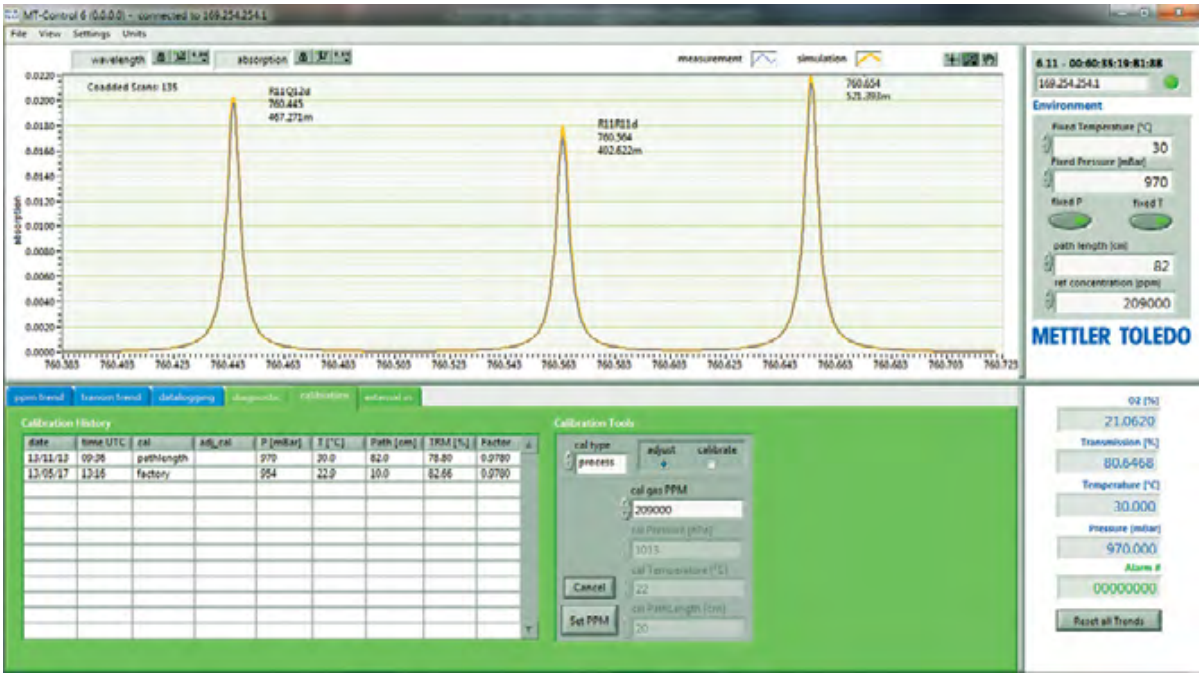


Figure 52 Calibration

6.3.7 Analog Outputs (optional)

When an Ethernet connection is established to a GPro 500 with the option Direct Analog Outputs, the tab "external out" appears. This screen is used to configure the 4…20 mA passive analog outputs (for correct wiring please refer to chapter 5 (Electrical Connections) on page no 67). Please note that there is no configuration menu in the M400 in order to set up the direct analog outputs.

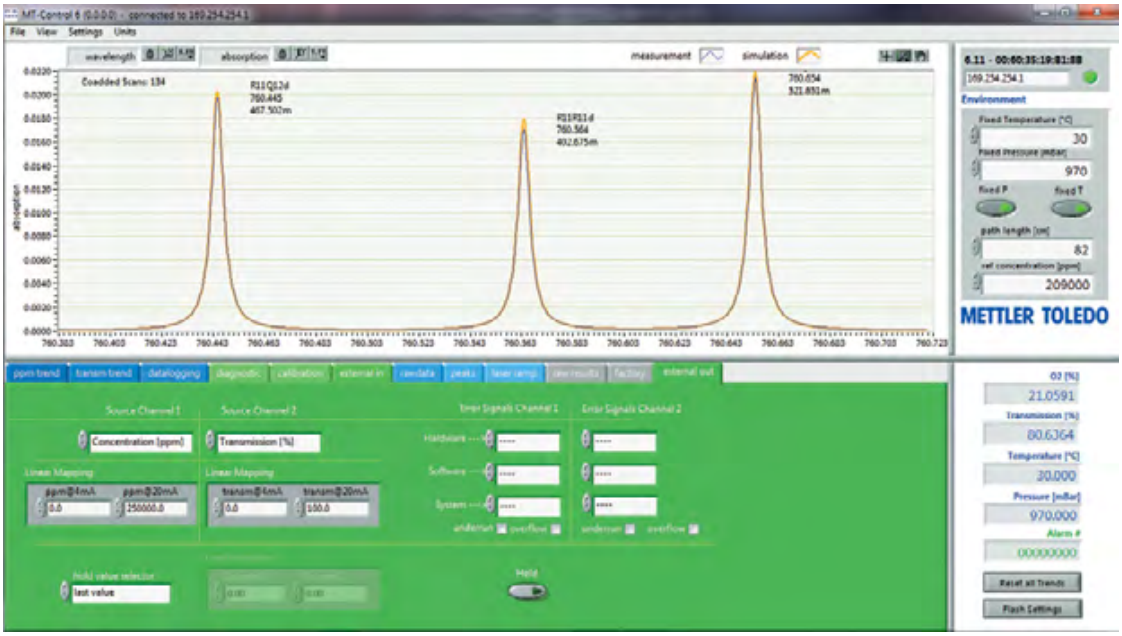


Figure 53 Analog outputs (optional)

For each channel to be used, select the parameter to be mapped to the channel using the pull down menu. The following measured values can be mapped on each channel:

- Concentration (ppm)
- Concentration (%v)
- Pressure (mbar and psi)
- Temperature (°C and °F)
- Transmission (%)
- DLI (days)
- TTM (days)

When the parameter is selected, key in the range that has to be linearly mapped to the 4…20 mA values. Units must be the same as those of the parameter selector above.

WARNING

For SIL2 installations the direct analog output version must be used and only these outputs should be connected to external systems.

An M400 transmitter can be added if desired, but note that the M400 is not SIL certified and its 4-20mA outputs MUST NOT be used.

Figure 54 Selecting a parameter

To assign the high-level error signals to each channel (hardware, software and system) to be relayed to the control system, use the corresponding pull-down menu, see picture below. The following choices can be selected:

- No alarm: when the error occurs, no action is taken to set the analog outputs in alarm condition.
- Alarm condition low (3.6 mA)
- Alarm condition high (22 mA)

Additionally, when the analog outputs can be set to the 3.8 mA or 21 mA state when an out-of-range condition has to be detected by the system. To do this, check the corresponding box (underrun/overflow).

Figure 55 Selecting alarms

Hold mode: during operations such as calibration as well as when in alarm state, the reading when in hold mode can be set to the following values:

- Last value
- Fixed value

The fixed readings for the gas concentration, temperature, pressure and % transmission can be set using the corresponding fields.

Figure 56 Selecting hold mode

6.4 The Viewer

The viewer is a diagnostic tool that enables you to view data that was earlier logged by the MT-TDL software and stored on the SIM card in GPro 500.

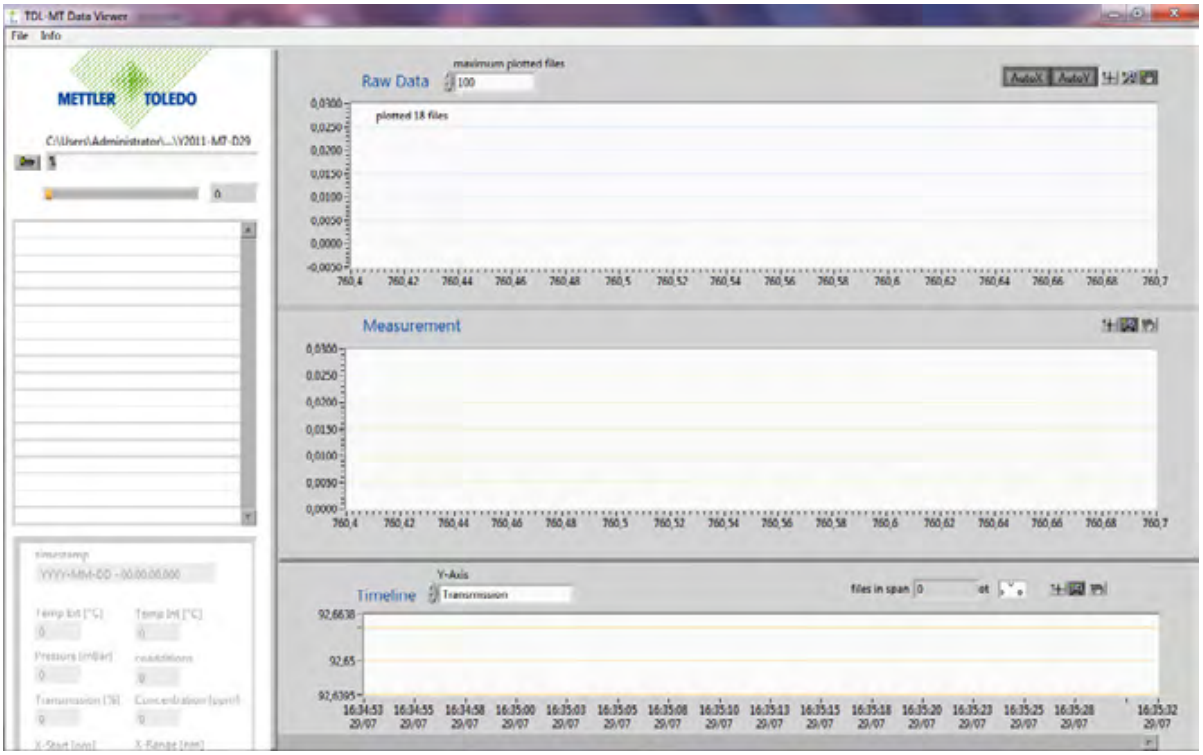


Figure 57 The viewer

With the MT-TDL Viewer log files that has been downloaded and stored on your PC can be viewed/ analyzed.

7 Operation, Maintenance and Calibration

7.1 M400

Key features of the M400 are the Integration of ISM functionality and the unique mixed-mode input feature (accepting conventional or ISM sensors).

Figure 58 M400 front

1 8 languages
   – English
   – Spanish
   – French
   – German
   – Italian
   – Portuguese
   – Russian
   – Japanese
2 Large backlit display (4 text lines)
3 Password protection (5 digit, numeric)
4 **Multi parameter unit**
5 **ISM (the availability of specific ISM functions is dependent of the measured parameter)**
   – Plug and Measure
   – Dynamic Lifetime Indicator (DLI)
   – Adaptive Calibration Timer (ACT)
   – Time to Maintenance Indicator (TTM)
   – CIP/SIP/Autoclaving counter
   – Calibration history
6 FM CI1 Div 2, Atex Zone 2, IP 65 /NEMA 4X protection
7 Quick Setup Mode

7.1.1 Instrument Start-up

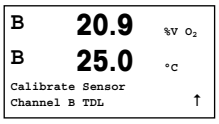
Assuming that the TDL is connected to the M400 Transmitter, the TDL will power-up automatically when power is switched on to the M400. The start-up time is approximately 1 min.

7.1.2 Instrument Shut-down

To shut down the instrument simply disconnect it. No other measures needs to be taken.

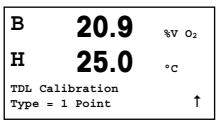
7.2 Verification and Maintenance

One-point calibration for TDL gas sensors



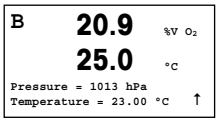
Enter calibration mode as described in section 7.1 "Enter Calibration Mode".

A one-point calibration of gas sensors is always a slope (i.e. with air) calibration. A one point slope calibration is done in air or any other calibration gas with defined gas concentration.



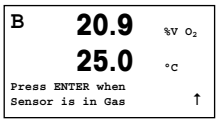
Select 1 point as calibration type.

Press [ENTER].



Enter values for the effective temperature and pressure values of the gas used for calibration. When using the calibration tube for calibration, use values measured manually for the gas present in the calibration tube.

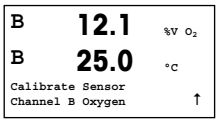
Adjust the optical path length for your individual system.



