

Speed Sensors for Turbochargers

Blade Pass Speed Sensors

ACTIVE EDDY CURRENT

- NOVA
- APOLLO

PASSIVE EDDY CURRENT

- Hermes 3.5
- Hermes 4
- Hermes 5

Variable Reluctance Speed Sensors

- Artemis Series:
- Metal housing
- PPS housing
- Epoxy overmould housing



Turbocharger Speed measurement – more efficiency and protection

The key advantage of using a turbocharger speed sensor is that the regulation of the airflow in the engine can be handled much faster and with more accuracy – enabling better use of the compressor map, thereby maximising the performance of the turbocharger and the engine. Use of a speed sensor can also protect the turbocharger against any catastrophic failures caused by over-speed conditions. Adaptation of the engine to changing driving conditions in today's traffic – and also to the air density changes at different altitudes - will also benefit from turbocharger speed measurement.

Speed sensing technologies for turbochargers

Two technologies are mainly used to generate a reliable turbocharger speed signal. These are the Variable Reluctance (VR) sensor, which is used in combination with a ferromagnetic target (e.g. a flat on the turbo shaft), or a passive or active Eddy-Current sensor which is mounted into the compressor cover and detects the pass of the compressor blades which are made of a conductive material (not necessarily ferrous).

VR sensor

A permanent magnet inside the sensor creates a magnetic field which penetrates into the shaft or disk with the target structure. The flat on the rotating shaft of a turbocharger, or notches in the sealing disk, create variations of the magnetic field which are transformed into a voltage signal by the sensor coil. The Artemis sensor line is based on the VR principle.

Passive Eddy Current Sensor

Compressor blades are detected by a special coil system which detects eddy currents that are induced as the blades pass through the permanent magnetic field of the sensor. The Hermes sensor line is based on the passive eddy current principle.

Active Eddy Current Sensor for blade pass detection

The sensor uses an oscillator system (consisting of a coil, a capacitor and an amplifier) to induce eddy currents in the compressor blade. The oscillatory frequency changes when the blades pass by the sensor tip, the demodulatory change producing an electrical signal that can be used to calculate speed. The Apollo sensor is based on the active eddy current principle.

3 different technology platforms with unlimited customized configuration

Artemis - Variable Reluctance Speed Sensors

- Used with combination of a ferromagnetic target, e.g. a flat on the turbo shaft.
- Potted PPS housing sensor up to 180° C
- Over-molded epoxy housing up to 220° C
- Potted steel housing up to 250° C
- Cable assembly up to 270° C

Hermes - Passive Blade Pass Sensor

- Speed sensor is mounted into the compressor cover and detects the pass of the aluminum compressor blades.
- Compressor blades are detected by a special coil system that detects eddy currents present in the blades. These are induced as the blades pass the permanent magnetic field of the sensor.
- Over-molded thermoplast (PEEK) or thermoset (EPOXY) housings up to 230° C
- Cable assembly up to 270° C
- Electronics in the connector module up to 125° C

Apollo – Active Blade Pass Sensor

- Speed sensor is mounted into the compressor cover and an oscillating system detects the pass of the compressor blades – either aluminum or titanium – when they pass in front of the sensor tip.
- Over-molded thermoplast housing up to 230° C
- High temp ASIC electronics in the connector module up to 230° C
- Cable assembly up to 270° C

OR

- High temp ASIC electronics integrated in the sensor shaft up to 230° C
- Cable assembly up to 270° C

