GB

Fluid Property Sensor

FPS2000

Installation guide and specifications

DD0000067 Rev –

www.parker.com/hfde

ENGINEERING YOUR SUCCESS.

Contents

General precautions

FPS sensor should remain in the carrier packaging until set-up on the application. If removed from the system, the FPS sensor should be placed back in its carrier packaging.

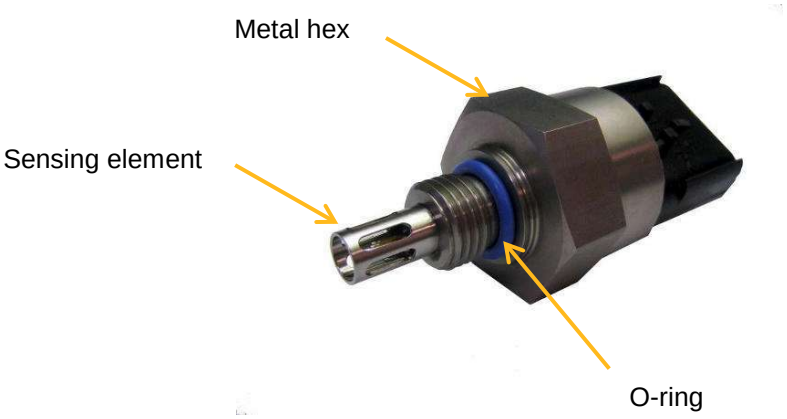
Do NOT remove the plastic protective cap of the probe before its final installation into equipment or line. Handling precautions should be taken to avoid any damage to the sensing element.

Before set-up, a visual check should ensure the O-Ring is present in the FPS sensor groove (see picture below)

Handling precautions should be taken to avoid any damage to the sensing element. The sensing element zone should never be touched by any installation tools or operator hands (see picture below).

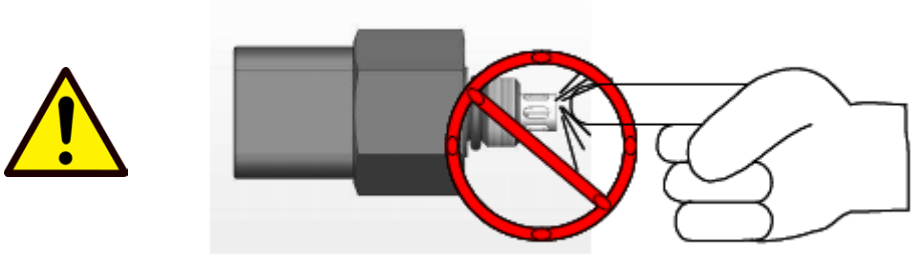
If sensor falls during set-up procedure realisation, the sensor should be rejected and not set-up on the application.

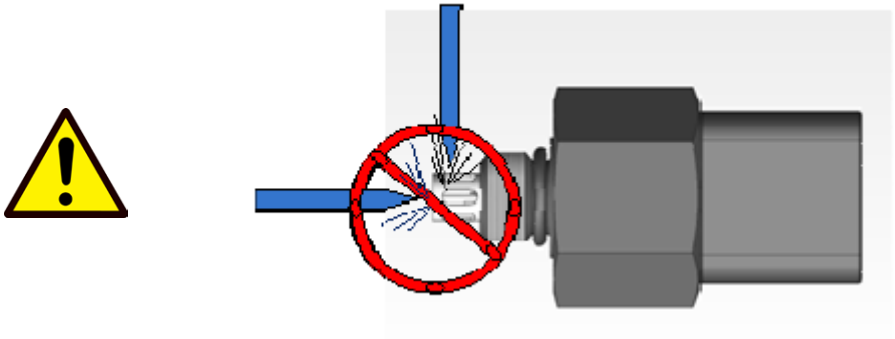
The set-up mounting or dismounting torque should be applied to the FPS sensor body (metal Hex) and should never be applied to the sensor connector itself (see picture below).



CAUTION

Do NOT push; poke or otherwise touch the Tuning Fork with any object or instrument, as this may cause damage to the Sensor.





