LENTISENS GmbH

Module Series L-HD

TECHNICAL SPECIFICATIONS	Titanium Pressure Sensor Modules for Industrial High Pressure Applications

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MAIN FEATURES

- Relative pressure sensing modules with resistive Wheatstone bridge
- Titanium sensor body made as one piece part
- Resolution 0.01%span
- Nominal pressure ranges from 100 MPa to 500 MPa
- Operating temperature range from -45°C up to +200°C
- Dielectric strength 700 VAC

APPLICATION

- Heavy industrial applications
- Hydraulics and pneumatics
- Chemical industries
- Machine construction
- Pumping stations and compressors

DESCRIPTION

New solutions in pressure measurement by Silicon on Sapphire technology

The highly sensitive element of this pressure sensor family is a two-layer sapphire-titanium membrane with monocrystalline silicon resistive strain gauges. Due to a stable connection with titanium the monocrystalline sapphire membrane is a perfect elastic element that acquires the best quality at high deformation levels and preserves its elastic and insulating properties at temperatures up to 400°C. Monocrystalline silicon resistive strain gauges are atomically connected to the sapphire and provide almost no hysteresis or fatigue effects. Exceptional insulating properties and radiation resistance of sapphire enable utilization of the sensitive element within the temperature range from -200°C to +350°C even under the impact of high electromagnetic interferences and radiation. Our strain gauge elements are manufactured by solid-state microelectronic methods and provide high quality and long therm stable repeatability.

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TECHNICAL DATA

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STANDARD PRESSURE RANGES

Nominal pressure range	[MPa]	**100**	**160**	**200**	**250**	**400**	**500**
Under pressure [1)]	[MPa]	-1	-1	-1	-1	-1	-1
Over pressure	[MPa]	150	240	300	375	500	600
Burst pressure	[MPa]	250	400	450	500	600	750

Note

1) Reverse pressure

All values relating to relative pressure. Customer specific pressure ranges on request.
100 MPa = 1000 bar

TEMPERATURE RANGES

Standard operating temperature range, option 1	(-45 to +125)°C
Extended operating temperature range, option 2	(-45 to +155)°C
High operating temperature range, option 3	(-45 to +200)°C

ELECTRICAL PARAMETERS

If not otherwise mentioned valid in the specified operating temperature ranges.

Parameter	**Min.**	**Typ.**	**Max.**	**Unit**
Bridge offset voltage [1)]	-10		+10	mV
Offset TC	-0.05		+0.05	%span/K
Full scale output signal [1)]	100	150	200	mV
Span TC	-0.05		+0.05	%span/K
Signal resolution			0.01	%span
Nonlinearity (best fit straight line)	-0.15		+0.15	%span
Hysteresis			0.05	%span
Output signal repeatability	-0.05		+0.05	%span
Bridge resistance [2)]	3.4	4.0	4.6	kΩ
Bridge resistance TC	1650		1850	ppm/K
Dielectric strength	700			VAC

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Isolation resistance at room temperature	100			MΩ
Isolation resistance over operating temperature range	20			MΩ
Bridge supply voltage, DC	5		10	V
Long term stability of sensitivity	-0.15		0.15	%span/ year
Additional offset error caused by vibration impact [3)]	-0.05		0.05	%span
Additional offset error caused by mounting torque [4)] at pressure port types MH1, MH2, MB1, MB2 with inner threads at pressure port types 2M, 2U with outer threads	 -0.02 -0.25		 0.02 0.25	%span

Notes

1) At 10 V bridge supply voltage, 25°C and ambient pressure
2) At 25°C and ambient pressure
3) For condition details see section mechanical parameters
4) Refer also to section mechanical parameters

MECHANICAL PARAMETERS

Material of process media wetted sensor part	Titanium alloy with 87% titanium
Ingress protection	IP 40
Module weight	29 g to 34 g depending on pressure port type, for details see also section pressure ports
Min. vibration proofness (sinus) according to IEC 68-2-6 and IEC 68-2-38	500 m/s^2 at (10 to 5000) Hz
Min. multiple shock proofness according to IEC 68-2-32	1000 m/s^2 Shock pulse width 2 ms
Max. mounting torque at pressure port types MH1, MH2, MB1, MB2 with inner threads [5)] for nominal pressure ranges (100 to 250) MPa for nominal pressure ranges (400 to 500) MPa	 35 Nm 50 Nm
Max. mounting torque at pressure port types 2M, 2U with outer threads [5)] for nominal pressure ranges (100 to 250) MPa for nominal pressure ranges (400 to 500) MPa	 50 Nm 80 Nm

Notes

5) Only with proper tools at hex allowed. See also section pressure ports.

