TLP300 CANopen

INCLINOMETER

MEMS technology tilt sensor

CHARACTERISTICS

- MEMS technology
- High protection level and wide temperature range
- High temperature stability
- Resolution up to 0.01°
- Single axis range ±180° or 0 ... 360°
- Dual axis range up to ± 85°

ADVANTAGES

- Gyro-compensated
- Excellent accuracy
- Reliability and long service life for outdoor applications
- Compact dimensions
- Designed for harsh enviromental conditions

IP67 — High protection level

Shock/vibration resistant

Redundancy output

Reverse polarity protection

°C -40...+85 — Wide temp. range

CANopen output

CANopen Safety

MEMS — MEMS sensors technology

X , Y — Horizontal version

Z — Vertical version

High accuracy

High repeatability

RoHS compliant — Directive 2011/65/EU

CE — EU conformity

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Top Sensors Manufacture

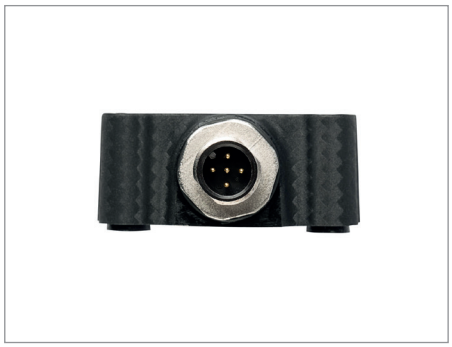
PRODUCT DESCRIPTION

An inclinometer measures the angle to the direction of the gravity in one or more axes.

TLP300 is the new family of inclination sensors, based on the MEMS technology, capable of working in extreme conditions and hard environments, subjected to sharp movements, shocks and high vibrations.

The perfect synthesis of precision, stability, robustness and cost, which make it suitable for use on mobile devices and applications such as: cranes, aerial platforms, operating and earth moving machines.

The integration of accelerometers and gyroscopes with sensor fusion proprietary algorithms, ensure high performances over all the operating range.



Agricultural machinery

Construction

Earth moving

Handling and **lifting**

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PRODUCT CODE

ORDER CODE(1) T L P 3 0 0 . [a] . [b] . [c] . [d] . [e] . [f] . [g] . [h] . [i]

a Power supply range
- **2** = 9 ... 30 V DC
- **6** = 8 ... 36 V DC

b Axis type
- **O** = Dual axis (floor mounting)
- **V** = Single axis (wall mounting)

c Measurement range
- **360** = 0 ... 360 deg
- **XXX** = ± XXX deg

d Output type
- **6** = CANopen
- **28** = CANopen with diagnostics
- **43** = CANopen safety

e Connections
- **1** = Male connector M12, 5-pin PUR cable 30cm
- **2** = Male flange connector M12, 5-pin
- **20** = Overmolded Deutsch DT04-4P, PUR cable 30cm
- **20A** = Overmolded Deutsch DT04-4P, PUR cable 30cm pinout type A

f Architecture(2)
- **S** = Single tilt sensor
- **R** = Redundant tilt sensors

g Options
- **0** = Static (without gyro-compensation function)
- **1** = Dynamic (with gyro-compensation function)

h Customization
- **X** = None
- **?** = Customization code

i Approvals
- **1** = Standard components(3)
- **2** = SIL2/PLd

(1) Not all combinations can be ordered. Please contact TSM for confirmation before placing an order.
(2) Redundanted primary measures, acquired by a single logical unit and published on the CANOpen output by one or more PDOs, according to the selected mapping.
(3) MTTFd > 100 years (EN ISO 13849-1) a) b)
a) Standard component. It does not constitute a safety component as defined in the Machinery Directive 2006/42/CE.
b) Every second failure of an electronic component is regarded as a dangerous failure.

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TECHNICAL SPECIFICATION

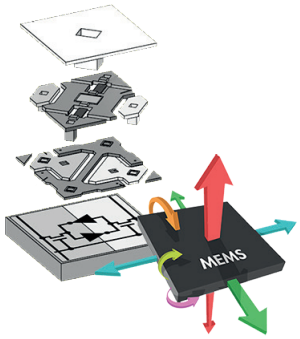
Measuring range	Up to ±85° for dual axis type ±180° and 0 ... 360° for single axis type
Static accuracy (Ta = 25 °C)	±0.3°
Resolution	0.01°
Temperature drift (at 0° inclination)	±0.01 °/°C typ. (**)
Protection class	IP67 (acc. to EN 60529)
Temperature range	-40°C ... +85°C
Housing	Glass fiber reinforced polyamide
Weight approx.	70 g
Shock resistance	acc. to EN 60068-2-27 50 G, 11 ms, 100 shocks per axis Axis : X, Y, Z
Vibration resistance	acc. to EN 60068-2-6 10 ... 500 Hz, 10g, 2h per axis Axis : X, Y, Z
Corrosion resistance	Salt spray tests acc. to EN ISO 9227 / ISO 12944-6

ELECTRICAL CHARACTERISTICS

Power supply range	See order code
Consumption typ.	30 mA (12 VDC, w/o load) 15 mA (24 VDC, w/o load)
Startup time	< 1.5 s
Interface	CANopen CANopen safety
CANopen profile conformity	CiA 301
EMC compatibility **(Industrial electromagnetic environment)**	acc. to EN 61326-1, EN 61326-3-1
Conducted electrical transients immunity (*):	Surge test acc. to ISO7637-2 pulse 1, 2a, 2b, 3a, 3b Momentary drop in supply voltage acc. to ISO 16750-2 §4.6.1 Reset behaviour at voltage drop acc. to ISO 16750-2 §4.6.2 Starting profile acc. to ISO 16750-2 §4.6.3 Load dump acc. ISO 16750-2 §4.6.4 Test A
EU conformity	EMC directive 2014/30/EU UNECE Reg. 10 R06 (*) RoHS directive 2011/65/EU + 2015/863/EU

OPERATING PRINCIPLE

MEMS, or Micro Electro-Mechanical System, is a chip-based technology where sensors are composed of proof masses sprung between capacitive plates. Each mass act like a moving plate of a variable capacitor formed by an array of interlaced 'fingers'.
When the sensor is tilted, the mass moves changing the distance between the plates and therefore the capacitance. By measuring the capacitance variation the angle value can be detected.



