

TYPE APPROVAL CERTIFICATE

This is to certify:**That the Monitoring System**

with type designation(s)
**TT-Sense thrust and torque measuring system,
Control box 0399-0428, Rotor 200 mm to 1000 mm**

Issued to

**VAF Instruments B.V.
Dordrecht, Zuid-Holland, Netherlands**

is found to comply with

DNV GL rules for classification – Ships, offshore units, and high speed and light craft

Application :

Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV GL.

Location classes:

Type	Temperature	Humidity	Vibration	EMC	Enclosure
Control box 0399-0428	A	B	A	A	B
Rotor 200 mm to 1000 mm	A	B	B	A	B

Issued at **Høvik** on **2019-06-19**

This Certificate is valid until **2024-06-18**.

for **DNV GL**

DNV GL local station: **Rotterdam**

Approval Engineer: **Ståle Sneen**

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**Trond Sjøvåg
Head of Section**

This Certificate is subject to terms and conditions overleaf. Any significant change in design or construction may render this Certificate invalid. The validity date relates to the Type Approval Certificate and not to the approval of equipment/systems installed.



Product description

TT-Sense thrust and torque measuring system comprising a control box (stator) and rotor equipment as follows:

Control box 0399-0428 at stator part

Power supply:	115 or 230 VAC, 50 or 60 Hz +/- 10%
Power consumption:	40 VA maximum
Input:	2.4 GHz fully protected encrypted signal
Outputs:	RS 485 for MODBUS protocol, Optional 4-20 mA isolated current output, Optional Ethernet port for service purposes only.
Dimensions:	407 x 360 x 119 mm

Rotor equipment

Material mounting rings:	carbon steel (C45E)
Material outside cover:	polyurea coated high density foam
Material compensator arms:	carbon steel (C45E)
Material protection tube:	aluminium
Shaft speed detection:	accelerometer signal
Output:	2.4 GHz fully protected encrypted signal
Dimensions:	200 mm to 1000 mm, depending on shaft diameter
Operating temperature:	0°C to 60°C
Measuring tolerance:	Thrust [kN]: < 1.0% FS Torque [kNm]: < 0.25% FS Power [kW]: < 0.25% FS

The TT-Sense measuring system can be mounted on propeller or drive shafts. When a shaft is subject to thrust or torque this will result in a small strain at the shaft surface. LEDs and extremely accurate optical cells can detect these small movements of the surface in axial and tangential directions. The measured values are, together with temperature and rpm data, 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.

Radio specification

Bluetooth Adaptive Frequency Hopping between 79 channels in the 2.4 GHz ISM-band (2402 MHz - 2480 MHz). Typical radio transmitting power is 4 dBm / 2.5 mW from a directional antenna.

Approval conditions

The Type Approval covers hardware listed under Product description. When the hardware is used in applications to be classed by DNV GL, documentation for the actual application is to be submitted for approval by the manufacturer of the application system in each case. Reference is made to DNV GL rules for classification of ships Pt.4 Ch.9 Control and monitoring systems.

Application/Limitation

Installation of TT-Sense is to be performed as described in the Technical Manual 674.

Type Approval documentation

Tests carried out

Applicable tests according to class guideline DNVGL-CG-0339, November 2016.

EMC radiated electromagnetic field immunity test was extended to cover frequency range 2 GHz to 6 GHz at 3 V/m (according to EN 301 489-1 V2.1.1 and EN 301 489-3 V1.6.1).

EMC conducted emission test from 150 kHz to 30 MHz and radiated emission test from 30 MHz to 6 GHz according to CISPR 32:2015+COR1:2016 for Class A equipment.

Marking of product

Manufacturer: VAF Instruments BV

Type No.: TT-Sense

Serial No.: Unique. The approval covers serial numbers 18.2652 and higher.

Supply: 115/230 VAC, 50/60 Hz

Periodical assessment

The scope of the periodical assessment is to verify that the conditions stipulated for the type are complied with, and that no alterations are made to the product design or choice of systems, software versions, components and/or materials.

The main elements of the assessment are:

- Ensure that type approved documentation is available
- Inspection of factory samples, selected at random from the production line (where practicable)
- Review of production and inspection routines, including test records from product sample tests and control routines
- Ensuring that systems, software versions, components and/or materials used comply with type approved documents and/or referenced system, software, component and material specifications
- Review of possible changes in design of systems, software versions, components, materials and/or performance, and make sure that such changes do not affect the type approval given
- Ensuring traceability between manufacturer's product type marking and the type approval certificate

Periodical assessment is to be performed after 2 years and after 3.5 years. A renewal assessment will be performed at renewal of the certificate.

END OF CERTIFICATE