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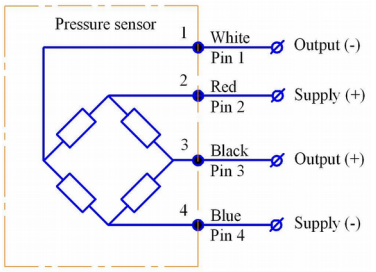
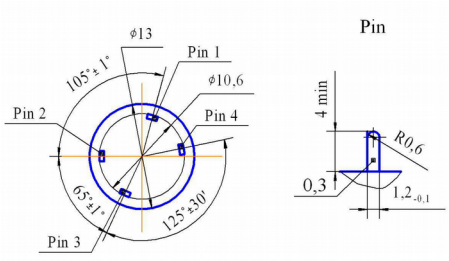
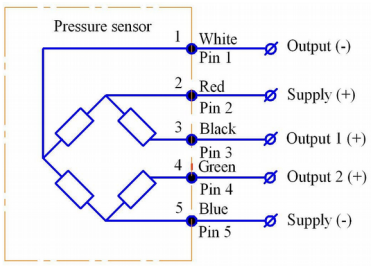
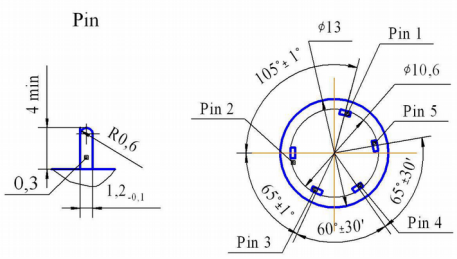
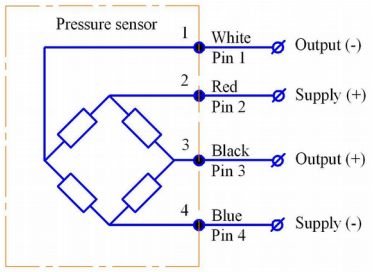
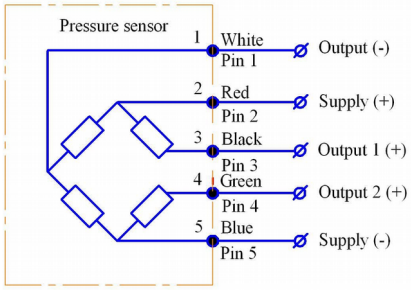
SENSOR BRIDGE CIRCUITS

Modules with solder pins

Sensor bridge type/ pin mapping	Circuit diagram	Mechanical drawing of pin configuration
Closed Pin 1: output minus Pin 2: supply plus Pin 3: output plus Pin 4: supply minus		
Open Pin 1: output minus Pin 2: supply plus Pin 3: output plus 1 Pin 4: output plus 2 Pin 5: supply minus		

Modules with flexible wires

Sensor bridge type/ wire mapping	Circuit diagram	Notes
Closed white: output minus red: supply plus black: output plus blue: supply minus		All wires with cross-sections of 0.09 mm and PTFE insulation
Open white: output minus red: supply plus black: output plus 1 green: output plus 2 blue: supply minus		All wires with cross-sections of 0.09 mm and PTFE insulation