NOTE 1: Contact Parker Hannifin for other mounting options.

NOTE 2: The use of thread-locking fluid or gel (e.g., Loctite®) may be recommended based on the customer's standard procedures for mounting M14 stainless steel part on their machines or systems.

CAUTION: Care should be exercised to prevent thread-locking fluid or gel from contacting the wetted parts of the sensor (tuning fork, RTD and protective shroud).

SAFETY NOTE:

Sensor installation points may be hot, fluids may be under pressure and high flow and/or fluids may be chemically aggressive or corrosive. Protective equipment and security procedures should be used when making sensor installations and dismantling.

Recommended applications

Prior to installation, the customer must confirm with Parker that the sensor is suitable for the application.

The FPS2000 is built to operate in hydrocarbon based liquids such as lubricants and fuels.

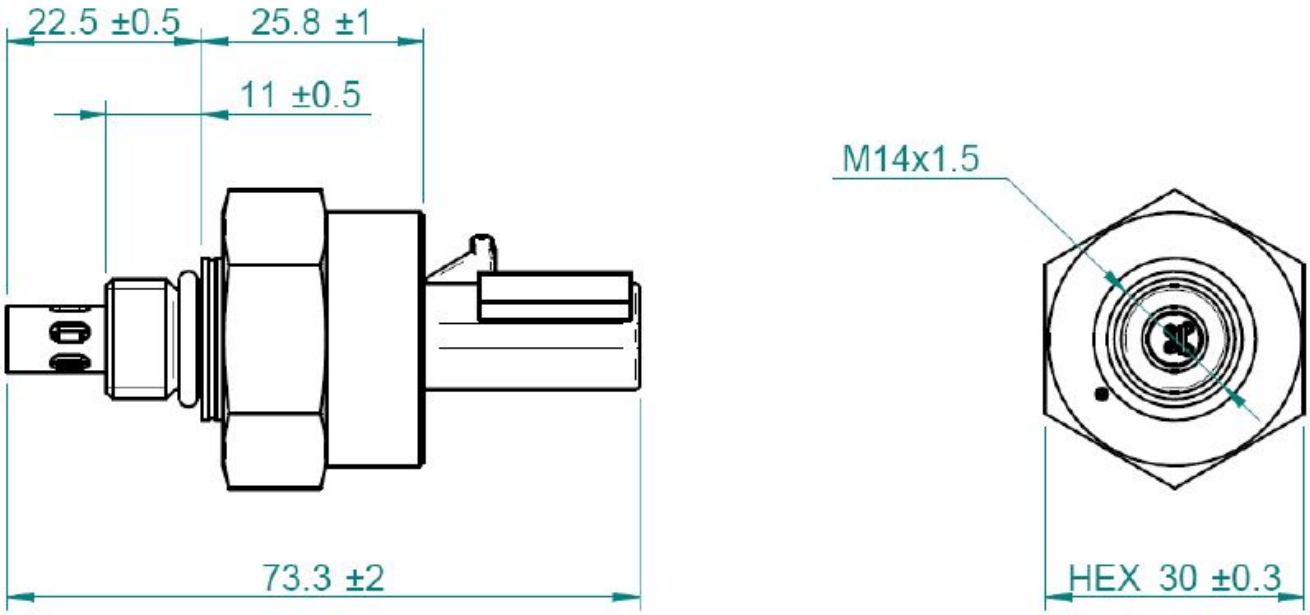
The FPS2000 can be typically used in liquids which are engine, hydraulic, compressor, transformer, gear and transmission oils as well as diesel fuel, biodiesel fuels, kerosene and heavy fuel oil on the condition that their properties comply with the indicated measurement ranges for each of the measured parameters. Using the FPS for a different application than the one it has been purchased is not recommended, unless Parker and customers have both agreed on the suitability of this new application. Measurements in non Newtonian, conductive - like aqueous or ionic solutions-, multi-phasis or corrosive liquids should not be performed.

The FPS2000 should always be handled in accordance with the instructions in the owner's manuals, whenever it is in use or shipment. Contact Parker for special applications.