AND

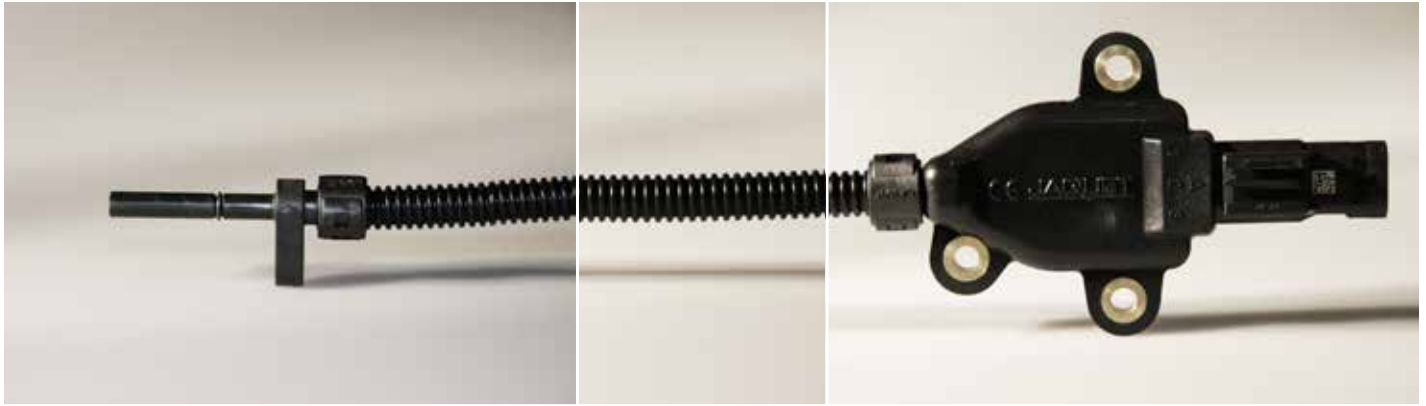
- Sensor diagnostics and temperature information
- Configurable for different blade division

TurboTach for R&D

TurboTach is a lab application set with a sensor, a cable and a special indicator. Made to provide a direct speed indication, a proportional 4 .. 20 mA signal and an overspeed protection function for the use in your turbocharger R&D lab. Please see the TurboTach system brochure for more information.

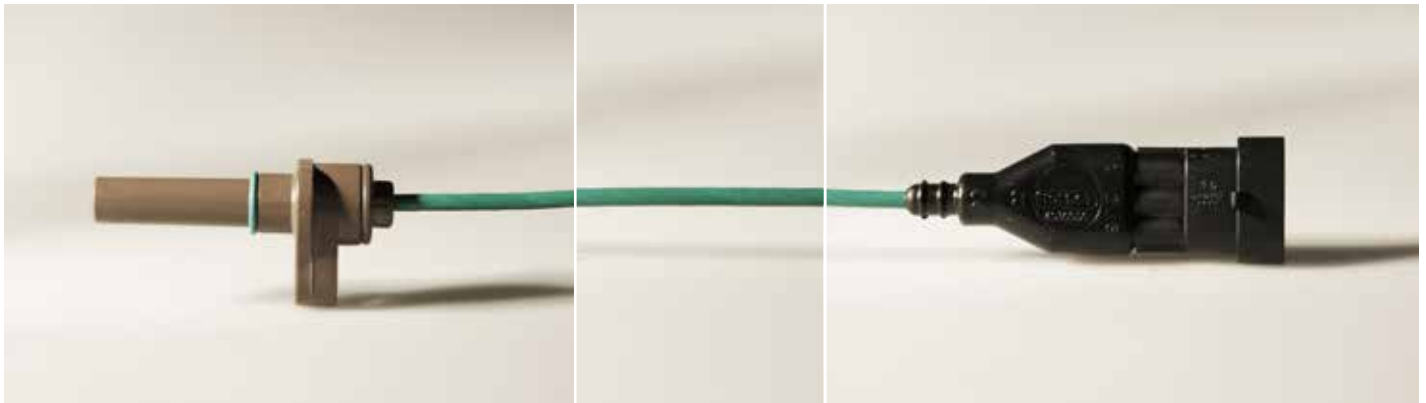


DSE 0605.00 T10HV | Hermes 4.0



Principle	Housing material	Target	Target material	Output signal	Shaft length	Shaft diameter	Ambient temperature			Additional features
							Housing	Cable	Connector	
Passive Eddy current	Epoxy	Blade	Aluminum Titanium	Square wave	38 mm	Ø 6 mm	180 °C	260 °C	125 °C	Convolute - clip