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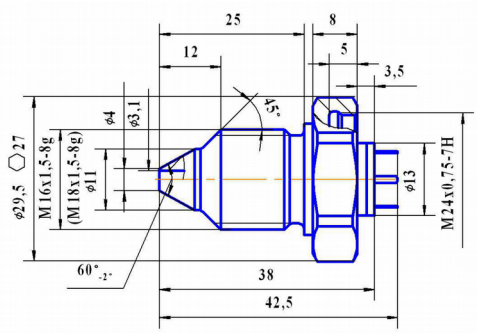
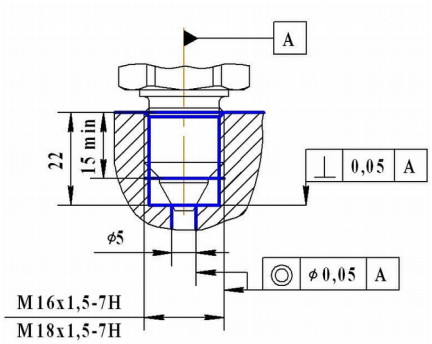
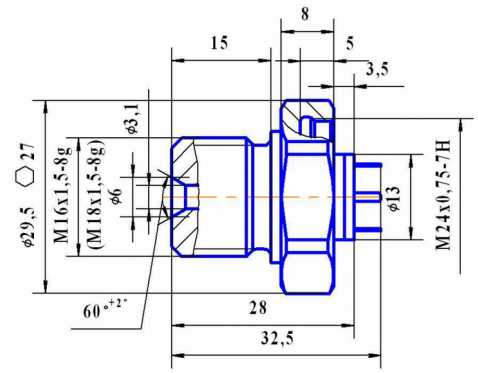
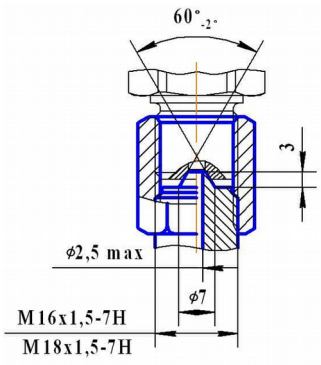
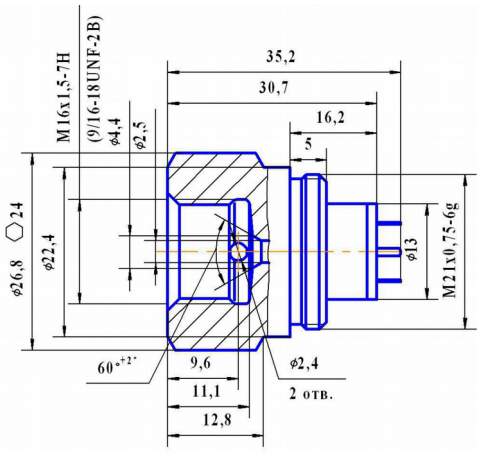
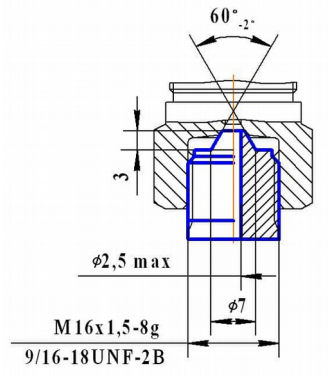
PRESSURE PORTS

Pressure modules with solder pins		
Designation	Pressure port drawing	Recommendation for mounting
Code: **MH1** Thread: M16x1.5-8g HEX: 27 Weight: 34 g **Code:** **MH2** Thread: M18x1.5-8g HEX: 27 Weight: 34 g	 **D-01**	
Code: **MB1** Thread: M16x1.5-8g HEX: 27 Weight: 30 g **Code:** **MB2** Thread: M18x1.5-8g HEX: 27 Weight: 30 g	 **D-02**	
Code: **2M** Thread: M16x1.5-7H HEX: 24 Weight: 29 g **Code:** **2U** Thread: 9/16-18UNF-2B HEX: 24 Weight: 29 g	 **D-03**	