Description

Weight: <90g

Dimensions: All dimensions are in millimetres.



Environment conditions

Temperature

Continuous operating temperatures:

- Sensor electronics: -40 to +125°C
- Fluid temperature: -40 to +150°C

Pressure

The sensor head is fully functional over a pressure range: 0 bar ≤ P ≤ + 25 bar (375 psi).

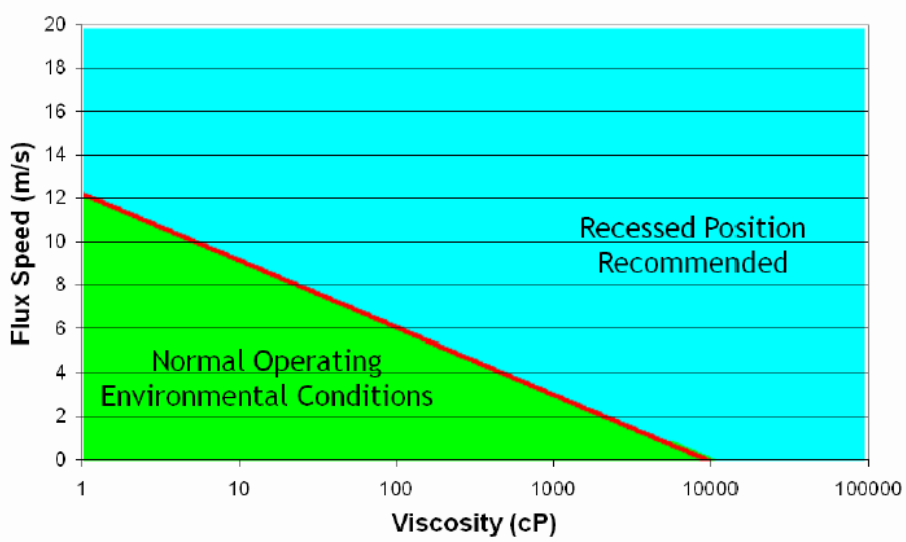
Physical Fluid Properties

Continuous operating:

- Viscosity: 0.0 to 50.0 cP
- Density: 0.000 to 1.500 gm/cc
- Dielectric Constant: 1.00 to 6.00
- Fluid Temperature: -40 ºC to +150ºC

Fluid Flow Speed

- Sensor head in fluid flow
- Low Risk of TFK Failure in Recessed Position



Vibration

Continuous operating:

- 0-20 Grms

Media Examples

Lubricants, oils, fuels, refrigerants, solvents and process fluids.

Casing

- Mating connector type is FCI female receptacle.
- Sensor with mating connector is IP 68 rated when assembled.
- Sensor body is stainless steel.
- Threaded Adapter Fitting (M14x1.5) with O-Ring Seal

Storage

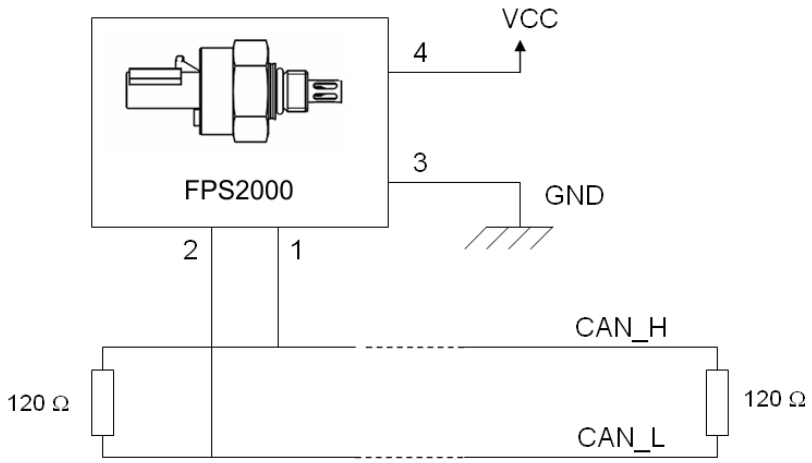
The FPS2000 must be stored with protection material as used for the shipment. Do not forget to put on the probe protection.