Place the sensor in the calibration gas (e.g. air). Press [ENTER].

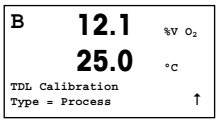
Depending on the used drift control (see chapter 8.2.3.5) one of the two following modes is active.

Process calibration for TDL gas sensors



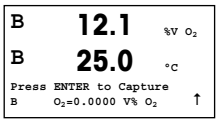
Enter calibration mode as described in section 7.1 "Enter Calibration Mode".

A process calibration of gas sensors is always a slope calibration.



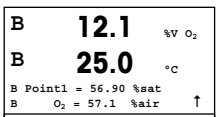
Select Process as the calibration type.

Press [ENTER]

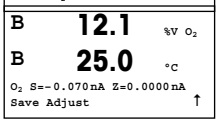


Take a sample and press the [ENTER] key again to store the current measuring value. To show the ongoing calibration process, A or B (depending on the channel) is blinking in the display.

After determining the concentration value of the sample press the ► key again to proceed with the calibration.



Enter the concentration value of the sample then press the [ENTER] key to start the calculation of the calibration results.



After the calibration the slope "S" is displayed.

In case of a successful calibration, the calibration values are stored in the cal history and taken over (Adjust), stored in the cal history and not taken over (Calibrate) or discarded (Abort).

If "Adjust" or "Calibrate" are chosen, the message "Calibration successful" is displayed. The M400 returns to the measuring mode.

Calibration using a calibration cell (for O_2 measurements only)

For a more accurate calibration the calibration cell can be used. Doing this the TDL

(the units head) needs to be removed from the probe. Then it has to be mounted on the calibration cell according to the illustration below. Before calibration is started new values for path length, temperature and pressure have to be entered on M400. Then the calibration gas is flowed through the calibration cell and the calibration is done in the calibration menu of M400.

During calibration with the calibration cell the process is still sealed and no extra precautions need to be taken.

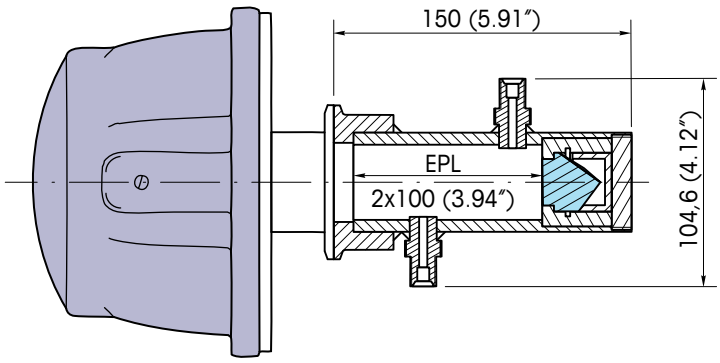


Figure 59 Calibration cell

7.3 Maintenance

The GPro 500 TDL is designed to reduce maintenance to a minimum. Experience has shown that maintenance interval of more than 3 months is acceptable for most applications. The maintenance operations described in this section will secure a continuous and safe operation of the monitor.

7.3.1 Routine maintenance

GPro 500 has no moving parts and require no consumables. TTM and DLI in M400 can generate maintenance requests - for instance if the transmission drops. For best performance, however, we recommend to routinely carry out the following steps:

- Check optical transmission regularly (daily). This can be done automatically by TTM and DLI or WARNING relay or similar.
- Clean windows when necessary (see below).
- For applications where the concentration of the measured gas is normally zero (zero gas application): Check instrument response by applying some gas at least once every 12 months. Apply sufficiently high gas concentrations to obtain a strong instrument response for at least 10 minutes (at least 70 minutes after power on). No warnings or errors should be displayed during the test. Contact your supplier if you are in doubt about your instrument.
- Check calibration every 12 months (depending on the required accuracy). Recalibrate if necessary, see "Calibration" on page no 100.

7.3.2 Remove the probe or wafer cell from the process

The GPro 500 is removed from the process by loosening the four bolts on the flange and carefully extracting it. If necessary the purging connection may have to be removed as well. For wafer cell removal, the process must first be stopped, or the pipe section isolated via closure of isolation valves. The flange mounting bolts can then loosened and removed and the wafer cell carefully extracted from the pipe flanges.

WARNING

Before removing the probe or wafer cell from the process it is very important to verify with the plant manager that it is safe. The process must be shut down or in a state so it is safe to expose the ambient environment to it.

WARNING

Do not turn off the purging before removing the probe. This will prevent the optical surfaces from being contaminated

7.3.3 Removing & cleaning the corner cube

To remove the corner cube you need to unscrew the end cap on the probe. Thereafter the unit containing the corner cube can be taken out. Carefully clean the surface of the corner cube and remount it. The optical surface can be cleaned with non-hazardous, non-abrasive detergents or solvents. Iso-propyl alcohol (IPA) is the recommended solvent for optical component cleaning.

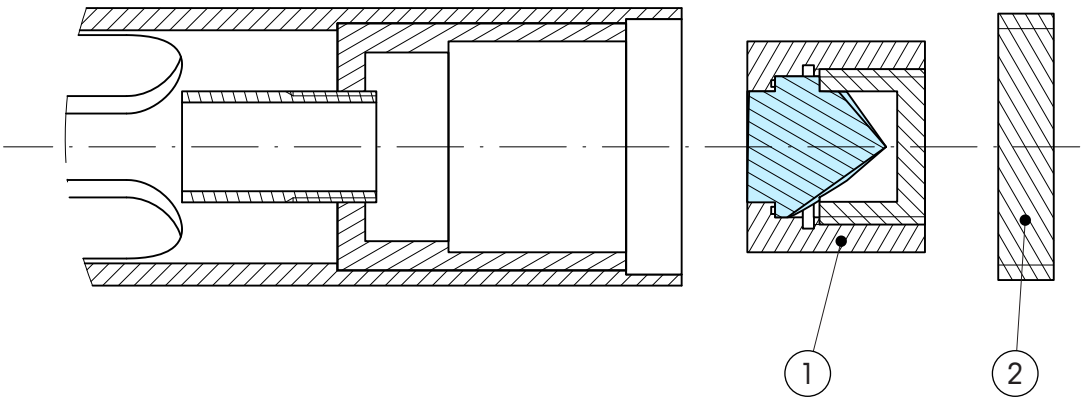


Figure 60 Cleaning/Replacing the corner cube on standard probe (SP) and non-purged probe (NP).

1 Corner cube module
2 Probe end cap

As the in-line wafer cells is integral of the process and in order to maintain the integrity of the PED (Pressure Equipment Directive) certification, the corner cube should not be removed.

7.3.4 Cleaning the probe process window

To clean the process window you need to remove the probe from the process, see 7.3.2 on page no 97. Remove the sensor head, unscrew the probe and then unscrew the purging tube with holder. Carefully clean the surface of the process window. The optical surface can be cleaned with non-hazardous, non-abrasive detergents or solvents. Iso-propyl alcohol (IPA) is the recommended solvent for optical component cleaning.

WARNING

Do not remove the process window from the window module since that will void the pressure certificate.

The process side purge connection is fitted with a seal between the fitting and the purge housing to conform to the pressurized equipment directive (PED). To ensure the integrity of this seal and to prevent damage when connecting the purge tube to the fitting, a back spanner (wrench) must be used to securely hold the fitting body as the purge pipe nut is tightened, as illustrated in Figure 61 below.

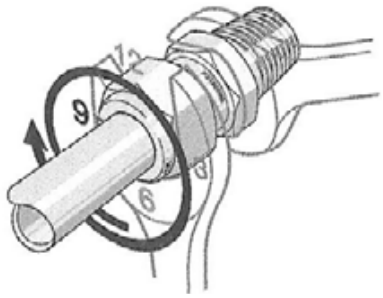


Figure 61 Connecting purge pipe to process side purge fitting.

WARNING

Do not remove and/or disassemble the purge gas inlet for process (7). If disassembled, the PED pressure certificate is void.

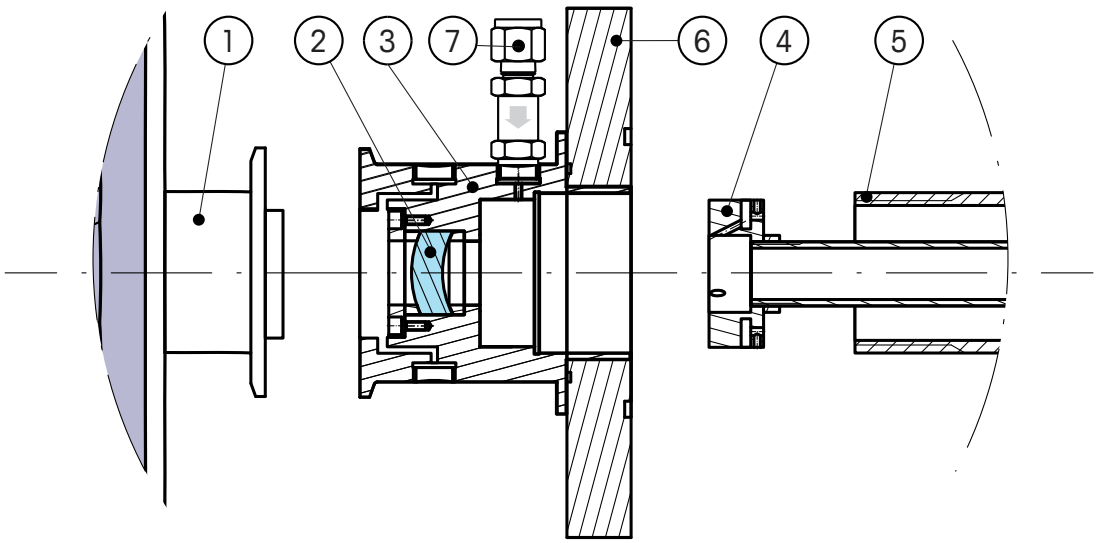


Figure 62 Cleaning the probe process window.

1 Sensor head
2 Process window
3 Window module
4 Purging tube with holder
5 Probe
6 Flange
7 Purge gas inlet fitting process side

WARNING

The high pressure glass in the probe must not be subject to any mechanical impact which might cause damage to the glass (scratch, gash etc.). When cleaning the glass it must be done with a soft cloth. Make sure that it is safe to dismount the probe before cleaning.

If the process window cannot be cleaned correctly, the whole window module and flange assembly need to be replaced.

WARNING

The window module 3 is securely attached to the flange 6 using hex head screws. Do not attempt to remove or untighten the screws, as this will void the PED pressure certificate.

WARNING

When reassembling the probe 5, carefully slide the purging tube 4 inside and screw the probe into the flange 6 until the thread is fully seated. This is to ensure the tightness of the purging system inside the probe.

7.4 Calibration

If the GPro 500 is installed together with the M400 transmitter, then the M400 can be used to perform calibration/verification directly. See section 7.1 for details or refer directly to the M400 manual for further information.

7.4.1 Process Calibration

Calibration directly in the process can be done if the concentration of the gas to be measured is known and stable. This is very convenient and is done very quickly from the calibration menu on M400. For details, see the M400 manual on page 67.

7.4.2 Calibration using calibration cells (O_2 only)

For O_2 analyzers, the optional calibration cell can be used to provide a quick and accurate calibration/validation check. Doing this the TDL (the units head) needs to be removed from the probe. Then it has to be mounted on the calibration cell according to the illustration below. Before calibration is started new values for path length, temperature and pressure have to be entered on M400. Then the calibration gas is flowed through the calibration cell and the calibration is done in the calibration menu of M400.

☞ During calibration with the calibration cell the process is still sealed and no extra precautions need to be taken.

