



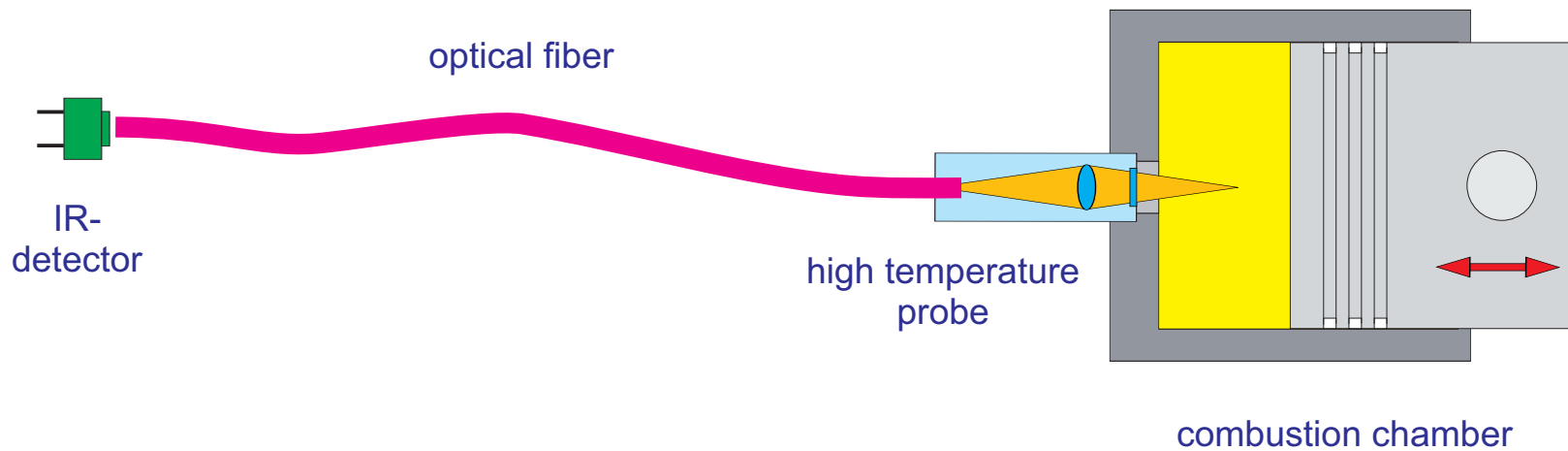
**Innovative Metrology
for Combustion Engines
with
Optical Sensors
and
Fiberoptical Sensors**



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Combustion Chamber Thermometer

CCT Fast fiberoptical temperature sensor for application in combustion chambers



CPS 1500 B

Characteristics

- Membrane diameter: 1.5 mm
- Mounting thread : M 3 x 0,5
- Permanently connected amplifier
- Max. sensor head temperature : 400 °C
- Max. membrane temperature : 600°C
- Fiberoptical cable : silicon rubber with Kevlar strength member
- Frequency range : 1 Hz40 kHz
- Pressure ranges : 0-10 ...0-250 bar
- Pressure overload : 20 % (FSO)
- Supply voltage : 12 V DC
- Output signal : analog voltage signal output



Cylinder Pressure Sensor

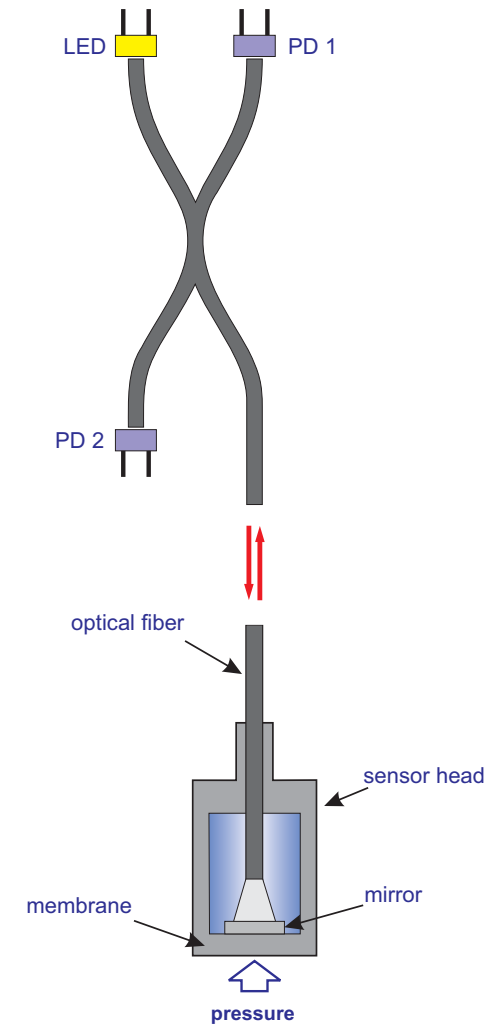
CPS 1500 B



Applications:

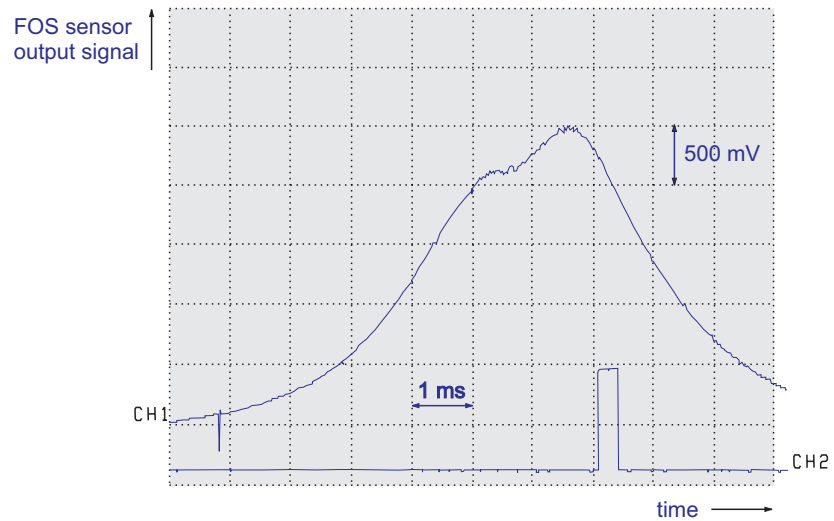
- Permanent engine cylinder pressure control
- Permanent engine cylinder pressure monitoring
- Motor tuning
- Car racing sports
- Combustion engine development

Measuring Principle

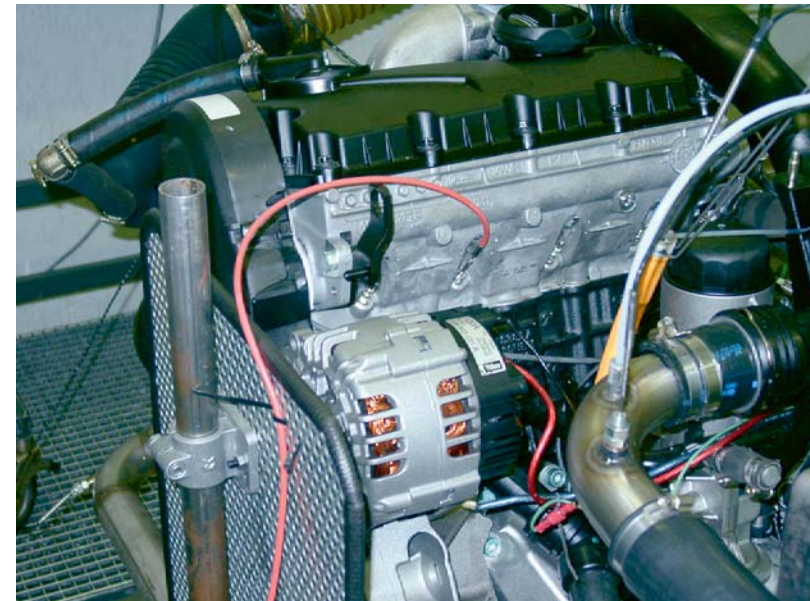


Cylinder Pressure Sensor

CPS 1500 B



FOS pressure sensor CPS 1500-B mounted in glow plug measuring adapter, combustion chamber signal, sensor sensitivity: 20 mV/bar