DSE 1210.10 xx | Artemis Variable Reluctance



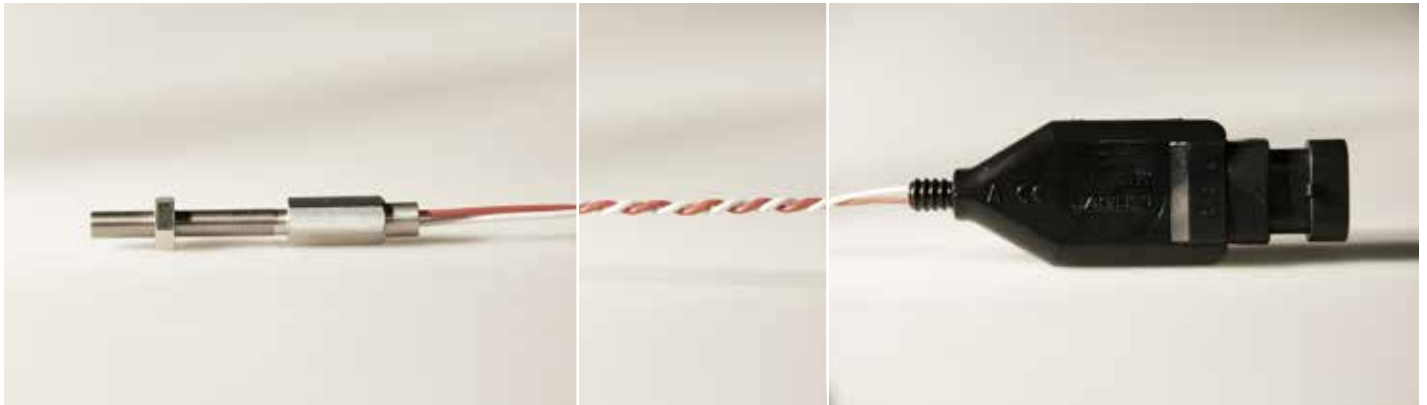
Principle	Housing material	Target	Target material	Output signal	Shaft length	Shaft diameter	Ambient temperature			Additional features
							Housing	Cable	Connector	
VR	PPS	Flat	Steel	Sinus wave	42.2 mm	Ø 12.85 mm	180 °C	260 °C	125 °C	None

DSE 0805.01 | Hermes 5.1



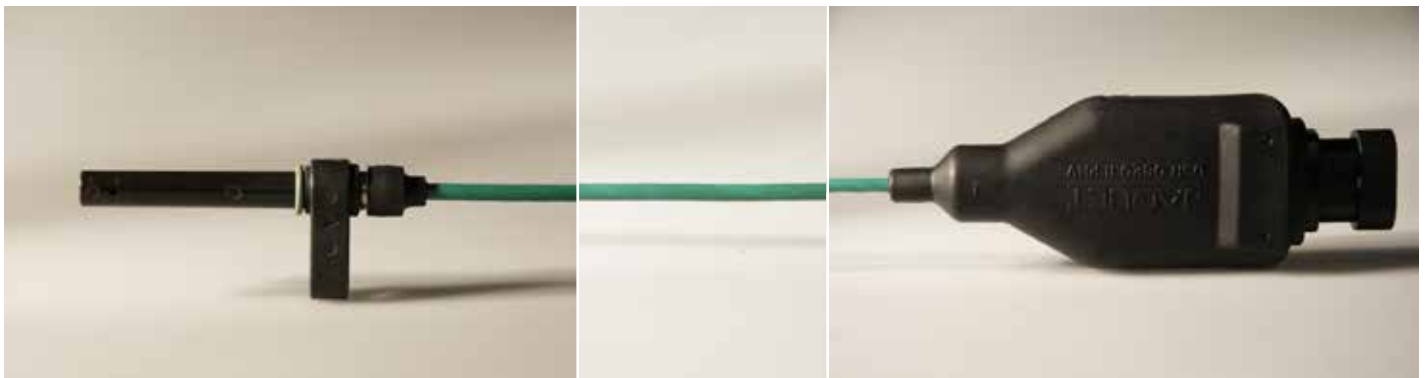
Principle	Housing material	Target	Target material	Output signal	Shaft length	Shaft diameter	Ambient temperature			Additional features
							Housing	Cable	Connector	
Passive Eddy current	PEEK	Blade	Aluminium - Titanium	square wave	47.5 mm	Ø 8.2 mm	230 °C	260 °C	125 °C	None