Storage temperatures:

- -50 to + 150°C

Electrical description, output characteristics

- Supply voltage: minimum 9 VDC, typical 12 or 24 VDC and maximum 36 VDC.
- Power consumption : < 100mA, typical 70 mA for 12 VDC power supply
- CAN Bus physical media: These 2 wires have a characteristic impedance of 120 Ωnd are symmetrically driven with respect to the electrical currents.



Dimensions, mechanical interface and mounting guidelines

- Take care while removing the protective cap off the probe.
- This should be done only when the probe will be placed in the fluidic interface.

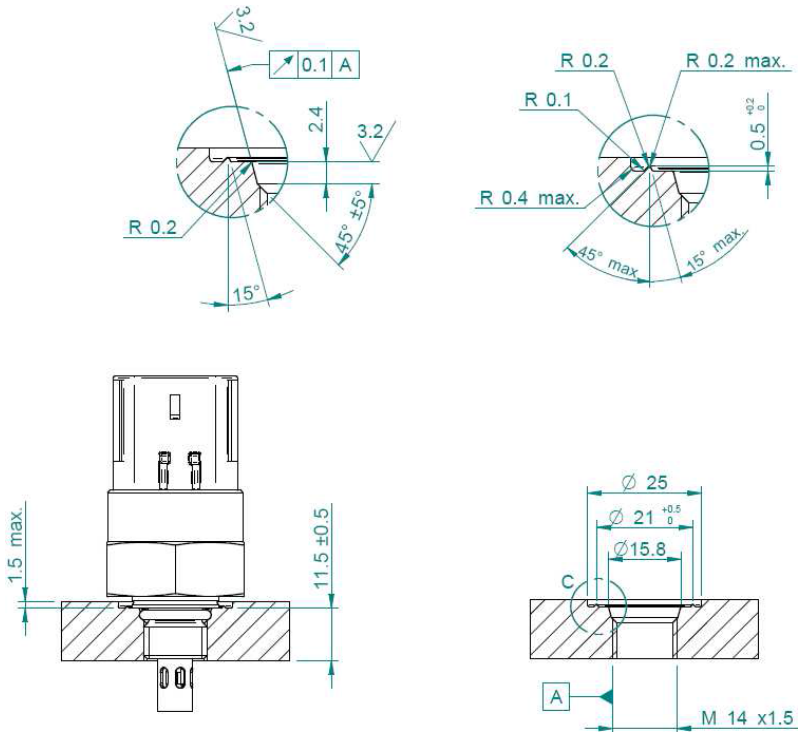
Safety Note: Sensor installation points may be hot, fluids may be under pressure and high flow and/or fluids may be chemically aggressive or corrosive. Protective equipment and procedures should be used when making sensor installations and dismantling.

Sensor mounting proposal

- **Mounting torque**: 27Nm, +/-3 Nm (torque wrench is recommended for mounting)
- The use of thread-locking fluid or gel (e.g., Loctite®) may be recommended based on the customer's standard procedures for mounting M-14 stainless steel parts on their machines or systems.

CAUTION: Care should be exercised to prevent thread-locking fluid or gel from contacting the wetted parts of the sensor (tuning fork, RTD and protective shroud).

- **Mounting Envelope**: 'Mounting specifications as per SAE J2244'



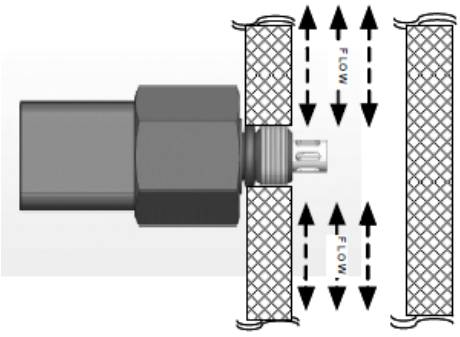
Choice of location on engine or other mechanical systems