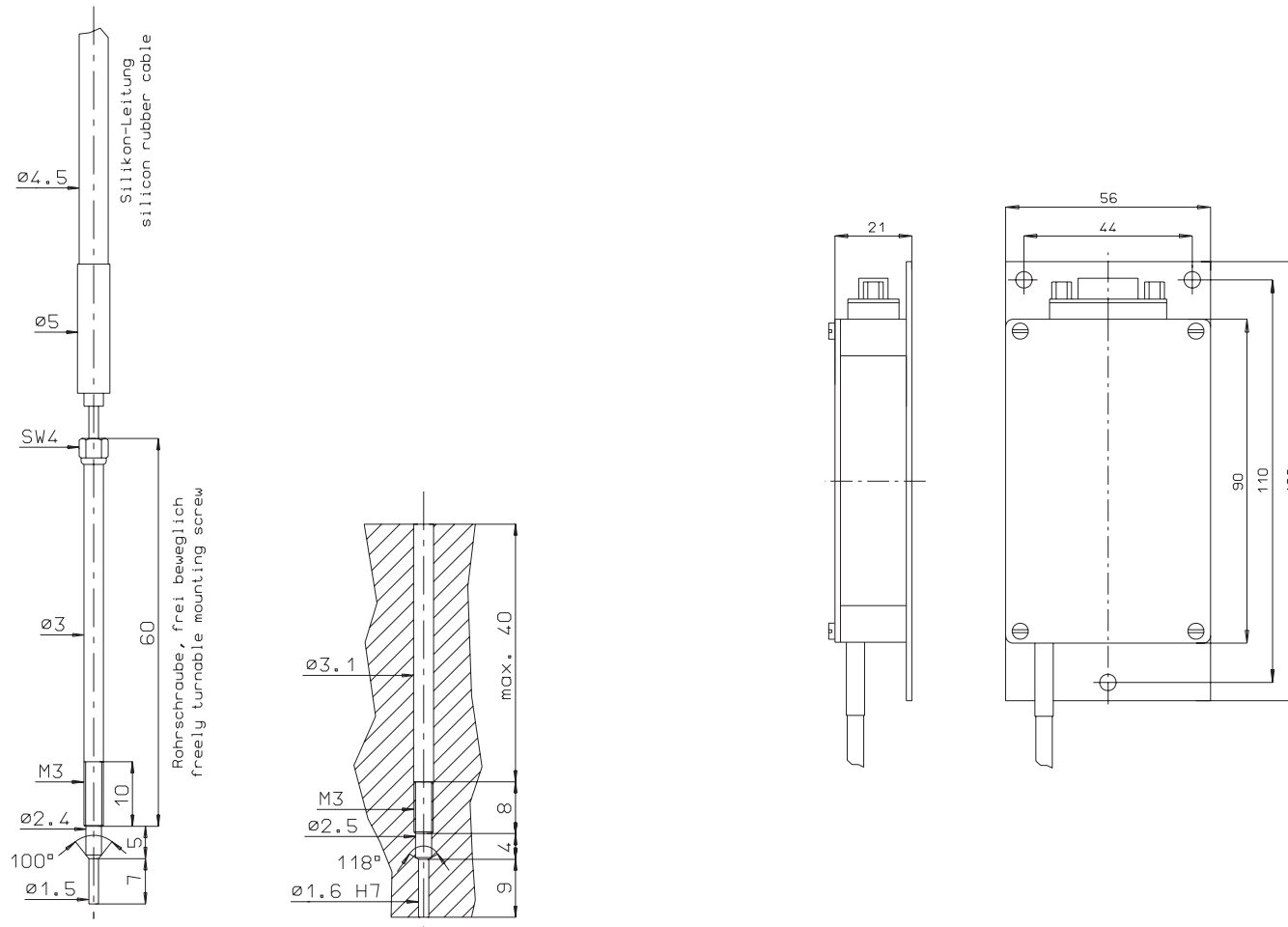


Cylinder Pressure Sensor



MESSTECHNIK GMBH
CPS
4/4

CPS 1500 B



FOS The experts in metrology
MESSTECHNIK GMBH

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CPS 3000 B

Characteristics

- Membrane diameter: 3.0 mm
- Mounting thread : M 4 x 0,5
- Permanently connected amplifier
- Max. sensor head temperature : 300 °C
- Fiberoptical cable : silicon rubber with Kevlar strength member
- Frequency range : 1 Hz40 kHz
- Pressure ranges : 0-10 ...0-3000 bar
- Pressure shock resistant
- Pressure overload : 20 % (FSO)
- Supply voltage : 12 V DC
- Output signal : analog voltage signal output



Pressure Sensor

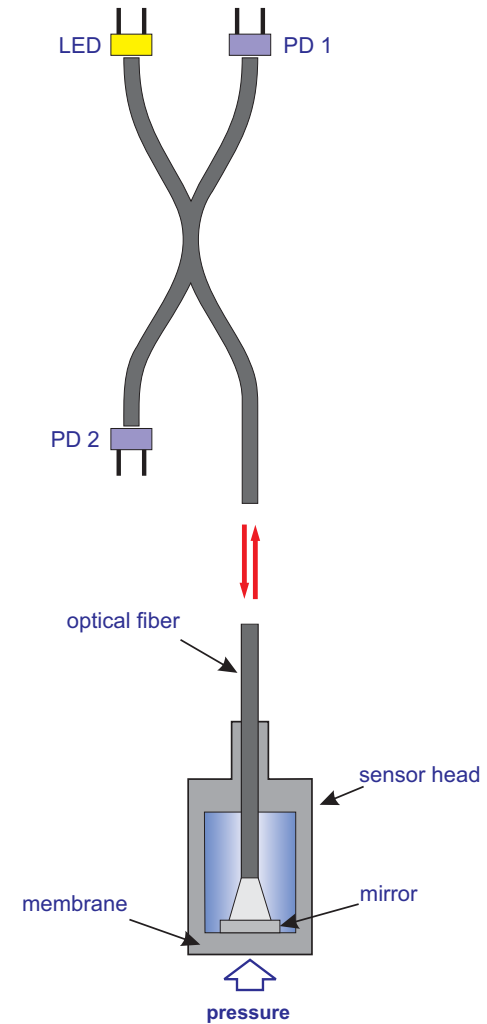
CPS 3000 B



Applications:

