

# TDLS GPro™ 500

## Tunable Diode Laser Spectrometer for O<sub>2</sub>



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 76 and Relationship of Equipment Protection Levels to ATEX Categories on page no 95.

**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.

### 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. Do not use alternating current or main power supply.

	<b>WARNING</b> Installation of cable connections and servicing of this product require access to shock hazard voltage levels.
--	--

	<b>WARNING</b> Power supply and relay or open collector (OC) contacts wired to separate power source must be disconnected before servicing.
--	--

	<b>WARNING</b> Power supply must employ a switch or circuit breaker as the disconnecting device for the equipment.
--	---

	<b>WARNING</b> Electrical installation must be in accordance with the National Electrical Code and/or any other 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



	<b>WARNING</b> Devices of these series are approved for operation in hazardous locations.
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	<b>WARNING</b> 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



#### 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<sup>2</sup> to 1.5 mm<sup>2</sup> (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**

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



**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.

**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<sup>2</sup> to 1.5 mm<sup>2</sup> (AWG 24–16).



**WARNING**

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

**Correct disposal of the unit**

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

## 1.4 Measuring principle

The GPro™ 500 TDL is an optical instrument designed for continuous in-situ gas monitoring in stack, pipes and similar applications and is based on tunable diode laser absorption spectroscopy (TDLAS). The GPro™ 500 TDL 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.



In order for the purging of GPro™ 500 TDL to work properly the process gas needs to flow at the measuring point – read more about this in chapter 2.2 (Flow conditions at measuring point) on page no 28 and chapter 3.1.2 (Process side purging) on page no 31.



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. In the case of oxygen described in this manual it is actually three lines that are used. The laser wavelength is scanned across the chosen absorption lines of the gas to be measured. 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. Furthermore, the use of three absorption lines gives a secure way of determining that the correct lines are used due to the fact that their relative height and position constitutes their „finger print“ – Spectra/D™ – see Figure 1 on page no 16. 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.

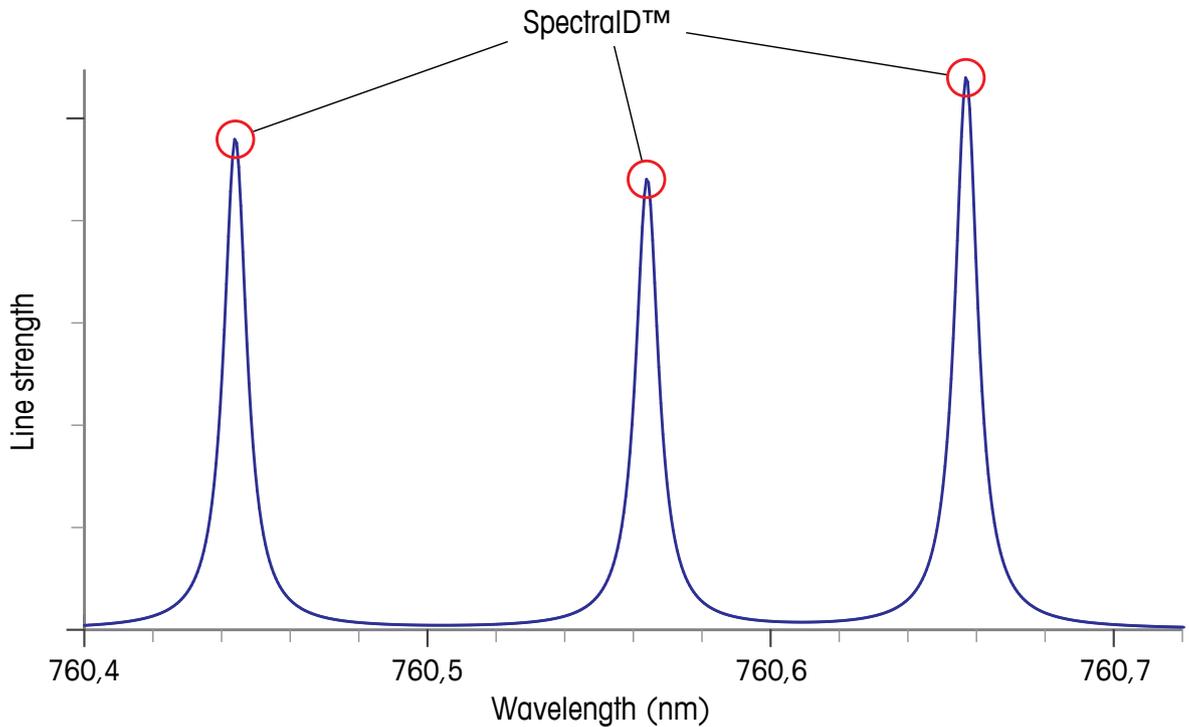


Figure 1 The SpectraID™ principle



The GPro™ 500 TDL measures the concentration of only the FREE molecules of the specific gas, thus not being sensitive to the molecules bound with some other molecules into complexes and to the molecules attached to or dissolved in particles and droplets. Care should be taken when comparing the measurements with the results from 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 98.

### 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.

### 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

#### **1.4.4 Cross interference**

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

##### **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 98).

## 1.5 Instrument description

The GPro™ 500 TDL consists of 3 separate units, the TDL head (The Sensor head attached to one out of three possible insertion probes), a junction box and the user interface (M400). Additionally purging with N<sub>2</sub> and pressure and temperature measurements must be available. The setup at the measuring point is illustrated in "Setup of GPro™ 500" on page no 19.

### 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 93). The 4–20 mA signals for temperature and pressure compensation are connected to the sensor's head through the connecting device. The Ethernet interface can be accessed through the connecting device as well. For more information in installation in hazardous areas, please refer to chapter 8 (Explosion Protection) on page no 76.

In standard setup, the GPro™ 500 is connected to the M400 that provides a convenient user interface for setting up the mandatory application-specific analyzer parameters during commissioning, for verification and calibration of the system, and for using the i/o capabilities built into the M400, 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 2 (Setup of GPro™ 500) on page no 19). For more information on the MT-TDL Software, please refer to chapter see 6 (Service) on page no 58.

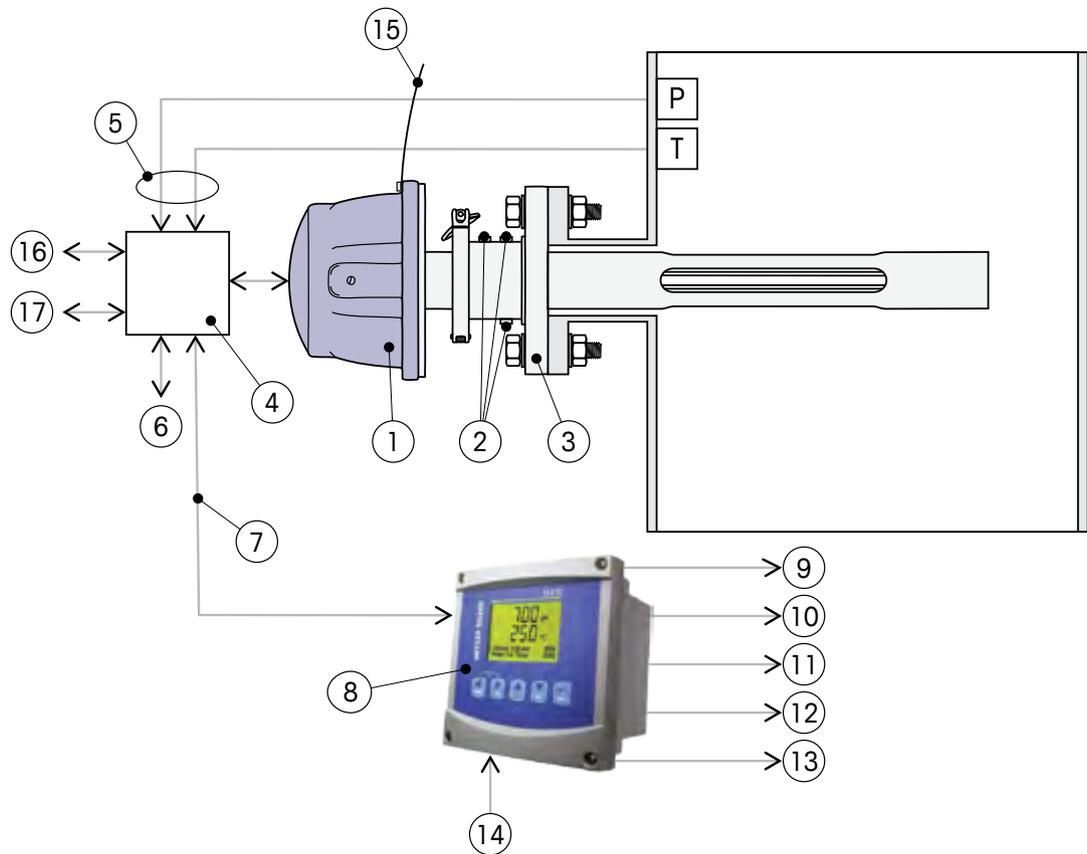


Figure 2 Setup of GPro™ 500

- 1 GPro™ 500 sensor head with insertion probe (here the 390 mm probe)
- 2 Purging with N<sub>2</sub>, 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 limit required.



Figure 3 GPro™ 500

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. Attached to the TDL head is the measurement probe. 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 of the GPro 500 on page no 40) and (Dimensions of the ANSI 2"/300lb flange of the GPro 500 on page no 40). The optical alignment is robust and reliable and does not require manual alignment, and the purging prevents dust and other contamination from settling on the optical surfaces.



Figure 4 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 5 M400 transmitter Type 3

For more information refer to chapter 7.1 (M400) on page no 70 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 93 – Purging box for M400.

## 1.5.2 Sensor head

The combined transmitter and receiver unit is called the TDL head. This part 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 parts of the sensor head are non-wetted and never get in contact with the process. The power required for the sensor head is 24 V, 5 W minimum.

### 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.



### 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 92

The terminals are suitable for single wires/flexible leads 0.2 mm<sup>2</sup> to 1.5 mm<sup>2</sup> (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 probe

The probe exists in several standard versions where 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 does the following:

- **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 58 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), around 760 nm. 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**

<b>Size and weight</b>	
Dimensions	524,5 x Ø175,5 mm
Weight	8 kg

<b>Material of construction</b>	
Steel	316L
Optical elements	AR coated Quartz, AR coated Borosilicate
Seals	Kalrez® 6674, Graphite compounds

<b>Measurement</b>	
Effective optical path length (EPL)	Fixed 100, 200 and 400 mm, depending on probe 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).
Detection limit	0.01% Vol (100 ppmv) with 1 m path length and ambient standard conditions (no dust load, dry gas, O2 in N2)
Display units	ppm-v, % Vol O2
Accuracy	2% of reading or 100 ppm, whichever is bigger
Linearity	Better than 1%
Resolution	<0.01% Vol O2 (100 ppmv)
Zero drift	Negligible (<2% of measuring range between maintenance intervals)
Sampling rate	1 s
Repeatability	± 0,25 % of reading or 0,05% O2 whichever is greater.
Response time (T90)	O2 in N2, 21% to 0% in < 2 s

<b>Electrical inputs &amp; outputs</b>		
	Number of outputs (analog)	2 (optional)
	Current outputs	Passive 4...20 mA outputs, galvanically isolated, alarms to 3.6 mA or 22 mA conform to NAMUR NE43 guidelines
	Measurement error through analog outputs	Non-linearity $<\pm 0.002$ mA over the 1 to 20 mA range Offset error $<\pm 0.004$ mA (zero scale) Gain error $<\pm 0.04$ 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	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

<b>Calibration</b>		
	Calibration (factory)	Full calibration
	Calibration (user)	One-point and process calibration

<b>Operating conditions</b>		
	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	Typically < 1 minute
Purging	
Instrument side purging	Yes, flow < 0.5 l/min.
Data logger	
Function	Logging of all sensor data on SD card
Interval	See chapter 6.3.3 (Data logging) on page no 65.
Format	SPC

**Table 2 Product data probe**

Size and weight	
Probe lengths	Short probe: Physical length: 290 mm Effective length: 100 mm Medium probe: Physical length: 390 mm Effective length: 200 mm Long probe: Physical length: 590 mm Effective length: 400 mm
Weight	4 kg (290 mm probe) 5 kg (390 mm probe) 6 kg (590 mm probe)

Material of construction	
Steel (medium-wetted)	1.4404 (comparable to 316L), C22 Hastelloy
Optical elements	AR coated Quartz, AR coated Borosilicate
Seals	Kalrez® 6375, Graphite compounds

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

Purging	
Process side purging	Nitrogen, >99.7 % purity (minimum recommended), 0.5...5 l / min. (any other "O2 free" clean and dry gas can be used, the purity requirements are: conform to standard set by ISO 8573.1, class 2-3, analog to instrument air)
	<b>WARNING:</b> Check valve is required (not provided with GPro™ 500 – see "Accessories" on page no 93).
Corner cube purging	Yes, via process side purging

<b>Operating conditions</b>		
	Temperature range	0... +250 °C (+ 32 ... +482 °F) optional: 0... +600 °C (+ 32 ... 1112 °F) with additional Thermal Barrier and graphite gaskets.
	Pressure range	Measuring: 5 bar (72.52 psi); max. pressure: 20 bar (290.1 psi)
	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)

<b>Installation</b>		
	Flange size	DN50/PN25 or ANSI 2"/300lb
	Required gasket for proper flange sealing (not provided with GPro™ 500 – see Appendix chapter 2.3 (Accessories) on page no 93.	Dimension: 82.14 x 3.53 mm

**Table 3 Product data M-400**

<b>Electrical inputs &amp; outputs</b>		
	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

<b>ISM diagnostics parameters</b>		
	% 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)

<b>Alarms triggers</b>		
	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 by 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 stack diameters of straight duct before and 3 stack diameters of straight duct after the point of measure. This will lead to laminar flow conditions which is favorable for stable measurement conditions.

### 2.3 Measuring head placement

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.

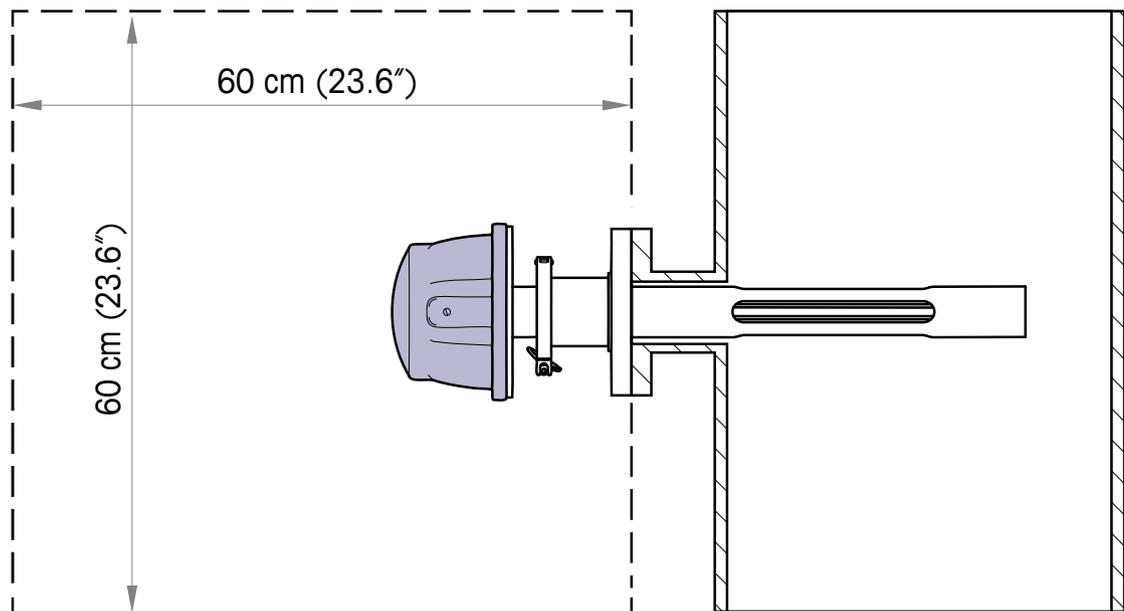


Figure 6 Minimum free space at the process flange.

## 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 facilitate 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 facilitate final adjustment of the probe head which may include rotation by max.  $\pm 90$  degrees. Please be sure to provide a coupling which is suitably long.

## 2.4 Flanges and stack hole requirements

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 of the GPro 500 on page no 40 and Dimensions of the ANSI 2"/300lb flange of the GPro 500 on page no 40.



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. See Minimum free space at the process flange. on page no 28.



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 43. Maximum cable length between sensor head and junction box is 5 m.

### 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<sup>2</sup> and the maximum length is 100 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 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.