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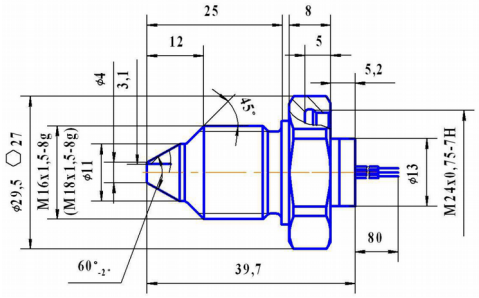
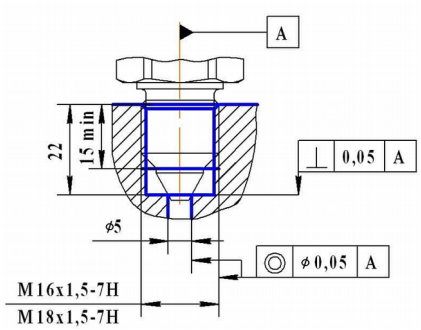
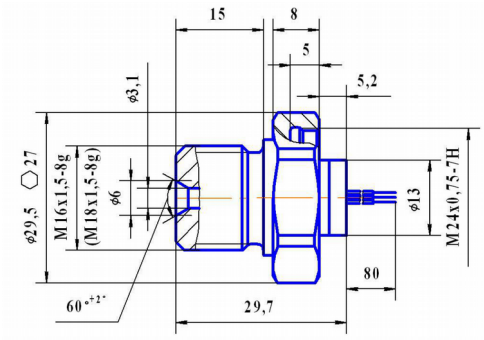
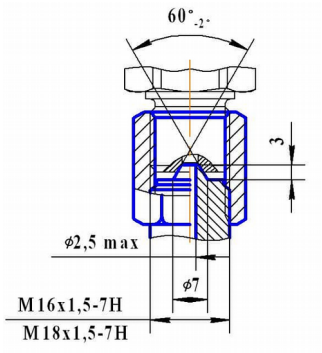
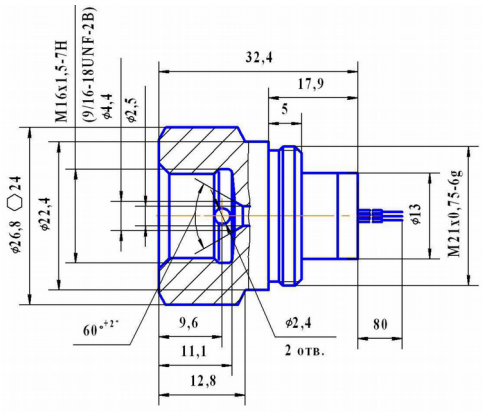
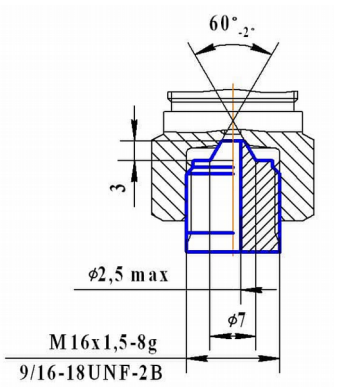
Pressure modules with flexible wires		
Designation	Pressure port drawing	Recommendation for mounting
Code: **MH1** Thread: M16x1.5-8g HEX: 27 Weight: 34 g **Code:** **MH2** Thread: M18x1.5-8g HEX: 27 Weight: 34 g	 **D-04**	
Code: **MB1** Thread: M16x1.5-8g HEX: 27 Weight: 30 g **Code:** **MB2** Thread: M18x1.5-8g HEX: 27 Weight: 30 g	 **D-05**	
Code: **2M** Thread: M16x1.5-7H HEX: 24 Weight: 29 g **Code:** **2U** Thread: 9/16-18UNF-2B HEX: 24 Weight: 29 g	 **D-06**	

RECOMMENDED PROCESS MEDIA

All gases and liquids and their mixtures which are not aggressive against titanium alloys like air, sea water, 5% vitriol acid, chlorine water, chloride solutions, mineral oils, ethyne etc.

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ORDERING CODES

	Product family	Pressure range	Tempera-ture range	Sensor bridge circuit	Pressure port type	Electrical connection
High pressure sensor module	L-HD					

Standard pressure ranges

(0 to 100) MPa	100
(0 to 160) MPa	160
(0 to 200) MPa	200
(0 to 250) MPa	250
(0 to 400) MPa	400
(0 to 500) MPa	500

Media temperature range

-45°C to +125°C	1
-45°C to +155°C	2
-45°C to +200°C	3

Sensor bridge circuit

Closed bridge	0
Open bridge	1

Pressure port type

M16x1.5-8g outer conic sealing (pressure port drawing D-01, D-04)	MH1
M18x1.5-8g outer conic sealing (pressure port drawing D-01, D-04)	MH2
M16x1.5-8g outer conic sealing (pressure port drawing D-02, D-05)	MB1
M18x1.5-8g outer conic sealing (pressure port drawing D-02, D-05)	MB2
M16x1.5-7H inner conic sealing (pressure port drawing D-03, D-06)	2M
9/16-18UNF-2B inner conic seal. (pressure port drawing D-03, D-06)	2U

Electrical connection

Solderable flexible wires with 80 mm length (standard)	L
Solder pins with 4.5 mm height	P

In case other wire lengths are wished please add the required length to the wire code L in millimeters. For example L100 for 100 mm wire length.

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	Product family	Pressure range	Tempera-ture range	Sensor bridge circuit	Pressure port type	Electrical connection
Ordering example						
High pressure sensor module for (0 to 2500) bar and (0 to 250) MPa resp., operating temperature range (-45 to +155)°C with M18x1.5-8g outer conic sealing acc. to D01 and solder pins, sensor bridge closed	**L-HD**	**250**	**2**	**0**	**MH2**	**P**

Your order code according to this example would be:

L-HD-250-20-MH2-P

PRODUCT MARKING

All pressure sensor modules are marked on hex including the product code and a 6 digit serial number like shown on the right side in the picture below.

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