- Fuel injection systems
- Hydraulic systems

Measuring Principle

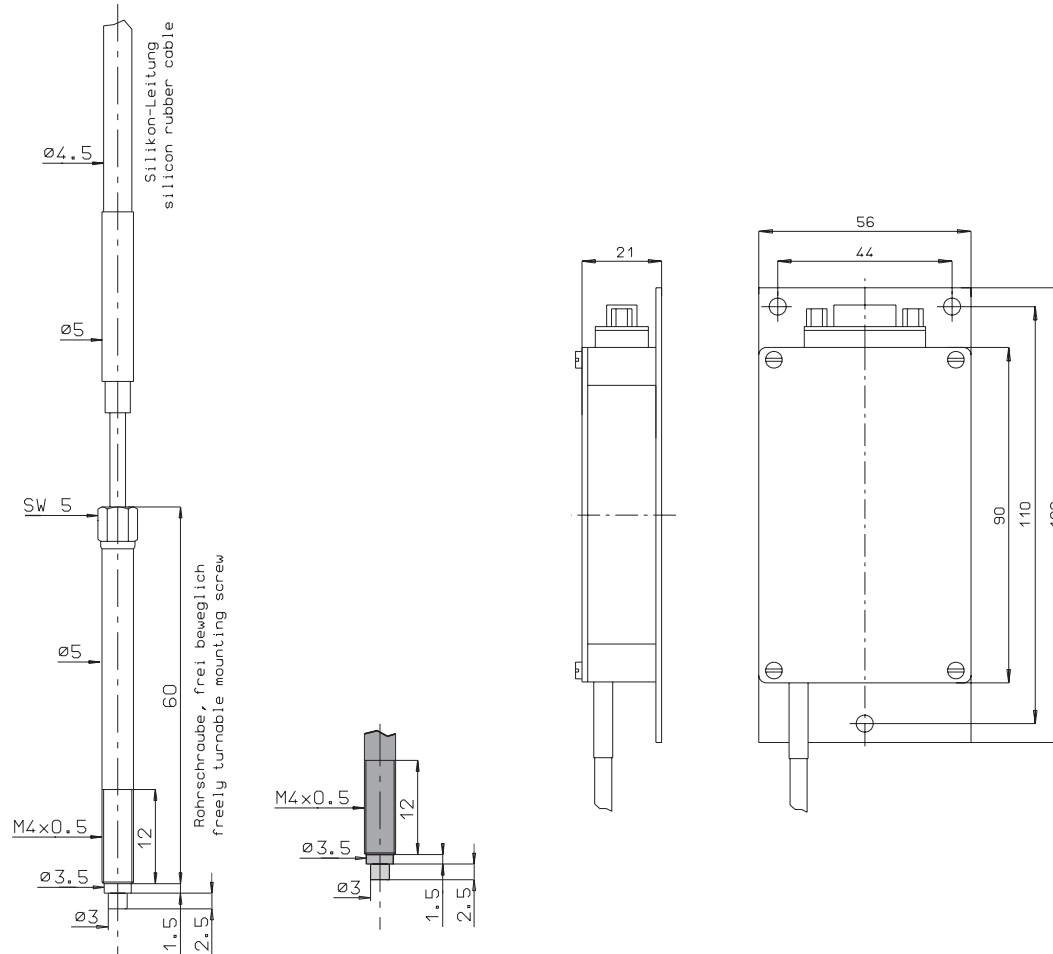


Pressure Sensor



MESSTECHNIK GMBH
CPS3
3/3

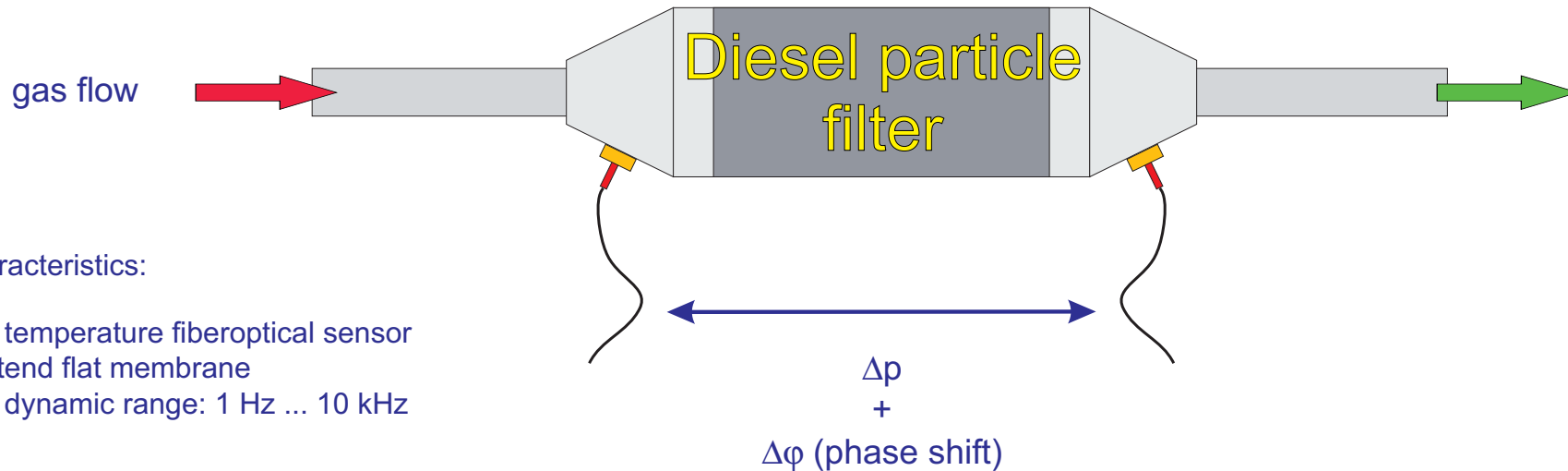
CPS 3000 B



Exhaust Gas Pressure Sensor

EGPS

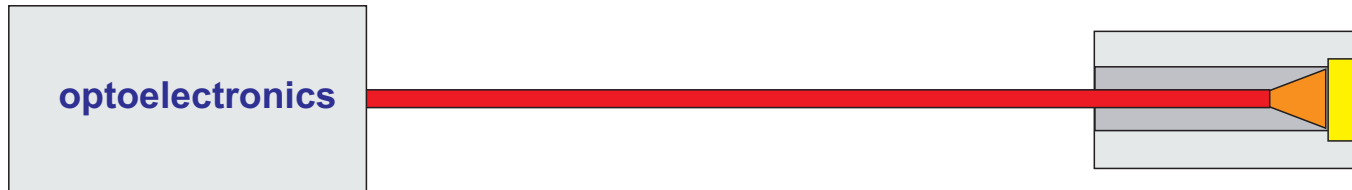
Fast fiberoptical pressure sensor for application in engine exhaust systems



Characteristics:

- High temperature fiberoptical sensor
- Frontend flat membrane
- High dynamic range: 1 Hz ... 10 kHz

FOOM



- Photodetectors
Range: 200 ... 6.000 nm
- Spectrometers
- FOS Optronics

- Single optical fiber
- Bundle of optical fibers

- Optical indicating probes
- Imaging optics



Glowplug with intergrated fiberoptical pressure sensor

GP-IPS



GP-IPS

for cylinder pressure controlled combustion

- patent pending construction
- new glow tip
- new glow procedure (electronic temp. control)
- M 8 and M 10 glowplugs
- integrated fiberoptical pressure sensor
with \varnothing 1,5 ... 3 mm diaphragm
- programmable sensor characteristic

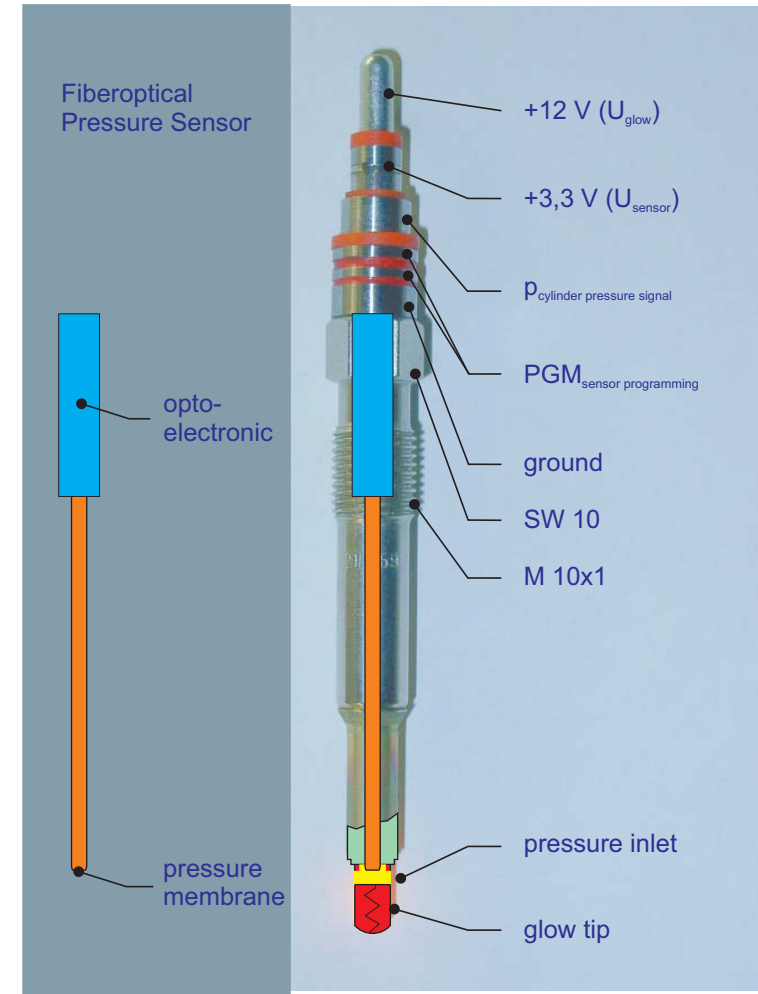
Glowplug with intergrated fiberoptical pressure sensor

GP-IPS



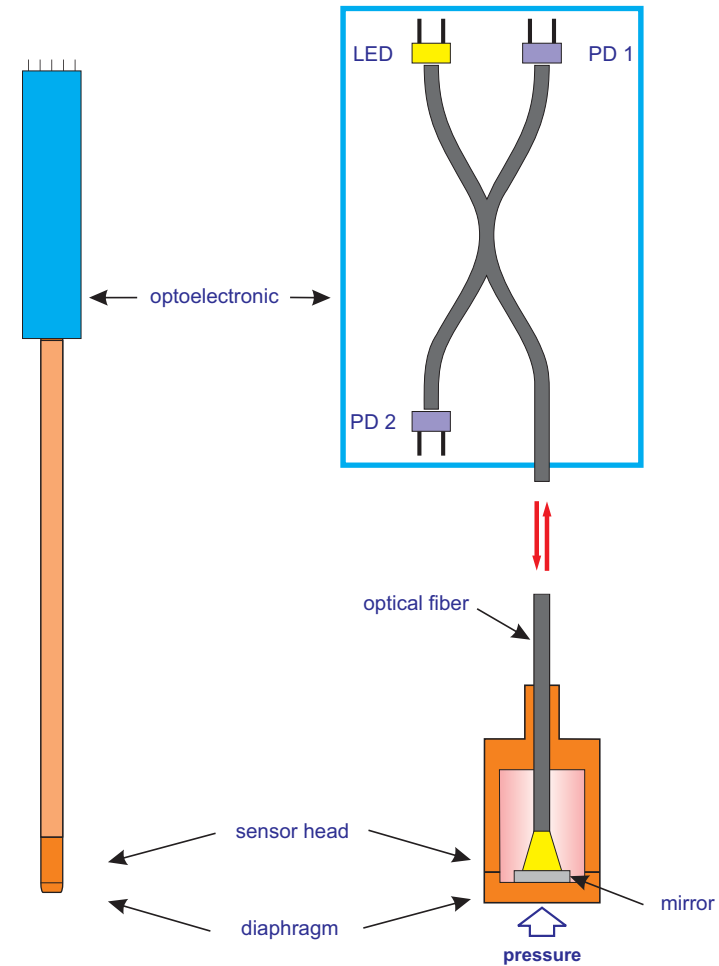
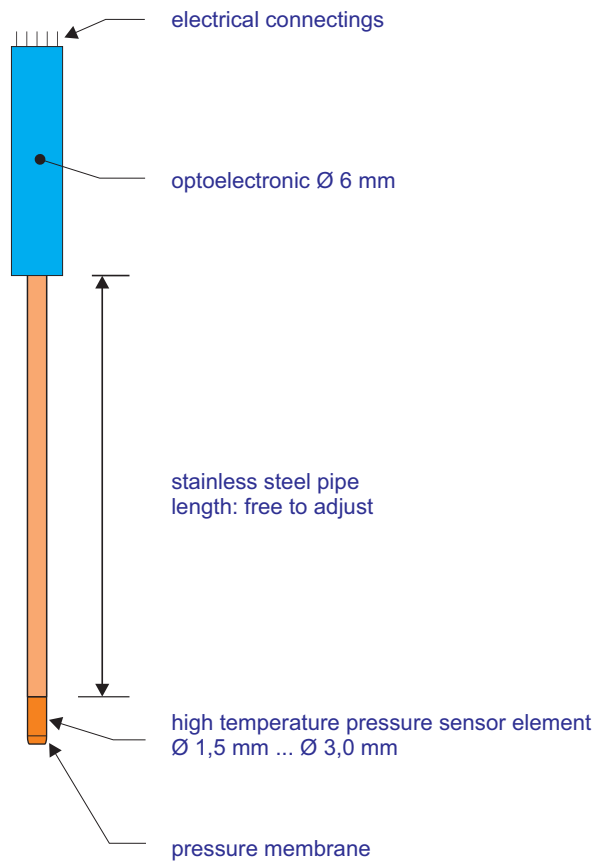
The new glowplug technology