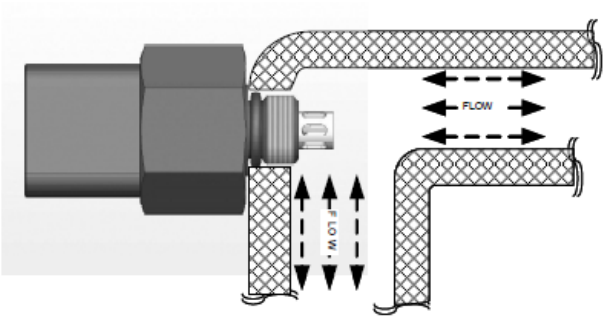
- The preferred location is in the pressurized oil gallery, filter head or flooded conduits. Please take care that the sensor installation does not restrict flows below system design specifications.
- For best performance, sensor should be mounted to optimize fluid flow through sensor opening. Minimum considered flow should be 0.2m/s to insure rapid fluid exchange across the sensor element.
- Minimize the risk of air, particulate loading at the sensor element and shroud.
- Oil sump (pan) installations are not recommended if the oil in the sump becomes entrained with high volumes of air or gas during machine or system operation. This condition will not damage the sensor, but the sensor will be monitoring an “oil/air” emulsion vs. pure oil condition.
- Avoid close proximity of uncontrolled and rapid changing heat sources for better metrological performance.

Mounting position

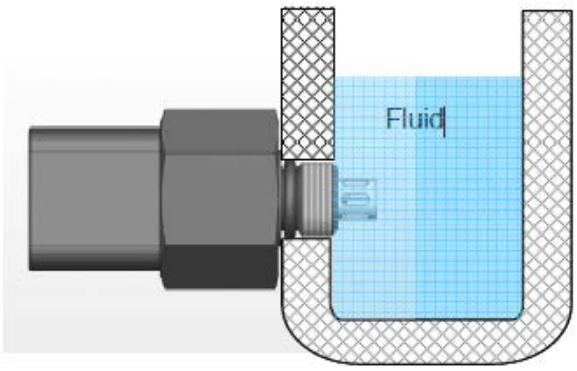
The physical orientation of the sensor will have no direct impact on the performance. While the sensor can be mounted in a fluid at any angle, for optimum long term performance on Engine or heavy wear applications, the pressure side of the oil gallery is optimum to keep a steady and consistent fluid-flow across the sensing element to best represent the oil condition seen by the lubrication system.

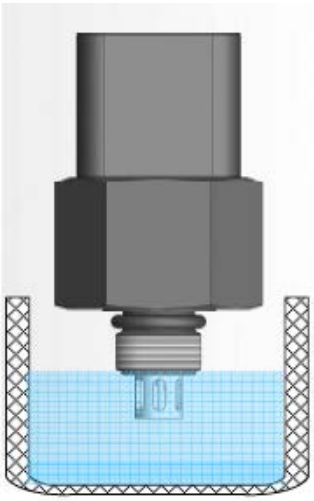
- The sensor should be oriented in a manner that air/moisture/particles etc. are not collected around the sensing element. This means avoid installation in ‘deadhead’ locations (i.e., recessed drill ports). If air/particles are trapped around the sensing element it can eventually result in poor output or in other ways possibly damage the sensor or distort the signal and result in unexpected measurement data. To minimize the risks of the above, the sensor should always be mounted in such a way that air / particles can be naturally evacuated and are not collected around the sensing element.
- Installation depth in the inlet tube or manifold shall be done in such manner that the sensor shroud openings are located in the primary flow stream and free from any obstacle or obstruction of flow after assembly in the manifold.





