

AVENI | SENSE



—  
SMALL  
SMART  
RUGGED  
**SENSOR**

—  
VISCOSITY  
DENSITY  
TEMPERATURE  
EMBEDDED  
**MEASUREMENT**

For light, medium & heavy  
petroleum products

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**devil**®  
sensor

# devil<sup>®</sup>

sensor



## A UNIQUE DENSITY, VISCOSITY SENSOR



**DEVIL<sup>®</sup> FOR LIGHT FUELS** is the only density + viscosity + temperature sensor available on the market, dedicated to light refined cuts. Compact, robust and digital, the DEVIL<sup>®</sup> is to be embedded into installations such as fuel quality control systems, fuel composition analysis modules, fuel dispensers for trucks & cars, and refining process lines. It uniquely simplifies fuel monitoring and leads to more accurate custody transfer metering.

**DEVIL<sup>®</sup> FOR HEAVY OILS** benefits from a robust design, featuring an extended viscosity range that fits residual oil properties. It provides real-time continuous density, dynamic viscosity, kinematic viscosity & temperature measurements. Compact, rugged and fully digital, the DEVIL<sup>®</sup> for heavy oils is an instrument of choice that is installed in diesel, HFO engines. It is also an affordable and smart alternative to costly process viscometers for the monitoring of heavy cuts.

## SMALL, SMART, & RUGGED

MesoScale<sup>®</sup> - Miniaturized sensing element



High technology. Industry oriented



Plug n' play - calibrated



Reduced maintenance



Resistant to outdoor conditions



No moving parts - industrial packaging



Analog & digital outputs (GSM/GPRS as an option)



ATEX certified

## HIGH TECHNOLOGY BRICK. FIELD ORIENTED.

DEVIL<sup>®</sup> encloses a unique technology brick - MesoScale<sup>®</sup> - based on millimeter-scale, metal-made mechanics innovately positioned across the flow line. Its reduced dimensions allow for a use with small tubings (<1/4"), providing excellent dynamic behavior and tolerance to particles & deposition. MesoScale<sup>®</sup> can also be used in static fluids, self-compensating the influence of fluid pressure & temperature changes through embedded low power, high resolution electronics.

The Selfbalancit<sup>®</sup> technology was built to provide continuous ASTM-compliant measurements at the process level by compensating in real-time the pressure & temperature variations that naturally arise during industrial operations.



# DEVIL® FOR LIGHT PETROLEUM PRODUCTS

DEVIL® FOR LIGHT AND MEDIUM PETROLEUM PRODUCTS HAS BEEN DESIGNED TO MAKE AVAILABLE DENSITY, VISCOSITY MEASUREMENTS TO EMBEDDED, MOBILE APPLICATIONS WHERE SMALL SIZE, INTEGRATION & PERFORMANCE PLAY A KEY ROLE.

## DENSITY, VISCOSITY, ANYWHERE, ANYTIME

### A CLOSER LOOK AT CUSTODY TRANSFER METERING

Adding the DEVIL® to conventional flow metering solutions increases the metering accuracy, ensuring that the right quantity of fuel was delivered.

### INSTANT ACCESS TO FUEL QUALITY

Density & viscosity measurements can be used to characterize fuel quality, ensuring its purity prior to delivery and ultimately detecting alteration sources such as leaks or water intrusion. Thanks to its rugged design, DEVIL® can either be used inline the distribution line or immersed into the tank for periodic checks.

### IDEAL FOR REMOTE MONITORING

In order to equip mobile assets or remote installations with real-time fluid surveillance, DEVIL® can be coupled to a GSM/GPRS telemetry unit that provides power autonomy and data transmission to a dedicated server. SMS can also be sent in parallel to any supervision team when reaching alarm levels or on a periodic basis. Density & viscosity measurements become available anywhere.

### COST EFFECTIVE REFINING OF LIGHT FUELS

Embedding the DEVIL® into fuel characterization & fuel quality modules allows for online density + viscosity correction : DEVIL® contributes to reducing refining cycles thanks to high-tier metrological performances and unrivaled dynamic behavior.

### APPLICATIONS

- > Pipelines / refining
- > Quality control
- > Fuel tanks, terminals
- > Custody transfer metering
- > Fueling stations, dispensers
- > Ground fueling – aviation
- > Fueling trucks
- > Analyzers, flash point, pour point, fuel quality analyzers (FTIR...)