DSE 0603.02 THV | Hermes 3.5



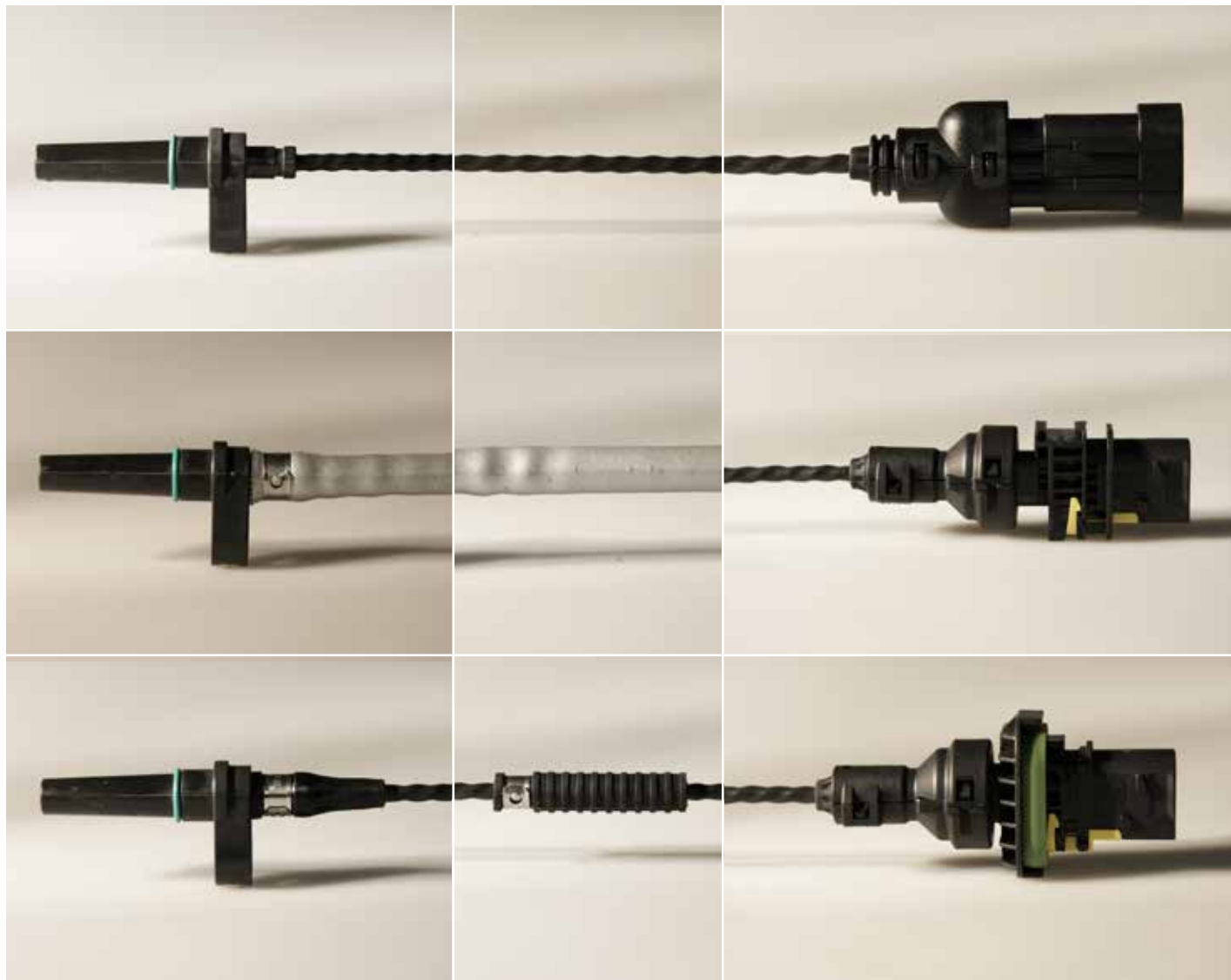
Principle	Housing material	Target	Target material	Output signal	Shaft length	Shaft diameter	Ambient temperature			Additional features
							Housing	Cable	Connector	
Passive Eddy current	Metal body	Blade	Aluminium - Titanium	Square Wave	40 mm	M6	250 °C	260 °C	125 °C	None