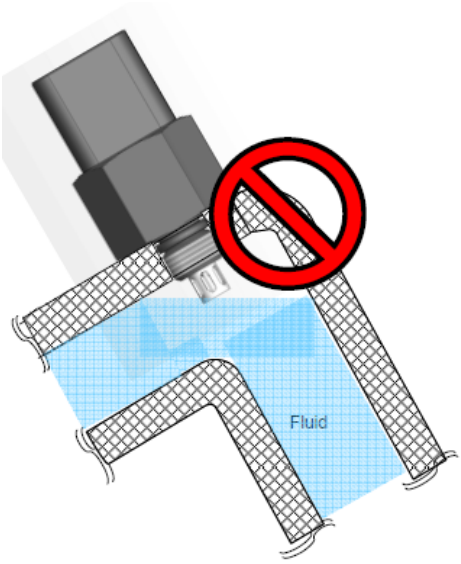
- The sensor may also be used in an open system or beaker to test fluid samples for lab bench applications. When performing beaker or lab bench testing, it may be necessary to shake the sensor in the fluid to displace any air trapped in or around the sensor shroud that could interfere with the sensing element contacting the fluid under test.

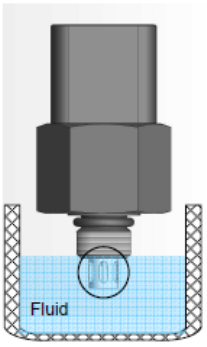


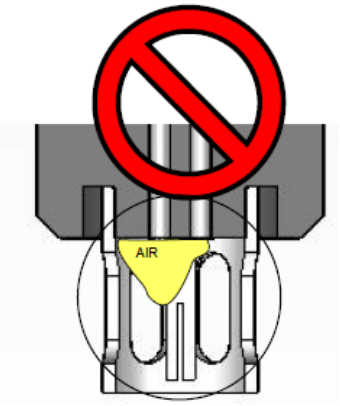


CAUTION!

It is important to install the sensor in an orientation that would minimize the potential of air entrapment caused by air-bubbles or forming an air-pocket around the sensing element. If air-bubbles or an air-pocket forms around the sensing element, it will cause the sensor to measure the combined gas & fluid properties as exposed under test.







Sensor & Connector protection

- When the mating connector is not attached to the sensor, the integrated connector should always be protected from fluids, moisture, dust, and mechanical damage by means of a protection cap or similar. The connector should not be filled with grease. The wire harness needs to be clamped 50 - 150mm from the back of the connector.
- The sensor and wire harness needs to be routed, or protected so that they cannot be stepped on, pushed or pulled.
- To minimize the risk of intrusion of water, particles, dust etc., especially to the integrated connector, and to minimize the risk for mechanical damage, the sensors should, as far as possible, be located in a protected area.
- The sensor element needs to be protected in a manner so that when it is removed from the fluidic interface and handled in a service shop that the sensor cannot be damaged due to handling. A protective cap (provided with sensor) should be used whenever the sensing element is not mounted or in use.

Cleaning procedure

CAUTION!

No rub, brush or physically contact the tuning fork sensor with a swab or brush.

When removed from the fluid, the probe should be protected with the provided cap.

1. Raw Cleaning with Isopropanol
2. Rinse with Deionized Water
3. Intense Ultrasonic Cleaning during 2 hours with Isopropanol at 50°C
4. Rinse with Isopropanol
5. Rinse with Deionized Water

Specifications

Performance specifications

Maximum ratings	Symbol	Value	Unit
Supply Voltage (Peak)	Vcc	60	Vdc
Ambient Operating Temperature (electronics)*	Te	-40 to +125	°C
Ambient Operating Temperature (fluid)*	Tf	-40 to +150	°C
Storage Temperature**	Tstg	-50 to +150	°C
Input Current @12Vdc (In rush)	Imax	< 200	mA
Operating Pressure	P	25 (Note 1)	Bar
Vibration (Peak)		20	Grms

Peak conditions: less than 10% of the operating time.

* Ambient Operating Temperature: Service temperature range at which the sensor and its electronics can operate securely.