### FLUIDS

- > Light fuels: SP95, SP98
- > Kerosene: JETA1, AVGAS
- > Naphta
- > Gasoline, mid/heavy fuel oils, biodiesel
- > GPL, GNL, Ethanol

### RELATED NORMS

- ASTM D1657 - ASTM D1298 - ASTM D2270
- ASTM D445 - ASTM D4052 - ASTM D7777
- ISO 2909 - ISO3104 - ISO3448

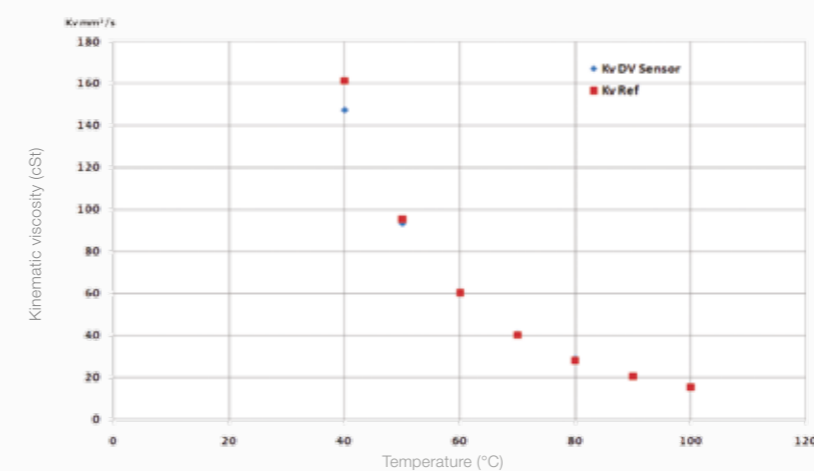
# DEVIL® FOR HEAVY PETROLEUM PRODUCTS

AVENISENSE MAKES AVAILABLE TRUE DENSITY, DYNAMIC & KINEMATIC VISCOSITY TO THE INDUSTRY, I.E. FOR HEAVY OIL ENGINES, LUBRICATED MACHINERIES.

## DEDICATION TO HEAVY PETROLEUM PRODUCTS

DEVIL® for heavy petroleum products benefits from a large tolerance to particles & deposition, with the capability to operate with high repeatability at 40°C/50°C/100°C. The Selfbalancit® technology allows for automatic temperature compensation, removing the need for highly accurate temperature regulation units.

DEVIL KINEMATIC VISCOSITY READINGS COMPARED TO REFERENCE METHOD (ASTM)



### ONLINE HEAVY OIL VISCOSITY MONITORING FOR LARGE ENGINES

DEVIL® for heavy oils is designed to maximize the performance of large marine & power engines. Embedded along the fuel injection line, the sensor optimizes fuel's burning efficiency through continuous inline viscosity measurements.

### VISCOSITY INDEX, CORRELATION WITH ASTM

Viscosity index can be calculated by using two DEVIL® at different temperatures, in such way, DEVIL® provides results in correlation with ASTM methods.

### APPLICATIONS

- > Diesel, HFO engines (injection), boilers, heaters
- > Marine, industrial, power generation engines
- > Viscosity index
- > Crude oil characterization

### FLUIDS

Heavy fuel oils, residual fuel oils, distillate fuels, Marine diesel fuels, MGO, MDO, IFO, MFO, HFO ...

### RELATED NORMS

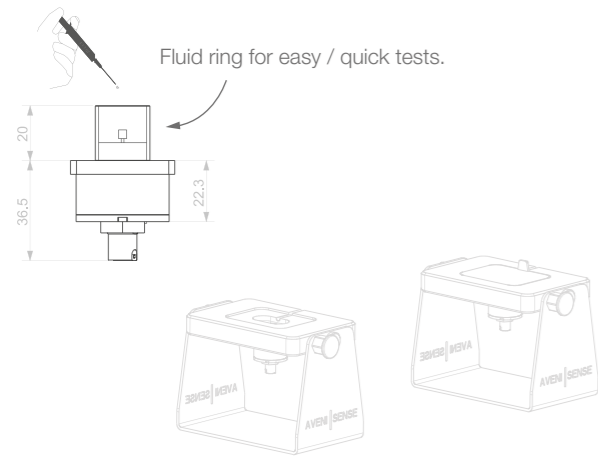
- ASTM D2270 - ASTM D341 - ASTM D445 - ISO2909

# MECHANICAL INTEGRATION

(DIMENSIONS IN mm.)

## LABORATORY SET-UP

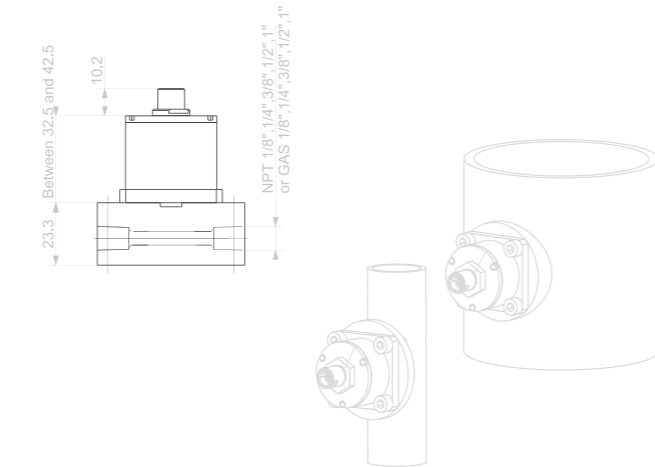
Used in oven, regulated baths, or bench.



