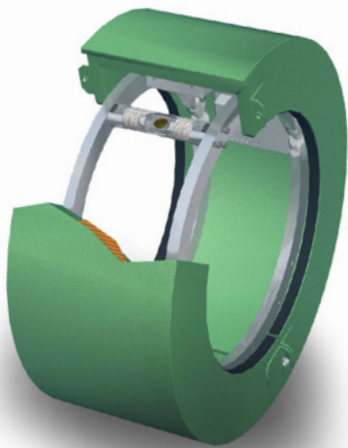


VAF

INSTRUMENTS



T-Sense[®]

Optical Torque Measuring Systems

660

Product Bulletin

WWW.VAF.NL

TO BE
REALLY
SURE

Introduction

The use of a T-Sense® torque measuring system means efficiency improvement, overload protection and prevention of breakdown costs. For example in the shipping industry its application has lead to savings up to 5% on fuel costs. The system is based on extremely accurate optical sensor technology and can be mounted around shafts in power transmission systems.

Why a torque measuring system?

A torque meter provides you with precise information on engine performance related to consumed energy. By giving instantaneous read-out of torque, speed and power, the effects of operational changes are monitored. Because these effects are measured, you can use your engine-driven installation in its most efficient way. This will considerably reduce your fuel costs, one of the primary cost drivers.

Where is the T-Sense® torque measuring system used?

T-Sense® torque measuring systems are used for engine-driven installations in all kinds of power and propulsion plants. For example continuous power output measurement of ships propulsion, continuous power consumption measurement, continuous level check for torque, speed and power and direct visual control of changes in engine settings, trim and draught.

Possible system extensions

A full range of T-Sense® torque measuring systems is available. The standard output of the torque measuring system consists of a torque, shaft speed and power signal. The system can be extended with fuel consumption measurement and speedlog/GPS input.

Your advantage

Designed for durability and accuracy

The systems have a robust design. They are built to withstand the typical harsh environmental conditions in ships, engine rooms, dredgers, steelworks and heavy industries. Innovative optical sensor technology guarantees high accuracy with an overall error of less than 0,25% F.S.D.

No maintenance required

T-Sense® torque measuring systems are maintenance-free as a result of noncontact power and signal transmission. They are designed to work continuously. No recalibration is needed, because signals are stable during its lifetime.

Easy installation and commissioning

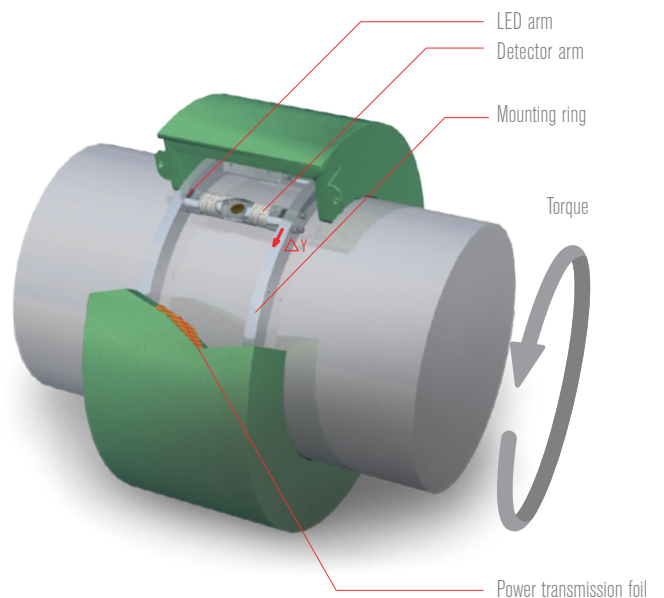
The intelligent design enables installation by customers staff.

Principle of operation

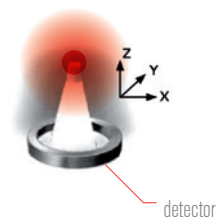
The T-Sense® measuring system can be mounted on propeller or drive shafts. When a shaft is subject to torque this will result in a small strain at the shaft surface. A LED and an extremely accurate optical cell can detect these small movements of the surface. The measured values are transferred continuously from the rotating shaft to the stator part through a 2,4 GHz wireless data connection. Power transmission from the stator to the rotating shaft is performed by means of induction.

The stator part consists of a bracket, a power transmission coil, a data signal receiver and a control box equipped with digital and analogue output connections. These outputs can be linked directly to the vessels data network, monitoring or control system.