- new glowplug tip
- reduced heat loss
- useful for intermediate glowing and T_{constant} -operation
- improved combustion



Glowplug with intergrated fiberoptical pressure sensor

GP-IPS



Glowplug with intergrated fiberoptical pressure sensor

GP-IPS



Wer dynamische Druckverläufe mit beweglichen Stiften mißt, hat im Physikunterricht nicht aufgepaßt oder hält Massenträgheit für eine Alterserscheinung.

Guys measuring dynamic pressures with moving rod systems, have been sleeping during the physics lessons or think about inertial mass as a symptom of old age.

Dr. E. Giese
Dipl.-Phys.
FOS Meßtechnik GmbH,
Schacht-Audorf



Drucksensoren mit Stößelstiften haben innere Reibung (sticking) und zeigen Hysterese, die im Verlauf der Betriebsdauer undefiniert zunehmen.

Pressure sensors using push rod systems show internal friction and hysteresis which increase undefined during runtime.

H.C. Sonderegger
Firmengründer
Company Founder
Kistler Instrumente AG,
Winterthur

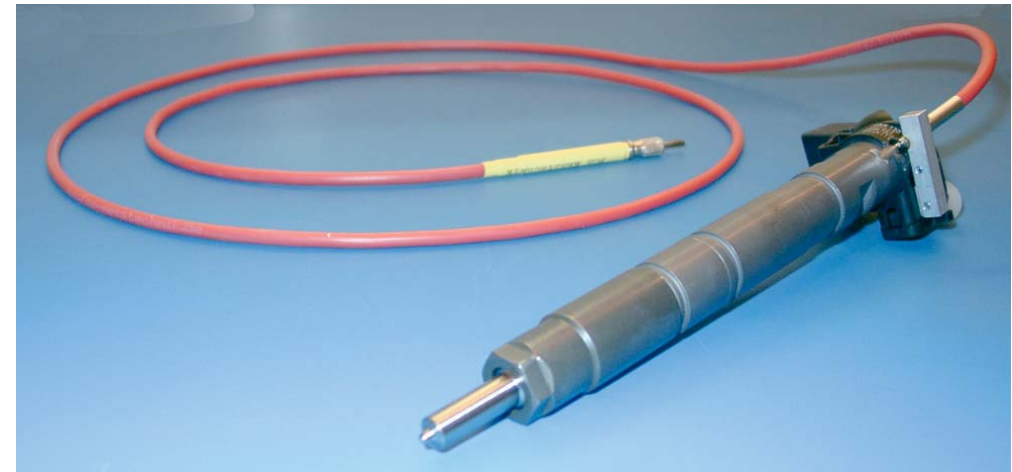
... und daher hat **FOS** eine Glühkerze mit einem Membrandrucksensor entwickelt.

... and this is the reason why **FOS** has developed a glowplug with a membrane pressure sensor inside

NLS-1

Characteristics

- Fiberoptical measuring system
- Absolute free of EMI with electrical supply of piezoelectric actuator
- High resolution system (1.000 μm = 5.000 V)
- High bandwidth : 0 ... 80 kHz
- No influence on injector properties
- Can be integrated in already existing constructions and all standard injectors



NLS-1

Applications:

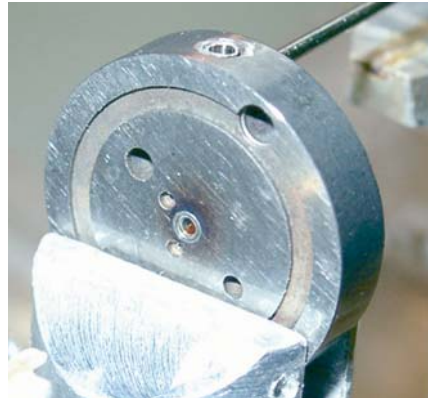
- Common rail injectors
- Needle lift monitoring
- Injection system adjustment
- Long term tests of injector ageing
- Injection system optimizing



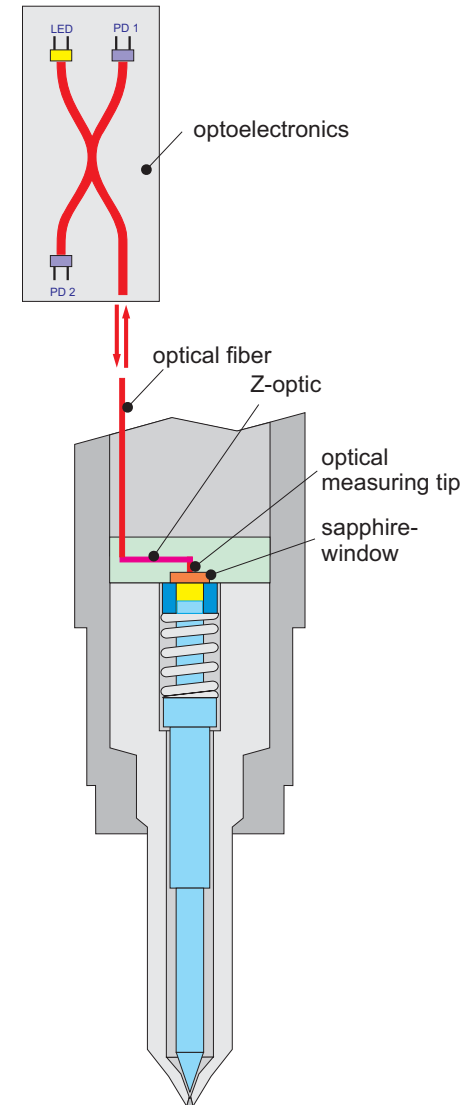
CR-Injector with fiberoptical needle lift measuring system

Fiberoptical Needle Lift Sensor

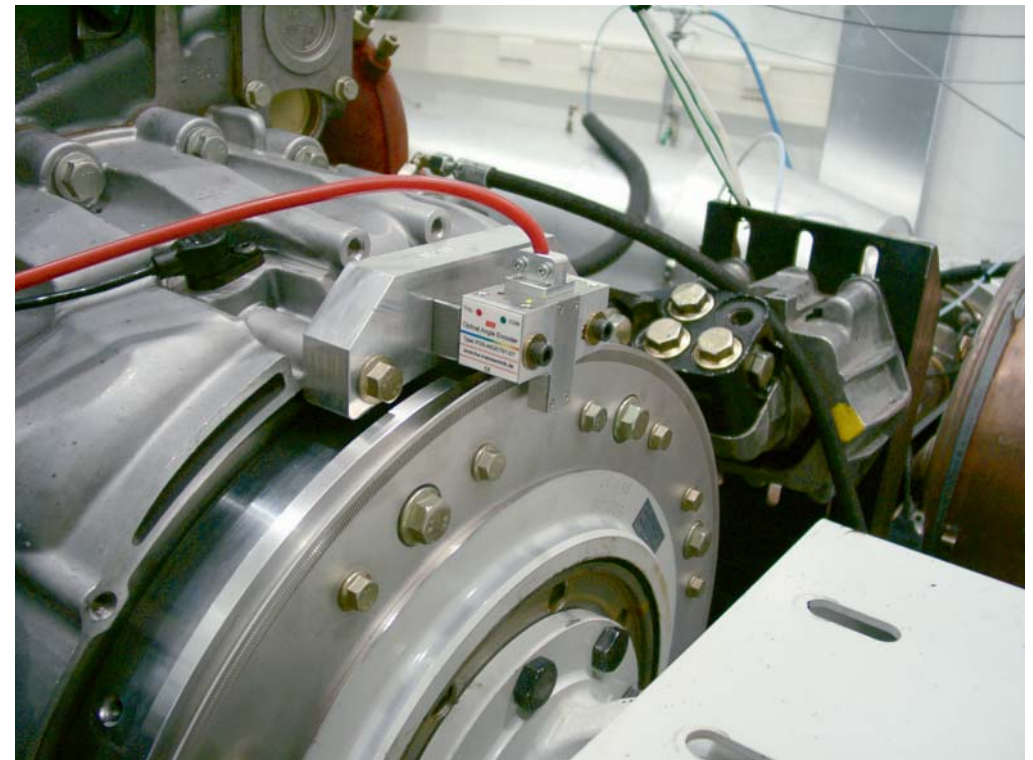
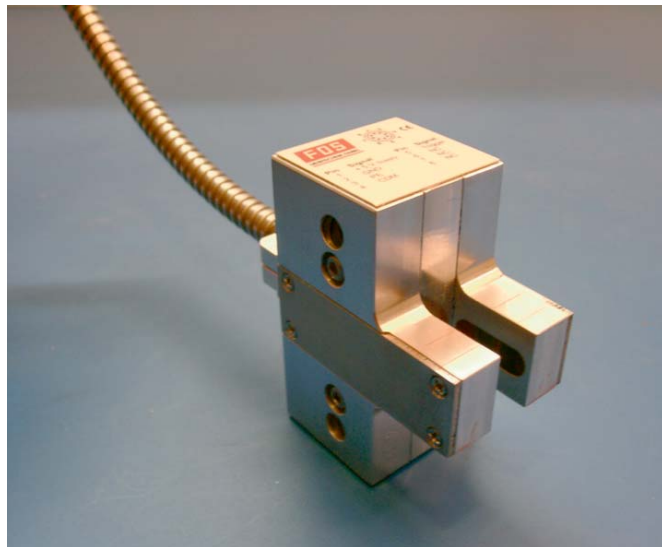
NLS-1