If the process is running it is recommended to connect and turn on the purging at maximum flow before inserting the probe into the process. This is to avoid instant contamination of the optics.

##### 3.1.2 Process side purging

The GPro™ 500 is laser based and therefore it needs to expose optical surfaces to the process. These surfaces will be contaminated over time because of the process gas (dust, oxidation, etc.). Normally they will be contaminated very fast if the purging is lost or not sufficient. In order to extend the maintenance interval the surfaces are purged with a clean gas. Now, since GPro™ 500 measures oxygen, you can not purge with instrument air since it contains oxygen. The solution is to purge with Nitrogen or any other clean, non-explosive and dry O<sub>2</sub> free gas. GPro™ 500 is designed to consume as little nitrogen as possible and still keep the optical surfaces clean. The nitrogen consumption during normal operation is less than 1 l/min. which means that if you have ten bottles with 3300 StdLiters (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. The nitrogen consumption rarely exceeds 5 l/min.

##### 3.1.3 Process side purging

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 deposition onto the optical surfaces.

Another alternative is to use a nitrogen generator which will eliminate the hassle of the nitrogen bottle logistic. In some plants there will be Nitrogen available at large quantities which of course is the superior situation. However, N<sub>2</sub> purity, dryness and particle content must comply with the specification stated in ISO 8573.1, class 2–3, analog to instrument air.

The purging is attached to the 6 mm 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 7 (Optimizing the purge flow) on page no 32.

**WARNING**

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

**3.1.4 Adjusting the purging flow**

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.

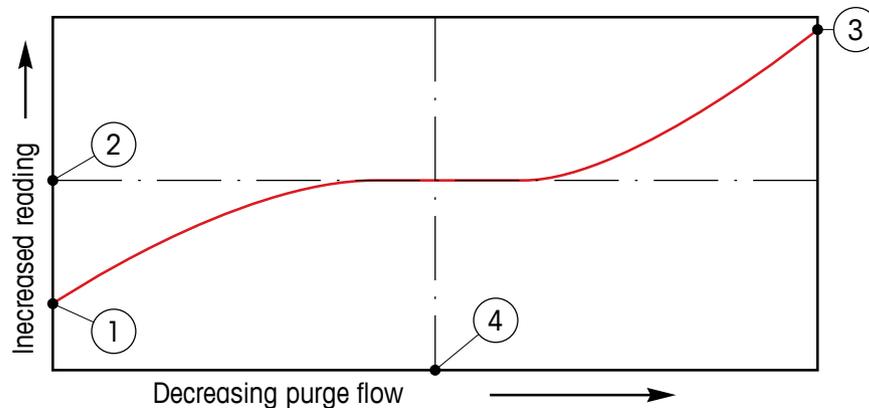


Figure 7 Optimizing the purge flow

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.

**WARNING**

The GPro™ 500 can not operate in process conditions where process gas stream is minimum to none. This would make the effective path length (see "Dimensions and Drawings" on page no 36) too variable.

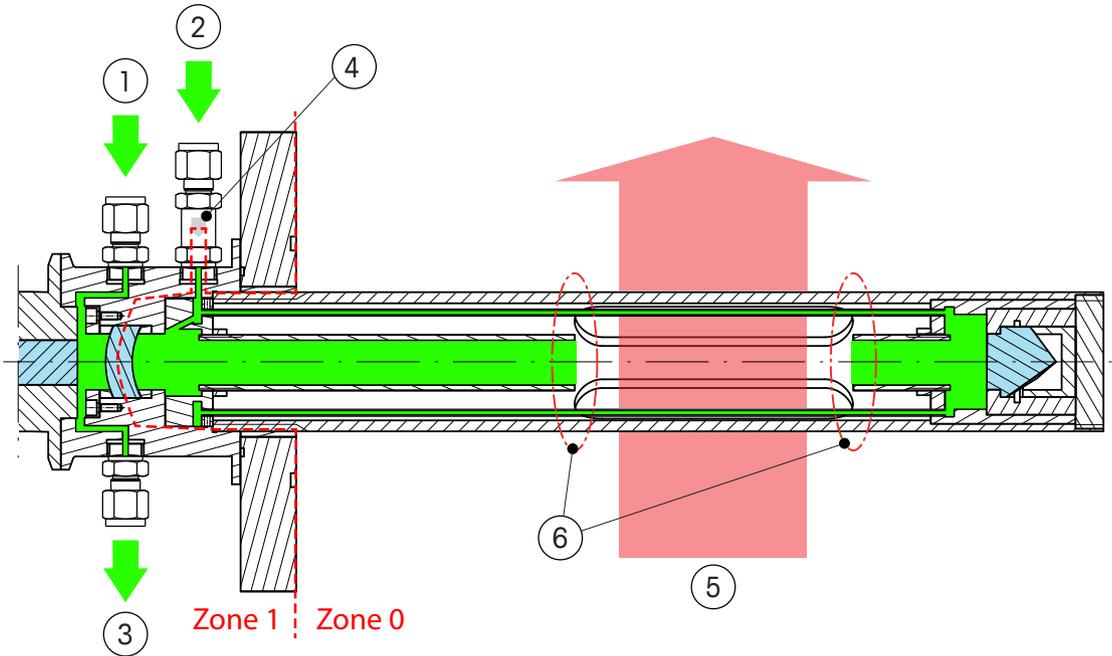


Figure 8 Purging configuration

- 1 Purge gas inlet for instrument side (6 mm Tube Fitting for DIN, 1/4" 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, 1/4" 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" on page no 32.

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 9 below.

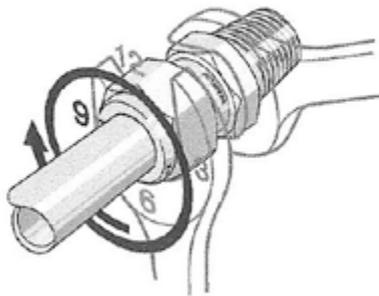


Figure 9 Connecting purge pipe to process side purge fitting.



**WARNING**

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

### 3.1.5 Instrument side purging

When oxygen is measured it is essential that all regions along the laser beam are free from oxygen – except for the measurement region.



#### WARNING

Instrument side purging must be sufficient in order to maintain the temperature of the sensor head below the maximum acceptable limit of  $<55\text{ }^{\circ}\text{C}$  ( $<130\text{ }^{\circ}\text{F}$ ).



#### WARNING

When the process gas stream is on, the instrument side purging must always be on in order to avoid ingress of gas stream into the sensor head.

### 3.1.6 Installing the thermal barrier

When the temperature of the process gas is above  $250\text{ }^{\circ}\text{C}$  the electronics and the laser in the encapsulation need to be protected. For this purpose the accessory "Thermal barrier" can be used. It isolates the heat sensitive parts by adding an extra cushion of purge gas between the housing and the process flange. The purge gas must then be led first through the thermal barrier and then into the probe according to the illustration below.

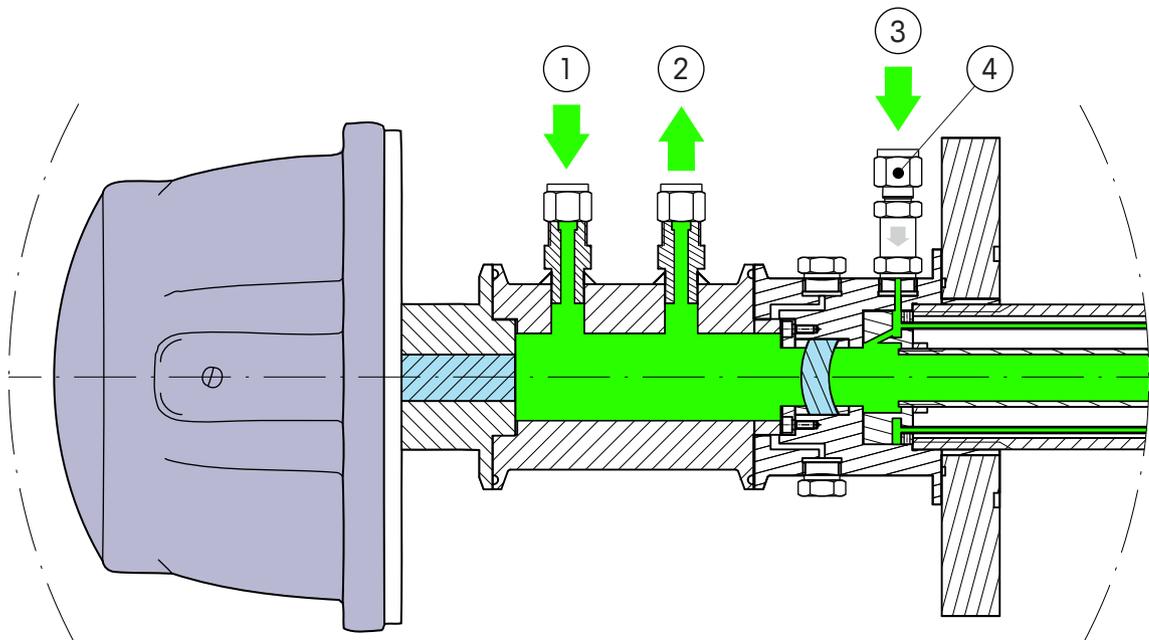


Figure 10 Purging configuration

- 1 Purge gas inlet for thermal barrier (6 mm Tube Fitting)
- 2 Purge gas outlet for thermal barrier (6 mm Tube Fitting)
- 3 Purge gas inlet for process side (Must have a check valve)
- 4 Mandatory check valve (to be supplied by the user)

## 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 your local supplier (see Sales and Service on page no 98) 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.



### 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 the DCS by the user.

## 4 Dimensions and Drawings

The GPro™ 500 is available with 3 different probe lengths. It can also be equipped with two flange sizes – DN50/PN25 and ANSI 2"/300 lb. 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**.

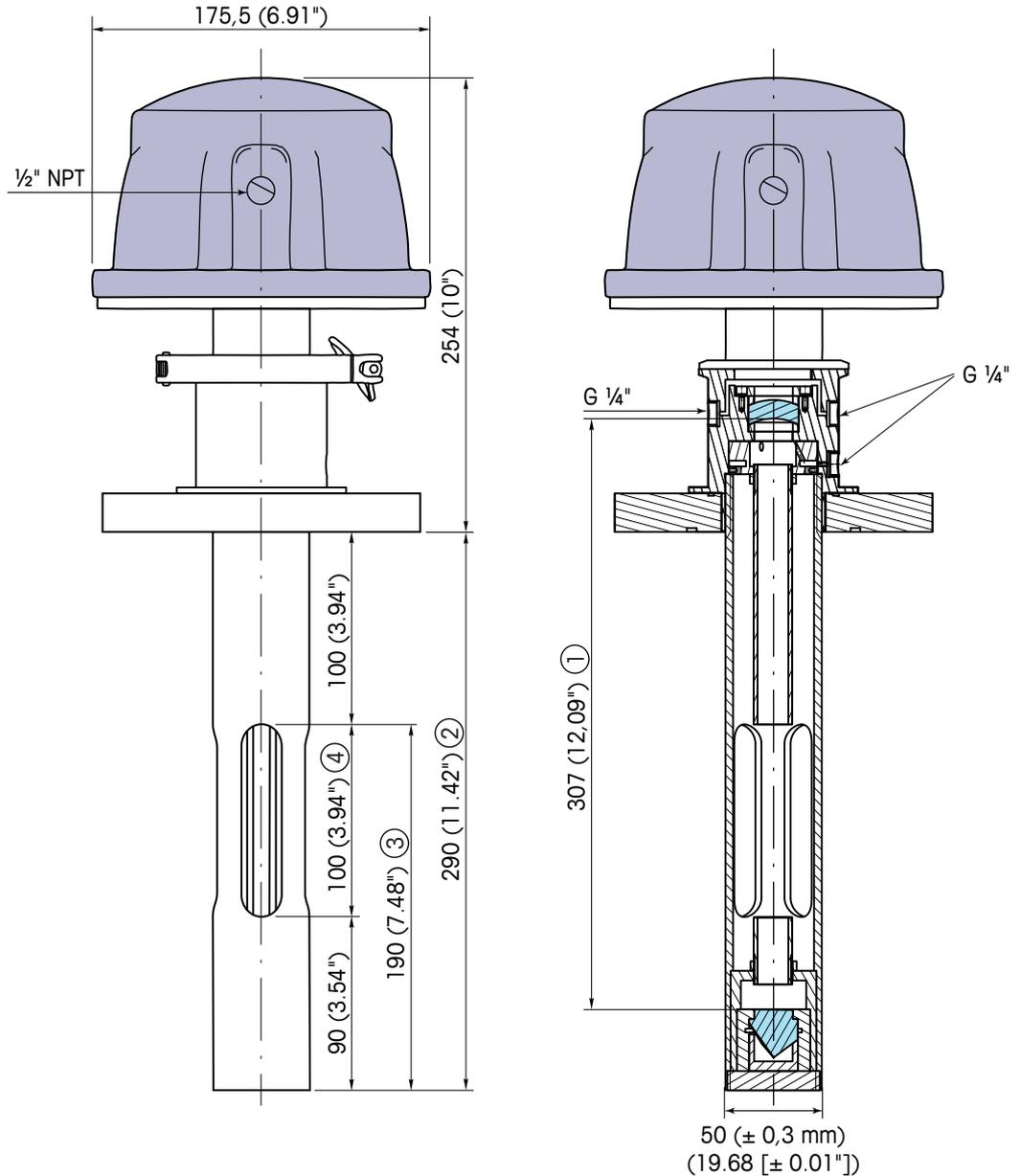


Figure 11 Dimensions of the 290 mm probe

Definition of the lengths:

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

**Table 4 Required flanges for some typical configurations**

Nominal path length	Probe length	Insertion length	Effective path length	Pipe size DN	Pipe size SPS	# of flanges
307 mm	290 mm	190 mm	100 mm	100 mm	4"	2
307 mm	290 mm	190 mm	100 mm	150 mm	6"	2
307 mm	290 mm	190 mm	100 mm	200 mm	8"	1
407 mm	390 mm	290 mm	200 mm	200 mm	8"	2
407 mm	390 mm	290 mm	200 mm	250 mm	10"	2
407 mm	390 mm	290 mm	200 mm	300 mm	12"	1
607 mm	590 mm	490 mm	400 mm	300 mm	12"	2
607 mm	590 mm	490 mm	400 mm	400 mm	16"	2
607 mm	590 mm	490 mm	400 mm	500 mm	20"	2
607 mm	590 mm	490 mm	400 mm	600 mm	24"	1