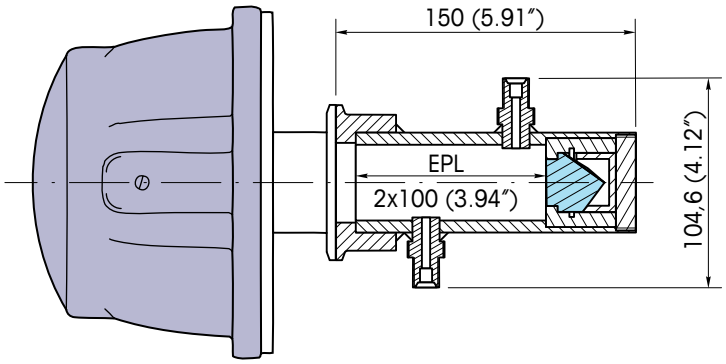


Figure 63 Calibration cell

7.5 Residual Hazards

☞ **Despite all precautionary measures taken, residual hazards still remain.**

7.5.1 Leaky connections

- Connections can become loosened through the effects of vibration.
- The connection between measurement probe and process adaptor is a potential source of leakage.

☞ The connections between the measurement probe and the process adaptor must be checked regularly by the user/operator, and kept in full working condition.

WARNING

Leaky connections can allow process medium to escape to the environment, presenting a hazard for persons and the environment.

7.5.2 Electricity failure

WARNING

In case of electricity failure (releasing of the fuse) make sure that the mains power is properly disconnected before starting any trouble shouting.

7.5.3 Heat protection

WARNING

The housing is not equipped with heat protection. During operation the surface of the housing can reach high temperatures and cause burns.

7.5.4 External influences

☞ Objects falling on the housing can damage or destroy the TDL head, or cause leaks etc.

☞ Lateral forces may damage or destroy the TDL head.

8 Explosion Protection

8.1 ATEX

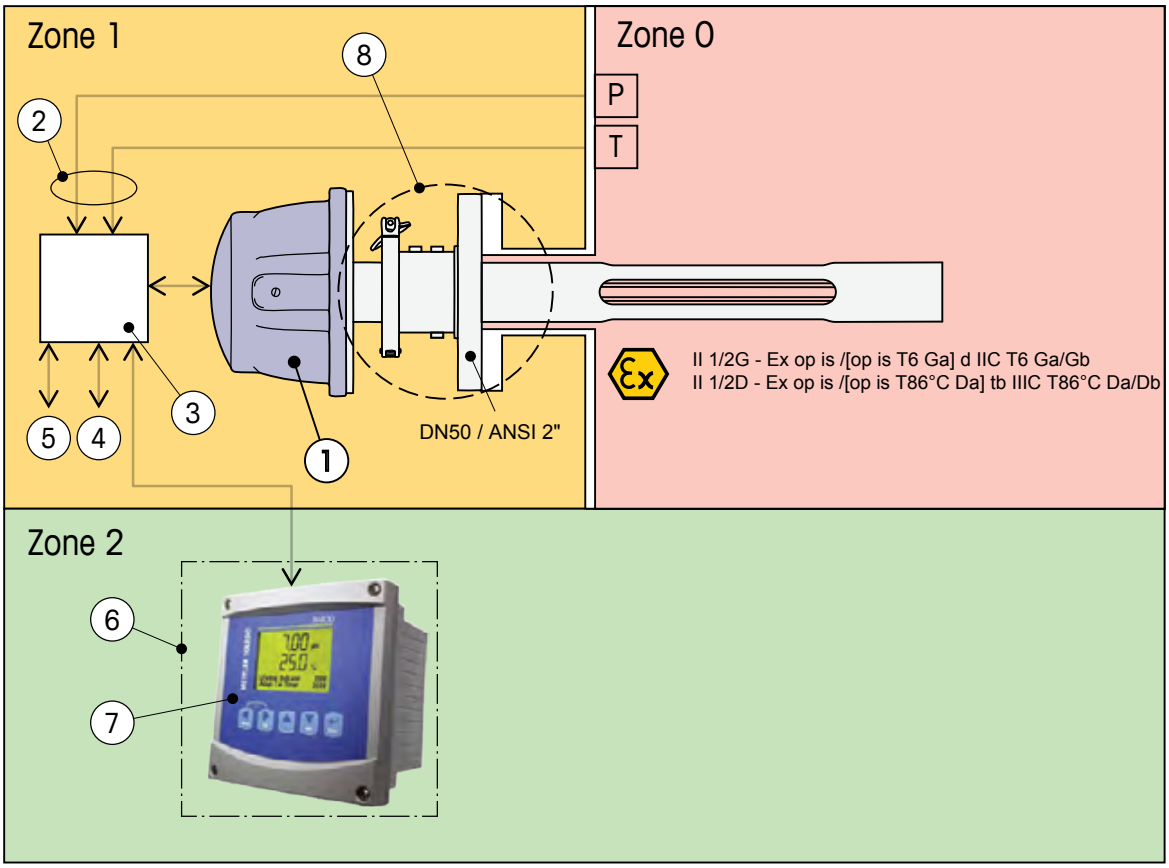


Figure 64 Ex setup

1 GPro 500
2 2 x 4...20 mA (pressure and temperature)
3 Junction Box (Ex-e)
4 Ethernet
5 External power supply
6 Purge box for Zone 1 (optional)
7 M 400
8 For detailed cross section view – see Figure 65 (The GPro 500 Interface between Zone 0 and Zone 1) on page no 103

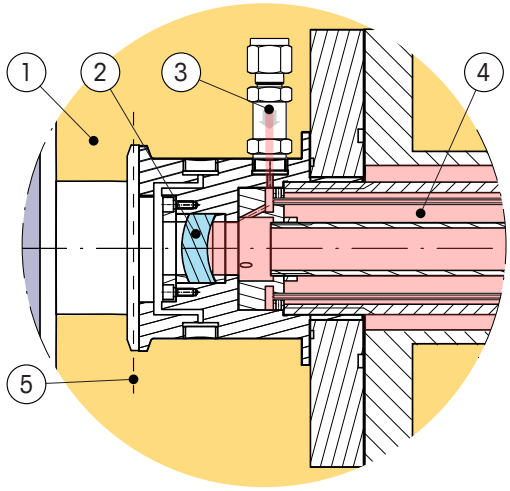


Figure 65 The GPro 500 Interface between Zone 0 and Zone 1

1 Zone 1 region
2 Process window
3 Check valve
4 Zone 0 region
5 Interface sensor head – probe

The process window and the check valve make sure that Zone 0 and Zone 1 are physically separated. The sensor head is always in Zone 1 and the probe is in Zone 0.

CAUTION

For intended installation in an Ex classified area, please observe the following guidelines (ATEX 94/9/EC).

Ex classification: **Ex II 1/2G - Ex op is/[op is T6 Ga] d IIC T6 Ga/Gb**
and
Ex II 1/2D - Ex op is/[op is T86°C Da] tb IIIC T80°C Da/Db

Designation and number of the declaration: SEV 12 ATEX 0114

WARNING

In the normal configuration, the temperature at the interface 5 between the sensor head and the probe may not exceed 55 °C. If the temperature exceeds 55 °C at the interface to the sensor head temperature class T6 (85 °C) is no longer valid and the ATEX classification is violated.

WARNING

If the temperature at the interface 5 between the sensor head and the probe exceeds 55 °C, the Thermal Barrier – see chapter 2.3 (Accessories) on page no 126 – has to be used in a way that the temperature at the interface to the sensor head never exceeds 55 °C. If the temperature exceeds 55 °C at the interface to the sensor head temperature class T6 (85 °C) is no longer valid and the ATEX classification is violated.

WARNING

The metallic enclosure of the TDL sensor has to be connected by conductive wiring with the grounding system of the plant.

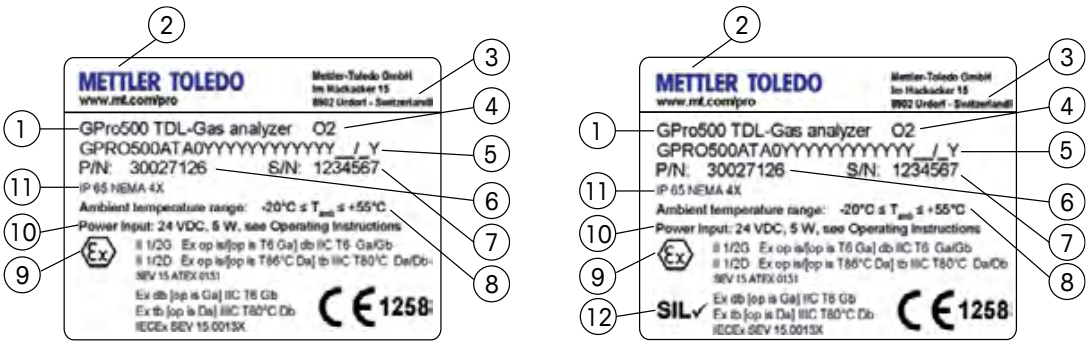


Figure 66 Label.

1 Gas to be measured: Oxygen (O_2), Carbon monoxide (CO) or Water vapour (H_2O)
2 Manufacturer
3 Country of origin
4 Product name
5 Product key
6 Part no.
7 Serial no.
8 Ambient temperature limits
9 ATEX markings
10 Power rating
11 Enclosure ratings
12 SIL Mark

1/2" NPT

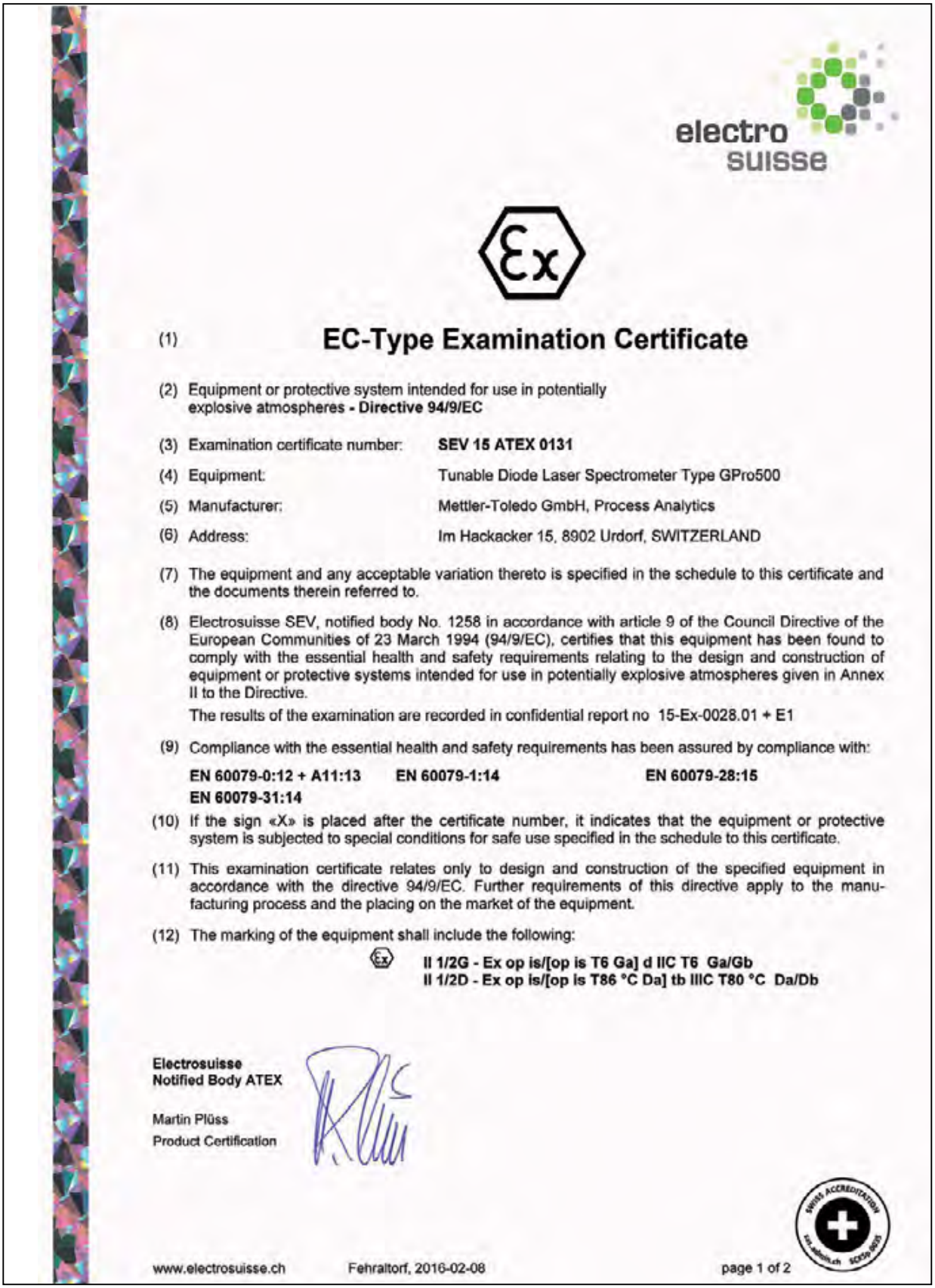
WARNING -
DO NOT
OPEN
THE DEVICE

Figure 67 Note label.