(*) Valid only for 8 ... 36 V DC version
(**) Drift < ±0.01 °/°C for temperature compensated versions (Options .2 and .3) in the range -20°C … +60°C

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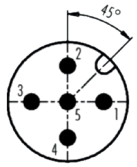
1 & 2] ELECTRICAL CONNECTION M12 X 5 PINS



Pinout

1	CAN-GND*
2	+Vin
3	GND*
4	CAN-H
5	CAN-L

* GND and CAN_GND terminals are internally connected to each other and identical in their function

20] ELECTRICAL CONNECTION DEUTSCH DT04-4P

Pinout

1	CAN-L
2	CAN-H
3	+Vin
4	GND

20A] ELECTRICAL CONNECTION DEUTSCH DT04-4P pinout type A

Pinout

1	+Vin
2	GND
3	CAN-L
4	CAN-H

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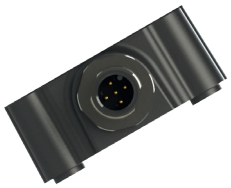
COUNTING DIRECTION

Dual axis

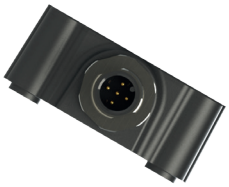
TLP300 dual axis inclinometer

The 2-dimensional tilt sensor must be mounted with the base plate in horizontal position, i.e. parallel to the horizontal line.
The sensor can be tilted to both the X and Y axes at the same time.
A separate measure is provided for each axis.

+X



-X



+Y

-Y

Single axis

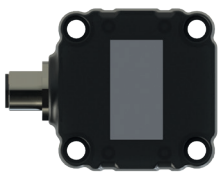
TLP300 single axis inclinometer

The 1-dimensional tilt sensor must be installed with the base plate in vertical position, i.e. Z-axis perpendicular to the force of gravity.

The default "zero point" position is the one shown in the following images.

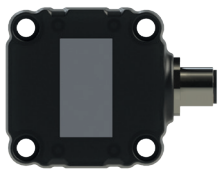
Z = 0°

Z = 90°



Z = 180°

Z = 270°



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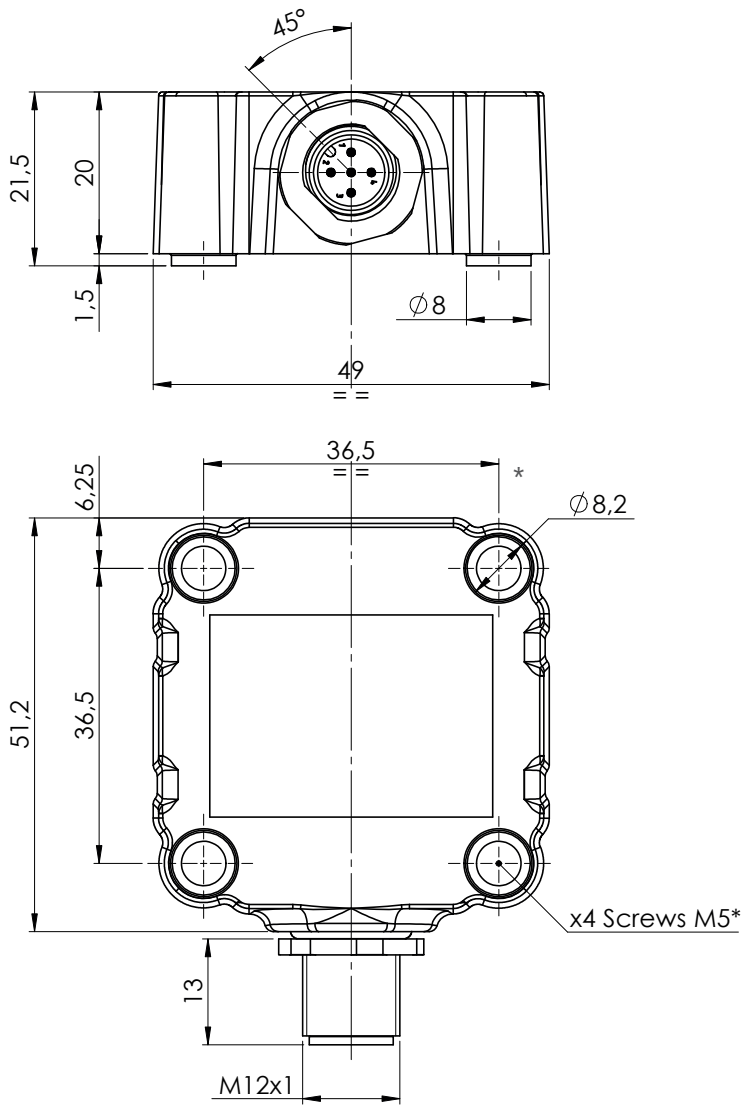
DIMENSIONS [mm]



* MAX tightening torque 2Nm

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