The stator part can optionally be connected to a PEM 2 touch screen, which displays, shaft power, torque and speed. The PEM 3 Propulsion Efficiency Monitor displays all fuel consumption data, engine load diagram, power data, etc.

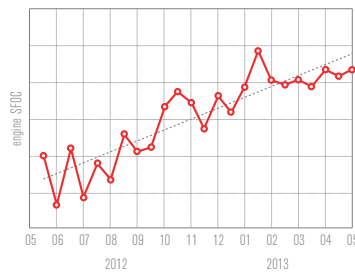
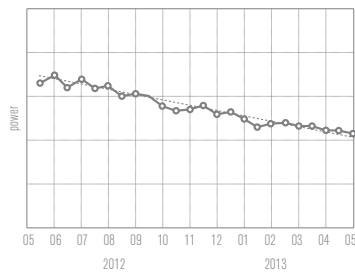


Δy is a small movement of the propeller shaft surface due to strain
measuring principle



Optical displacement measurement

Typical system arrangement



Efficiency monitoring

Trip reports
Cumulative values
Engine load diagram



Fault detection



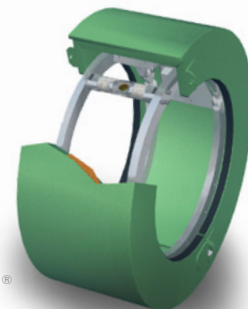
SPU 3



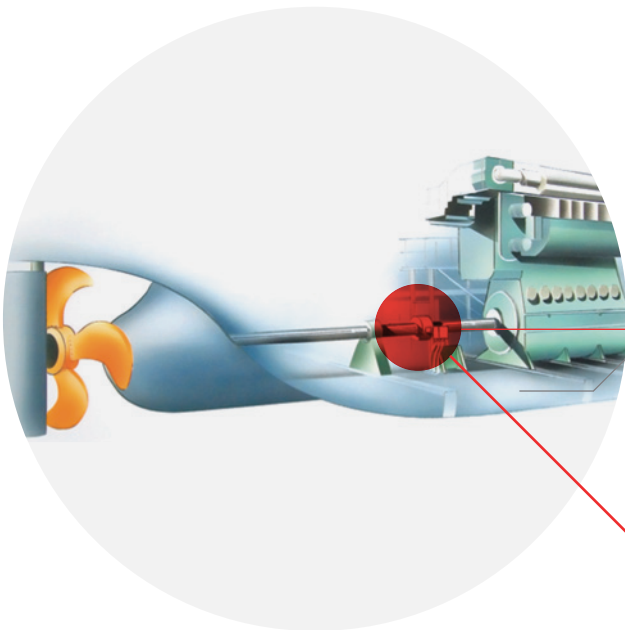
Speed log/GPS



12x PT2 flow meter
(flow + temp)
for max. 6 consumers



T-Sense®



Typical T-Sense® torque measuring system with optional
fuel consumption measurement and outputs

Features & benefits

VAF Instruments has developed the T-Sense® torque measuring system with modern and user-friendly electronics, based on proven very accurate optical sensor technology. The standard T-Sense® torque measuring system will be delivered with an interface box for easy connection to the ships data network, monitoring or control system. A PEM 2 touch screen display or PEM 3 Propulsion Efficiency Monitor, can be supplied as a monitoring device.

Features	Benefits
Optical measuring principle	No time consuming mounting of strain gauges
	High accuracy and repeatability
	Detection of torsional vibrations
Extreme accuracy of optical sensor (within nanometer range)	Very accurate output signals resulting in high measuring accuracy and repeatability
	Torsional vibration analysis is possible during long interval period
Wireless transmission of data and power	No maintenance
	No wear
Digital output signal available	Easy and accurate digital data transfer to the vessels network, monitoring or control system
	Only 1 communication cable to the bridge
	User friendly installation
Easy installation and commissioning without assistance	Low overall installation costs
	No engineering or commissioning assistance needed
Calibrated for life	No need for recalibration
	No servicing costs
	Low costs of ownership
A genuine VAF Instruments product	75 years of experience in sensor technology for maritime applications
Manufactured by a ISO 9001 certified organization	Assured constant product quality
Touch screen display	No operator training required
	User friendly human interface