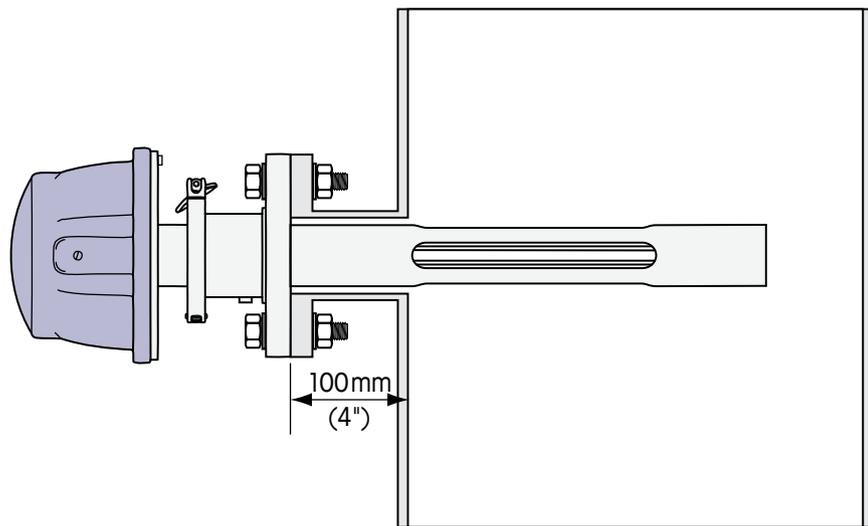


Figure 12 One flange configuration

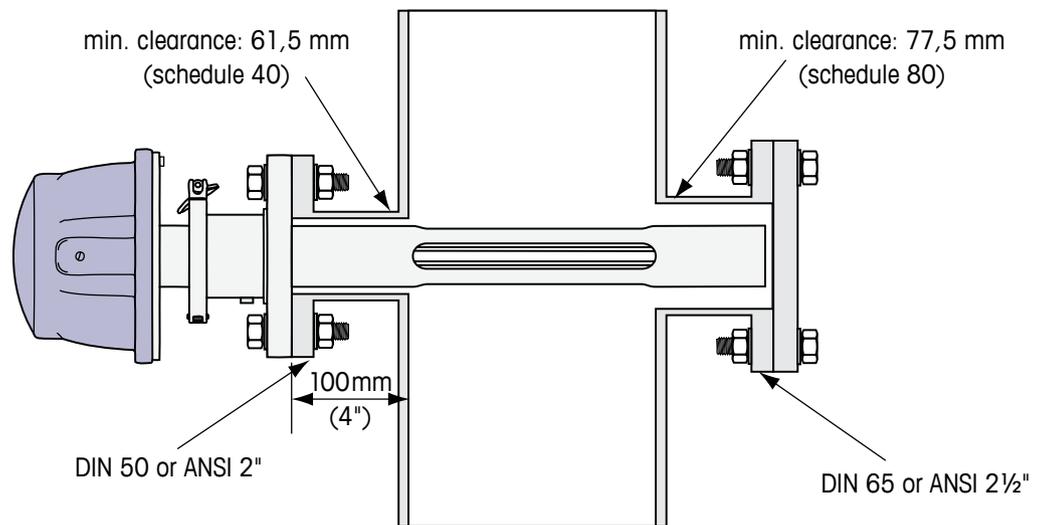


Figure 13 Two flange configuration

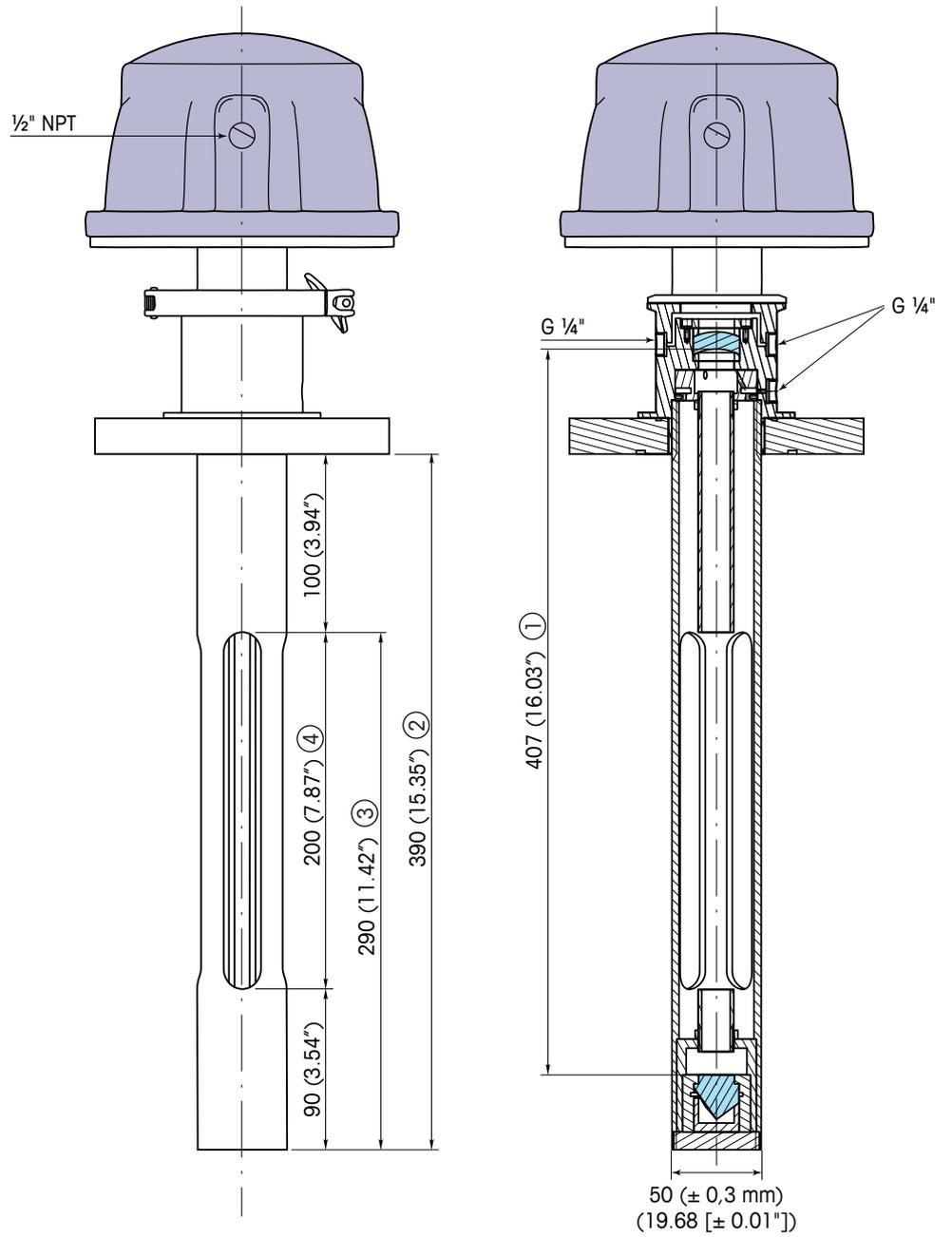


Figure 14 Dimensions of the 390 mm probe

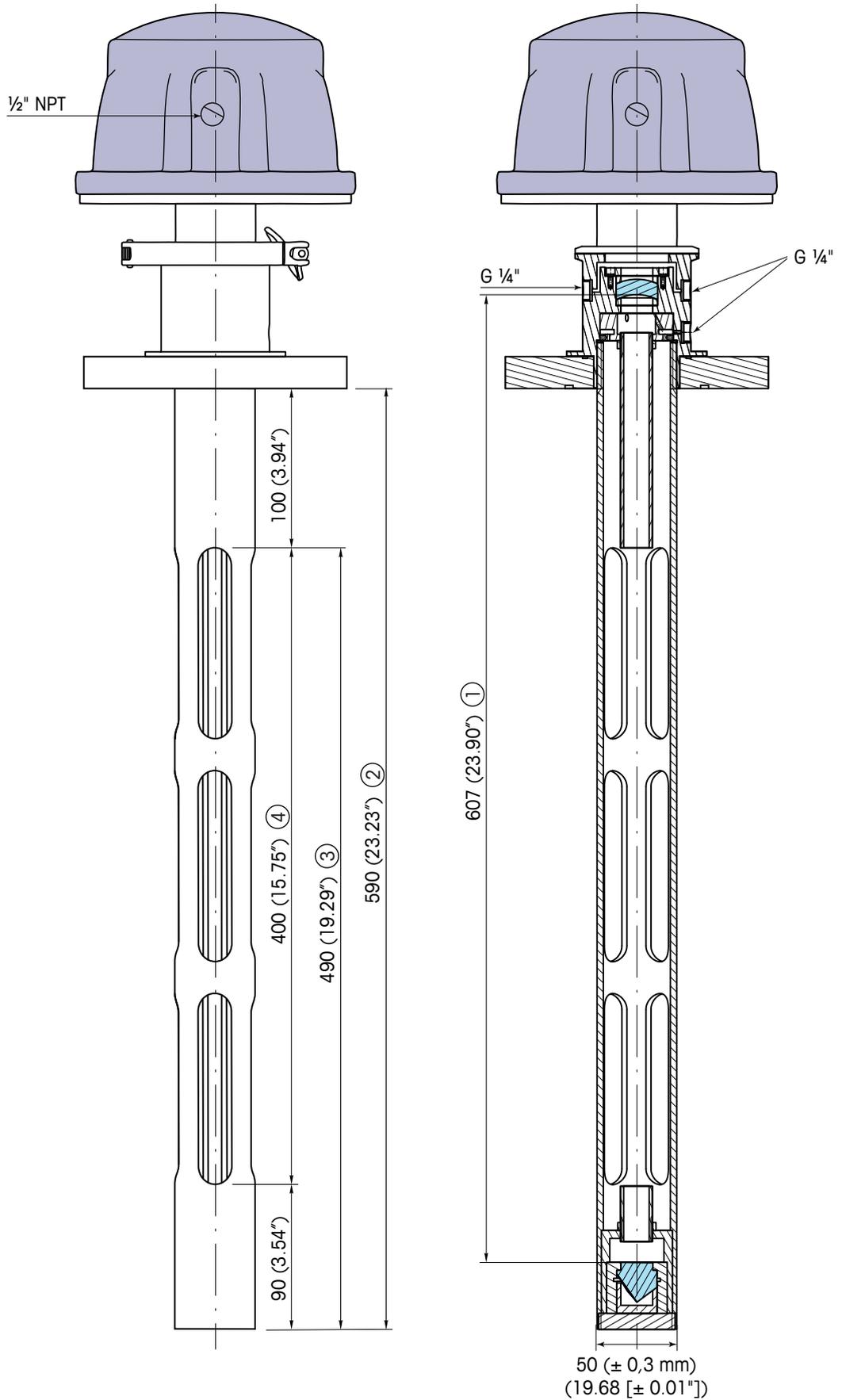


Figure 15 Dimensions of the 590 mm probe

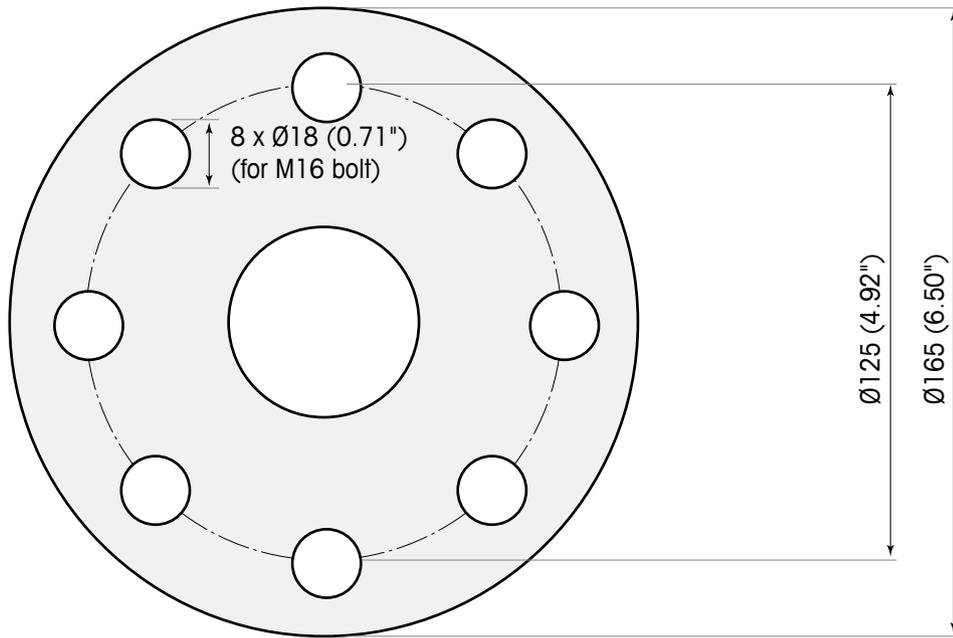


Figure 16 Dimensions of the DN50/PN25 flange of the GPro 500

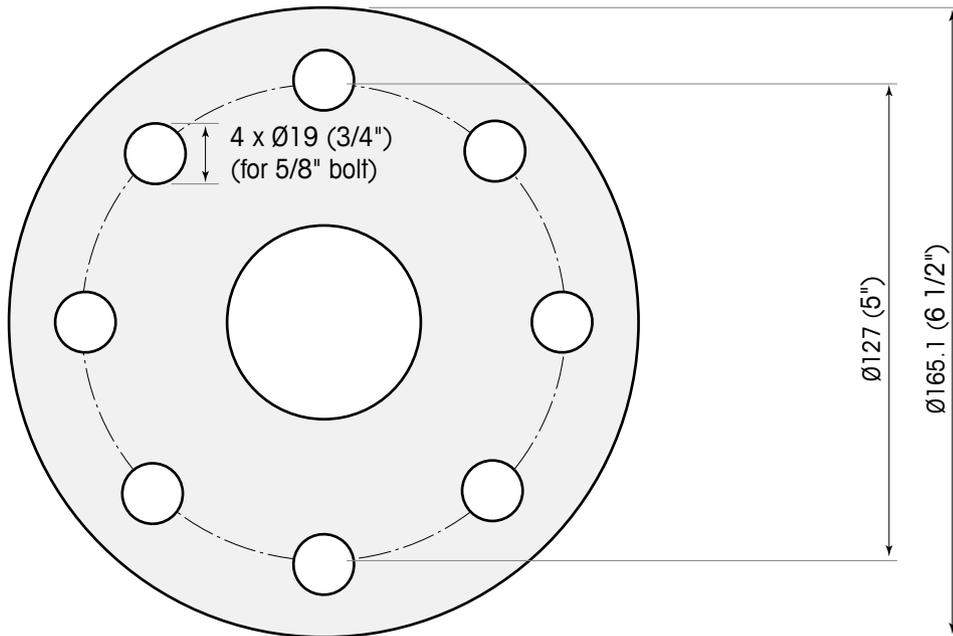


Figure 17 Dimensions of the ANSI 2"/300lb flange of the GPro 500

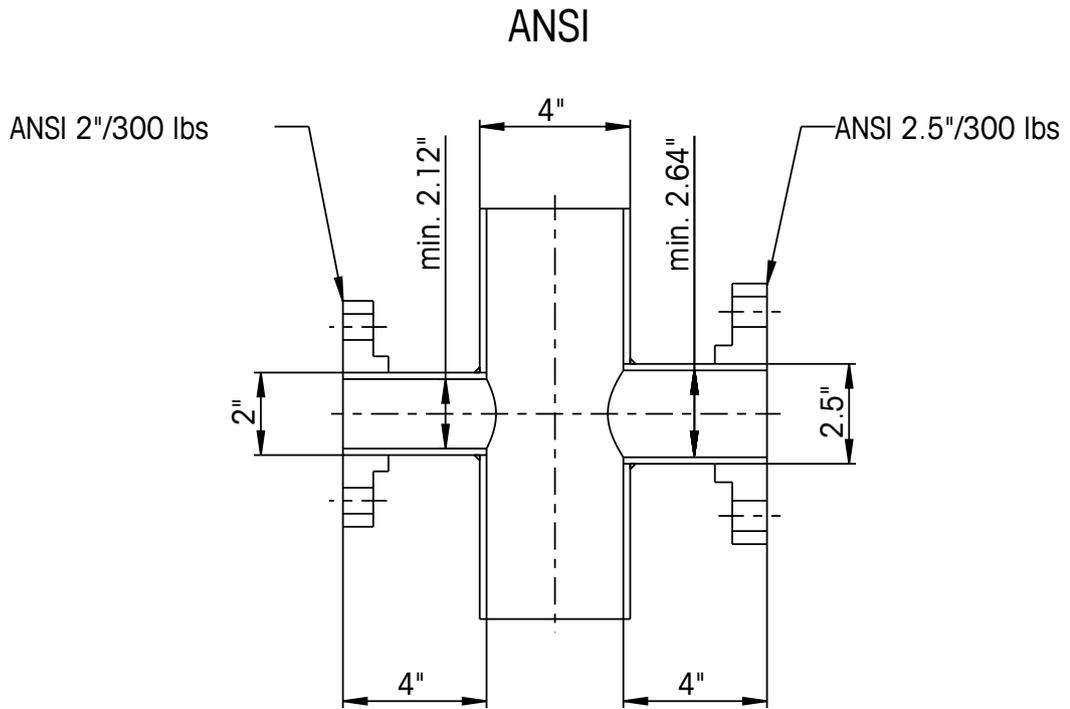
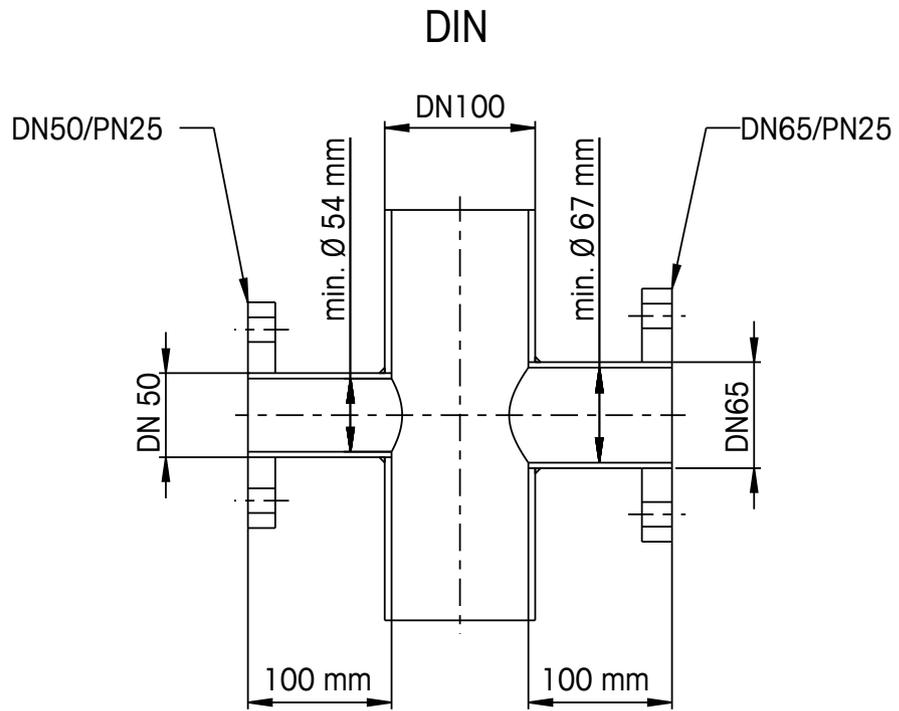