For further guidelines for ATEX compliance please also consult the following chapters of these operating instructions:

– see chapter 3 (Installation and Start-up) on page no 34
– see chapter 5 (Electrical Connections) on page no 67
– see chapter 7 (Operation, Maintenance and Calibration) on page no 94

Figure 68 Grounding label.



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EC-Type Examination Certificate

(1)

(2) Equipment or protective system intended for use in potentially explosive atmospheres - **Directive 94/9/EC**

(3) Examination certificate number: **SEV 15 ATEX 0131**

(4) Equipment: Tunable Diode Laser Spectrometer Type GPro500

(5) Manufacturer: Mettler-Toledo GmbH, Process Analytics

(6) Address: Im Hackacker 15, 8902 Urdorf, SWITZERLAND

(7) The equipment and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

(8) Electrosuisse SEV, notified body No. 1258 in accordance with article 9 of the Council Directive of the European Communities of 23 March 1994 (94/9/EC), certifies that this equipment has been found to comply with the essential health and safety requirements relating to the design and construction of equipment or protective systems intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The results of the examination are recorded in confidential report no 15-Ex-0028.01 + E1

(9) Compliance with the essential health and safety requirements has been assured by compliance with:

EN 60079-0:12 + A11:13 **EN 60079-1:14** **EN 60079-28:15**
EN 60079-31:14

(10) If the sign «X» is placed after the certificate number, it indicates that the equipment or protective system is subjected to special conditions for safe use specified in the schedule to this certificate.

(11) This examination certificate relates only to design and construction of the specified equipment in accordance with the directive 94/9/EC. Further requirements of this directive apply to the manufacturing process and the placing on the market of the equipment.

(12) The marking of the equipment shall include the following:

II 1/2G - Ex op is/[op is T6 Ga] d IIC T6 Ga/Gb
II 1/2D - Ex op is/[op is T86 °C Da] tb IIIC T80 °C Da/Db

Electrosuisse
Notified Body ATEX

Martin Plüss
Product Certification

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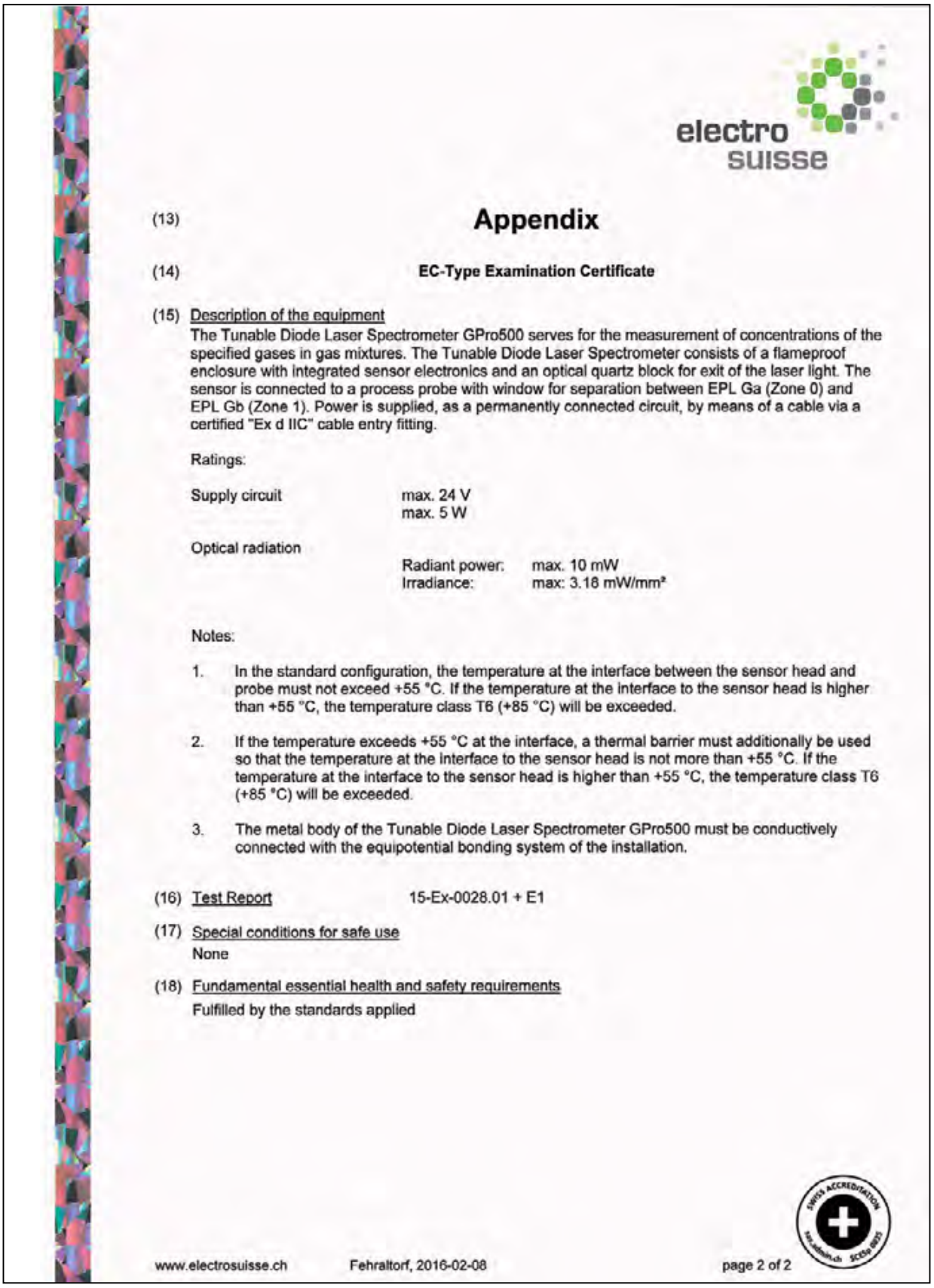
Figure 69 ATEX Cerfificate (page 1/2).



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(13) **Appendix**

(14) **EC-Type Examination Certificate**

(15) Description of the equipment

The Tunable Diode Laser Spectrometer GPro500 serves for the measurement of concentrations of the specified gases in gas mixtures. The Tunable Diode Laser Spectrometer consists of a flameproof enclosure with integrated sensor electronics and an optical quartz block for exit of the laser light. The sensor is connected to a process probe with window for separation between EPL Ga (Zone 0) and EPL Gb (Zone 1). Power is supplied, as a permanently connected circuit, by means of a cable via a certified "Ex d IIC" cable entry fitting.

Ratings:

Supply circuit	max. 24 V max. 5 W
Optical radiation	
Radiant power:	max. 10 mW
Irradiance:	max: 3.18 mW/mm²

Notes:

1. In the standard configuration, the temperature at the interface between the sensor head and probe must not exceed +55 °C. If the temperature at the interface to the sensor head is higher than +55 °C, the temperature class T6 (+85 °C) will be exceeded.
2. If the temperature exceeds +55 °C at the interface, a thermal barrier must additionally be used so that the temperature at the interface to the sensor head is not more than +55 °C. If the temperature at the interface to the sensor head is higher than +55 °C, the temperature class T6 (+85 °C) will be exceeded.
3. The metal body of the Tunable Diode Laser Spectrometer GPro500 must be conductively connected with the equipotential bonding system of the installation.

(16) Test Report 15-Ex-0028.01 + E1

(17) Special conditions for safe use

None

(18) Fundamental essential health and safety requirements

Fulfilled by the standards applied

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Figure 70 ATEX Cerfificate (page 2/2)

METTLER TOLEDO

EU Declaration of Conformity / EU-Konformitätserklärung / Déclaration de conformité européenne / Declaración de conformidad UE / Certificazione di conformità UE / EC декларация за съответствие / EU Prohlášení o shodě / EU-overensstemmelseserklæring / Δήλωση συμμόρφωσης Ε.Ε. / ELi vastavusdeklaratsioon / EU-vaatimustenmukaisuusvakuutus / Dearbhú Comhréireachta AE / EU izjava o sukladnosti / EU Megfelelőségi nyilatkozat / EU適合宣言 / EU 적합성 선언 / ES atitikties deklaracija / ES atbilstības deklarācija / Dikjarazzjoni ta' Konformità tal-UE / EU-conformiteitsverklaring / Deklaracja zgodności UE / Declaração de Conformidade da UE / Declaraţie de conformitate UE / Декларация о соответствии требованиям ЕС / EÚ Vyhlásenie o zhode / Izjava o skladnosti EU / EU-försäkran om överensstämmelse / เอกสารแสดงการปฏิบัติตามมาตรฐานสหภาพยุโรป (Declaration of Conformity) / EU 一致性声明

Product / Produkt / **Produit** / Producto / **Prodotto** / Продукт / **Výrobek** / Produkt / **Προϊόν** / Toode / **Tuote** / Táirge / **Proizvod** / Termék / **製品名** / 제품 / **Gaminys** / Izstrādājums / **Prodott** / Product / **Produkt** / Produto / **Produs** / Продукция / **Produkt** / Izdelek / **Produkt** / ถังเก็บ / **产品**	**GPro 500**
Manufacturer / Hersteller / **Fabricant** / Fabricante / **Produttore** / Производител / **Výrobce** / Producent / **Κατασκευαστής** / Tootja / **Valmistaja** / Déantúsóir / **Proizvođač** / Gyártó / **メーカー** / 제조업체 / **Gamintojas** / Ražotājs / **Manifattur** / Producent / **Producent** / Fabricante / **Producător** / Производитель / **Výrobca** / Proizvajalec / **Tillverkare** / ผู้ผลิต / **制造商**	**Mettler-Toledo GmbH** Im Hackacker 15 8902 Urdorf, Switzerland

This declaration of conformity is issued under the sole responsibility of the manufacturer. / Die alleinige Verantwortung für die Ausstellung dieser Konformitätserklärung trägt der Hersteller. / **La présente déclaration de conformité est établie sous la seule responsabilité du fabricant.** / La presente declaración de conformidad se expide bajo la exclusiva responsabilidad del fabricante. / **La presente certificazione di conformità è rilasciata sotto la responsabilità esclusiva del produttore.** / Настоящата декларация за съответствие е издадена под единствената отговорност на производителя. / **Toto prohlášení o shodě vydává výrobce na svou vlastní odpovědnost.** / Producenten er eneansvarlig for udstedelsen af denne overensstemmelseserklæring. / **Η παρούσα δήλωση συμμόρφωσης εκδίδεται με αποκλειστική ευθύνη του κατασκευαστή.** / See vastavusdeklaratsioon on väljastatud tootja ainuvastutusel. / **Vaatimustenmukaisuusvakuutus on annettu valmistajan yksinomaisella vastuulla.** / Is faoi fhreagracht an déantúsóra amháin a eisítear an dearbhú comhréireachta seo. / **Ova izjava o sukladnosti izdaje se pod punom odgovornošću proizvođača.** / Az alábbi megfelelőségi nyilatkozat kiadásáért kizárólag a gyártó felelős. / **この適合宣言書はメーカーの単独責任において発行されます。** / 이 적합성 선언은 제조업체의 단독 책임하에 발행되었습니다. / **Ši atitikties deklaracija išduota tik gamintojo atsakomybe.** / Šī atbilstības deklarācija ir izdota vienīgi uz ražotāja atbildību. / **Din id-dikjarazzjoni ta' konformità hi maħruġa taħt ir-responsabbiltà unika tal-manifattur.** / Deze conformiteitsverklaring wordt verstrekt onder de exclusieve verantwoordelijkheid van de producent. / **Ta deklaracja zgodności została wystawiona na wyłączną odpowiedzialność producenta.** / Esta declaração de conformidade é emitida sob a responsabilidade exclusiva do fabricante. / **Prezenta declaraţie de conformitate este emisă pe răspunderea exclusivă a producătorului.** / Настоящая декларация о соответствии выпущена под исключительную ответственность производителя. / **Toto vyhlásenie o zhode vydáva výrobca na vlastnú zodpovednost'.** / Za izdajo te izjave o skladnosti je odgovoren izključno proizvajalec. / **Denna försäkran om överensstämmelse utfärdas på tillverkarens eget ansvar.** / เอกสารแสดงการปฏิบัติตามมาตรฐานนี้ออกให้ภายใต้การรับผิดชอบแต่เพียงผู้เดียวของผู้ผลิต / **本一致性声明基于制造商独立承担责任的原则。**