Principle of fiberoptical measuring setup

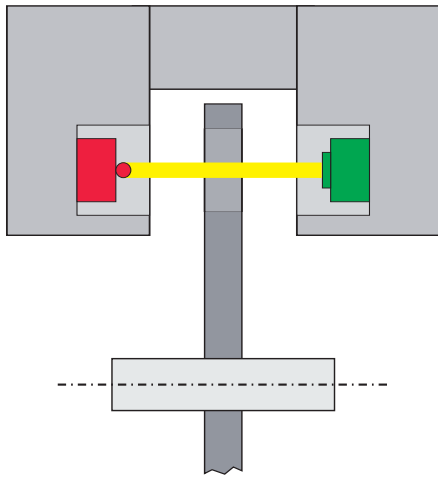


Optical Angle Encoders

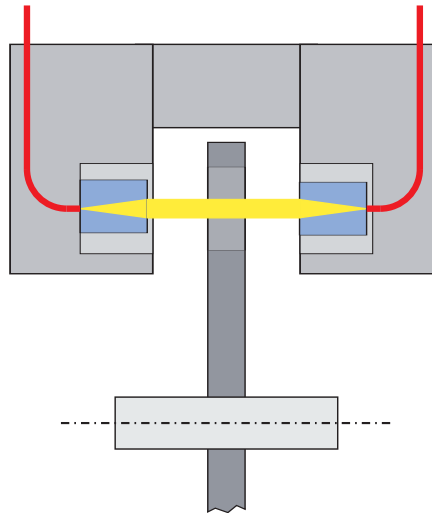


- Reliable
- Simple mounting and handling
- High temperature operation up to 300 °C
- Customer specific designs
- Signal and connector compatible to AVL indicating units
- Sensors made by FOS

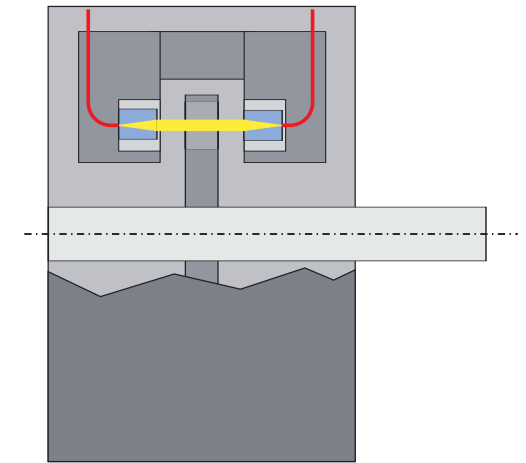
Overview



- OAE-A1-Series
- Open slot wheel system
- Optoelectronic integrated in sensor head
- 2-light-beam system (CDM, Trigger)
- T_{\max} 150°C



- OAE-A2-Series
- Open slot wheel system
- All fiberoptic sensor head
- 2-light-beam system (CDM, Trigger)
- T_{\max} 300°C
- Noise and EMI protection by fiberoptic transmission



- OAE-A3-Series
- Hermetically sealed shaft encoder
- All fiberoptic sensor head
- 2-light-beam system (CDM, Trigger)
- T_{\max} 150°C
- Noise and EMI protection by fiberoptic transmission

Optical Angle Encoders

Additional Components



Slot Wheels
(customer design)



Pulse Multiplier

Optical Angle Encoders

Additional Components



Low Noise
Signal Converters



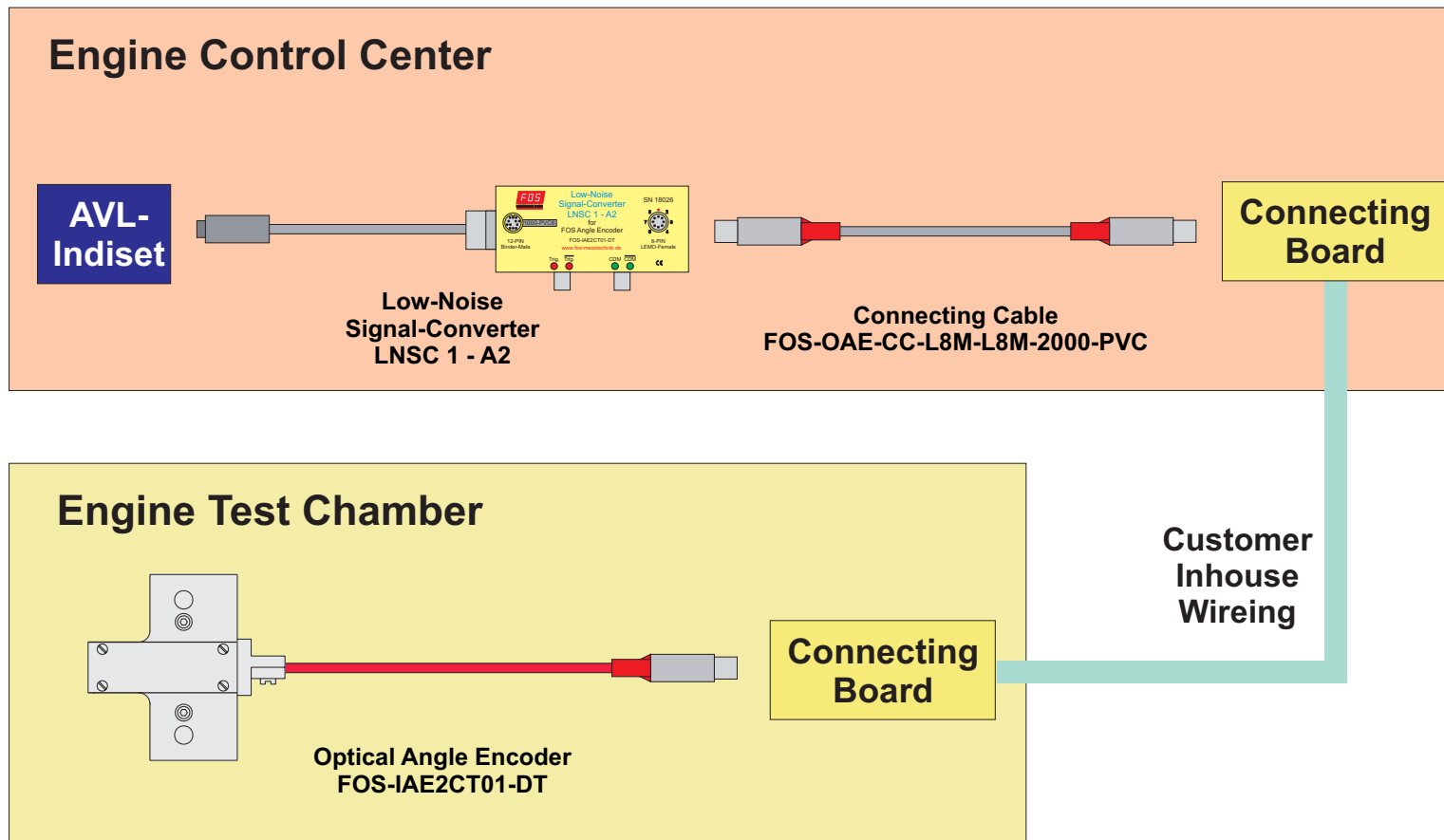
Signal and Supply Units
(battery powered)