Figure 18 Recommended welded flange dimensions

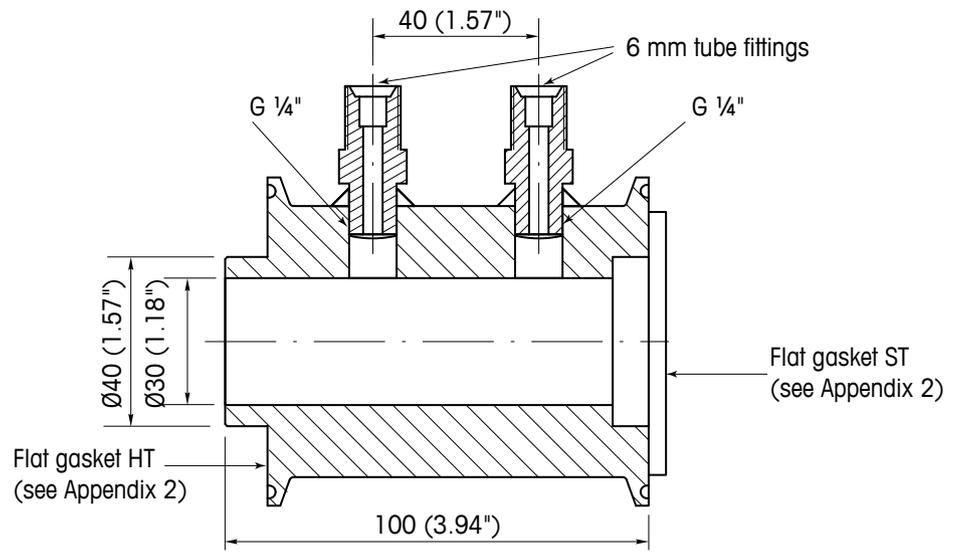


Figure 19 Dimensions of the thermal barrier.

## 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<sup>2</sup> to 1.5 mm<sup>2</sup> (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 of 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 20 on page no 46).
- 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 of 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 46 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.

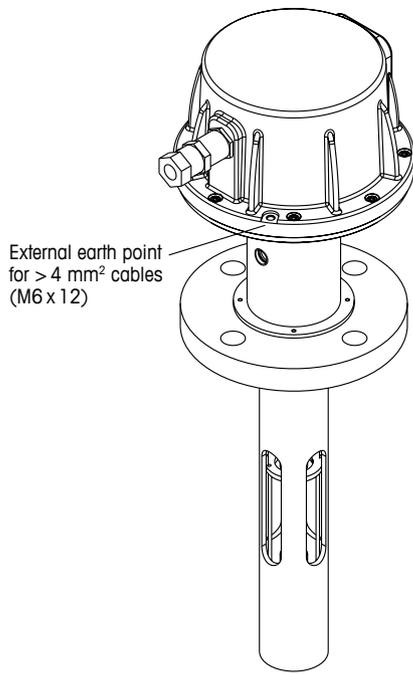


Figure 20 External earth point.

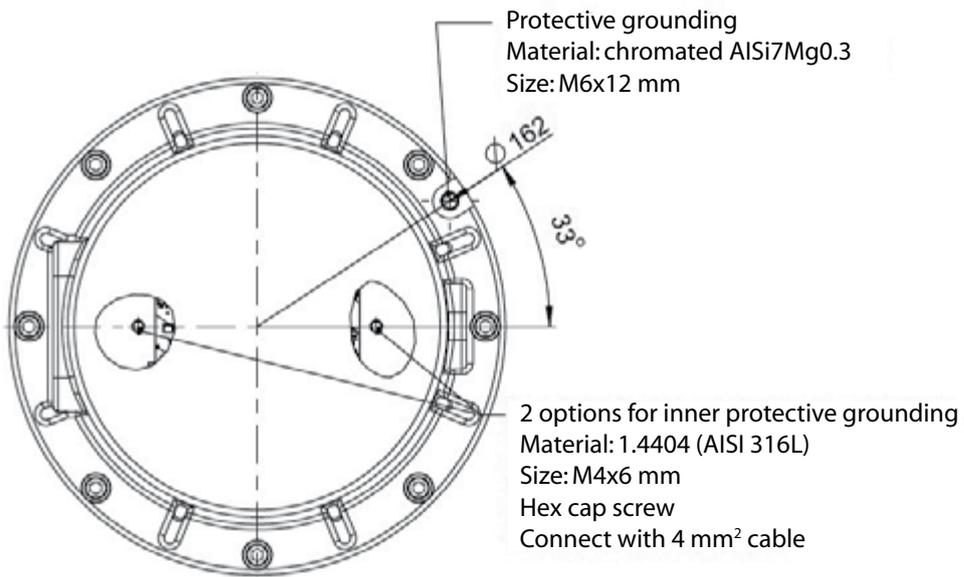


Figure 21 Protective Grounding.

## 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:

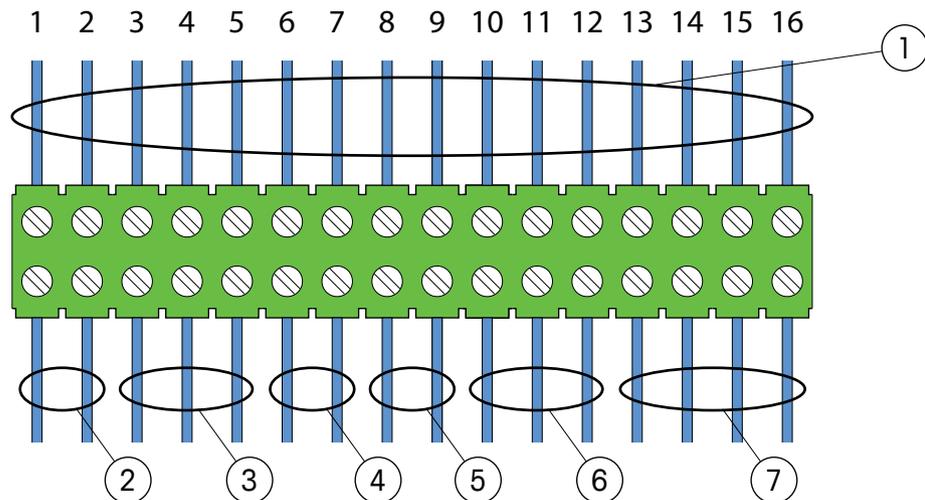
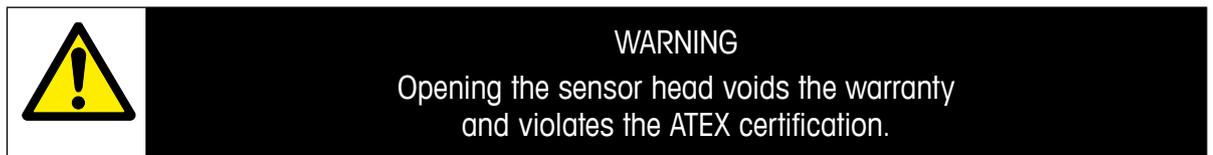


Figure 22 Connections in the junction box

- 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

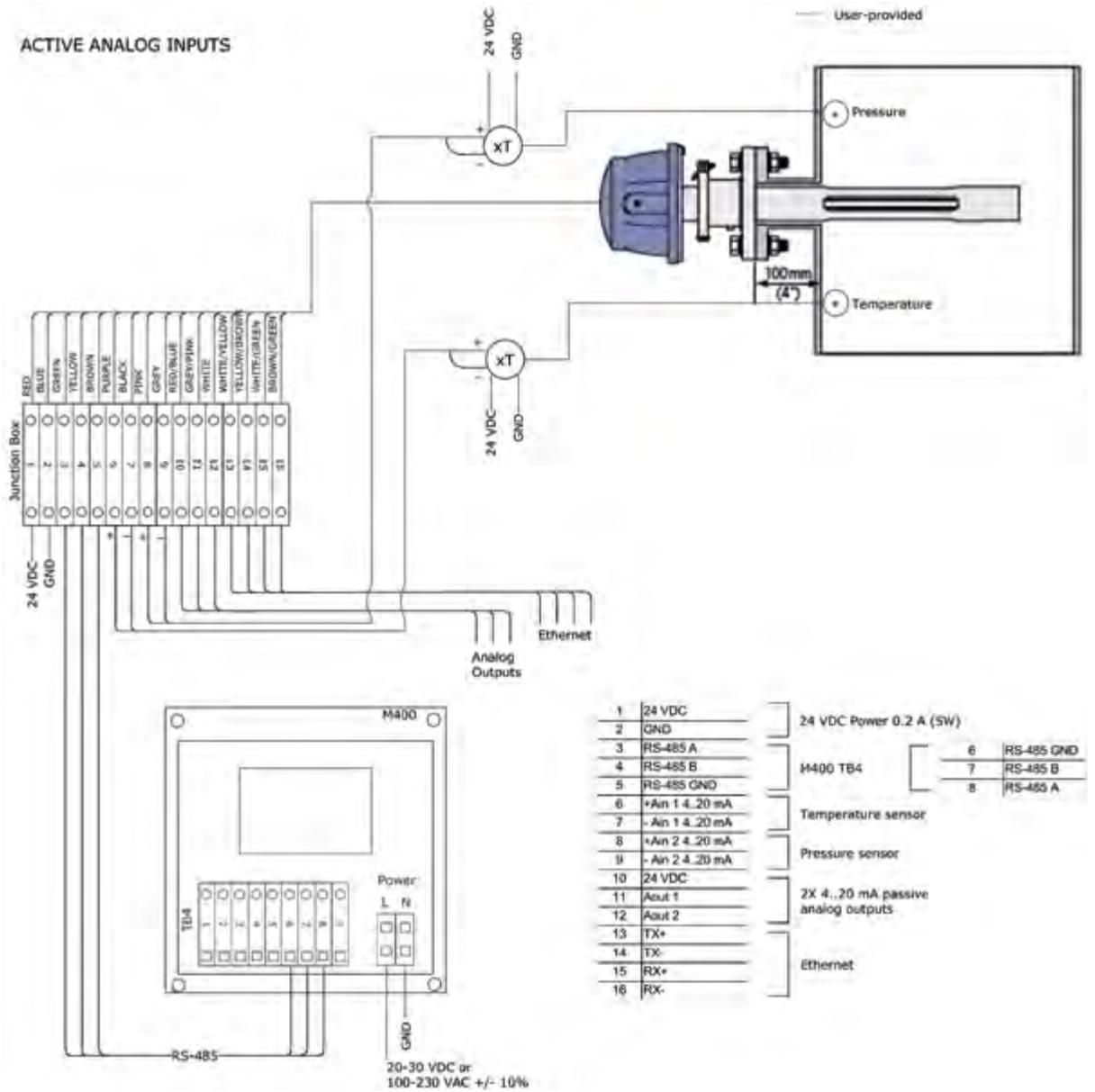


Figure 23 Wiring diagram with active analog outputs.



**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	Direct analog 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

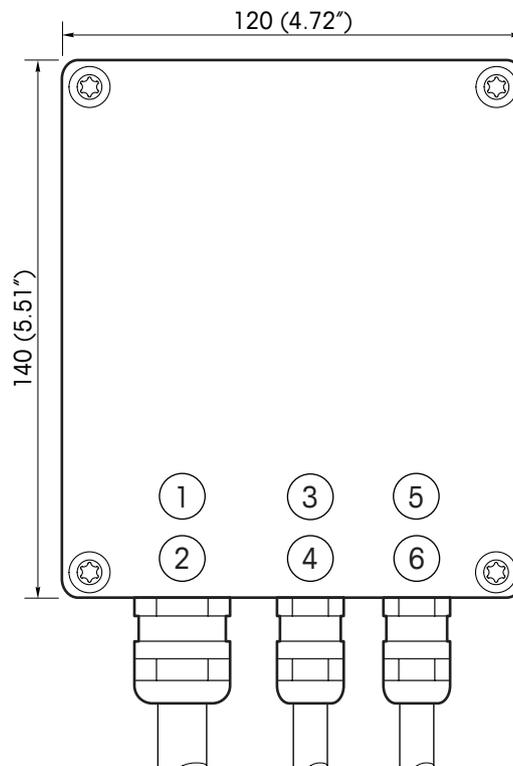


Figure 25 The junction box GHG 731.11 (EX-e)

- 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 connections 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 93.

The terminals are suitable for single wires/flexible leads 0.2 mm<sup>2</sup> to 1.5 mm<sup>2</sup> (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

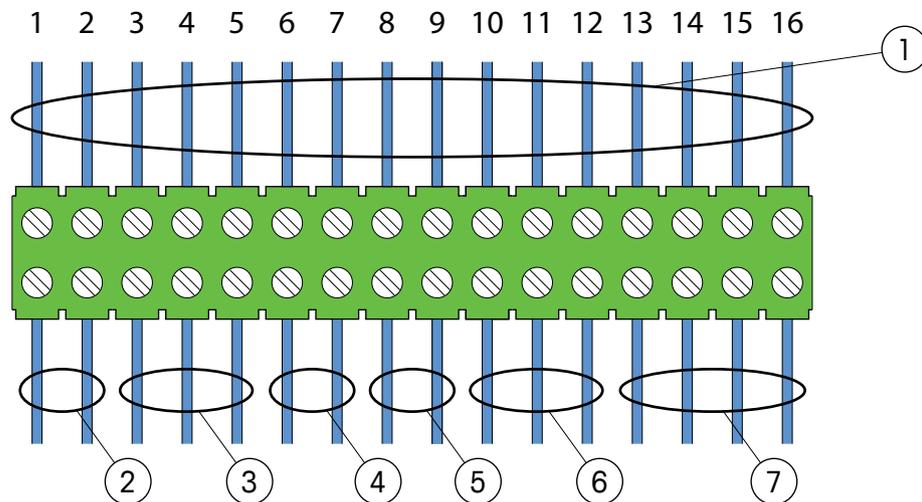


Figure 26 Connections in the junction box

- 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

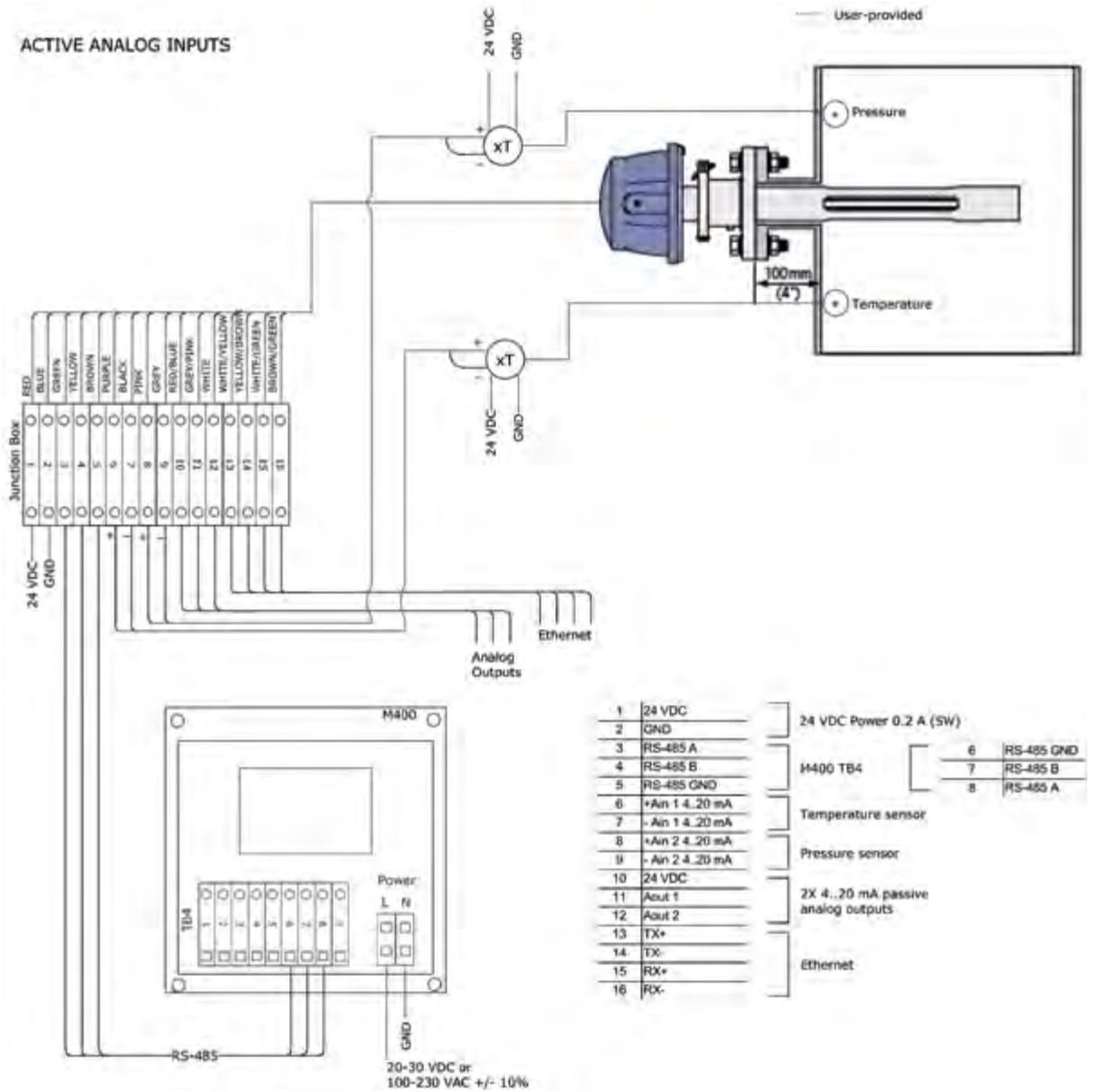


Figure 27 Wiring diagram with active analog outputs.