The object of the declaration described above is in conformity with the following European directives and standards or normative documents: / Der oben beschriebene Gegenstand der Erklärung erfüllt die Vorschriften der folgenden europäischen Richtlinien und Normen oder normativen Dokumente: / **L'objet de la déclaration décrit ci-dessus est en conformité avec les directives et normes européennes suivantes et autres documents à vocation normative :** / El objeto de la declaración descrita anteriormente se ajusta a lo establecido en las siguientes directivas, normas y documentos normativos europeos: / **L'oggetto della dichiarazione di cui sopra è conforme a direttive, norme o standard europei di seguito:** / Предметът на декларацията, описан по-горе, е в съответствие със следните европейски директиви и стандарти или нормативни документи: / **Výše popsaný předmět prohlášení je v souladu s následujícími evropskými směrnicemi a normami nebo normativními dokumenty:** / Genstanden for erklæringen, som beskrevet ovenfor, er i overensstemmelse med følgende europæiske direktiver og standarder eller normative dokumenter: / **Το αντικείμενο της δήλωσης που περιγράφεται παραπάνω συμμορφώνεται με τις παρακάτω ευρωπαϊκές οδηγίες και πρότυπα ή κανονιστικά έγγραφα:** / Ülalkirjeldatud deklareeritav toode on kooskõlas järgmiste Euroopa direktiivide ja standardite või normdokumentidega: / **Yllä määritetyn vakuutuksen tavoite noudattaa seuraavien eurooppalaisten direktiivien, normien tai normatiivisten asiakirjojen vaatimuksia:** / Tá cuspóir an dearbhaithe a dtugtar cur-síos air thuas de réir na dtreoracha agus na gcaighdeán Eorpach nó de réir na ndoiciméad normatach Eorpach seo a leanas: / **Predmet izjave naveden iznad u skladu je sa sljedećim europskim direktivama i normama normativnih dokumenata:** / A fent említett nyilatkozat tárgya megfelel az alábbi európai irányelveknek, szabványoknak, illetve normatív dokumentumoknak:
/**上述の宣言書の目的は、機器が以下の欧州指令および規格あるいは規定文書に適合していることを宣言することです：** / 위에서 설명한 이 선언의 목적은 다음의 유럽 지침 및 표준 또는 규범 문서를 준수하는 데 있습니다. / **Pirmiau aprašytas deklaracijos objektas atitinka šias Europos direktyvas ir standartus ar norminius dokumentus:** / Iepriekš aprakstītais deklarācijas priekšmets atbilst tālāk norādītajām Eiropas direktīvām un standartiem vai normatīvajiem dokumentiem: / **L-oġġett tad-dikjarazzjoni deskritta hawn fuq hu konformi mad-direttivi Ewropej u l-istandards jew id-dokumenti normattivi li ġejjin:** / Het voorwerp van voornoemde verklaring is in overeenstemming met de volgende Europese richtlijnen en normen of normatieve documenten: / **Treść powyższej deklaracji jest zgodna z następującymi dyrektywami europejskimi oraz normami lub dokumentami normalizującymi:** / O objeto da declaração acima mencionada está em conformidade com as seguintes diretrizes e normas europeias ou documentos normativos: / **Obiectul declaraţiei descris mai sus este în conformitate cu următoarele directive şi standarde europene sau acte normative:** / Предмет декларации, описанный выше, соответствует следующим европейским директивам и стандартам или нормативным документам: / **Predmet vyššie uvedeného vyhlásenia o zhode je v súlade s nasledujúcimi európskymi smernicami a normami alebo normatívnymi dokumentmi:** / redmet zgoraj opisane izjave je skladen z naslednjimi evropskimi direktivami in standardi ali normativnimi dokumenti: / **Föremålet för försäkran som beskrivs ovan överensstämmer med följande europeiska direktiv och standarder eller harmoniserade dokument:** /
วัตถุประสงค์ของเอกสารตามที่อธิบายไว้ข้างต้นสอดคล้องกับข้อกำหนดและมาตรฐานหรือเอกสารกฎระเบียบของสหภาพยุโรปดังต่อไปนี้: /
上述声明的目标与下面的欧洲指令、标准或规范性文件相符：

Figure 71 EC Declaration of conformity (page 1/2)

METTLER TOLEDO

Marking / Kennzeichnung / **Marquage** / Marcado / **Marcatura** / Маркировка / **Označení** / Mærkning / **Σήμανση** / Märgistus / **Merkintä** / Comharthú / **Oznaka** / Jelölés / **マーキング** / 마킹 / **Ženklinimas** / Marķējums / **Immarkar** / Markering / **Oznaczenie** / Marcação / **Marcaj** / Маркировка / **Označenie** / Označevanje / **Märkning** / **การทำเครื่องหมาย** / **标记**	**EU Directive /** EU-Richtlinie / **Directive européenne** / Directiva UE / **Direttiva UE** / Директива на ЕС / **Směrnice EU** / EU-direktiv / **Οδηγία Ε.Ε.** / ELi direktiivi / **EU-direktiivi** / Treoir AE / **EU direktiva** / EU-irányelv / **欧州指令** / EU 지침 / **ES direktyva** / ES direktīva / **Direttiva tal-UE** / EU-richtlijn / **Dyrektywa UE** / Diretiva da UE / **Directiva UE** / Директива ЕС / Smernica EÚ / Direktiva EU / **EU-direktiv** / **ข้อกำหนดของสหภาพยุโรป** / **EU 指令**	**Harmonised Standards /** Harmonisierte Normen / **Normes harmonisées** / Normas armonizadas / **Standard armonizzati** / Хармонизирани стандарти / **Harmonizované normy** / Harmoniserede standarder / **Εναρμονισμένα πρότυπα** / Ühtlustatud standardid / **Yhdenmukaistetut standardit** / Caighdeáin Chomhchuibhithe / **Usklađene norme** / Harmonizált szabványok / **整合化された規格** / 조화된 표준 / **Darnieji standartai** / Saskaņotie standarti / **Standards Armonizzati** / Geharmoniseerde normen / **Normy zharmonizowane** / Normas Harmonizadas / **Standarde armonizate** / Гармонизированные стандарты / **Harmonizované normy** / Harmonizirani standardi / **Harmoniserade standarder** / **มาตรฐานที่สอดคล้องกัน** / **调和标准**
CE	**Pressurised Equipment Directive /** Druckgeräterichtlinie / **Directive Équipements sous pression** / Directiva sobre equipos a presión / **Direttiva sulle attrezzature a pressione** / Директива за оборудване под налягане / **Směrnice pro tlaková zařízení** / Direktiv om trykbærende udstyr / **Οδηγία εξοπλισμού υπό πίεση** / Rõhuseadmete direktiiv / **Painelaitetta koskeva direktiivi** / An Treoir maidir le Brú-Threalamh / **Direktiva o opremi pod tlakom** / Nyomás alatt lévő berendezésekről szóló irányelv / **压力设备指令** / 가압 장비 지침 / **Direktyva dėl slėginės įrangos** / Spiedieniekārtu direktīva / **Direttiva dwar Tagħmir Pressurizzat** / Richtlijn drukapparatuur / **Dyrektywa w sprawie urządzeń ciśnieniowych** / Diretiva dos Equipamentos sob Pressão / **Directiva privind echipamentele sub presiune** / Директива по оборудованию, работающему под давлением / **Smernica o tlakových zariadeniach** / Direktiva o tlačni opremi / **Tryckkärlsdirektivet** / **ข้อกำหนดของอุปกรณ์ที่มีการอัดแรงดัน** / **加压设备指令** Effective from July-19-2016: 2014/68/EU (OJEU, 2014, L189, p164) Module A1	EN12266-1: 2012
CE	**EMC Directive /** EMV-Richtlinie / **Directive CEM** / Directiva CEM / **Direttiva EMC** / Директива за електромагнитна съвместимост / **Směrnice EMC** / EMC-direktivet / **Οδηγία ΗΜΣ** / Elektromagnetilise ühilduvuse (EMC) direktiiv / **EMC-direktiivi** / An Treoir maidir le Comhoiriúnacht Leictreamaighnéadach / **Direktiva o elektromagnetskoj kompatibilnosti** / Elektromágneses összeférhetőségről (EMC) szóló irányelv / **EMC指令** / EMC 지침 / **Direktyva dėl elektromagnetinio suderinamumo** / EMS direktīva / **Direttiva dwar EMC** / EMC-richtlijn / **Dyrektywa EMC** / Diretiva CEM / **Directiva CEM** / Директива по электромагнитной совместимости / **Smernica o elektromagnetickej kompatibilite (EMC)** / Direktiva EMC / **EMC-direktivet** / **ข้อกำหนด EMC** / **EMC 指令** 2014/30/EU (OJEU, 2014, L96, P79)	EN 55011:2009+A1:2010 EN61326-1: 2013 EN61326-2-3: 2013
CE 1258[1]	**ATEX Directive /** ATEX-Richtlinie / **Directive ATEX** / Directiva ATEX / **Direttiva ATEX** / ATEX Директива / **Směrnice ATEX** / ATEX-direktivet / **Οδηγία ATEX** / ATEX-direktiivi / **ATEX-direktiivi** / An Treoir ATEX / **ATEX direktiva** / ATEX-irányelv / **ATEX指令** / ATEX 지침 / **Direktyva dėl sprogioje aplinkoje naudojamos įrangos** / Sprādzienbīstamas vides (ATEX) direktīva / **Direttiva dwar ATEX** / ATEX-richtlijn / **Dyrektywa ATEX** / Diretiva ATEX / **Directiva ATEX** / Директива ATEX / **Smernica ATEX** / Direktiva ATEX / **ATEX-direktivet** / **ข้อกำหนด ATEX** / **ATEX 指令** 2014/34/EU (OJEU, 2014, L96, p309)	EN60079-0: 2012 + A11:2013 EN60079-1: 2014 EN60079-28: 2015 EN60079-31: 2014

1 **Number of the Notified Body** / Nummer der notifizierten Stelle / **Numéro d'identification de l'organisme notifié** / Número del organismo notificado / **Numero dell'organismo notificato** / Номер на нотифициран орган / **Číslo notifikovaného orgánu** / Nummer for det bemyndigede organ / **Αριθμός του κοινοποιημένου οργανισμού** / Teavitatud asutuse number / **Ilmoitetun laitoksen numero** / Uimhir an Chomhlachta dar Tugadh Fógra / **Broj ovlaštenog tijela** / A bejelentett szervezet száma / **公認機関の番号** / 공인 기관의 수 / **Notifikuotosios įstaigos numeris** / Pilnvarotās iestādes identifikācijas numurs / **Numru tal-Korp Notifikat** / Nummer van de aangemelde instantie / **Numer jednostki notyfikowanej** / Número do Organismo Notificado / **Numărul organismului notificat** / Номер уполномоченного органа / **Číslo notifikovaného orgánu** / Številka obveščenega telesa / **Nummer för anmält organ** / จำนวนขององค์กรที่ได้รับแจ้ง / **认证机构编号** /

Place	Im Hackacker 15, 8902 Urdorf, Switzerland
Issued	25.02.2016

Head of Process Analytics Division	**Head of Quality Management**
Waldemar Rauch Head of Process Analytics Division	Peter Rowing Head of Quality Management

Figure 72 EC Declaration of conformity (page 2/2)

Mettler-Toledo AG
Process Analytics

Address: Im Hackacker 15, CH-8902 Urdorf, Switzerland
Mail address: P.O. Box, CH-8902 Urdorf, Switzerland
Phone: +41-44-729 62 11
Fax: +41-44-729 66 36
Bank: Credit Suisse, 8070 Zurich, BC 4835 / SWIFT CRESCHZZ80A
Account no.: 370501-21-4 CHF/IBAN CH65 0483 5037 0501 2100 4

www.mt.com/pro

SIL declaration of conformity
Functional safety according to
IEC 61508 and 61511

We
Wir
Nous

Mettler-Toledo AG, Process Analytics
Im Hackacker 15
8902 Urdorf
Switzerland Schweiz Suisse

declare under our sole responsibility that the product,
erklären in alleiniger Verantwortung, dass dieses Produkt,
déclarons sous notre seule responsabilité que le produit,

Description
Beschreibung
Description

GPro 500 Gas Analyzers Series

Smart key

GPRO500********__/_A**

We as manufacturer declare that the above gas analyzer series GPro 500 are suitable for use in safety instrumented systems according to IEC 61508 and IEC 61511. The primary function of the GPro 500 is the measurement of the concentration of the target gas for a safety instrumented function of Safety Integrity Level (SIL) 2. The appropriate safety instructions according to the operating instructions manual GPro 500. The software Product revisions will be carried out by the manufacturer in accordance with IEC 61508.
The software version (V6.X) encodes with "X" special modifications for each gas type and mechanical construction which has no influence on the safety function and detection capability.
The failure rate calculations were carried out by EXIDA and calculated via an FMEDA according to IEC 61508.