Cable Sets

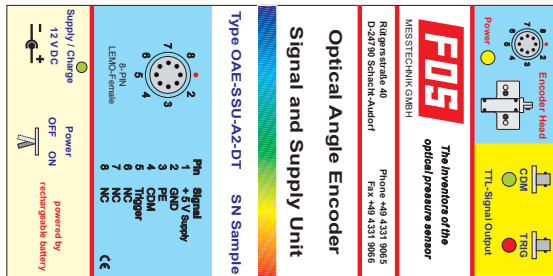
Optical Angle Encoders

Connecting Scheme Sample

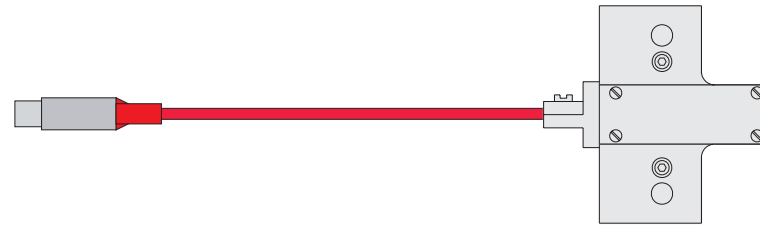


Optical Angle Encoders

Stand Alone System



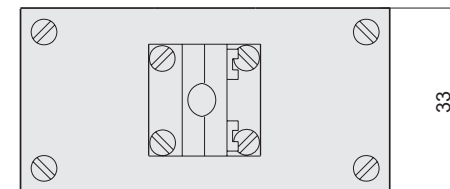
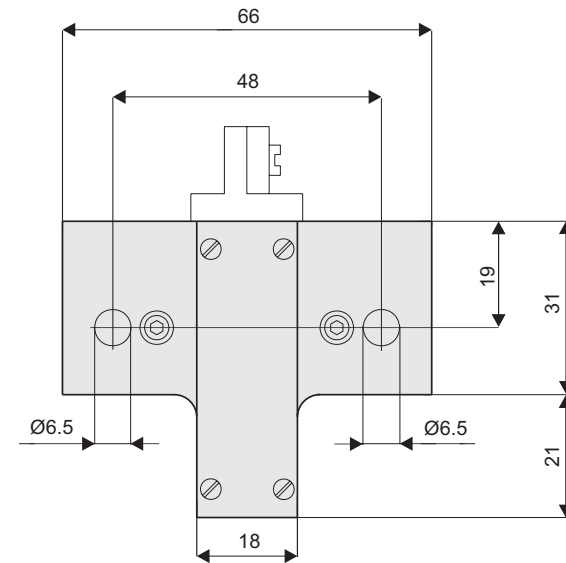
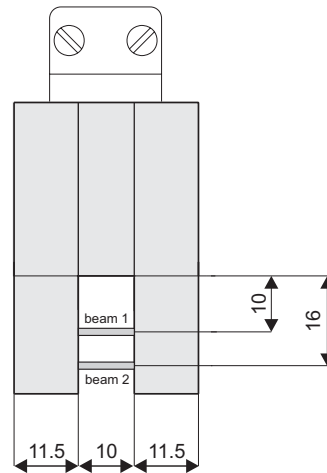
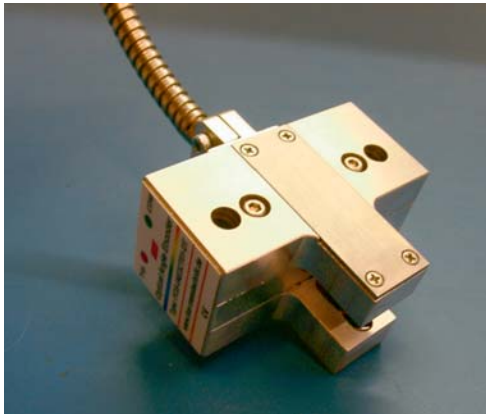
**Optical Angle Encoder
Signal and Supply Unit
OAE-SSU-A2-DT**



**Optical Angle Encoder
FOS-IAE2CT01-DT**

Optical Angle Encoders

Dimensions Type: FOS-IAE2CT01-DT



OCS

Characteristics

- Potential free measurement of ignition currents
- Optoelectronic system
- Frequency range 0-200 kHz
- Measuring range 0-200 mA,, 0-1000 mA
- Easy installation
- EMI proof
- High voltage protection by POF*
- Visible red light

* : POF = Polymer Optical Fiber



Optical Current Sensor



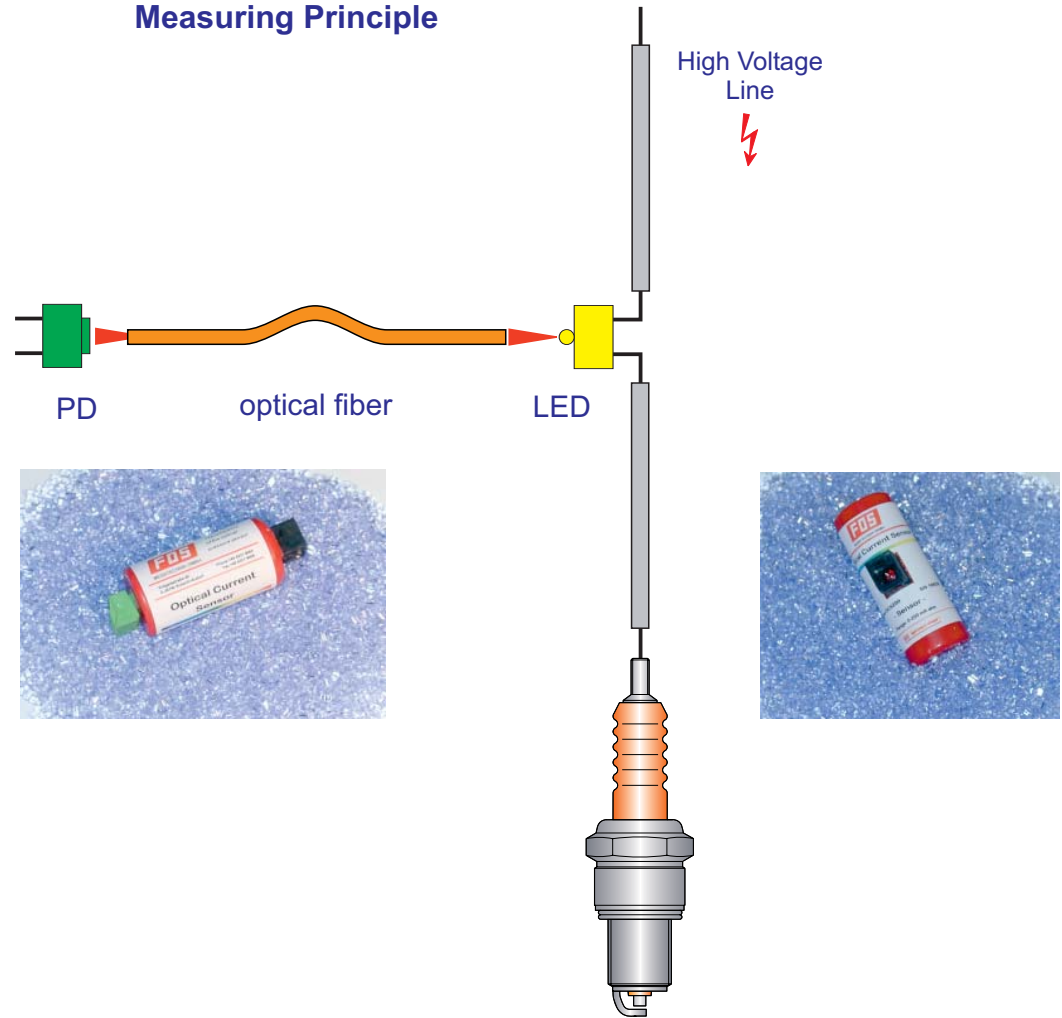
MESSTECHNIK GMBH

OCS
2/3

OCS

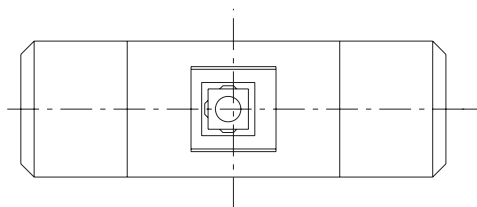
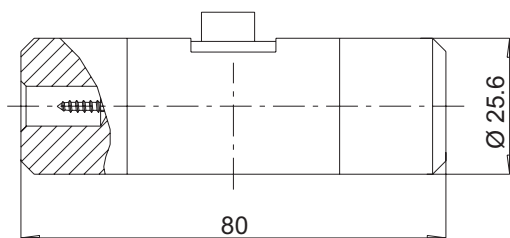


Measuring Principle



Optical Current Sensor

OCS



General characteristics

Ranges	0-200, ..., 0-1000 mA
Current direction	bidirectional (standard)
Optical fiber	Ø 1 mm POF
Accuracy	5 % FSO