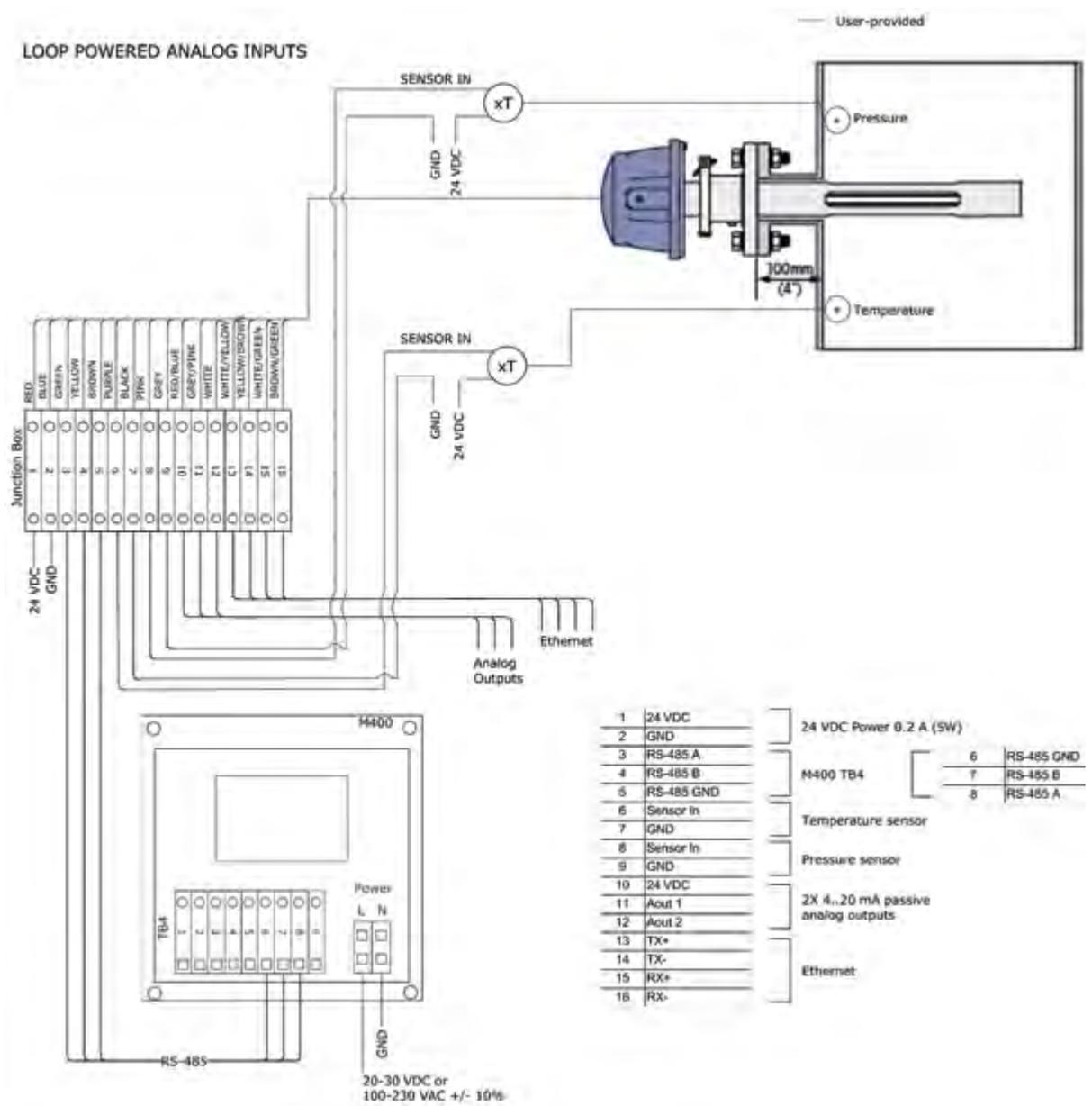


Figure 28 Wiring diagram with loop-powered analog inputs.

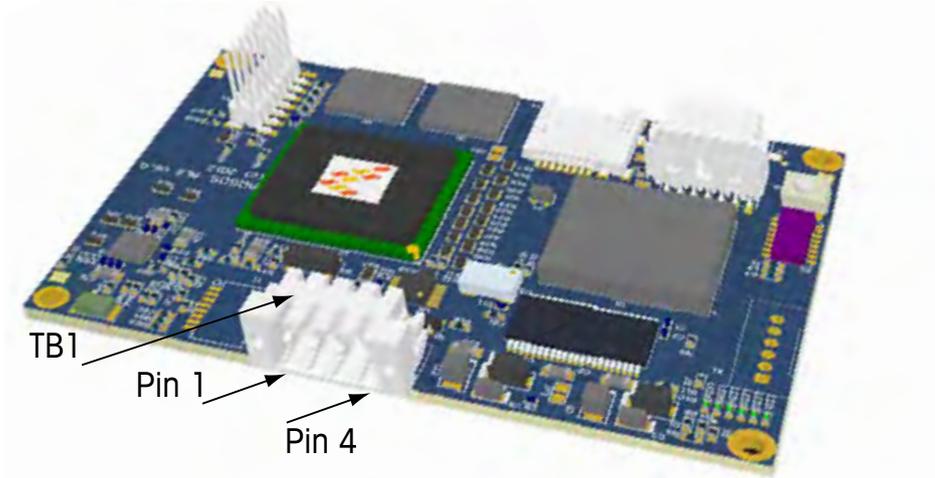


Figure 29 Connections on motherboard in the sensor head

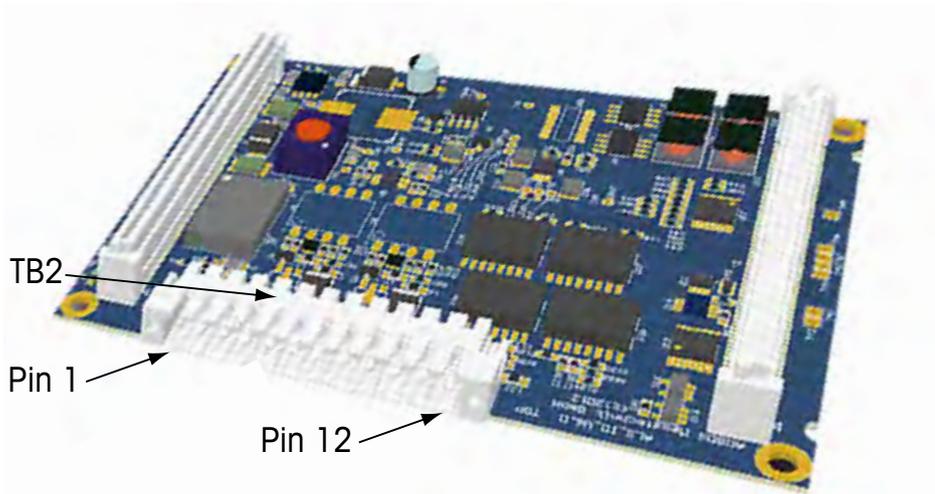


Figure 30 Connections on IO board in the sensor head

**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 analog 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 communica- tion with PC	13	White/Yellow	1	
TX-		14	Yellow/Brown	2	
RX+		15	White/Green	3	
RX-		16	Brown/Green	4	

**For all versions.**

	<p><b>WARNING</b></p> <p>All openings have to be closed with certified cable glands or blocking plugs of the same degree of certification as the GPro 500.</p>
---	--

	<p><b>WARNING</b></p> <p>It is essential that you observe all provided information and warnings. The system must be closed and grounded before switching on the system.</p>
---	---

### 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<sup>2</sup> (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 31 (Cable connections in M400) on page no 56.

**Table 7 Mains power supply terminals**

Signal	Terminal on mains power supply
Live	L
Neutral	N

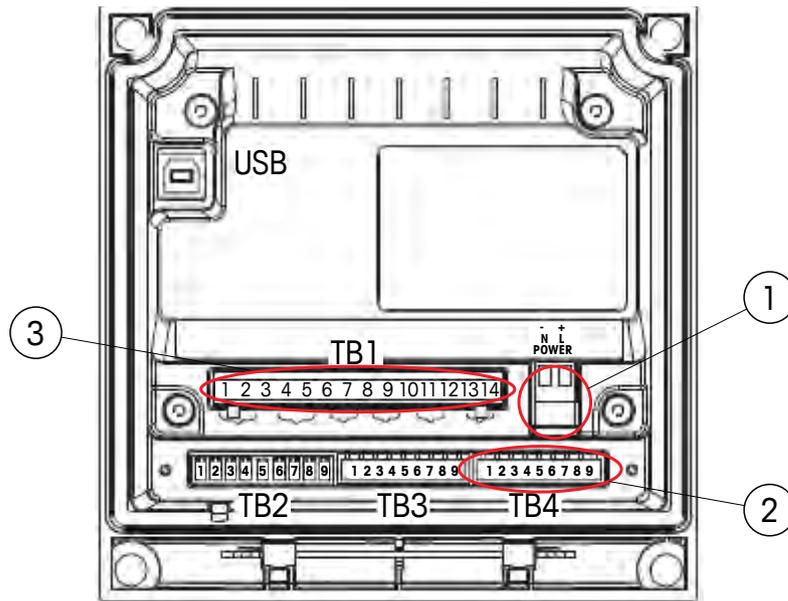


Figure 31 Cable connections in M400

- 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.

**Table 8 Connection of GPro™ 500 in M400**

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

**Table 9 Connection of the relays in M400**

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

## 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.

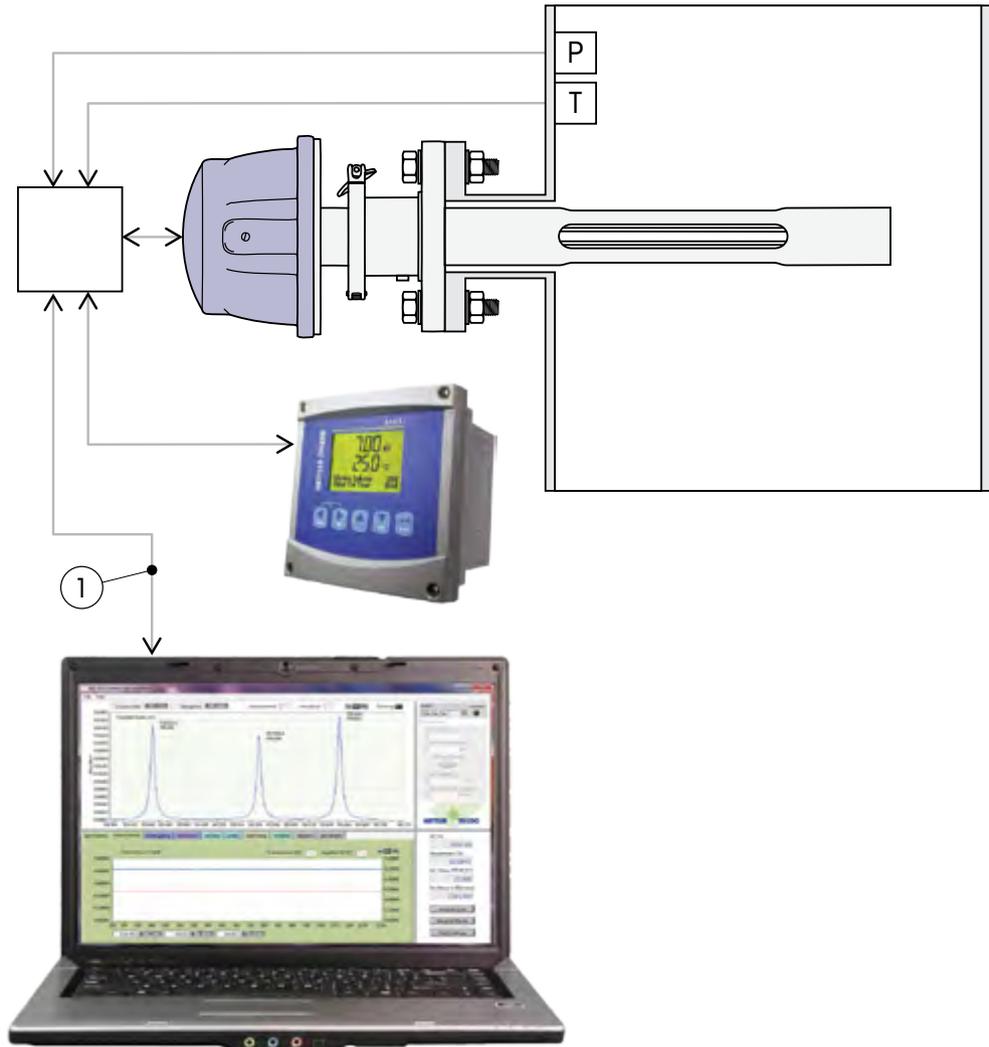


Figure 32 Connecting a PC

- 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.