DSE 0820.11 PHV | Nova



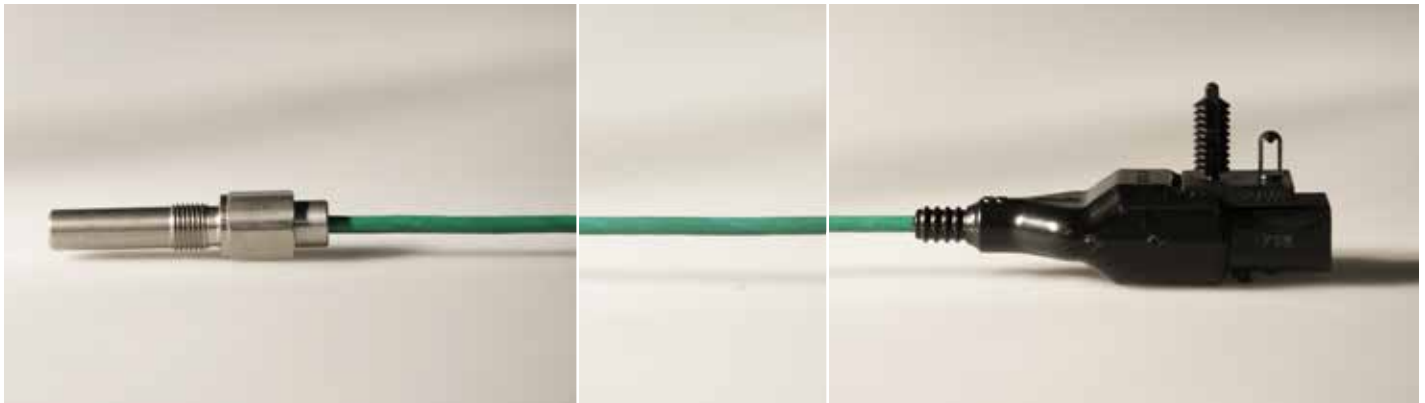
Principle	Housing material	Target	Target material	Output signal	Shaft length	Shaft diameter	Ambient temperature			Additional features
							Housing	Cable	Connector	
Active Eddy current	Epoxy	Blade	Aluminium - Titanium	Square wave	47.5 mm	Ø 7.6 mm	180 °C	260 °C	125 °C	None

DSE 1210.30 XXX | Artemis Variable Reluctance



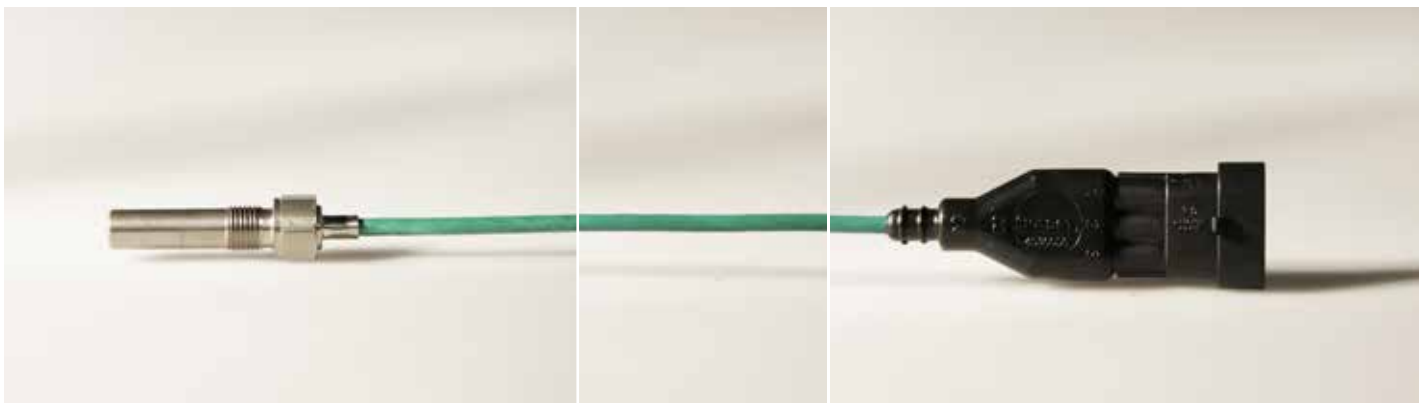
Principle	Housing material	Target	Target material	Output signal	Shaft length	Shaft diameter	Ambient temperature			Additional features
							Housing	Cable	Connector	
VR	Epoxy	Flat	Steel	Sinus wave	42.1 mm	Ø 12.85 mm	180 °C	260 °C	125 °C	Heat shield - Damper - Grommet