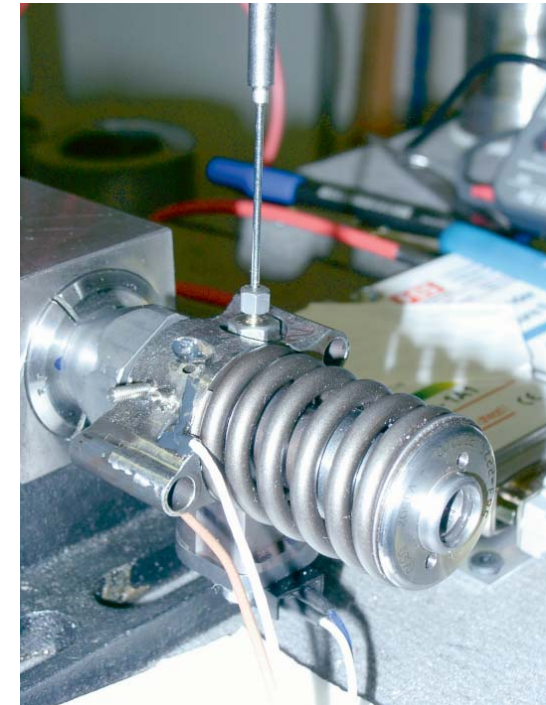
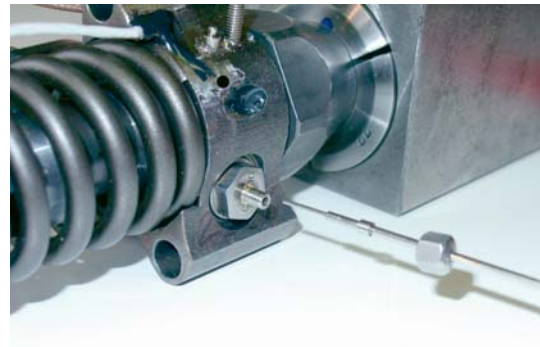
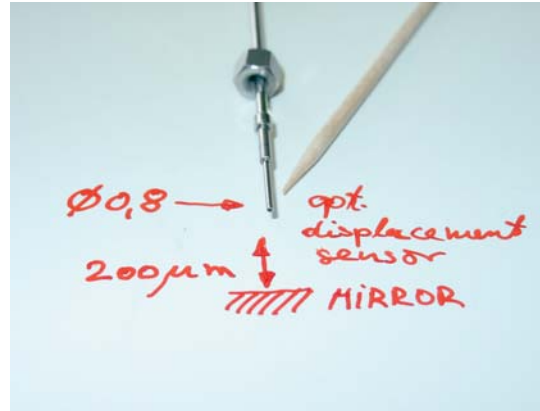
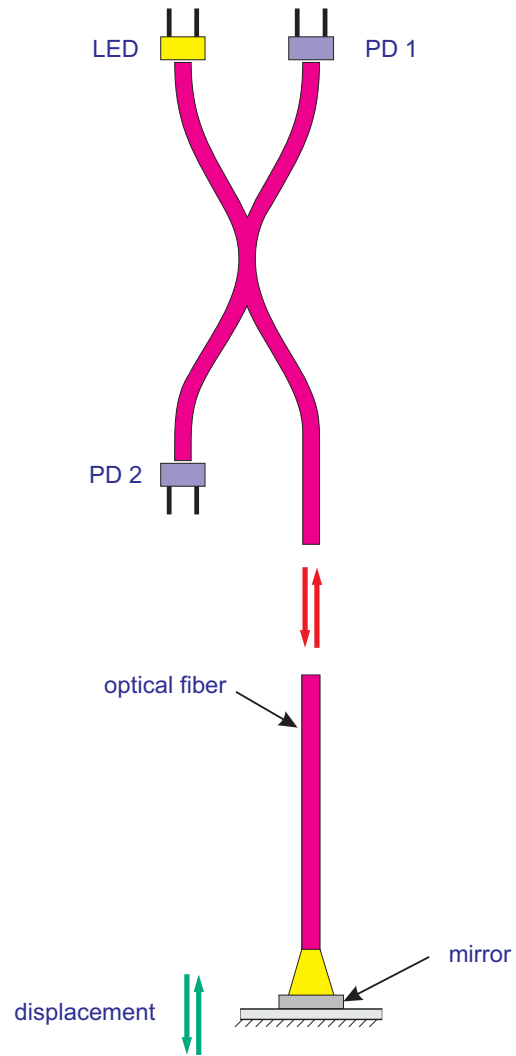
Electrical characteristics

Supply voltage	6-18 VDC
Bandwidth	0-200 kHz
Voltage loss over sensor	< 3,5 V
Current consumption	< 10 mA



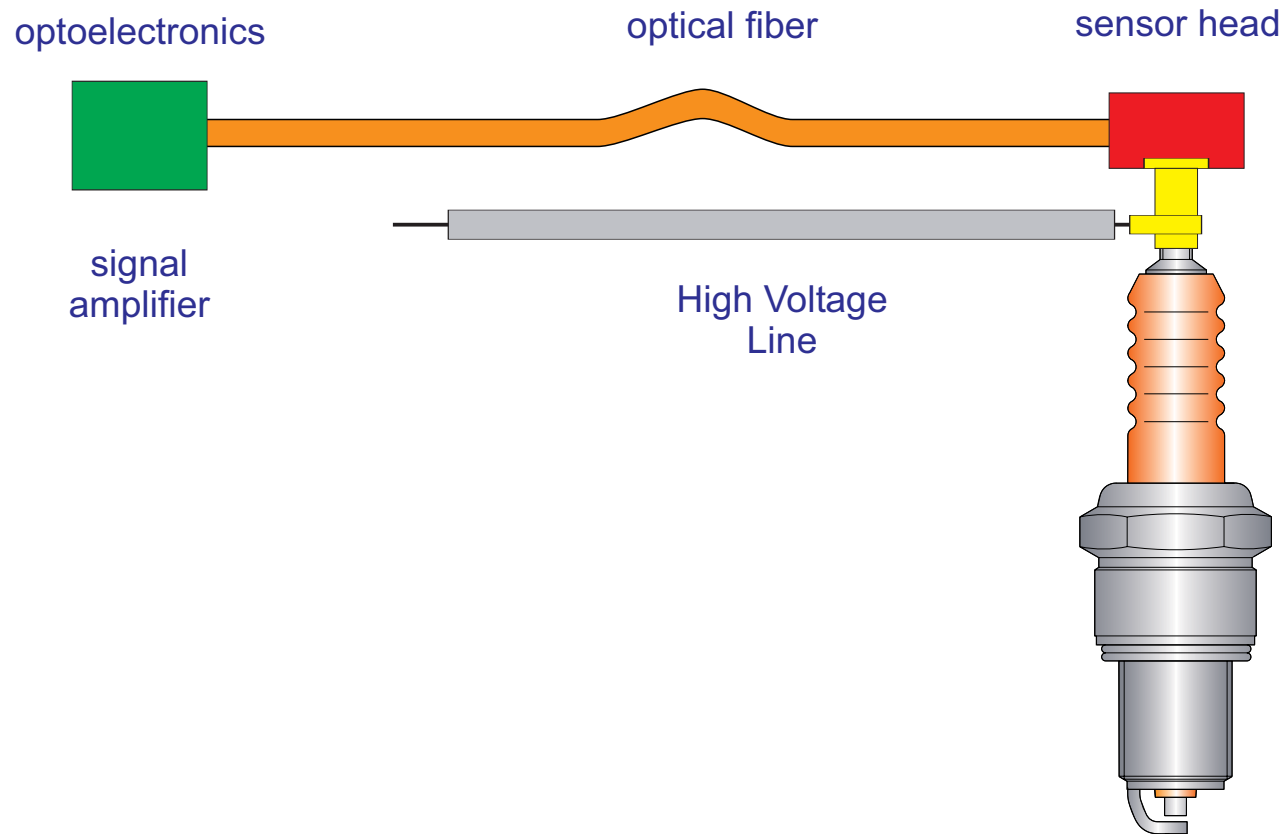
Fiberoptical Displacement Sensor

ODS



Fiberoptical Ignition Voltage Sensor

OVS



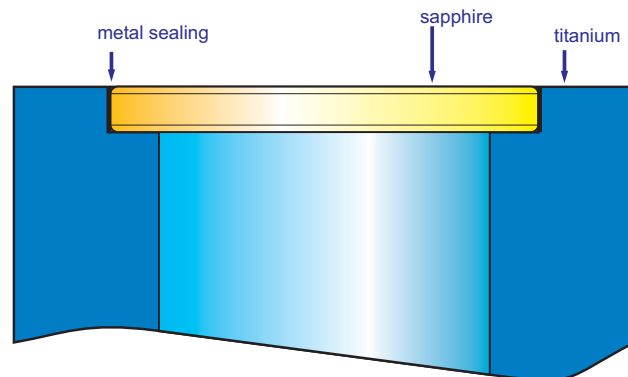
OWS-AX

Characteristics

- pressure proof up to 3.000 bar
- resists temperatures of 600 °C
- chemical resistant
- 100 % resistant against solvents
- optical transmission from 150 nm to 6.000 nm
- various mechanic designs
- complete optical probes