	<p><b>WARNING</b></p> <p>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.</p>
---	---

## 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 33 Network connections

Double click **Local Area Connection**



Figure 34 Local area connections

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

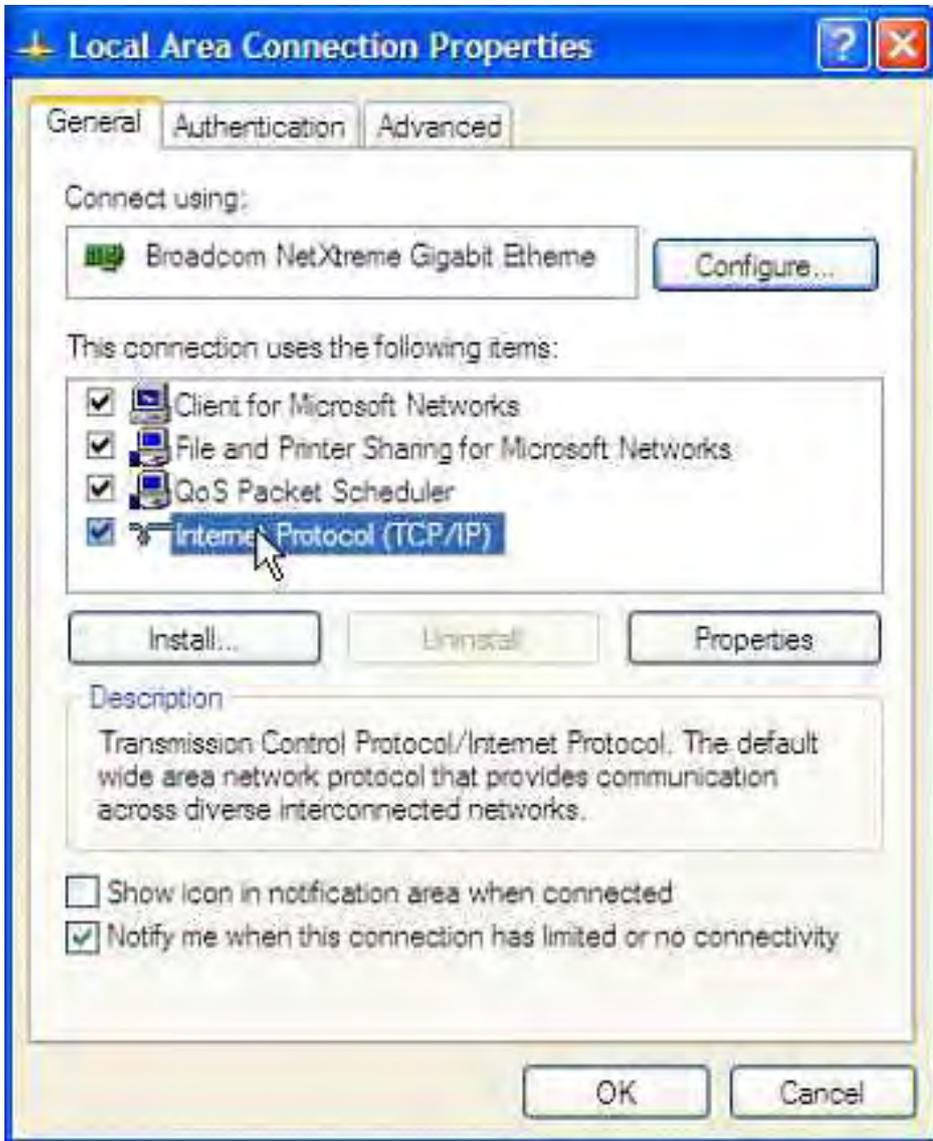


Figure 35 Local area connection properties

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]

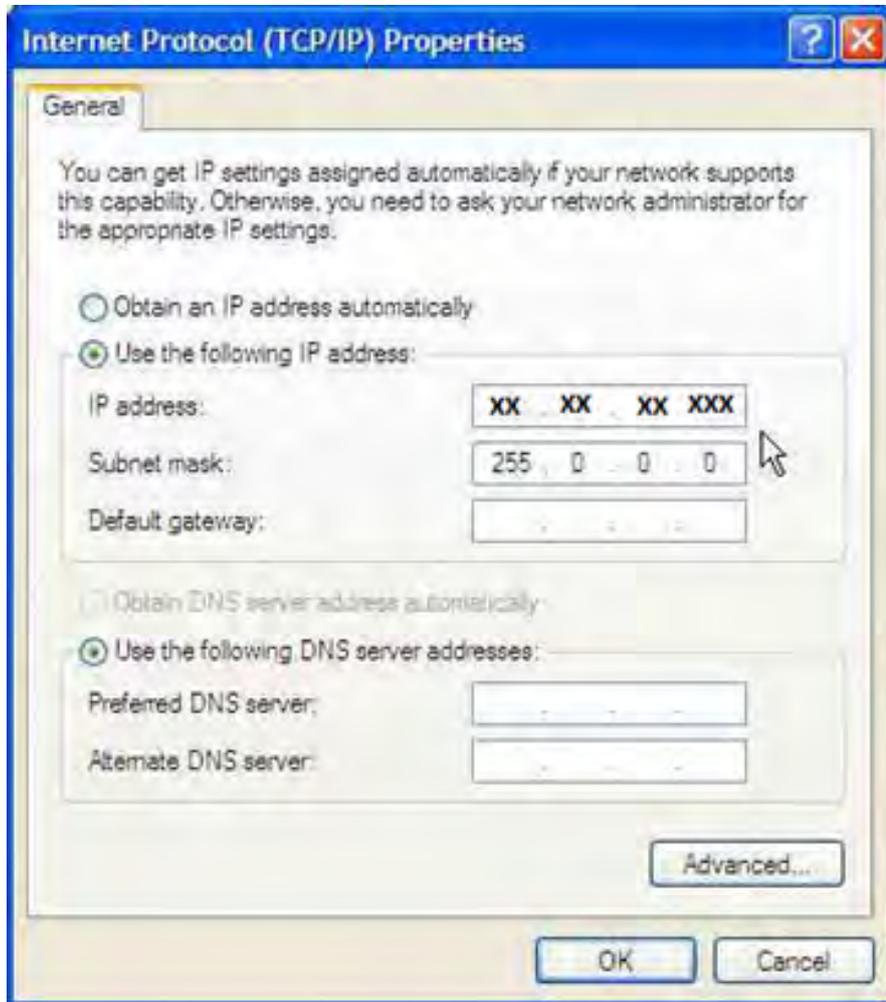


Figure 36 Internet protocol (TCP/IP) properties

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 V1.0.4.12s) 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.

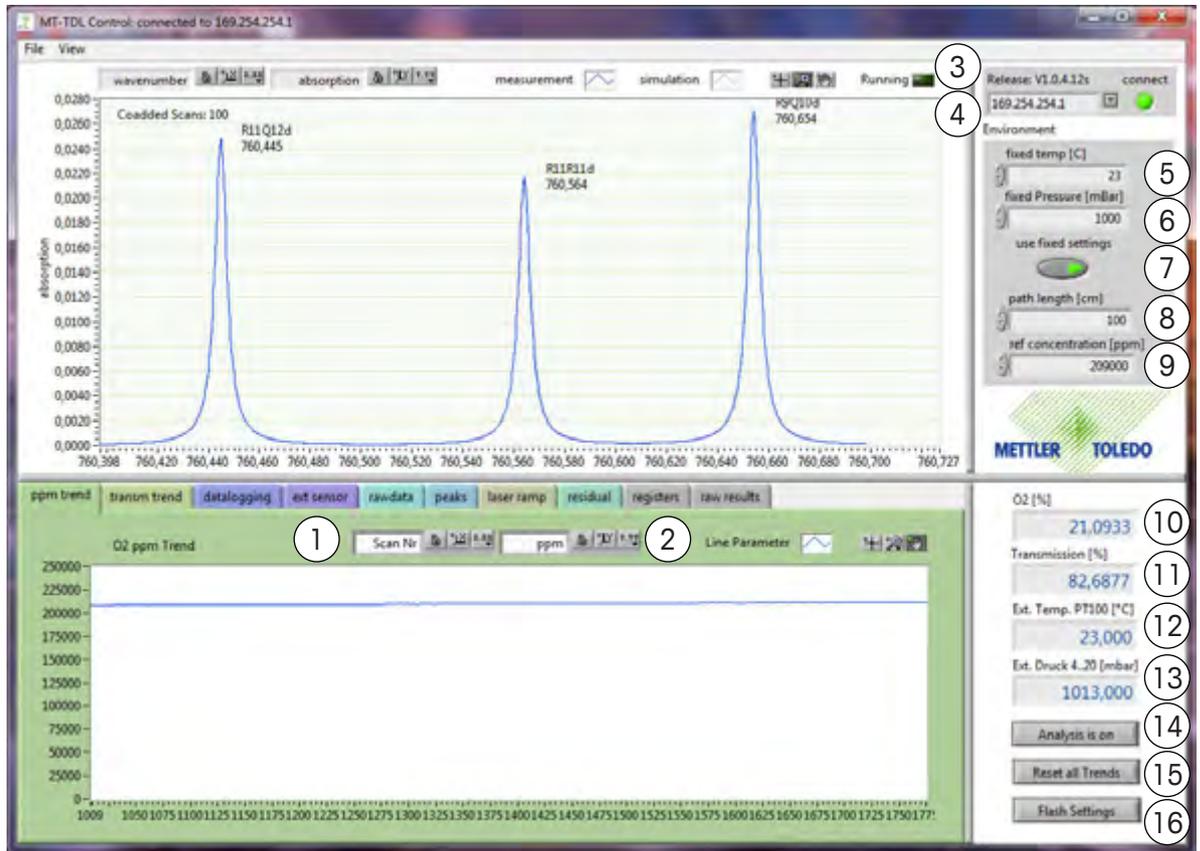


Figure 37 The ppm trend

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<sub>2</sub> concentration
- 11 Actual transmission
- 12 External temperature reading
- 13 External pressure reading
- 14 Analysis is on
- 15 Reset all trends
- 16 Flash settings

### 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.

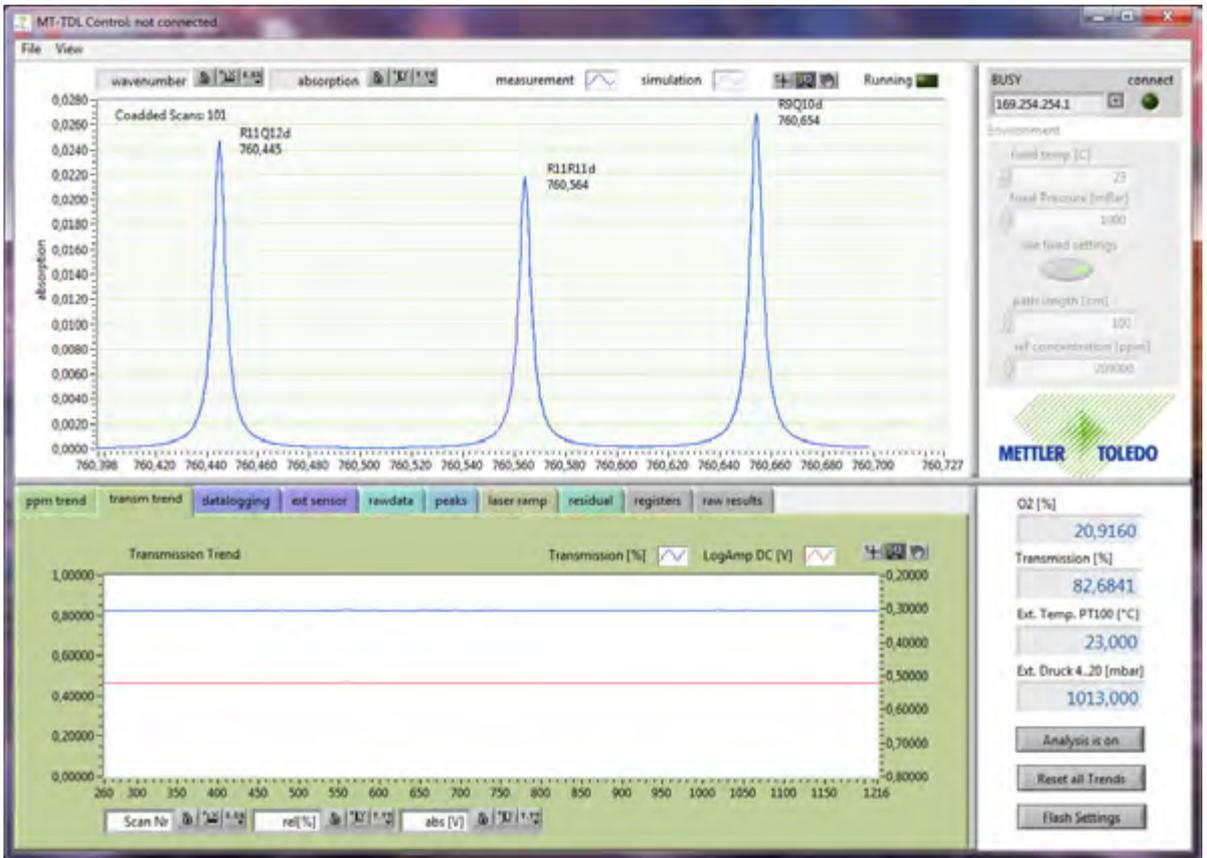


Figure 38 The transmission trend

### 6.3.3 Data logging

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

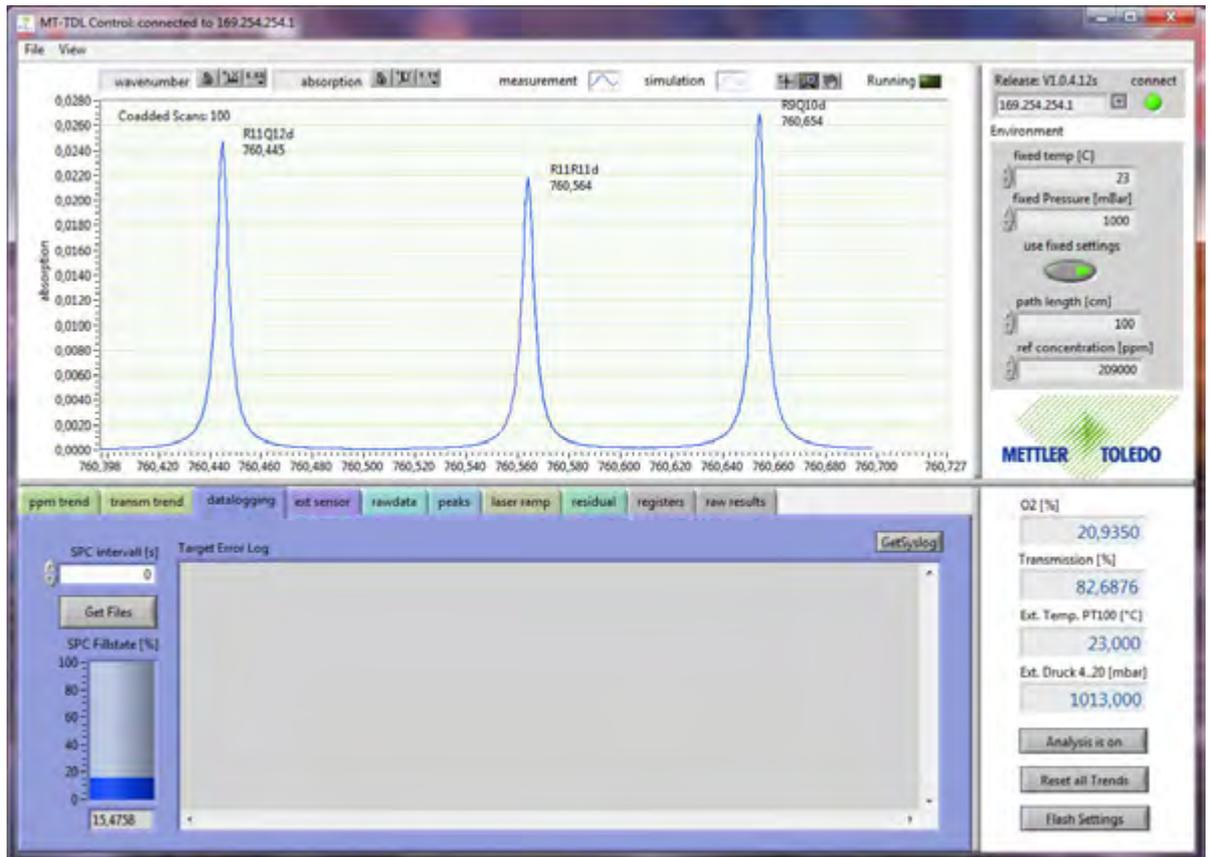


Figure 39 Data logging

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.

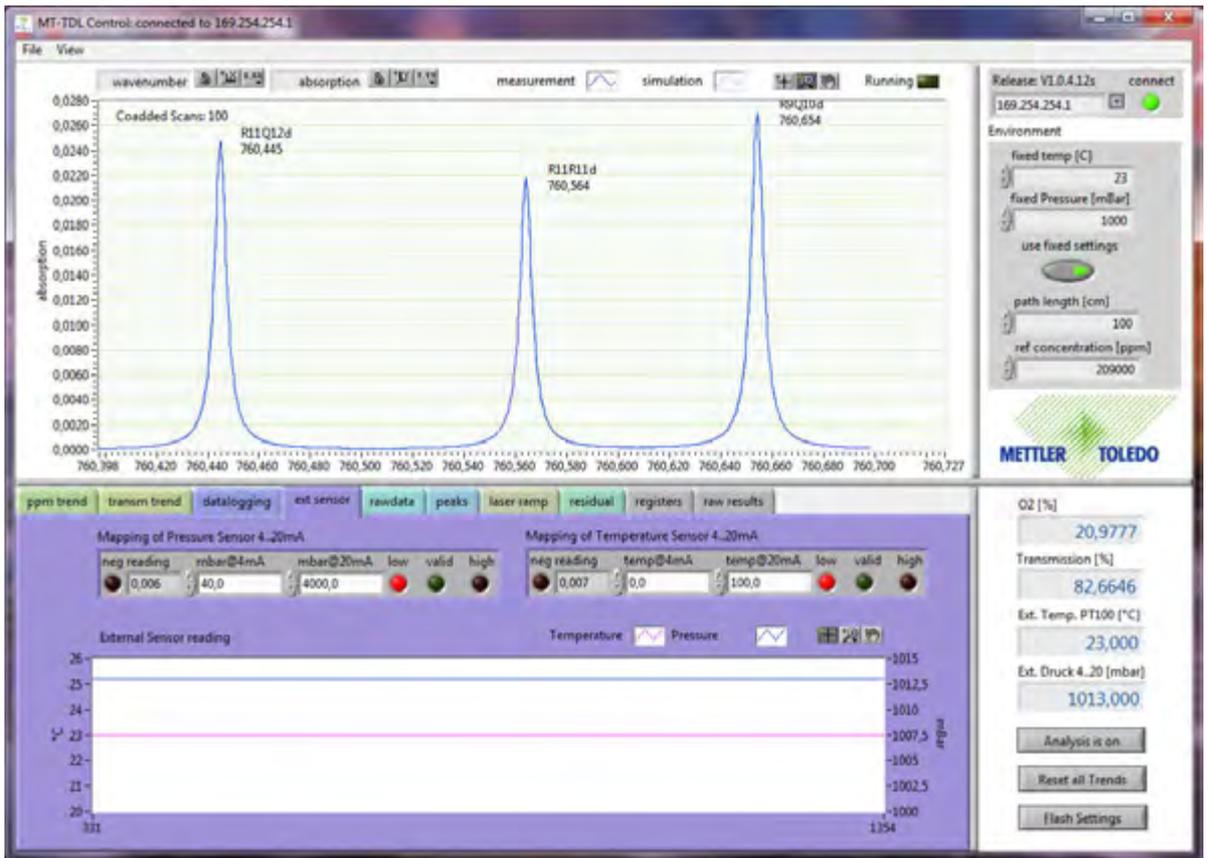


Figure 40 External sensors

### 6.3.5 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 43). Please note that there is no configuration menu in the M400 in order to set up the direct analog outputs.