DSE 1010.04 P8HZ | Artemis Variable Reluctance



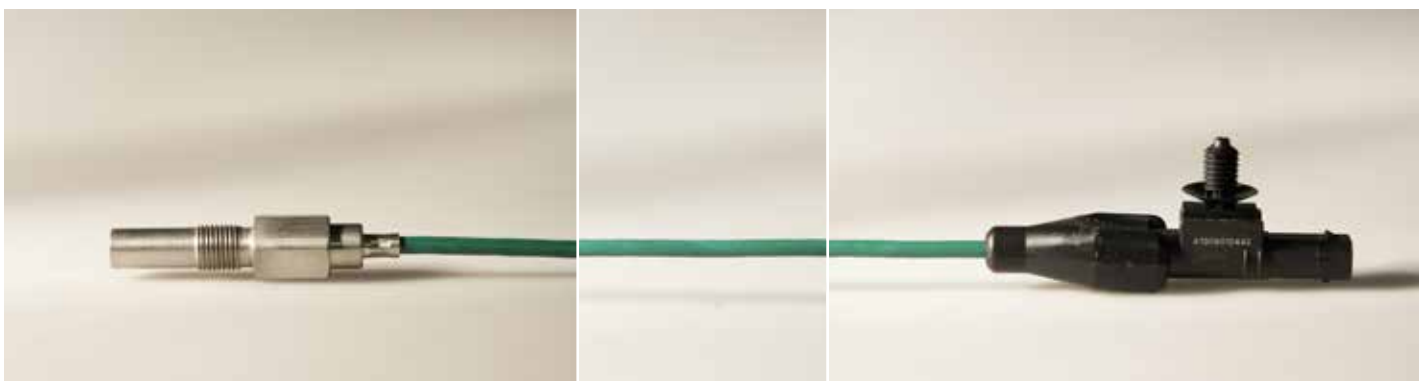
Principle	Housing material	Target	Target material	Output signal	Shaft length	Shaft diameter	Ambient temperature			Additional features
							Housing	Cable	Connector	
VR	Metal Body	Flat	Steel	Sinus wave	34.61 mm	M10x1	250 °C	260 °C	125 °C	Clips Heat shield

DSE 1010.08 P1HZ | Artemis Variable Reluctance



Principle	Housing material	Target	Target material	Output signal	Shaft length	Shaft diameter	Ambient temperature			Additional features
							Housing	Cable	Connector	
VR	Metal Body	Flat	Steel	Sinus wave	34.61 mm	M10x1	250 °C	260 °C	125 °C	Clips Heat shield