## SMALL PIPES & BYPASS

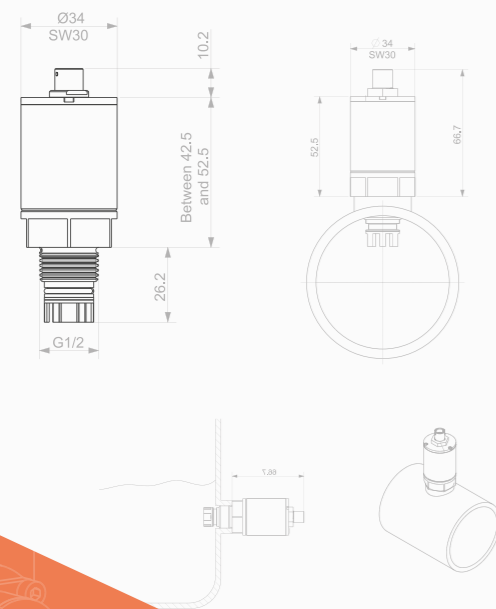
Used for integration into lab & process equipments, small lubrication lines, bypass out of main pipes.

### NESSI COMPATIBLE



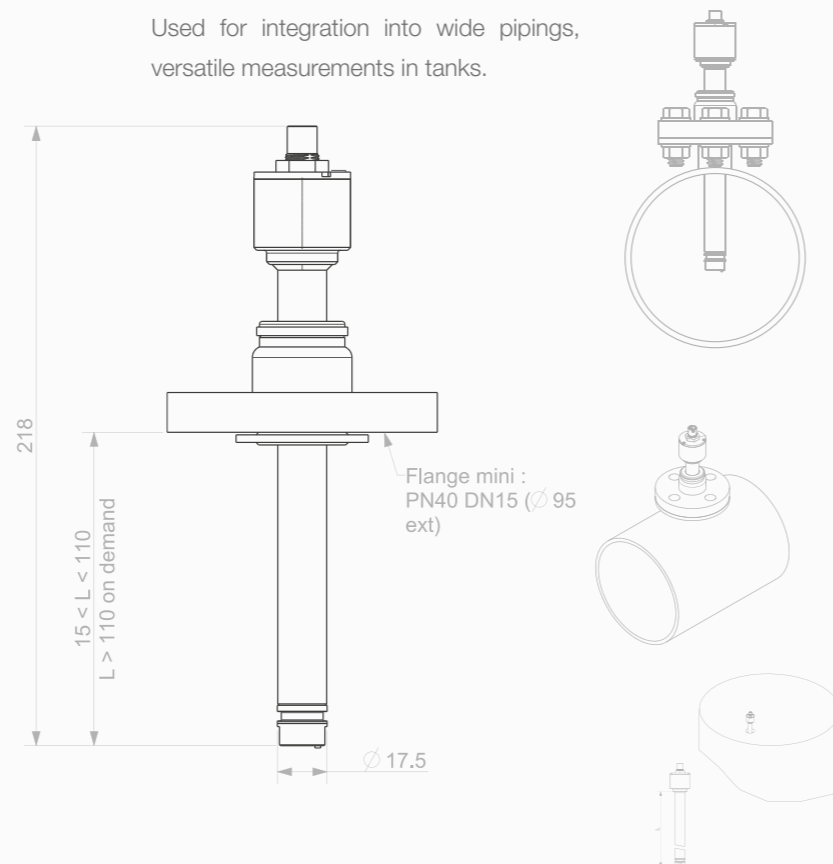
## SCREWED IN PIPE

Used for integration into larger pipings, tanks.



## FLANGED ON PIPE

Used for integration into wide pipings, versatile measurements in tanks.



# ACCESSORIES (OPTIONAL)

AveniReader	7" Touchscreen, 3 sensors inputs, graph display, real-time data display, parameters adjustment, data storage, connection to network.
AveniReader-SD	3" display, 1 sensor input, graph display, real-time data display, SD data storage
Calibration kit	Set of calibration fluids for metrological performance checks
Fluid open ring	Metallic ring to be mounted onto the DEVIL® for open air fluid pouring & checks
Soft2Sense	Enhanced Windows® compatible software for data collection, display, storage, multivariable graphs, compensation (equations...)