** Storage Temperature: Temperature range at which the sensor can be stored with no risk of damage.

Metrological characteristics

(@Vcc=12Vdc, T=100°C, unless otherwise noted)

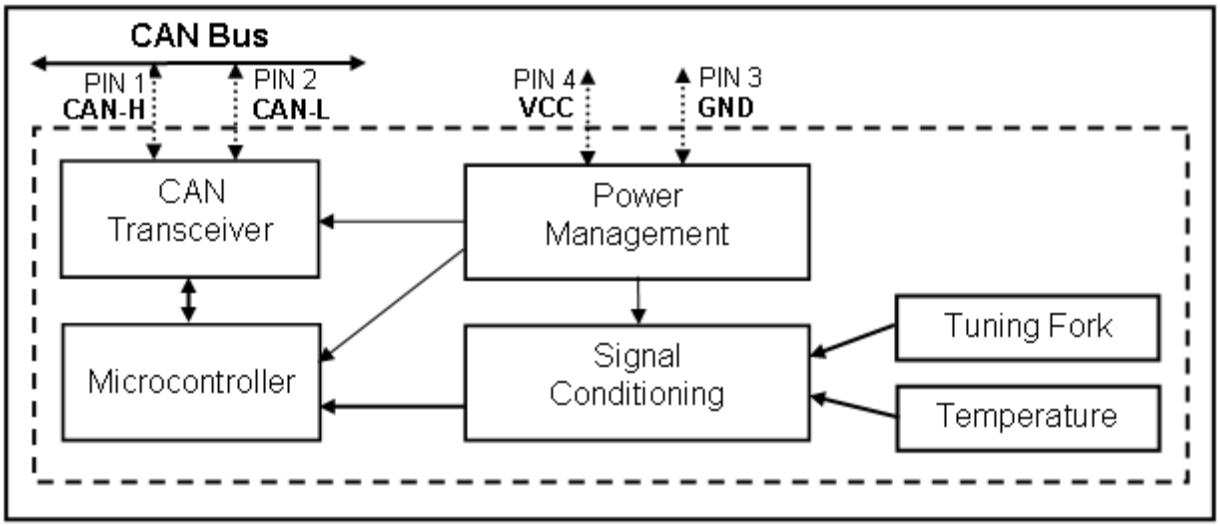
Multi-Parametric Measurement Ranges	Symbol	Min	Typ	Max	Unit
Viscosity (dynamic)	m	0.5	15	50	mPa-s (cP)
Viscosity (dynamic) Accuracy for viscosity > 10 mPa-s (cP)		-5	+/-2	+5	% Value
Viscosity (dynamic) Accuracy for viscosity < 10 mPa-s (cP)			+/- 0.2		mPa-s (cP)
Density	ρ	0.65	0.85	1.50	gm/cc
Density Accuracy		-3	+/-1	+3	% Value
Dielectric Constant	ε	1.0	2.0	6.0	-
Dielectric Constant Accuracy		-3	+/- 1	+3	% Value
Fluid Temperature	T	-40		150	°C
Temperature Accuracy	T		0.1		°C

Electrical characteristics

(@Vcc=12Vdc, T=100°C, unless otherwise noted)

Electrical Characteristics	Symbol	Min	Typ	Max	Unit
Supply Voltage	Vcc	9	12	36	Vdc
Supply Current (steady state)	Iavg		70	100	mA

Block diagram



Transmission data

Viscosity	Min	Typ	Max
Data Range (mPa-s)	0.0		1003.9
Limits (DATA)	0x0000		0xFAF9
Resolution (mPa-s per bit)		0.015625	
Update period (s)		30	

Density	Min	Typ	Max
Data Range (gm/cc)	0.000		1.9608
Limits (DATA)	0x0000		0xFAF6
Resolution (gm/cc per bit)		0.00003052	
Update period (s)		30	

Dielectric Constant	Min	Typ	Max
Data Range (-)	0.00		7.842
Limits (DATA)	0x0000		0xFAF1
Resolution (- per bit)		0.00012207	
Update period (s)		30	

Temperature	Min	Typ	Max
Data Range (°C)	-273.0		+1735
Limits (DATA)	0x0000		0xFB00
Resolution (°C per bit)		0.03125	
Update period (s)		30	

Self-diagnostic

Status message code	Bit position
Tuning Fork – impedance below normal or shorted to ground	1
Tuning Fork – impedance above normal or sensor damaged	2
Tuning Fork – ASIC over temperature conditions	3
Fit – simplex algorithm failed to converge	4
RTD – resistance below normal or shorted to ground	5
RTD – resistance above normal or sensor damaged	6
RTD – sensor temperature over temperature conditions	7
Internal – system error	8