DSE 1010.11 P6HZ | Artemis Variable Reluctance



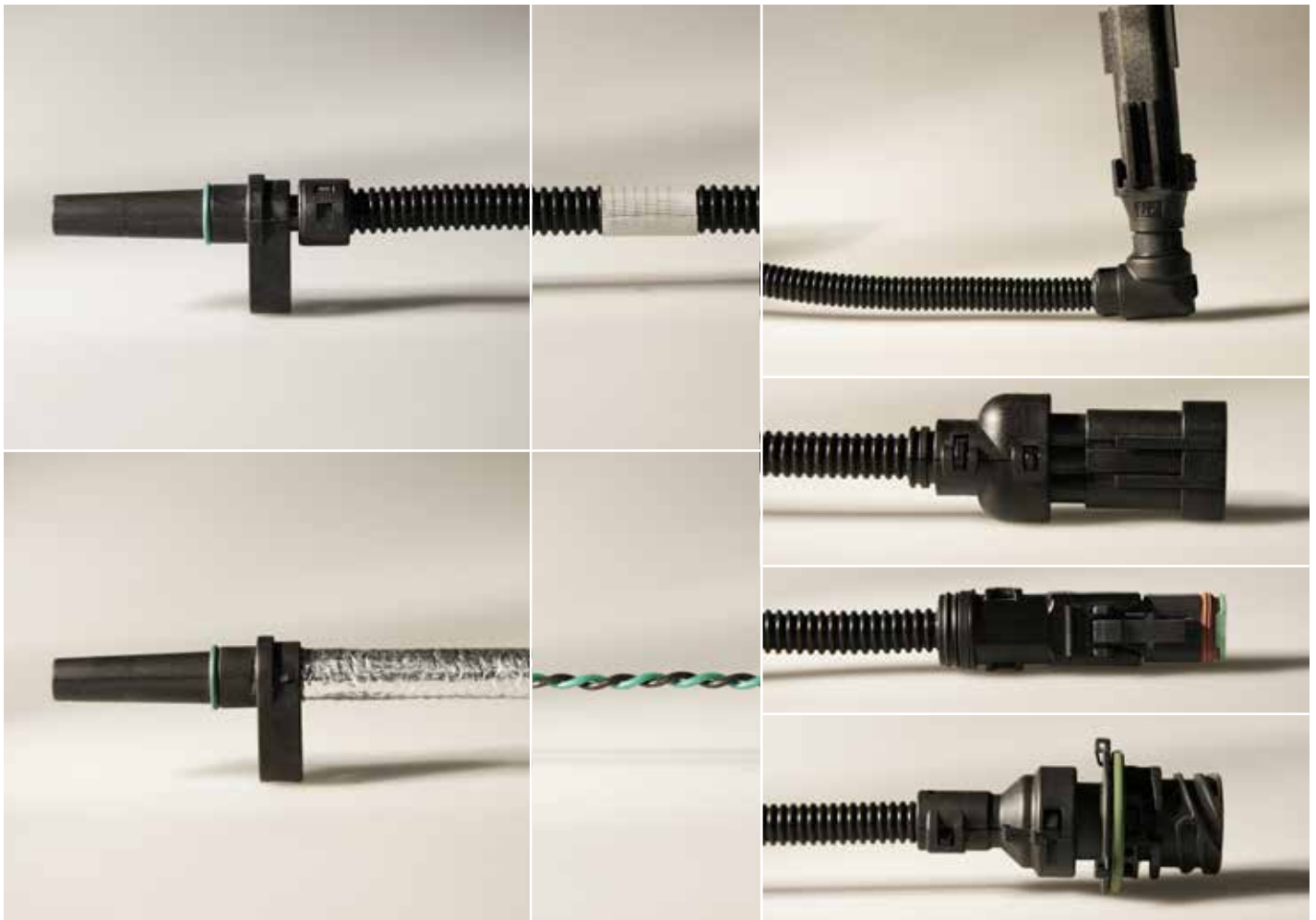
Principle	Housing material	Target	Target material	Output signal	Shaft length	Shaft diameter	Ambient temperature			Additional features
							Housing	Cable	Connector	
VR	Metal Body	Flat	Steel	Sinus wave	30 mm	M10x1	250 °C	260 °C	125 °C	Clips Heat shield

DSH 0620.11 PHV | Nova



Principle	Housing material	Target	Target material	Output signal	Shaft length	Shaft diameter	Ambient temperature			Additional features
							Housing	Cable	Connector	
Active Eddy current	Epoxy-metal	Blade	Aluminium - Titanium	Square wave	42.2 mm	Ø 6 mm M8	180 °C	260 °C	125 °C	None

DSE 1210.20 XXX | Artemis Variable Reluctance



Principle	Housing material	Target	Target material	Output signal	Shaft length	Shaft diameter	Ambient temperature			Additional features
							Housing	Cable	Connector	
VR	Epoxy	Flat	Steel	Sinus wave	42.1 mm	Ø 12.8 mm	180 °C	260 °C	125 °C	Tape - reflect shield convolute - tape

DSE 1210.20 P17HZ | Artemis Variable Reluctance



Principle	Housing material	Target	Target material	Output signal	Shaft length	Shaft diameter	Ambient temperature			Additional features
							Housing	Cable	Connector	
VR	Epoxy	Flat	Steel	Sinus wave	42.1 mm	Ø 12.8 mm	180 °C	200 °C	125 °C	Convolute - tape Viton cable

DSH 0601.00 PHV | APOLLO Prototype



Principle	Housing material	Target	Target material	Output signal	Shaft length	Shaft diameter	Ambient temperature			Additional features
							Housing	Cable	Connector	
Active Eddy current	Epoxy	Blade	Aluminium or Titanium	Rectangular 5V	38 mm	Ø 6 mm	180 °C	260 °C	125 °C	None

For more information please go to page 11.



The challenge and opportunity

Improved fuel economy and reduction of engine emissions are the major factors which regulate today's automotive industry. Turbocharging has become the key enabling technology for not only meeting these regulatory standards but also for delivering the desired large engine performance from a smaller 'downsized' engine. To maximize performance of the turbocharger (and the engine) it is essential to accurately measure the rotational speed of the turbocharger's compressor wheel or axle and transfer this information to the engine control unit.