Technical specification

T-Sense® torque measuring system

Control box at stator part	
Power supply	115 or 230 VAC, 50 or 60 Hz +/- 20%
Power consumption	40 VA maximum
Input	2,4 GHz fully protected encrypted signal
Output	Ethernet, RS 485 for Modbus protocol or 4-20 mA isolated current output (optional)
Dimensions	408 x 360 x 111 mm
Rotor equipment	
Material of mounting rings	carbon steel
Material outside cover	polyurea coated high density foam
Material compensator arms	carbon steel
Shaft speed detection	accelerometer signal
Output	2,4 GHz fully protected encrypted signal
Shaft diameter	min. 100 mm, max. 1000 mm
Dimensions	depending on shaft diameter
Operating temperature	-10°C to 60°C
Measuring tolerance	< 0,25% F.S.D.
PEM 2 touch screen ¹	
Power supply	24 VDC
Display	Touch screen, TFT, 320 x 234 pixels
Operating temperature	0° C to 55° C
Dimensions screen	5,6 inch
Front panel protection	IP65/NEMA4
PEM 3 Propulsion Efficiency Monitor ²	
Touch screen	
Power supply	24 VDC
Display	Touch screen, PCAP, 800 x 480 pixels
Operating temperature	0° C to 55° C
Dimensions screen	7 inch
Front panel protection	IP65/NEMA4
SPU 3 Signal Processing Unit	
Power supply	115 or 230 VAC ± 10%, 50 or 60 Hz
Protection class	IP65
Operating temperature	0° C to 55° C
Input	Modbus signal for torque, shaft speed and power, pulses from flowmeters and temperature via integrated PT 100 ³ temperature sensor, speed log as pulse input, GPS (NMEA) signal, 4-20 mA current input for shaft generator power level
Output ⁴	Modbus and Ethernet signal for torque, shaft speed, power, fuel consumption data and environmental data, optional relays for alarms and high/low torque levels
Notes: ¹⁾ For systems with T-Sense® only ²⁾ For systems including T-Sense® and SPU 3 Signal Processing Unit for connecting multiple I/O ³⁾ Refer to Product Bulletin 135 for MidFlow® Model PT ⁴⁾ For other output options consult VAF Instruments	



Options and accessoires

PEM 3 Propulsion Efficiency Monitor

The PEM 3 instantly displays torque, speed, shaft power and other selected measuring data. Additional flowmeter signals and temperature sensor (PT100) signals enable calculation of the engines fuel consumption with optional temperature compensation.

In combination with input signals from speedlog or GPS, the PEM 3 will calculate the temperature corrected fuel consumption per kW or per nautical mile.



PEM 3 T-Sense®

Features:

- Touch screen display;
- Easy menu structure;
- Display of bar graphs and engine load diagram;
- User friendly, log functions for alarms and instant detection of missing signals;
- Display of fuel consumption per kW;
- Display of fuel consumption per consumer;
- Display of fuel consumption per nautical mile;
- Remote accessible through standard webbrowsers;
- SPU 3 Signal Processing Unit included.

The PEM 3 helps the ship's crew and the owner to find the best settings for engine, trim and propeller pitch, as the effect of the changes will be instantly displayed.

PEM 2 Touch screen

For monitoring T-Sense® torque, shaft speed and power output **only**, we supply the PEM 2 touch screen as a stand alone unit.



PEM 2 T-Sense®

Applications

In combination with a PEM 3 or with the vessels monitoring system, the T-Sense® measuring system can be used in a variety of applications such as:

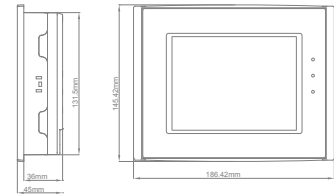
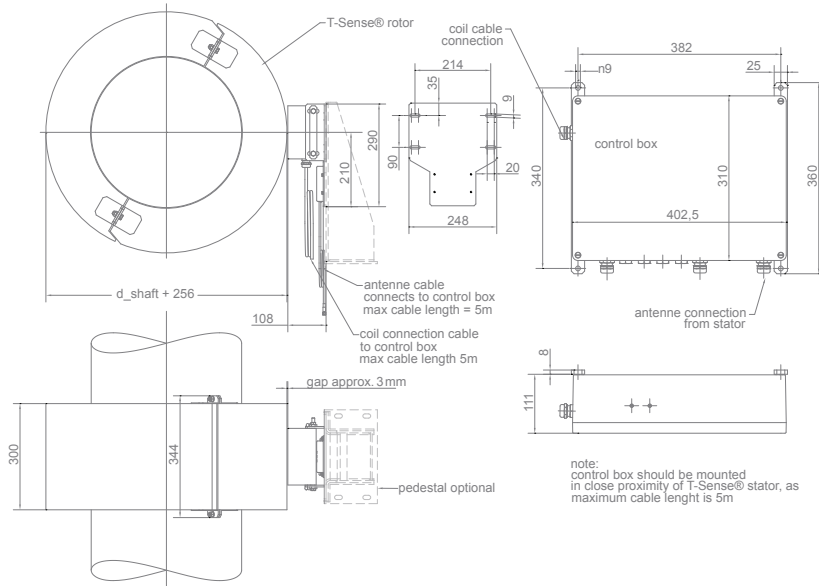
- Continuous power output measurements for ship propulsion;
- Visualisation of engine load margin. Avoiding engine overload;
- Continuous power and consumption management including specific fuel oil consumption;
- Direct visual control of changes in engine setting, trim and draught;
- Continuous and long term monitoring of torque, speed and power;
- Torsional vibration analysis for frequencies up to 50 Hz.