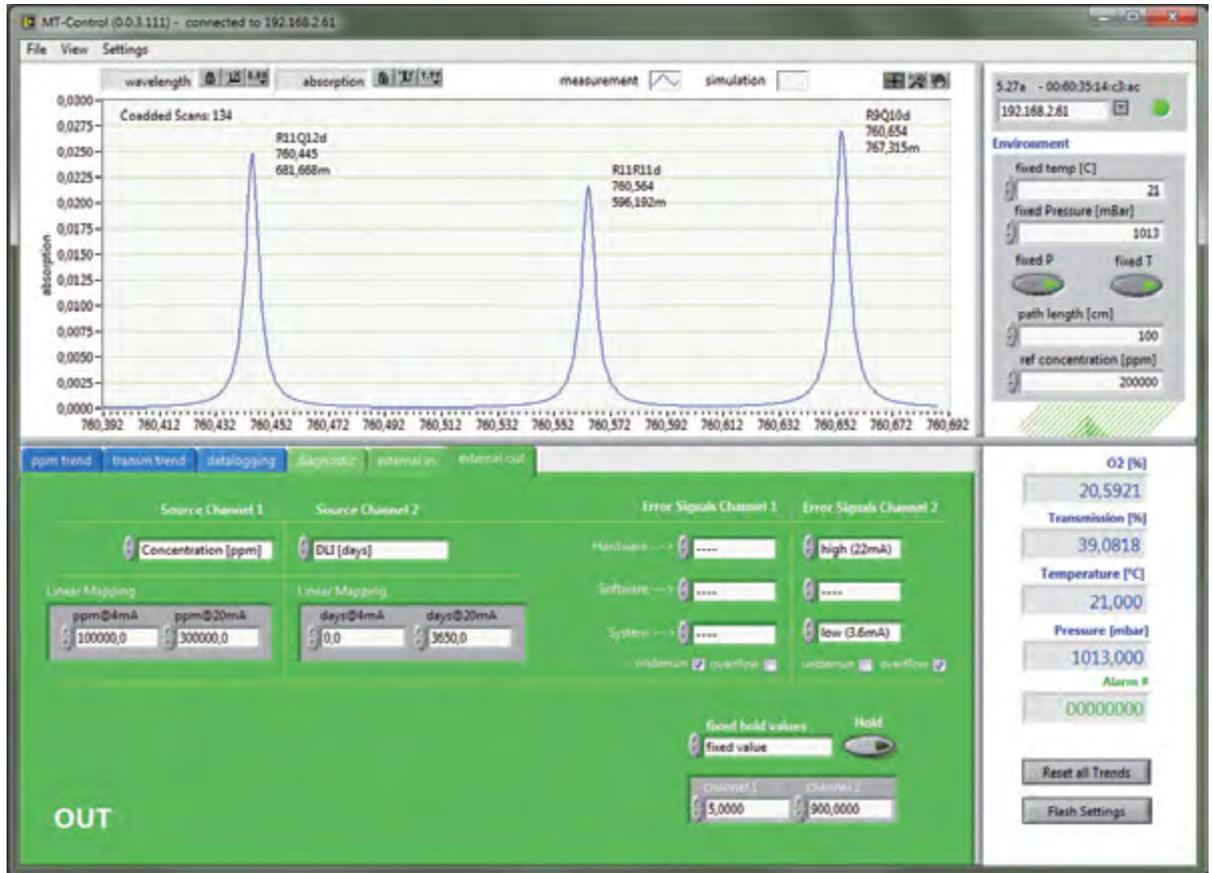


Figure 41 Analog outputs (optional)

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**

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



Figure 42 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 43 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 44 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.

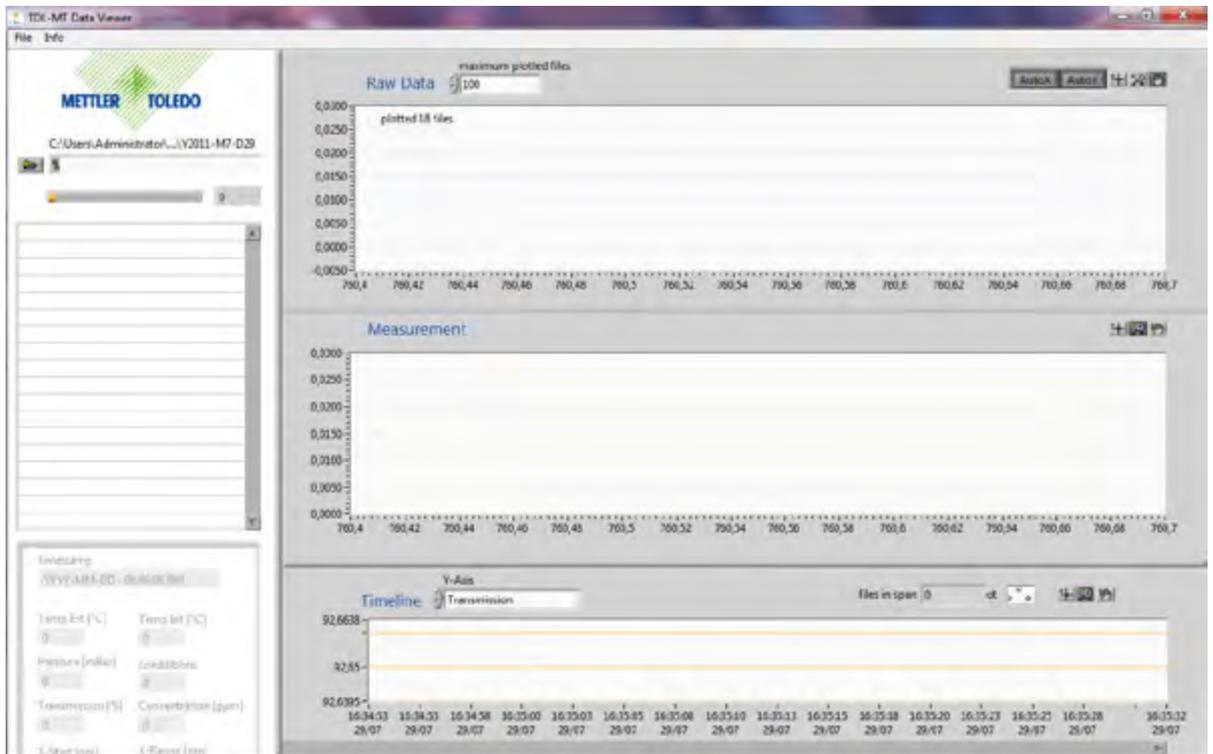


Figure 45 The viewer

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 46 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 Cl1 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 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.

### 7.2.1 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 74.
- At each calibration check, save instrument settings and measurement data recorded with some gas (setting-files and dump-files). This is for tracking purposes in case of future service issues.

### 7.2.2 Remove the probe 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.

	<p style="text-align: center;"><b>WARNING</b></p> <p>Before removing the probe 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.</p>
---	---

	<p style="text-align: center;"><b>WARNING</b></p> <p>Do not turn off the purging before removing the probe. This will prevent the optical surfaces from being contaminated</p>
---	--

### 7.2.3 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.

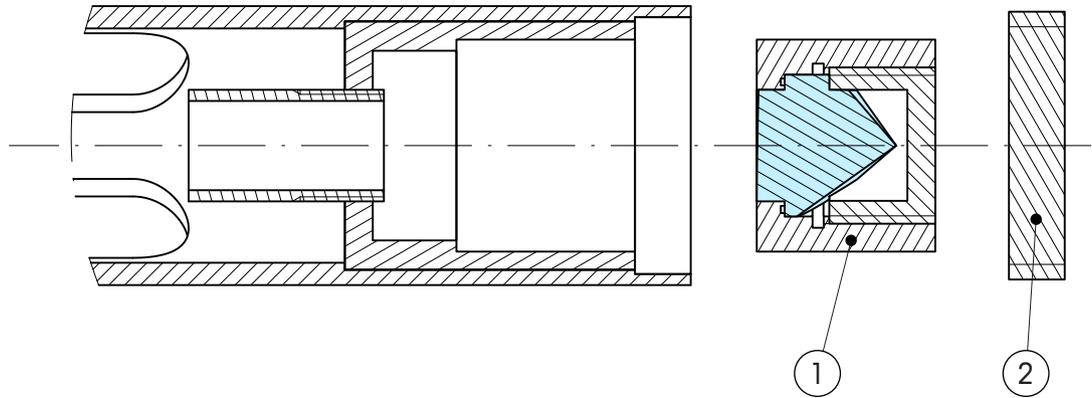


Figure 47 Cleaning/Replacing the corner cube.

- 1 Corner cube module
- 2 Probe end cap

### 7.2.4 Cleaning the process window

To clean the process window you need to remove the probe from the process, see 7.2.2 on page no 71. 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.



**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 48 below.

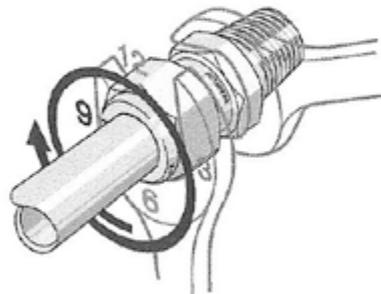


Figure 48 Connecting purge pipe to process side purge fitting.



**WARNING**

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

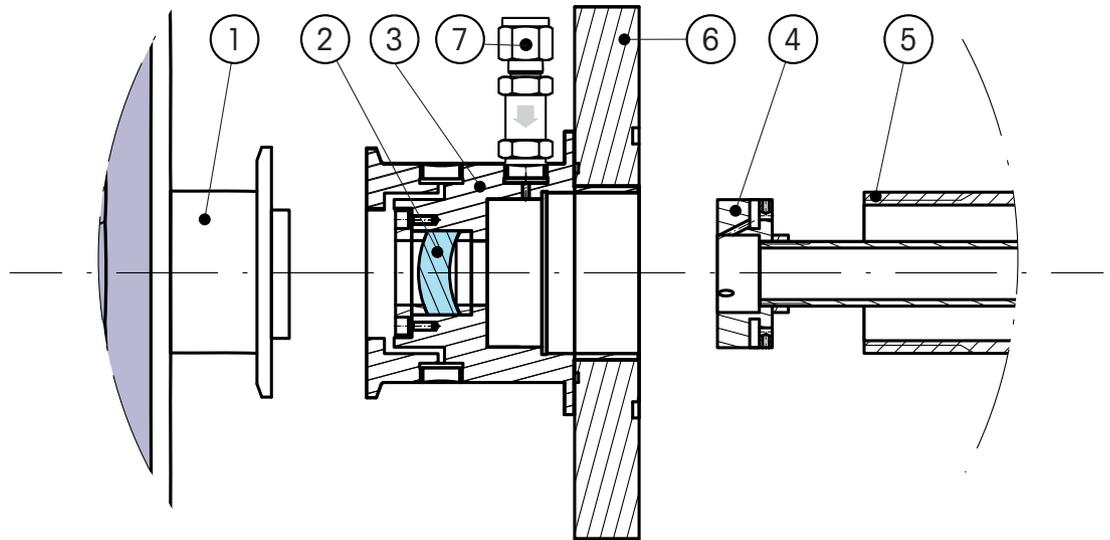


Figure 49 Cleaning the process window.

- 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.

## 7.3 Calibration

The calibration can be done using the M400. For information on how to calibrate see its manual 0150 chapter 7.2.2 on page 44 and 7.3.1 on page 46. There are two ways of calibrating – directly in the process or in an external calibration cell.

### 7.3.1 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.

### 7.3.2 Calibration using calibration cell

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.

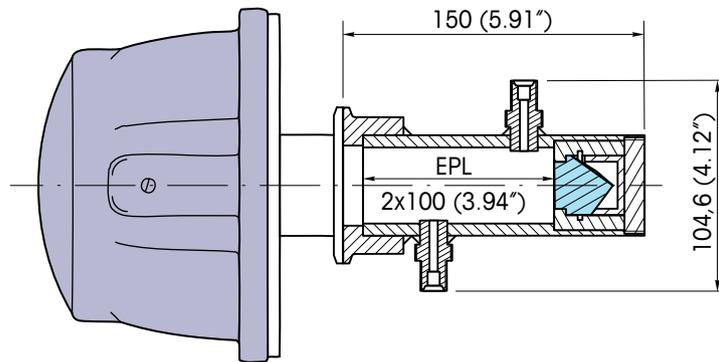


Figure 50 Calibration cell

## 7.4 Residual Hazards



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

### 7.4.1 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.

#### 7.4.2 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 shooting.

#### 7.4.3 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.

#### 7.4.4 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

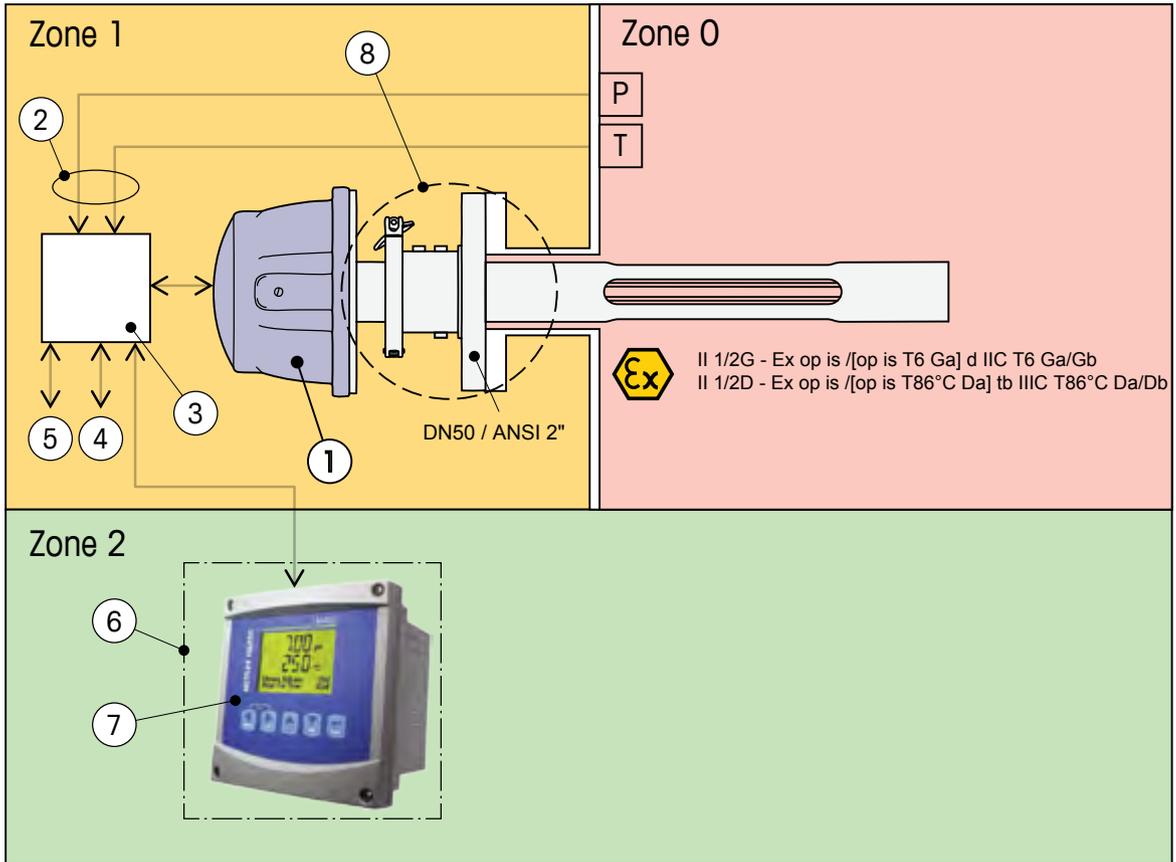


Figure 51 Ex setup

- 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 52 (The GPro™ 500 Interface between Zone 0 and Zone 1) on page no 77

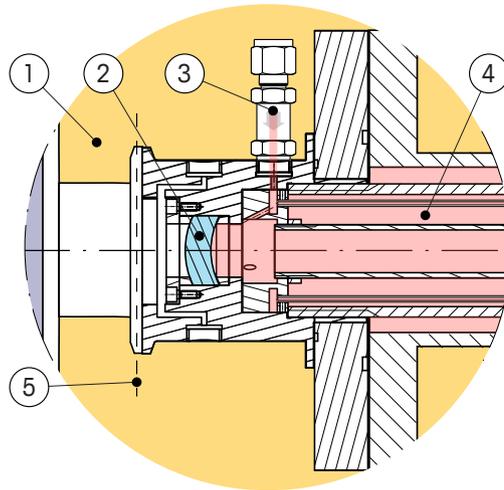


Figure 52 The GPro™ 500 Interface between Zone 0 and Zone 1

- 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 T86°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 93 – 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 oxygen sensor has to be connected by conductive wiring with the grounding system of the plant.