Why measure turbocharger speed?

Because it provides a cost-effective solution for maximizing the performance of the turbocharger and engine. A speed sensor will allow optimized use of the compressor map, meaning that the turbocharger can

- Run closer to the surge line for an increased low end torque
- Provide for higher peak power through efficient control of maximum speed
- Be used safely for during brake mode application

A turbocharger speed sensor will enable

- Faster adaptation to changing engine conditions
- Automatic adaptation of the turbocharger at different altitude levels since rpm is used as measuring value instead of pressure
- Synchronisation of bi-turbo configurations with V-engines
- Optimizations of transition points between multi-compressor systems

Addition of a speed sensor may allow use of a smaller turbocharger for the same efficiency, and also provide possibilities for obtaining diagnostic information about the turbocharger and engine.

As you can see there are many benefits of having a speed sensor on your turbocharger !

Why choose JAQUET?

JAQUET is a Swiss family business built upon 125 years of experience and knowledge of fine engineering. We are an innovative global technology leader and ISO/TS 16949 accredited supplier of automotive speed sensing solutions. Over the last 10 years we have become worldwide experts in the measurement of turbocharger speed - having the most advanced solutions on the market. JAQUET designs and manufactures the largest range of speed sensors available today for passenger car and truck segments. Most of the key turbocharger manufacturers rely on JAQUET speed sensors for their success. With over 7 million turbocharger sensors currently in use, we are the ideal partner to provide custom quality solutions, as well as a range of existing off-the-shelf products. We provide technical excellence, understanding and flexibility to design and manufacture low and high volume solutions which meet the needs of your specific application.



APOLLO, the advanced, cost-effective speed sensor for fast passenger car turbochargers

APOLLO – specifically designed for passenger car market – with advanced capability with less cost

Drawn from experience of being the key supplier for most of the turbocharger manufacturers and having over 7 million turbocharger sensors in traffic, JAQUET's new APOLLO turbocharger sensor is specifically designed for the passenger car market. Many engine designers have opted for the benefits of turbocharger speed measurement in both diesel and petrol driven units. The only challenges for the passenger car market, so far, have been the size of a speed sensor and its cost. APOLLO eliminates both of these obstacles – the sensor is extremely small, easily adaptable and economically priced.

APOLLO means more capability with less cost

The advanced features of the APOLLO sensor are based on a high temperature ASIC, developed by JAQUET for increasing underhood temperatures. The ASIC is built directly into the sensor body and provides performances and features unseen in this category of sensor elements; diagnostic functions, configuration capabilities, on board frequency division and a possibility to detect both aluminium and titanium blades. All of this is combined with a mechanical design which allows an easy assembly in the turbocharger.

APOLLO – designed to meet your needs

The APOLLO sensor can be provided with the high temperature ASIC electronics located either in the connector module, or integrated in the sensor shaft, depending on the specific application requirements and preference of the customer. Bespoke integrated connector solutions provide further possibilities for customization of this product.

Would you like to test APOLLO?

Sample sensors, with the final ASIC version, are now available at JAQUET to support ECU development and testing. For more information, samples and customization possibilities please do not hesitate to contact us.

We are pleased to help you drive for maximum efficiency.



Swiss know-how and quality matched to your demands

JAQUET manufactures speed sensors in quantities from 1 to millions per project per year. These typically customer specific solutions add value through being matched to individual applications. **Since 1889, a spirit of excellence complementing tradition and innovation.**



Automotive turbochargers

Turbocharger for trucks, passenger cars, construction equipment

- Speed of turbochargers
- Gearbox shaft and retarder speed



Railway systems

- Optimum traction control
- WSP (wheel slide protection) systems
- Speed information for automatic train control



Power generation

Gas, hydro, steam and wind turbines

- Overspeed protection
- Speed measurement and control



Hydraulics

Agricultural machinery, construction and mining equipment, cranes, ROV – remote operated vehicles

- Motors and pumps, flowrate measurement
- Position measurement, traction synchronization



Diesel and gas engines

Large diesel and gas engines in marine, rail, off-road applications and power production.

- Cam and crank shaft for dynamic position
- Turbocharger speed, engine diagnostics

Quality systems

ISO TS 16949
ISO 9001
AS 9100
IRIS



Worldwide and local to you through

JAQUET Technology sales offices, subsidiaries and distributors.