Diagnostic bit is set to '1' when error is detected

Standard SPN and standard PGN

Parameter	SPN	PGN	Byte Position	Length (byte)
Dynamic Viscosity	5055	64776	1	2
Density	5056	64776	3	2
Dielectric Constant	5468	64776	7	2
Oil Temperature Sensor	175	65262	3	2
Status code message	N/A	65329	1	1

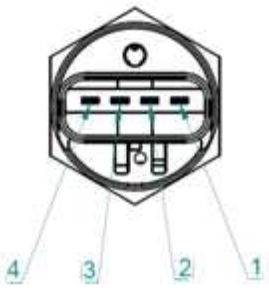
No delay is required between command write and data read.

CAN transmission Baudrate = 250kbps

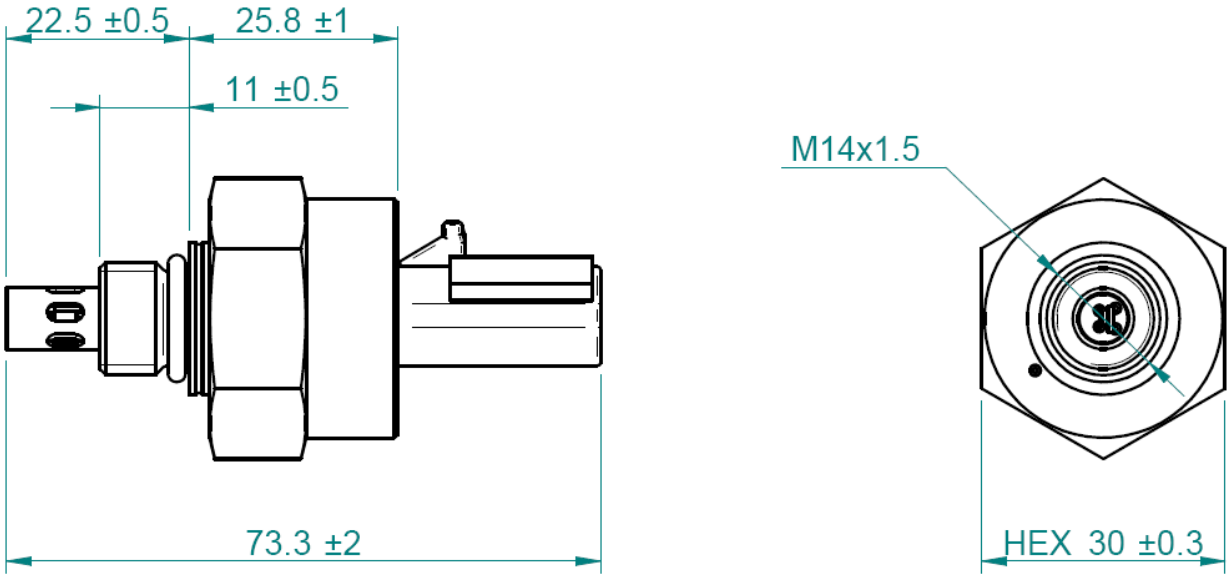
Connecting and mechanical packaging

Pin out assignment

No	Function
1	CAN_H
2	CAN_L
3	GND – Ground
4	VCC – Voltage Supply



Mechanical characteristics



All dimensions are millimetres (mm). Mating connector type is FCI female receptacle.

Sensor body is stainless steel.

M14 Viton O-ring provided for hermetical mounting.

Resistance to physical and chemical stresses.

- FPS2000 contains circuits to protect its inputs and outputs against Electrostatic discharges (ESD) up to ±25kV (air discharge)
- FPS2000 is protected against EMC interferences (SAE J1113-4)
- FPS2000 is protected against reverse polarity
- FPS2000 is cross wire protected
- Additional tests under harsh chemical conditions demonstrate good operation in presence of 5% nitric acid, soot, fuel, water, oxidized oil, a non-exhaustive list