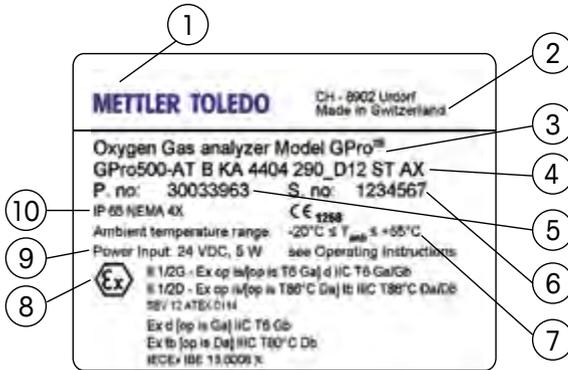


Figure 53 Label for ATEX version.

- 1 Manufacturer
- 2 Country of origin
- 3 Product name
- 4 Product key
- 5 Part no.
- 6 Serial no.
- 7 Ambient temperature limits
- 8 ATEX markings
- 9 Power rating
- 10 Enclosure ratings

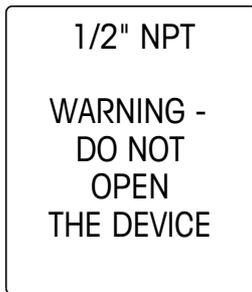


Figure 54 Note label.

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 31
- see chapter 5 (Electrical Connections) on page no 43
- see chapter 7 (Operation, Maintenance and Calibration) on page no 70



Figure 55 Grounding label.



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

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

(3) Examination certificate number: **SEV 12 ATEX 0114**

(4) Equipment: TDL oxygen measuring probe  
type GProTM 500 - YYYYYYYYYYYYYYYY - YY

(5) Manufacturer: **METTLER-TOLEDO AG, Process Analytics**

(6) Address: **Im Hackacker 15, CH-8902 Urdorf**

(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. 11-K-0214.01 Incl. extension 1 and 2.

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

**EN 60079-0:09                      EN 60079-1:07                      EN 60079-28:07**  
**EN 60079-31:09**

(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 T86°C Da/Db

**Electrosuisse**  
**Notified Body ATEX**

Martin Plöss  
Product Certification



Fehraltorf, 2013-03-14

SEV 12 ATEX 0114 / page 1 of 2

Zürich

Luppenstrasse 7      Tel. +41 44 956 11 11  
CH-8320 Fehraltorf      Fax +41 44 956 11 22  
info@electrosuisse.ch  
www.electrosuisse.ch

Figure 56 ATEX Certificate (Page 1/2).

(13)

## Appendix

(14)

### EC-Type Examination Certificate

(15) Description of the equipment

The TDL oxygen measuring probe type GProTM 500 – YYYYYYYYYYYYYYYYYY – YY serves for the measurement of the oxygen concentration in gas mixtures. The TDL oxygen sensor 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. 0.75 mW
Irradiance:	max: 0.24 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 TDL oxygen probe must be conductively connected with the equipotential bonding system of the installation.

(16) Test Report 11-K-0214.01 incl. extension 1 and 2

(17) Special conditions for safe use  
None

(18) Fundamental essential health and safety requirements  
Fulfilled by the standards applied.

 **Electrosuisse**  
**Notified Body ATEX**

Martin Plüss  
Product Certification




Fehraltorf, 2013-03-14

SEV 12 ATEX 0114 / page 2 of 2

ZAGS

Luppenstrasse 1    Tel. +41 44 956 11 11  
CH-8320 Fehraltorf    Fax +41 44 956 11 22  
info@electrosuisse.ch  
www.electrosuisse.ch

Figure 57 ATEX Certificate (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, CH-4835 / SWIFT CRESCH33  
Account no. 370501-21-4 CH / IBAN CH65 0483 5037 0501 210

www.mt.com/pro

## EC Declaration of conformity EG Konformitätserklärung CE Déclaration de Conformité



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 Series / Serie / Série

to which this declaration relates is in conformity with the following directive(s) and standard(s).  
auf welches sich diese Erklärung bezieht, mit der/den folgenden Richtlinie(n) und Norm(en)  
übereinstimmt.

À ce que cette déclaration rapporte est conforme aux directive(s) et aux norme(s) suivantes.

ATEX Directive  
ATEX Richtlinie  
ATEX Directive \_\_\_\_\_  
EMC Directive  
EMV-Richtlinie  
CEM Directive \_\_\_\_\_

94/9/EC  
94/9/EG  
94/9/CE  
2004/108/EC  
2004/108/EG  
2004/108/CE

EC-Type Examination Certificate / EG-Baumusterprüfung / Attestation  
d'Examen CE de Type  
SEV 12 ATEX 0114 ; Fehraltorf CH-8320, SEV 1258

Standard  
Norm  
Norme \_\_\_\_\_

EN 60079-0 :2009  
EN 60079-1 :2007  
EN 60079-28 :2007  
EN 60079-31 :2009  
EN 61326-1 :2006-05  
EN 61326-2-3 :2006  
IEC 61326-1 :2005-12  
IEC 61326-2-3 :2006  
IEC/EN 60529 :1991 + A1 :2000  
EN 61326-1 :2006-10  
EN 61326-2-3 :2007

Mettler-Toledo AG, Process Analytics

Waldemar Rauch  
Head of Process Analytics Division

Peter Rowing  
Head of Quality Management

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

Urdorf, 26.04.2012

This Original may not be copied, as subject to technical changes  
Dieses Original darf nicht kopiert werden, da es dem Änderungsdienst unterliegt.  
Cet original ne doit pas être copié, sujet de changement technique

CE\_GPro500\_April12\_inf.doc

Figure 58 EC Declaration of conformity

		<h1 style="margin: 0;">IECEX Certificate of Conformity</h1>	
<p><b>INTERNATIONAL ELECTROTECHNICAL COMMISSION</b>  <b>IEC Certification Scheme for Explosive Atmospheres</b>  <small>for rules and details of the IECEx Scheme visit <a href="http://www.iecex.com">www.iecex.com</a></small></p>			
Certificate No.:	IECEX IBE 13.0008X	issue No.:0	Certificate history: _____
Status:	Current		
Date of Issue:	2013-03-13	Page 1 of 3	
Applicant:	<b>Mettler-Toledo AG</b> Im Hackacker 15 8902 Urdorf Switzerland		
Electrical Apparatus: <i>Optional accessory:</i>	Oxygen measuring probe type GPro500		
Type of Protection:	Flameproof enclosure "d"; Optical radiation "op"; Protection by enclosure "t"		
Marking:	Ex d [op is Ga] IIC T6 Gb Ex tb [op is Da] IIIC T80°C Db -20 °C ≤ T <sub>a</sub> ≤ +55 °C		
Approved for issue on behalf of the IECEx Certification Body:	Prof. Dr. Tammo Redeker		
Position:	Head of Certification Body		
Signature: (for printed version)	_____		
Date:	_____		
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 <a href="#">Official IECEx Website</a> .			
Certificate issued by: <b>IBExU Institut für Sicherheitstechnik GmbH</b> Certification Body Fuchsmühlenweg 7 09599 Freiberg Germany			

Figure 59 IECEx Certificate (Page 1/3)



# IECEX Certificate of Conformity

Certificate No.: IECEX IBE 13.0008X

Date of Issue: 2013-03-13

Issue No.: 0

Page 2 of 3

Manufacturer: **Mettler-Toledo AG**  
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:

<b>IEC 60079-0 : 2011</b> Edition: 6.0	Explosive atmospheres - Part 0: General requirements
<b>IEC 60079-1 : 2007-04</b> Edition: 6	Explosive atmospheres - Part 1: Equipment protection by flameproof enclosures "d"
<b>IEC 60079-28 : 2006-08</b> Edition: 1	Explosive atmospheres - Part 28: Protection of equipment and transmission systems using optical radiation
<b>IEC 60079-31 : 2008</b> Edition: 1	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:  
[DE/IBE/ExTR13.0008/00](#)

Quality Assessment Report:  
[CH/SEV/QAR12.0004/01](#)

Figure 60 IECEx Certificate (Page 2/3)

		<h1>IECEX Certificate of Conformity</h1>	
Certificate No.:	IECEX IBE 13.0008X	Issue No.:	0
Date of Issue:	2013-03-13	Page 3 of 3	
<b>Schedule</b>			
<b>EQUIPMENT:</b>			
<i>Equipment and systems covered by this certificate are as follows:</i>			
<p>The Tunable Diode Laser Sensor (TDL) should be approved for measuring concentrations of oxygen in gas mixtures. The approval should be given for a flameproof encapsulation. The sensor contains optical elements, optoelectronics (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.</p>			
<b>CONDITIONS OF CERTIFICATION: YES as shown below:</b>			
<ul style="list-style-type: none"> <li>■ 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.</li> <li>■ 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.</li> <li>■ 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.</li> </ul>			

Figure 61 IECEx Certificate (Page 3/3)

## 8.2 FM Approval (US Version)



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

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

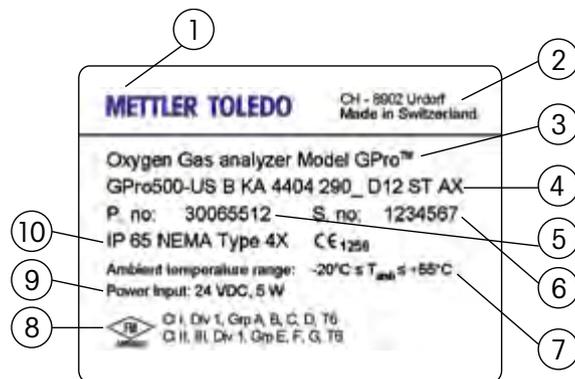


Figure 62 Label for US version.

- 1 Manufacturer
- 2 Country of origin
- 3 Product name
- 4 Product key
- 5 Part no.
- 6 Serial no.
- 7 Ambient temperature limits
- 8 FM markings
- 9 Power rating
- 10 Enclosure ratings

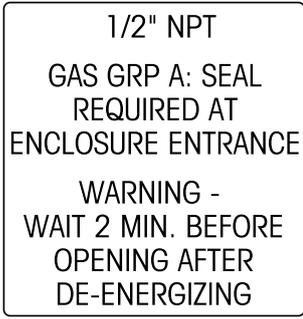


Figure 63 Note label.

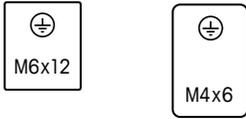


Figure 64 Grounding labels.

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 31
- see chapter 5 (Electrical Connections) on page no 43
- see chapter 7 (Operation, Maintenance and Calibration) on page no 70



FM Approvals  
1151 Boston Providence Turnpike  
P.O. Box 9102 Norwood, MA 02062 USA  
T: 781 762 4300 F: 781-762-9375 www.fmapprovals.com

# CERTIFICATE OF COMPLIANCE

## HAZARDOUS (CLASSIFIED) LOCATION ELECTRICAL EQUIPMENT

This certificate is issued for the following equipment:

***GPro 500-USabcdeAg. Gas Sensor.***

XP/ I/ 1/ ABCD/ T6 Ta= -20C to +55C; DIP/ II, III/ 1/ EFG/ T6 Ta= -20C to +55C;

Type 4X, IP65

a = Process Window: B or Q

b= Process O-ring Material: KA or GR

c = Wetted Materials: 4404 or C22

d = Probe Length: 290mm, 390mm, or 590mm

e= Process Connection: A03 or D12

f = Thermal Barrier: ST or HT

g= Interface: X or A

### Equipment Ratings:

Explosionproof for use in Class I, Division 1, Groups ABCD, T6; and Dust-ignitionproof for Class II, III, Division 1, Groups EFG, T6 Ta = -20C to +55C Hazardous (Classified) Locations; with an indoor/outdoor environmental rating of Type 4X/IP65.

### FM Approved for:

Mettler Toledo AG  
Urdorf, Switzerland

Figure 65 FM-Certificate. FM Approvals (Page 1/2).



This certifies that the equipment described has been found to comply with the following Approval Standards and other documents:

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

Original Project ID: 3044884

Approval Granted: January 9, 2013

Subsequent Revision Reports / Date Approval Amended

Report Number	Date	Report Number	Date
---------------	------	---------------	------

FM Approvals LLC

  
\_\_\_\_\_  
J. E. Marquedant  
Group Manager, Electrical

9 January 2013  
\_\_\_\_\_  
Date

Figure 66 FM-Certificate. FM Approvals (Page 2/2).

## 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 10 Error messages**

<b>Fault message</b>	<b>Explanations and actions</b>	<b>Action</b>
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	O2 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

## 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 7.2.2 (Remove the probe from the process) on page no 71.

### 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 11 GPro™ 500 Product key**

Gas Analyzer		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			
<b>Hazardous Area Approvals</b>			
ATEX Ex d, IECEx		A T	
FM Class 1 Div 1		U S	
<b>Process Windows *</b>			
Standard	(Borosilicate)	B	
High Temp	(Quartz)	Q	
<b>Process O-rings *</b>			
Standard	(Kalrez)	K A	
High-grade	(Graphite)	G R	
<b>Wetted Materials *</b>			
1.4404 (comparable to 316L)		4 4 0 4	
Hastelloy		C 2 2 _	
<b>Probe length *</b>			
290 mm		2 9 0 _	
390 mm		3 9 0 _	
590 mm		5 9 0 _	
<b>Process connection *</b>			
ANSI 2"/300lb		A 0 3	
DN50/PN25		D 1 2	
<b>Thermal barrier *</b>			
No thermal barrier (for temperatures up to 250 °C)		S T	
With thermal barrier (for temperatures up to 600 °C)		H T	
<b>Gas to measure</b>			
Oxygen		A	
<b>Interface</b>			
RS 485 (for M400)		X	
RS 485 and direct analog outputs		A	

## 2.2 Spare parts

**Table 12 Spare parts**

Spare part	Order number
Window Module Q GR 4404 D12	30 032 364
Window Module Q GR 4404 A03	30 032 365
Window Module B KA 4404 D12	30 032 366
Window Module B KA 4404 A03	30 032 367
Window Module Q GR C22 D12/A03	on request
Window Module B KA C22 D12/A03	on request
O2 Corner Cube Module B 4404	30 038 091
O2 Corner Cube Module Q 4404	30 038 092
O2 Corner Cube Module B C22	on request
O2 Corner Cube Module Q C22	on request

## 2.3 Accessories

**Table 13 Accessories**

Accessory	Order number
Thermal barrier	30 034 138
Junction box	30 034 149
Purging box for M400 Ex d	30 034 148
O <sub>2</sub> 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
Kit Flat gasket ST	30 080 914
Kit Flat gasket HT (Graphite)	30 080 915
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

## **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 AG  
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](mailto:info@mt.com)

If you send the TDL to Mettler Toledo or your local Mettler Toledo agent (see Sales and Service on page no 98) 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.



## Sales and Service

### Australia

Mettler-Toledo Ltd.  
220 Turner Street  
Port Melbourne  
AUS-3207 Melbourne/VIC  
Phone +61 1300 659 761  
Fax +61 3 9645 3935  
e-mail info.mtaus@mt.com

### Austria

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