Besides these standard applications VAF Instruments also manufactures special designs:

- Test bed shafts;
- Tailor-made software.

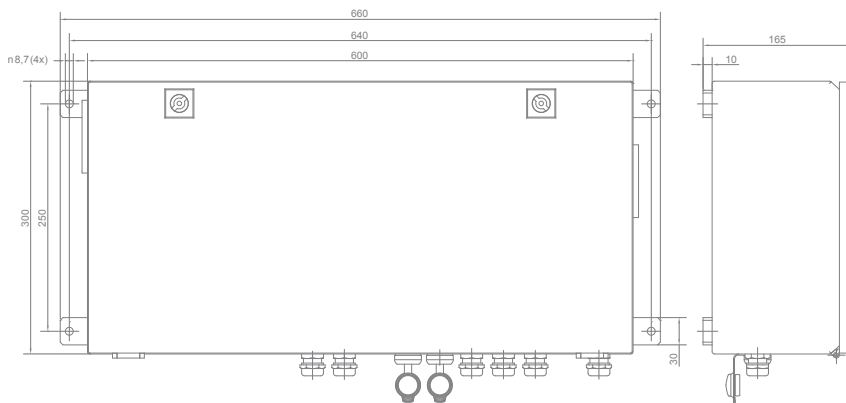
Dimensions

T-Sense® components

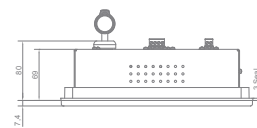
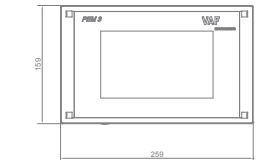


PEM 2 touch screen

For use with T-Sense® control box



PEM 3 SPU 3 Signal Processing Unit



PEM 3 touch screen

For use with SPU 3 Signal Processing Unit

Quotation & ordering information

1. Number of units per ship:			
2. Ships name / hull:			
3. Available shaft length [mm]:			
4. Please provide shaft line drawing for installation:			
☐ new building		☐ retrofitting	
5. Design conditions:			
power [kW]:			
speed [rpm]:			
shaft material:		shear modulus G [N/mm ²]:	
shaft diameter (+tolerance) [mm]:			
inside bore diameter [mm]:			
application	☐ propeller shaft	☐ dredge pump	☐ engine drive shaft
	☐ jet pump	☐ other:	
6. System:			
required output	torque	☐ RS 485/Modbus	☐ Ethernet
		☐ range 4 - 20 mA	☐ kNm
	speed	☐ RS 485/Modbus	☐ Ethernet
		☐ range 4 - 20 mA	☐ rpm
power		☐ RS 485/Modbus	☐ Ethernet
		☐ range 4 - 20 mA	☐ kW
		☐ other:	
options	☐ touch screen display for torque, shaft speed and power read-out		
	☐ fuel consumption measurement		
	☐ total power calculation for twin screw vessels		

Name:

Place and date:

For further information see relevant Product Bulletins
or www.vaf.nl

Represented by

VAF Instruments B.V.

Vierlinghstraat 24, 3316 EL Dordrecht, The Netherlands

P.O. Box 40, 3300 AA Dordrecht, The Netherlands

T +31 (0) 78 618 3100, F +31 (0) 78 617 7068

sales@vaf.nl, www.vaf.nl

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Agents and distributors in more than 50 countries.