	Failure rates (in FIT)
Fail safe detected (λ_{SD})	0
Fail Safe Undetected (λ_{SU})	0
Fail Dangerous Detected (λ_{DD})	2868
Fail Dangerous Undetected (λ_{DU})	271
Total Failure Rate (safety function)	3139

Safe Failure Function (SFF)	91%
SIL AC	SIL2

Mettler-Toledo AG, Process Analytics

Jean-Nic Adami
Gas Analytics MTPRO

Peter Rowing
Head of Quality Management

Place and Date of issue
Ausstellungsort und Datum
Lieu et date d'émission

Urdorf, 16.02.2015

Figure 73 SIL Declaration of conformity

IECEx Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION
IEC Certification Scheme for Explosive Atmospheres

for rules and details of the IECEx Scheme visit www.iecex.com

Certificate No.: IECEx SEV 15.0013X issue No.:1

Certificate history:
Issue No. 1 (2016-2-8)
Issue No. 0 (2015-11-16)

Status: **Current**

Date of Issue: **2016-02-08** Page 1 of 4

Applicant: **Mettler-Toledo GmbH**
Im Hackacker 15
8902 Urdorf
Switzerland

Electrical Apparatus: **Tunable Diode Laser Spectrometer GPro500 (refere to Annexe for exact type designation)**

Optional accessory:

Type of Protection: **Flameproof enclosure "d"; Optical radiation "op"; Protection by enclosure "t"**

Marking: **Ex db [op is Ga] IIC T6 Gb**
Ex tb [op is Da] IIIC T80 °C Db

Approved for issue on behalf of the IECEx Certification Body: Martin Plüss

Position: Manager Product Certification

Signature:
(for printed version)

Date: 2016-02-08

1. This certificate and schedule may only be reproduced in full.
2. This certificate is not transferable and remains the property of the issuing body.
3. The Status and authenticity of this certificate may be verified by visiting the Official IECEx Website.

Certificate issued by:

Electrosuisse div. Testing and Certification
Luppmenstrasse 1
CH-8320 FEHRALTORF
Switzerland

electro suisse

Figure 74 IECEx Cerfificate (page 1/4)

IECEx Certificate of Conformity

Certificate No.: IECEx SEV 15.0013X

Date of Issue: **2016-02-08** Issue No.: **1**

Manufacturer: **Mettler-Toledo GmbH**
Im Hackacker 15
8902 Urdorf
Switzerland

Additional Manufacturing location (s):

This certificate is issued as verification that a sample(s), representative of production, was assessed and tested and found to comply with the IEC Standard list below and that the manufacturer's quality system, relating to the Ex products covered by this certificate, was assessed and found to comply with the IECEx Quality system requirements. This certificate is granted subject to the conditions as set out in IECEx Scheme Rules, IECEx 02 and Operational Documents as amended.

STANDARDS:
The electrical apparatus and any acceptable variations to it specified in the schedule of this certificate and the identified documents, was found to comply with the following standards:

IEC 60079-0 : 2011 Edition: 6.0	Explosive atmospheres - Part 0: General requirements
IEC 60079-1 : 2014-06 Edition: 7.0	Explosive atmospheres - Part 1: Equipment protection by flameproof enclosures "d"
IEC 60079-28 : 2015 Edition: 2	Explosive atmospheres - Part 28: Protection of equipment and transmission systems using optical radiation
IEC 60079-31 : 2013 Edition: 2	Explosive atmospheres - Part 31: Equipment dust ignition protection by enclosure "t"

*This Certificate **does not** indicate compliance with electrical safety and performance requirements other than those expressly included in the Standards listed above.*

TEST & ASSESSMENT REPORTS:
A sample(s) of the equipment listed has successfully met the examination and test requirements as recorded in

Test Report:
CH/SEV/ExTR15.0015/01

Quality Assessment Report:

CH/SEV/QAR12.0004/04

Figure 75 IECEx Cerfificate (page 2/4)

IECEx Certificate of Conformity

Certificate No.: IECEx SEV 15.0013X

Date of Issue: **2016-02-08** Issue No.: **1**

Schedule

EQUIPMENT:

Equipment and systems covered by this certificate are as follows:

The Tunable Diode Laser Spectrometer GPro500 should be approved for measuring concentrations of the specified gases in gas mixtures. The sensor GPro500 consists of a flameproof enclosure and contains optical elements, optoelecronics (diode laser and silicon detectors), analog and digital electronics for signal processing and I/O structure. The sensor is driven by the M400 transmitter and communicates over RS485. The Sensor is connected to the process over a probe with process window and corner cube. Due to the process window the spectrometer has no direct contact to Zone 0 and can be disconnected during the running process.

Ratings:
Supply circuit max. 24 V
max. 5 W
Optical Radiation:
Radiant power: max. 10 mW
Irradiance: max: 3.18 mW/mm^2

CONDITIONS OF CERTIFICATION: YES as shown below:

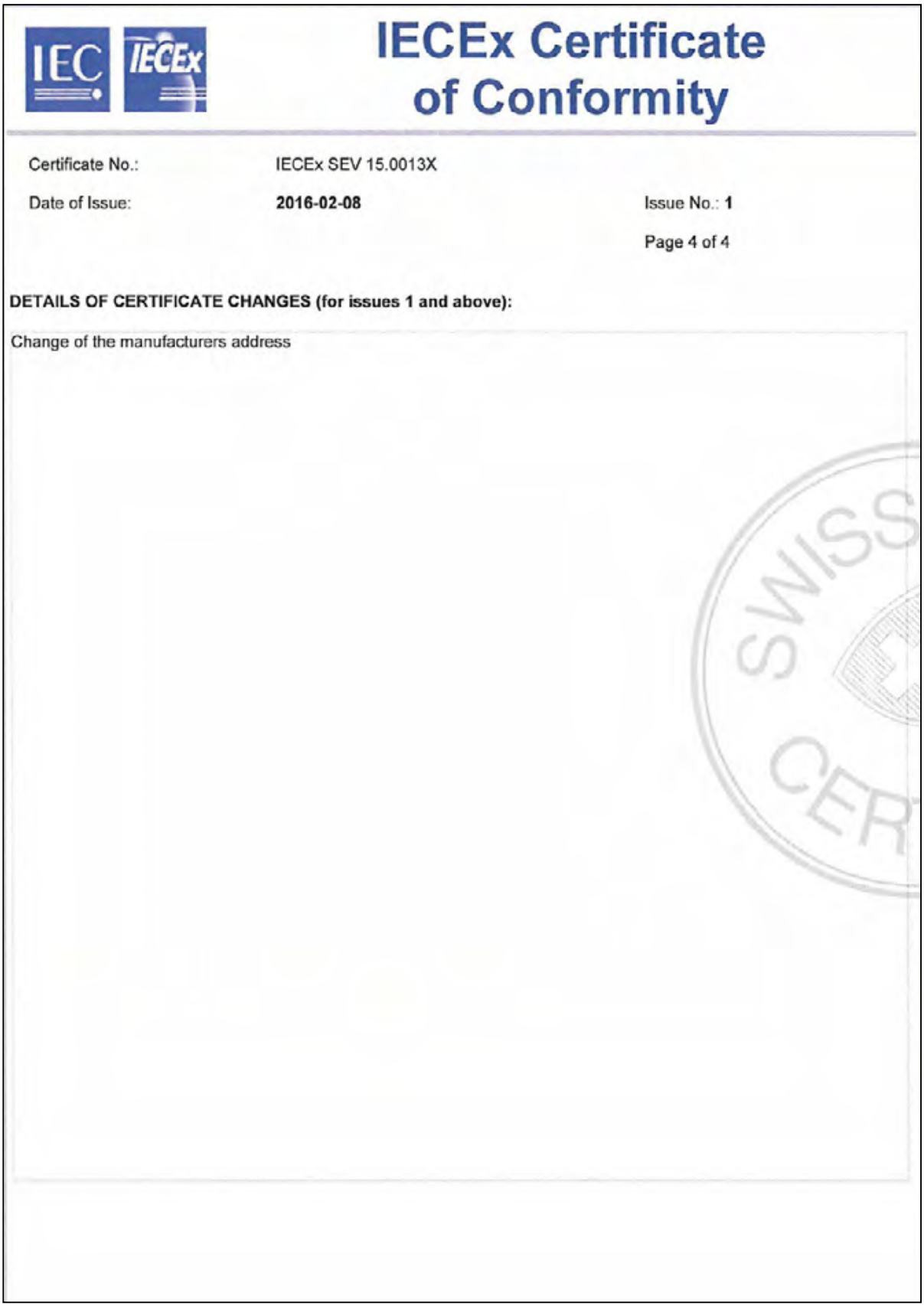
Repairs of the flameproof joints must be made in compliance with the constructive specifications provided by the manufacturer. Repairs must not be made on the basis of values specified in tables 1 and 2 of IEC 60079-1.

In the normal configuration, the temperature at the interface between the sensor head and the probe should not exceed +55 °C. The temperature at the interface to the sensor head is more than +55 °C, the temperature class T6 (85 °C) is exceeded.

If the temperature exceeds +55 °C at the interface, a thermal barrier to limit the temperature to less than +55 °C has to be used in addition.

The metal body of the TDL Spectrometer must be conductively connected with the equipotential bonding system of the Installation.

Figure 76 IECEx Cerfificate (page 3/4)



IECEx Certificate of Conformity

Certificate No.: IECEx SEV 15.0013X

Date of Issue: **2016-02-08** Issue No.: **1**

Page 4 of 4

DETAILS OF CERTIFICATE CHANGES (for issues 1 and above):

Change of the manufacturers address

Figure 77 IECEx Cerfificate (page 4/4)

8.2 FM Approval (US Version) Oxygen Measurement

Ex classification: CI I, Div 1, Grp A, B, C, D, T6
CI II, III, Div 1, Grp E, F, G, T6

– Designation and number of the declaration: Original project ID 3044884

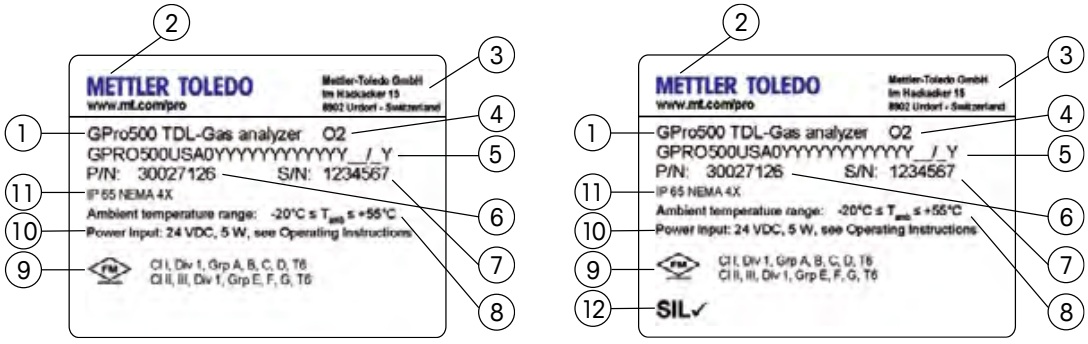


Figure 78 Label for US version.