OWS-AX



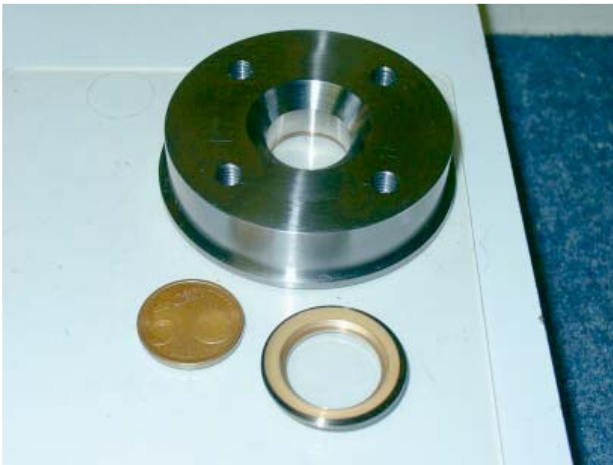
Schematic construction

Fields of use

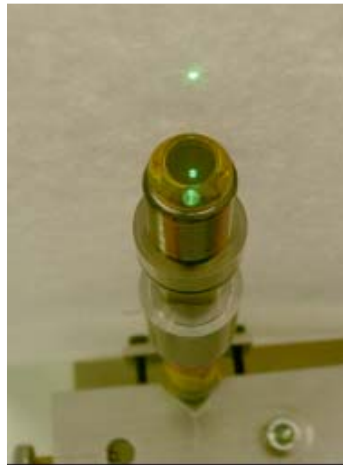
- chemistry
- chemical process control
- R&D
- laser technique
- food processing
- plastics processing
- optical flow control
- combustion engines
- spectroscopy
- ...

OWS-AX

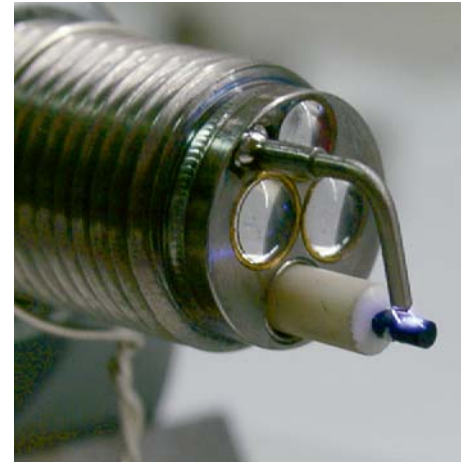
Design examples



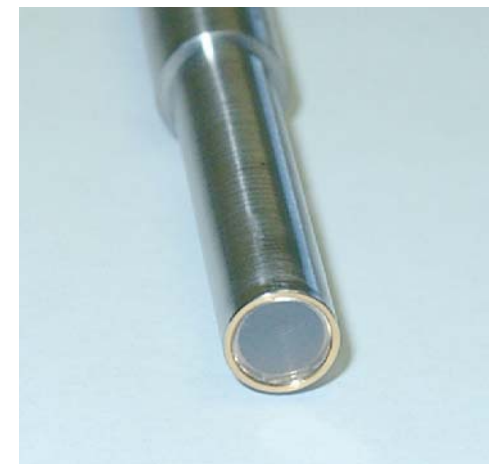
Sapphire window ($\varnothing 18$, $t=4$ mm)
for chemical process control



Spark plug probe with
integrated sapphire
window and sapphire
prism



Spark plug probe with
integrated sapphire
lenses and ignition
electrodes

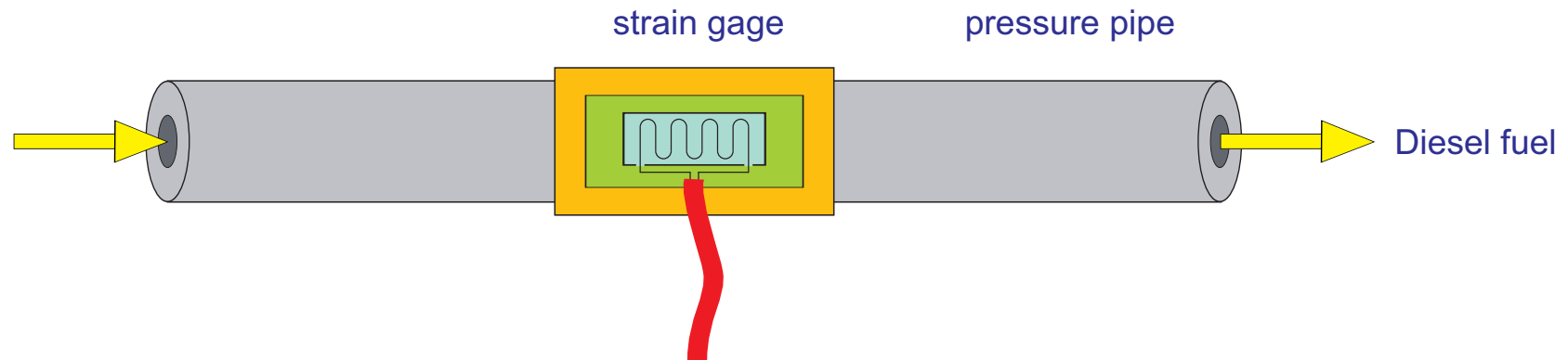


Optical endoscope sleeve

Pipe Pressure Sensor (strain gage)

PPS-SG

Non invasive pressure monitoring in high pressure pipes of injection systems

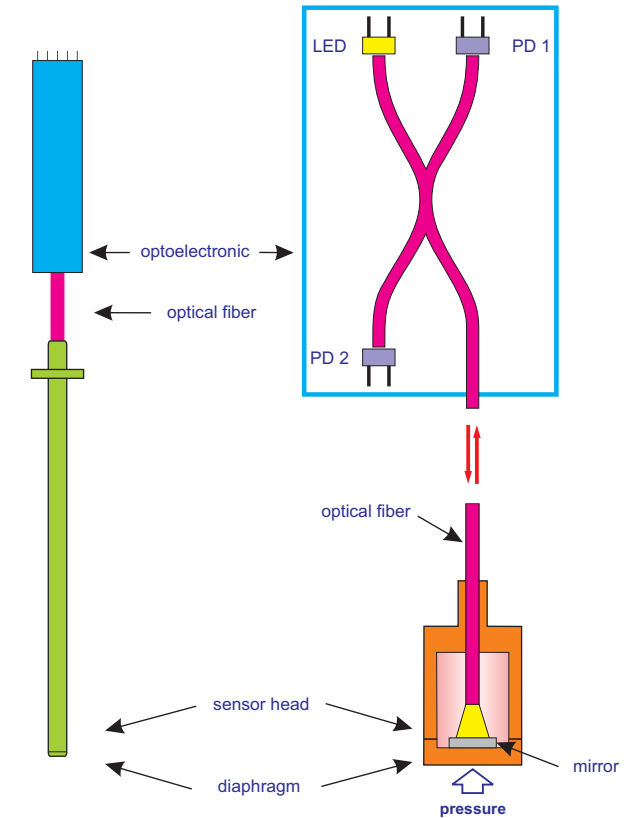
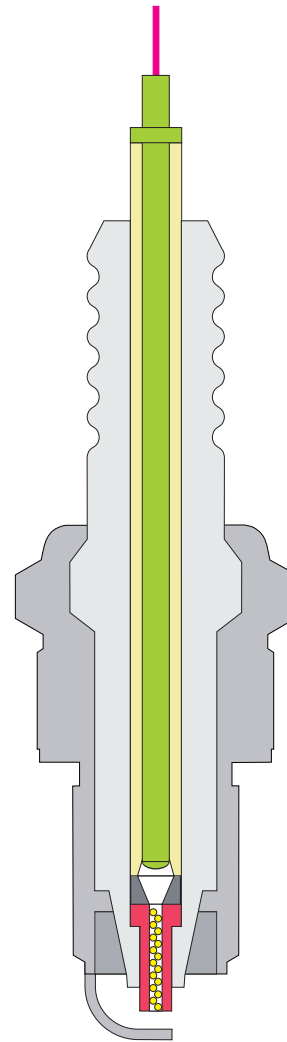
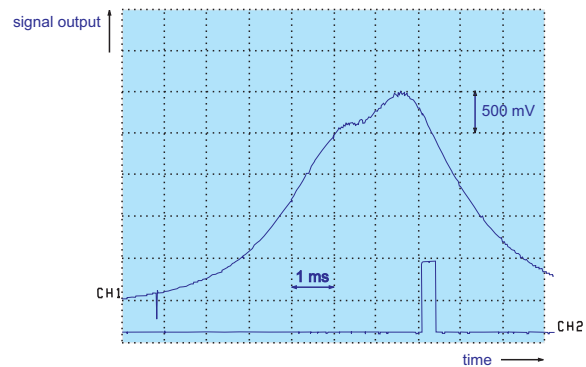


Spark Plug with integrated fiberoptical pressure sensor

SP-IPS

for cylinder pressure controlled combustion

- patent pending construction
- sensor not influenced by ignition voltage
- integrated fiberoptical pressure sensor with \varnothing 1,5 mm membrane
- programmable sensor characteristic
- signal frequency range 1 Hz ... 80 kHz



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Turbo Charger Control Sensor

TCS

Fiberoptical sensor for blade temperature and number of revolutions