# SPECIFICATIONS

## GENERAL SPECIFICATIONS

Measurements available	Density (kg.m <sup>-3</sup> ), kinematic viscosity (cSt), dynamic viscosity (cP), temperature (°C)
Sensing technologies	MesoScale®, Selfbalancit®
Measurement type, Fluid conditions	Continuous measurements, static or dynamic fluids
Sample volume	<1cm <sup>3</sup>
Response time	< 2sec
Calibration	Factory calibrated against ASTM standards – supplied with calibration certificate
Certification	CE, ATEX – II 1G Exia IIC T4 (optional), IECEx (optional), CSA (optional)
Environmental rating	IP67
Typical weight	320g

## METROLOGICAL PERFORMANCES<sup>1</sup>

Calibration ranges <i>(see product code for further information)</i>	Density :	600 kg.m <sup>-3</sup> ... 1500 kg.m <sup>-3</sup>
	Viscosity :	0.3cP ... 400cP
Environment conditions	Temperature :	0 °C ... 110 °C
	<i>(adjustable on demand)</i>	
Accuracy (typical, max)	Fluid T°C:	-40 °C ... 110 °C
	ATEX Environment T°C:	-40 °C ... 110 °C
	Pressure:	Atm ... 10 bar <i>(higher on demand)</i>
Repeatability	Viscosity:	0.8% F.S. (typ) 2% F.S. (max)
	Density:	0.1% F.S. (typ) 0.5% F.S. (max)
	Temperature:	0.2°C (typ) 0.5°C (max)
Integration	Viscosity:	0.5% F.S.
	Density:	0.1% F.S.
	Temperature:	0.1°C

## INTEGRATION

Communication protocols	USB	5 V (powered by USB port)
Power supply	RS232	5 VDC
	ModBus RTU (RS485)	6 – 28 VDC
	RS485 + Frequency	6 – 28 VDC
	RS485 + 3 x Analog 4-20mA	24 VDC
	RS485 + 3 x 0-10V	24 VDC
	ModBus TCP	6 – 10 VDC (external interface)
	Sealing (if applicable)	Viton®, Kalrez®
Max flow velocity	< 1m.sec <sup>-1</sup>	
Acquisition frequency	1Hz max, averaging available	
Wetted parts	SS316L, Inconel, Hastelloy	

<sup>1</sup>. Indicated performances have been obtained in controlled laboratory conditions using sensor's digital output. In practice, additional inaccuracy might arise due to application's conditions, use of the analog mode, fluid characteristics.

AVENISENSE IS A LEADING COMPANY IN THE DEVELOPMENT, MANUFACTURING AND SUSTAINING OF EMBEDDED FLUID PROPERTY SENSORS.

The company delivers plug & play sensing modules for the continuous monitoring of fuels, oils, chemicals, paints & inks. AVENISENSE is involved in long-term relationships with OEM integrators, distributors, and co-developing companies, worldwide. Industries served include refining, chemistry, wind & conventional power, marine transportation, land transportation. The company has its sales offices & manufacturing facilities in France, at the boarder with Switzerland (*Wider Geneva area*)

## Our sensors portfolio :



**NORTHDOME® - SPECIFIC GRAVITY, GAS DENSITY SENSOR** is an innovative sensing instrument that measures in real time the specific gravity, density, molar mass (optional) and temperature of gases. NORTHDOME® can be installed online, embedded onto larger systems or used for quality control. Applications range from explosion proof situations – measuring the quality of natural gas – to the accurate mix of industrial gases such as in the semiconductor industry.

**CACTUS® - OIL QUALITY SENSOR** is a breakthrough sensor that monitors the ageing of oils in service. The device is based on the continuous measurement of fluid's viscosity, density, relative humidity (water activity), and temperature. CACTUS® can either be installed online, embedded onto larger systems or used in a lab for quality control. The device becomes a decision-maker for maintenance teams, ultimately avoiding catastrophic failures due to poor lubrication and leading to reduced maintenance costs.



**WATERACT® - WATER ACTIVITY, RELATIVE HUMIDITY SENSOR** is a compact, smart sensor providing continuous water activity (aw) measurements. WATERACT® notifies users when water saturation would be reached, acting as an online equipment diagnostic device for example at the destination of the users of hydraulic, lubricating and insulation oils.

**SPHERE® - PRESSURE & TEMPERATURE SENSOR** is a smart pressure sensing technology. Thanks to a very low power consumption, the SPHERE® is either available as a conventional wired device or as a fully autonomous wireless sensor (ATEX). The product line is easy to operate and allows for quick and efficient deployment into a wireless sensor network.



« Please feel free to contact us, we will provide you with the right information, service & support »

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