1 Gas to be measured: Oxygen (O_2), Carbon monoxide (CO) or Water vapour (H_2O)
2 Manufacturer
3 Country of origin
4 Product name
5 Product key
6 Part no.
7 Serial no.
8 Ambient temperature limits
9 FM markings
10 Power rating
11 Enclosure ratings
12 SIL Mark

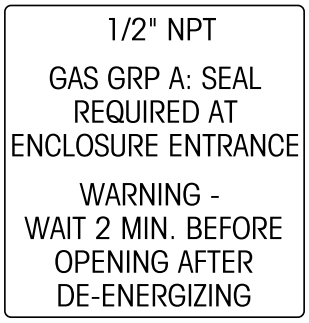


Figure 79 Note label.

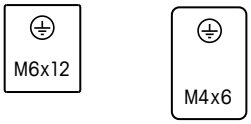


Figure 80 Grounding labels.

For further guidelines for FM compliance please also consult the following chapters of these operating instructions:

- see chapter 3 (Installation and Start-up) on page no 34
- see chapter 5 (Electrical Connections) on page no 67
- see chapter 7 (Operation, Maintenance and Calibration) on page no 94

CERTIFICATE OF CONFORMITY

1. **HAZARDOUS (CLASSIFIED) LOCATION ELECTRICAL EQUIPMENT PER US REQUIREMENTS**
2. **Certificate No:** **FM16US0256**
3. **Equipment:** **GPRo 500**
   (Type Reference and Name) **Gas Sensor**
4. **Name of Listing Company:** **Mettler-Toledo GmbH**
5. **Address of Listing Company:** **Im Hackacker 15 (Industrie Nord)**
   CH-8902 Urdorf
6. The examination and test results are recorded in confidential report number:

   3044884 dated 9th January 2013

7. FM Approvals LLC, certifies that the equipment described has been found to comply with the following Approval standards and other documents:

   FM Class 3600:2011, FM Class 3615:2006, FM Class 3810:2005,
   ANSI/NEMA 250:1991, ANSI/IEC 60529:2004

8. If the sign 'X' is placed after the certificate number, it indicates that the equipment is subject to specific conditions of use specified in the schedule to this certificate.
9. This certificate relates to the design, examination and testing of the products specified herein. The FM Approvals surveillance audit program has further determined that the manufacturing processes and quality control procedures in place are satisfactory to manufacture the product as examined, tested and Approved.
10. Equipment Ratings:

    Explosionproof for Class I, Division 1, Groups A, B, C and D; Dust-ignitionproof for Class II, Division 1, Groups E, F and G; Class III, Division 1 hazardous (classified) locations, indoors and outdoors (Type 4X, IP65) with an ambient temperature rating of -20°C to +55°C.

Certificate issued by:

J. E. Marquedant
Manager, Electrical Systems

19 August 2016
Date

To verify the availability of the Approved product, please refer to www.approvalguide.com

THIS CERTIFICATE MAY ONLY BE REPRODUCED IN ITS ENTIRETY AND WITHOUT CHANGE

FM Approvals LLC. 1151 Boston-Providence Turnpike, Norwood, MA 02062 USA
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Figure 81 FM-Certificate. FM Approvals (page 1/3).

SCHEDULE

US Certificate Of Conformity No: FM16US0256

11. The marking of the equipment shall include:

Class I Division 1, Groups A, B, C, D; T6 Ta = -20°C to +55°C; Type 4X, IP65

Class II, Division 1, Groups E, F, G, Class III, Division 1; T6 Ta = -20°C to +55°C; Type 4X, IP65

12. **Description of Equipment:**

General - The GPro 500 Gas Sensor is an optical instrument designed for continuous in-situ gas monitoring in stack, pipes, and similar applications. The sensor is based on tunable diode laser absorption spectroscopy (TDLAS) technology. The GPro 500 Gas Sensor utilizes a single side installation without the need for alignment to measure the average gas concentration along the line of sight path in the probe. The measuring principle used is infrared single line absorption spectroscopy, which is based on the fact that each gas has distinct absorption lines at specific wavelengths. The GPro 500 consists of 3 separate units, the TDL head (which is explosionproof rated and the subject of this certificate), and the insertion probe which has no electrical connections, a junction box and the user interface M400 (which are not explosionproof rated). The flange mounted insertion probes are available in 3 lengths.

Construction - The GPro 500 housing is a coated aluminum enclosure with a bolt on cover and is available with (1) ½ inch NPT conduit opening.

Ratings - The GPro 500 TDL head contains the laser module with a temperature stabilized diode laser, collimating optics, the main electronics and data storage. The unit is rated for a maximum of 24 VDC, 5 Watts. The laser source has a maximum radiation strength of 0.24mW/mm².

GPro 500-USabcdefghij_/_k. Gas Sensor.
a = Gases: A0, A1, C0, H0, H1, C2, C1, CC, S0, S1, L0, L1, M0, M1, N0, or N1
b = Process Interface: P, F, B, H, W, S, E, A, C, or K
c = Process Optics: B, C, Q, R, S, or T
d = Process Sealing: K, G, E, V, S, I, F, or M
e = Wetted Materials: S0, S1, C0, B0, T0, T1, C2, C4, A5, P0, P1, P2, S2, Z0, A0, S3, or S4
f = Optical path probes and extractive cell: 20, 40, 80, 01, 02, 03, 04, 05, 06, 10, or XX
g = Process Connection: PD, PA, LD, LA, GD, GA, MD, MA, ND, NA, W1, W2, W3, W4, W5, W6, S1, S2, S3, S4, S5, S6, J1, J2, J3, J4, J5, J6, J7, J8, J9, EM, or EI
h = Wall Thickness: 1, 2, 3, 4, 5, 6, or X
i = Filter: A, B, C, D, E, F, or X
j = Thermal Barrier: S or H
k = Communication Interface: X or A

13. **Specific Conditions of Use:**

None

14. **Test and Assessment Procedure and Conditions:**

This Certificate has been issued in accordance with FM Approvals US Certification Requirements.

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Figure 82 FM-Certificate. FM Approvals (page 2/3).

SCHEDULE

US Certificate Of Conformity No: FM16US0256

15. **Schedule Drawings**

A copy of the technical documentation has been kept by FM Approvals.

16. **Certificate History**

Details of the supplements to this certificate are described below:

Date	Description
9th January 2013	Original Issue.
19th August 2016	Supplement 4: Report Reference: RR206189, dated 19th August 2016 Description of the Change: revised model code, label drawing and manual.

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Figure 83 FM-Certificate. FM Approvals (page 3/3).

9 Troubleshooting

9.1 Error messages in the control unit

During operation essential status information about the instrument is displayed on M400. The instrument messages and their possible explanations and actions to be taken are given in the table below.

Table 11 Error messages

Fault message	Explanations and actions	Action
Signal Process Failed	Error during the fitting procedure	FAULT
Laser Source Error	Laser line not stable	FAULT
Bad Signal Quality	Transmission absent or too low; Signal too noisy	FAULT
Flashcard Error	Database error	FAULT
Simulation Mode Active	O_2 value manually set, not measured	FAULT
Pressure Input Error	4–20 mA signal out of range	MAINTENANCE REQUIRED
Pressure Input Invalid	Pressure out of range	MAINTENANCE REQUIRED
T Input Error	4–20 mA signal out of range	MAINTENANCE REQUIRED
T Input invalid	Pressure out of range	MAINTENANCE REQUIRED
Diskspace Low	Diskspace on flashcard low	MAINTENANCE REQUIRED
Laser Control Error	Failure or malfunction of laser temperature controller	FAULT
Internal T Exceeded	System board temperature exceeds range	MAINTENANCE REQUIRED
Configuration Mode	Ethernet connection active	MAINTENANCE REQUIRED
Hardware Error	Software-hardware inconsistent; on-board voltage out of range	FAULT
Laser Source Error	Laser current zero or out of range	FAULT

Messages	Comment	Action	Source	Relay State	Mapping
No sensor on channel 3	The M400 is unable to detect any of the ISM sensor(s) it can identify. If no sensor is found it will disply the message NO SENSOR DETECTED	– This is the initial message after Power on. – Wait for the GPro™ 500 to fully boot. – Check if the GPro™ 500 is powered and wait until the system is fully started. – Check the RS485 wiring of the GPro™ 500 to the M400 – Check with the MT-TDL software and the Ethernet port if the system is running correctly. – If timeout still occurs after 60 s, send unit back to METTLER TOLEDO.	M400	Fault	B disconnected
Signal Processing Failed	Fitting of the line profiles failed.	Send unit back to METTLER TOLEDO	TDL	Fault	Software error
Laser Source Error	The laser wavelength has shifted. Readjustment of the laser temperature necessary	Send unit back to METTLER TOLEDO	TDL	Fault	System error
Bad Signal Quality	Transmission lower than 5% threshold	Clean corner cube and process window. Check the gasket between TDL and probe. Rotate TDL on the probe to maximize Transmission. Reduce the dustload in the process.	TDL	Fault	System error
Flashcard Error	Missing or bad calibration and/or database data	Perform a calibration with the calibration tube. If still not successful, send unit back to METTLER TOLEDO for Flashcard exchange.	TDL	Fault	Software error
Pressure Input Error	Pressure reading out of extended range: 0.6 bara < P < 8 bara 4 – 20 mA input error: 4 mA > P > 20 mA	Check external pressure sensor and mapping	TDL	Maintenance request	System error
Temperature Input Error	Pressure reading out of extended range: –20°C<T<1000°C 4 – 20 mA input error: 4 mA > P > 20 mA	Check external temperature sensor and mapping	TDL	Maintenance request	System error
Configuration Mode	Ethernet port in use: diagnostic or configuration in progress	Disconnect Ethernet cable	TDL	Maintenance request	Software error
The GPro™ 500 error messages can be found in the M400 under the following path: Menu → Service → Diagnostics → TDL → Messages					

10 Decommissioning, Storage and Disposal

Please refer to chapter 1.1 (Safety information) on page no 11. Decommissioning may only be carried out by persons with appropriate training or by skilled technicians.

10.1 Decommissioning

Proceed as described in chapter 7.3.2 (Remove the probe or wafer cell from the process) on page no 97.

10.2 Storage

Store the GPro 500 in a dry place.

10.3 Disposal

It is recommended that the operator disposes of the device in accordance with local regulations. The operator must deliver the device either to a licensed private or public disposal company, or dispose of it himself in accordance with prevailing regulations. Waste is to be recycled or disposed of without causing any risk to human health, and without using procedures or methods that might harm the environment.

EC guidelines 75/442/EEC
91/156/EEC

Sorting

Sorting into waste groups takes place when dismantling the device. The groups are listed in the current European Waste Catalogue. This catalog is valid for all wastes, whether intended for disposal or for recycling.

The packaging is made up of the following materials:

- Cardboard
- Foam plastic

The housing is made of the following materials:

- Steel
- Polypropylene
- Medium wetted polymers as given in the specifications

Appendix 1 Compliance and Standards Information

- The GPro 500 TDL complies with the European Community "Electromagnetic Compatibility Directive" and "Low Voltage Directive".
- The TDL is rated in accordance to Over voltage Category II, Pollution Degree.
- The TDL complies with the Class B digital apparatus requirements of ICES-003 of Canada through the application of EN 55011:2007.
- L'analyseur est conforme aux Conditions B numériques d'appareillage de classe de NMB-003 du Canada par l'application du EN 55011:2007.
- This TDL complies with Part 15 of the US FCC Rules for Class B equipment. It is suitable for operation when connected to a public utility power supply that also supplies residential environments.
- The TDL has been assessed to IEC 61010-1:2001 +Corr 1: 2002 + Corr 2:2003 for electrical safety including any additional requirements for US and Canadian national differences.
- Mettler Toledo Ltd is a BS EN ISO 9001 and BS EN ISO 14001 certified organization.

Appendix 2 Spare Parts and Accessories

2.1 Configuration Options

The complete ordering information of the GPro 500 can be depicted from the table below. An example order number might be GPro 500-ATBGR4404390_D12HT-AX which would be a unit with ATEX Ex d approval, standard window, standard O-ring, steel of quality 316L, a probe length of 390 mm, a process flange with the dimension DN50/PN25 and a thermal barrier.

Table 12 GPro 500 Product key

Gas Analyzer	GPro™	5	0	0	A	T	A	0	P	B	K	S	0	2	0	P	D	1	X	S	_	_	/	_	X
30 027 126	GPro™	5	0	0	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/IECEx Ex d					A	T																			
FM Class 1 Div 1					U	S																			
Gases																									
Oxygen							A	0																	
Oxygen and Temperature							A	1																	
CO							C	0																	
H_2O							H	0																	
CO_2%							C	2																	
CO%							C	1																	
CO% + CO_2%							C	C																	
H2S							S	1																	
HCl ppm							L	0																	
Process interface																									
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 sealing*																									
Kalrez 6375											K														
Graphite											G														
Kalrez (FDA grade) 6230											F														
Wetted materials*																									
1.4404 (equivalent to 316L)												S	0												
1.4571												S	1												
Hastelloy C22												C	0												
Optical path probes and extractive cell*																									
200 mm														2	0										
400 mm														4	0										
800 mm														8	0										
1 m														0	1										
2 m														0	2										

Gas Analyzer	GPro™	5	0	0	A	T	A	0	P	B	K	S	0	2	0	P	D	1	X	S	_	_	/	_	X
30 027 126	GPro™	5	0	0	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	/	Y	Y
* Other configurations upon request																									
3 m														0	3										
4 m														0	4										
5 m														0	5										
6 m														0	6										
10 m														1	0										
None														X	X										
Process connection*																									
DN 50/PN 25																P	D								
ANSI 2"/300 lbs																P	A								
DN 50/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								
DN 50/PN 16																W	1								
DN 80/PN 16																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							
Filter*																									
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						
Thermal barrier*																									
No thermal barrier (up to 250 °C)																				S	_	_	/	_	
With thermal barrier (up to 600 °C)																				H	_	_	/	_	
Communication interface																									
RS 485 (for M400)																									X
RS 485 and direct Analog (SIL)																									A

2.2 Spare parts

Table 13 Spare parts

Spare parts	Order number
O_2 Corner Cube Module A0 B B0	on request
O_2 Corner Cube Module A0 Q S0	on request
O_2 Corner Cube Module B 4404	30 038 091
O_2 Corner Cube Module Q 4404	30 038 092
Corner Cube Module C0 F Q S0	30 111 366
Corner Cube Module H0 F B S0	30 111 367
Corner Cube Module H0 F Q S0	30 111 368
Kit Flat gasket ST	30 080 914
Kit Flat gasket HT (Graphite)	30 080 915
Filter S0 20 1 (40 µm)	30 111 369
Filter S0 20 2 (100 µm)	30 111 370
Filter S0 20 3 (200 µm)	30 111 371
Filter S0 40 1 (40 µm)	30 111 372
Filter S0 40 2 (100 µm)	30 111 373
Filter S0 40 3 (200 µm)	30 111 374
Filter S0 80 1 (40 µm)	30 111 375
Filter S0 80 2 (100 µm)	30 111 376
Filter S0 80 3 (200 µm)	30 111 390

2.3 Accessories

Table 14 Accessories

Accessories	Order number
Thermal barrier	30 034 138
Junction box	30 034 149
Junction box with 24 VDC power supply	30 260 135
Purging box for M400 Ex d	30 034 148
Calibration kit	30 034 139
Gasket for process flange (82.14 x 3.53 mm)	To be provided by the user
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
M400, Type 3	52 121 350
M400 Pipe mount kit	52 500 212
M400 Panel mount kit	52 500 213
M400 Protective hood	52 500 214
GPro Pin Spanner	30 129 726

Appendix 3 Disposal in Accordance with the Waste Electrical and Electronic Equipment (WEEE) Directive

The GPro 500S TDL is not considered to be within the scope of the Waste Electrical and Electronic Equipment (WEEE) Directive.

The TDL is not intended for disposal in a municipal waste stream, but shall be submitted for material recovery and recycling in accordance with any appropriate local regulations.

For additional information and advice on the disposal of the TDL, contact Mettler Toledo:

Mettler-Toledo GmbH
Im Hackacker 15
CH-8902 Urdorf
Switzerland
Tel: +41 44 729 61 45
Fax: +41 44 729 62 20
Global e-mail: info@mt.com

If you send the TDL to Mettler Toledo or your local Mettler Toledo agent (see Sales and Service on page no 130) for disposal, it must be accompanied by a correctly completed decontamination certificate.

Appendix 4 Equipment Protection

4.1 Traditional Relationship of Equipment Protection Levels (EPLs) to Zones

Equipment Protection Level Zone (EPL)	Zone
Ga	0
Gb	1
Gc	2
Da	20
Db	21
Dc	22

When these are used in the installation, no further risk assessment is required. Where a risk assessment has been used, this relationship can be broken so as to use a higher or lower level of protection.

For more information on Equipment Protection Levels (EPLs) refer to Annex D of IEC 60079-0:2007 or EN 60079-0:2009

Ga 0 Gb 1 Gc 2 Da 20 Db 21 Dc 22

4.2 Relationship of Equipment Protection Levels to ATEX Categories

Equipment Protection Level Zone (EPL)	ATEX Category
Ga	1G
Gb	2G
Gc	3G
Da	1D
Db	2D
Dc	3D

Appendix 5 ESD Guidelines

ESD (ElectroStatic Discharge)

ESD is the rapid, spontaneous transfer of electrostatic charge induced by a high electrostatic field. Electrostatic damage to electronic devices can occur at any point from manufacture to field service. Damage results from handling the devices in uncontrolled surroundings or when poor ESD control practices are used. Generally damage is classified as either a catastrophic failure or a latent defect.

A catastrophic failure means that exposure to an ESD event has caused an electronic device to stop functioning. Such failures can usually be detected when the device is tested before shipment.

A latent defect, on the other hand, is more difficult to identify. It means that the device has only been partially degraded from exposure to an ESD event. Latent defects are extremely difficult to prove or detect using current technology, especially after the device is assembled into a finished product.

Usually, the charge flows through a spark between two objects at different electrostatic potentials as they approach one another.

It is of utmost importance that ESD protective procedures are used during service in the field. The components used in GPro 500 have all been protected from ESD through the whole production chain.

Ground Everything

Effective ESD grounds are of critical importance in any operation, and ESD grounding should be clearly defined and regularly evaluated. According to the ESD Association Standard ANSI EOS/ESD all conductors in the environment, including personnel, must be bonded or electrically connected and attached to a known ground, bringing all ESD protective materials and personnel to the same electrical potential. This potential can be above a „zero" voltage ground reference as long as all items in the system are at the same potential. It is important to note that non-conductors in an Electrostatic Protected Area (EPA) cannot lose their electrostatic charge by attachment to ground.

ESD guidelines

In many facilities, people are one of the prime generators of static electricity. Therefore, wrist straps must be used while carrying out maintenance and service on the GPro 500, to keep the person wearing it connected to ground potential. A wrist strap consists of the cuff that goes around the person's wrist and the ground cord that connects the cuff to the common point ground.

Work Surface

An ESD protective work surface is defined as the work area of a single individual, constructed and equipped to limit damage to ESD sensitive items. The work surface helps to define a specific work area in which ESD sensitive devices may be safely handled. The work surface is connected to the common point ground by a resistance to ground of 106 Ohms to 109 Ohms. This is done by using a soft bench mat, which is connected to ground, on the work surface. All equipment must be connected to grounded outlets and all personnel must wear wrist straps connected to the bench mat using a cord.

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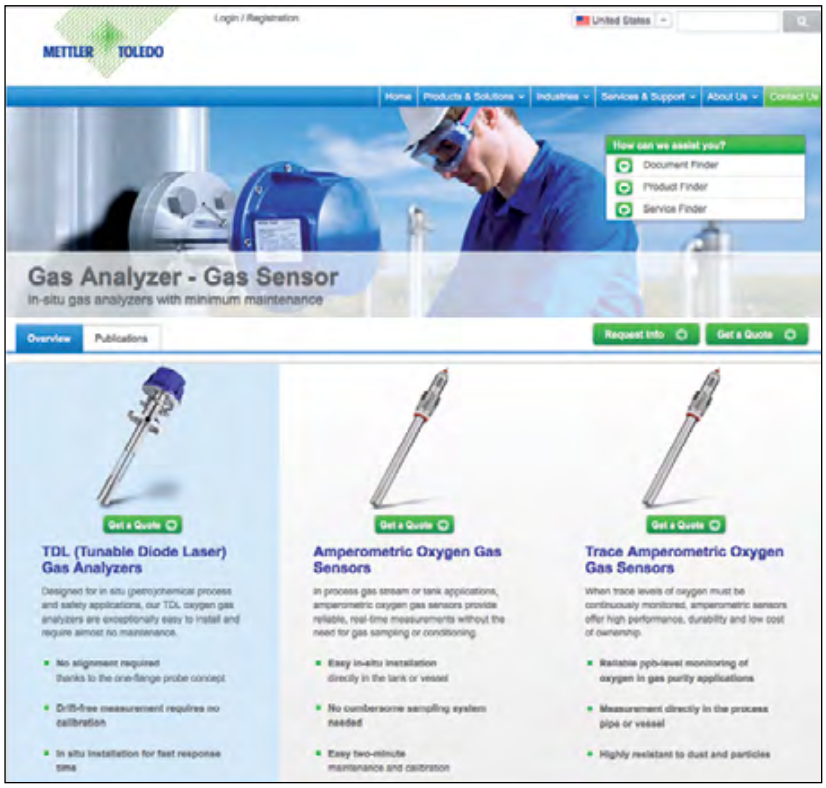

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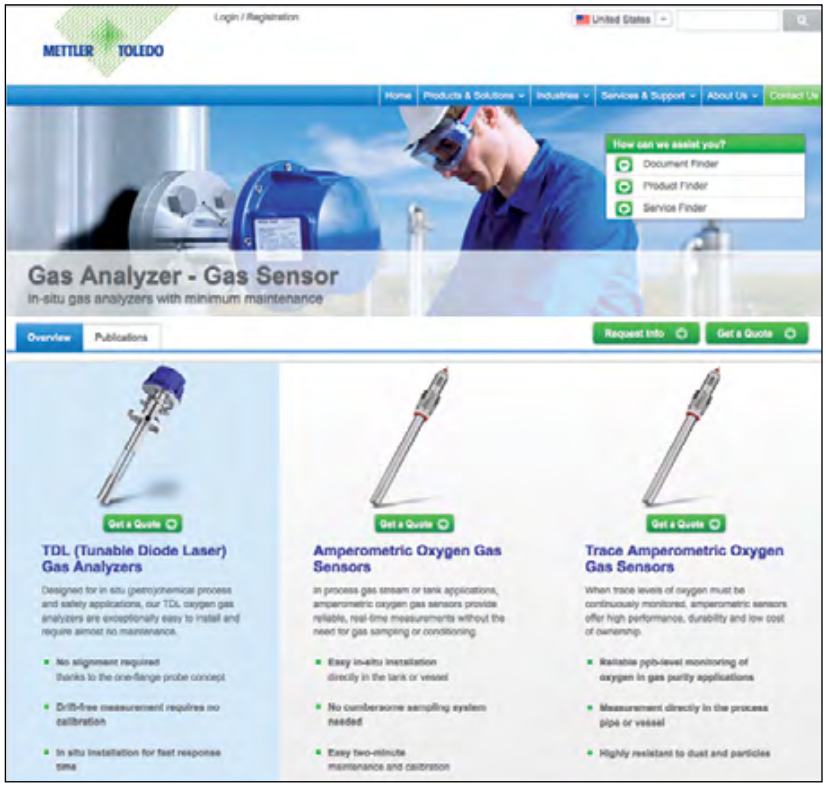

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