

RoaDyn S660

Type 9248A1

Wheel force transducer for racing, SUVs, transporters and light trucks

WFT for measuring three forces and moments on a rotating wheel; a major constituent in modern vehicle development.

- 6x6 compensation matrix for highest measurement accuracy
- User-friendly thanks to modular design
- Fail safe through automatic identification
- Durable and reliable through optimized components using modern FE methods
- Approved high quality of components by a durability test according to SAE J328
- Excellent signal quality due to digitization already in the wheel electronics

Description

The RoaDyn S660 wheel force transducer is a multiaxial measuring system for use in the development and testing of complete chassis and chassis components of vehicles. During measurement the RoaDyn S660 replaces a standard wheel and measures the forces and torques applied through the tire contact patch in the three directions of the wheel coordinate system.

While using the wheel force measuring system, it is important to ensure that it changes the characteristics of the car and components to be tested as little as possible. For this reason, the masses of the unsprung components and the moments of inertia of the rotating system must correspond as closely as possible to those of the particular standard wheel.

Design

Suitable mechanical components like inner part, outer part and wheel offset adapter are used to mount the six replaceable 3-component load cells between wheel hub and rim ring. This modularity offers an extremely high degree of versatility. All of the standard components of the system apart from the mechanical elements can be retained when it is adapted to suit different rim sizes and wheel hub geometries.

Calibration

In addition to the individual load cells, the entire system is also calibrated with a 6x6 matrix. This ensures that the effect of these components on the sensitivity of the complete system is taken into account and that accuracy is improved.



Digitization

The signals are amplified before leaving the load cells and passed on to the hub electronics for filtering, digitization and encoding. The data stream is transmitted contact-free via in-board or out-board transmission to the on-board electronics. Here the physical quantities F_x , F_y , F_z , M_x , M_y and M_z are calculated from the raw signals and transformed from the rotating coordinate system of the wheel into the non-rotating vehicle coordinate system.

The measurement data is output in both analog and digital form. The digital output is available in CAN, Ethernet or other data acquisition system formats. In addition, customer-specific signals such as tire pressure, temperature, etc. can be detected synchronously by the on-board electronics.

Simulation

The design of the mechanical structural parts takes account of the expected forces and torques acting on the vehicles on which they are used. With the help of fatigue behavior tests and computer-aided engineering (FEM), Kistler takes these demands into account without compromising on durability.

Application

- Measuring operating loads during typical vehicle driving maneuvers
- Input data for the design of new components
- Verification of design loads
- Measuring test stand control data for road simulators
- (Permanent) application as multi-axis force measuring unit in road simulators
- Development of active chassis control systems such as ABS, ESP, etc.
- Investigations of vehicle behavior in specific or critical driving situations
- Input data for fatigue calculations and numeric simulations
- Development of computer models

Usually 4 or 2 WFTs are used. Occasionally, measurements with a single WFT are also employed for component or tire development. The various test vehicles require adaptation to new wheel/hub geometries. The modular design of the WFTs and proficient support by Kistler application centers has proved successful for this purpose.

At the same time as the WFTs, systems for wheel motion measurement or optical sensors (such as for measuring tire and body slip angle, speed or accelerations) can also be used.

Adaptations for applying individual sensors to the measuring wheels are available in the Kistler product range.

Technical data

Measuring range ¹⁾	F _x	kN	-60 ... 60
	F _y	kN	-36 ... 36
	F _z	kN	-60 ... 60
	M _x	kN·m	-7,5 ... 7,5
	M _y	kN·m	-8,5 ... 8,5
	M _z	kN·m	-7,5 ... 7,5
Rotary angle accuracy		°	≈0,1
Weight WFT ²⁾	m	kg	≈18,3

Maximum loads

Degree of protection			IP65
Operating temperature range		°C	<125
Alu components			
Max. speed ³⁾	In-board transmission	min ⁻¹	2 300
	Out-board transmission	min ⁻¹	4 000
Max. impact acceleration	x, y, z	g	50

Accuracy

Linearity		%FS	≤0,5
	Typical ⁴⁾	%FS	≤0,15
Hysteresis		%FS	≤0,5
	Typical ⁴⁾	%FS	≤0,10
Crosstalk forces		%FS	≤0,5
	Typical ⁴⁾	%FS	≤0,10

Permitted alternating stress (rotating bending fatigue test)

The requirements according to SAE J328 are exceeded.

500 000 LC at 6.0 kN·m – standard application

500 000 LC at 6.5 kN·m – racing application

¹⁾ It is assumed that these extreme values do not occur simultaneously. The moments refer to the wheel center (ET = 0).

²⁾ With 6x16" aluminum rim, rotor, wheel electronics, hub adapter but without offset adapter, wheel bolts and tires

³⁾ Vehicle speed depending on the wheel diameter

⁴⁾ The typical accuracy corresponds to the median of the results of end-of-line and re-calibrations

Sensor setup

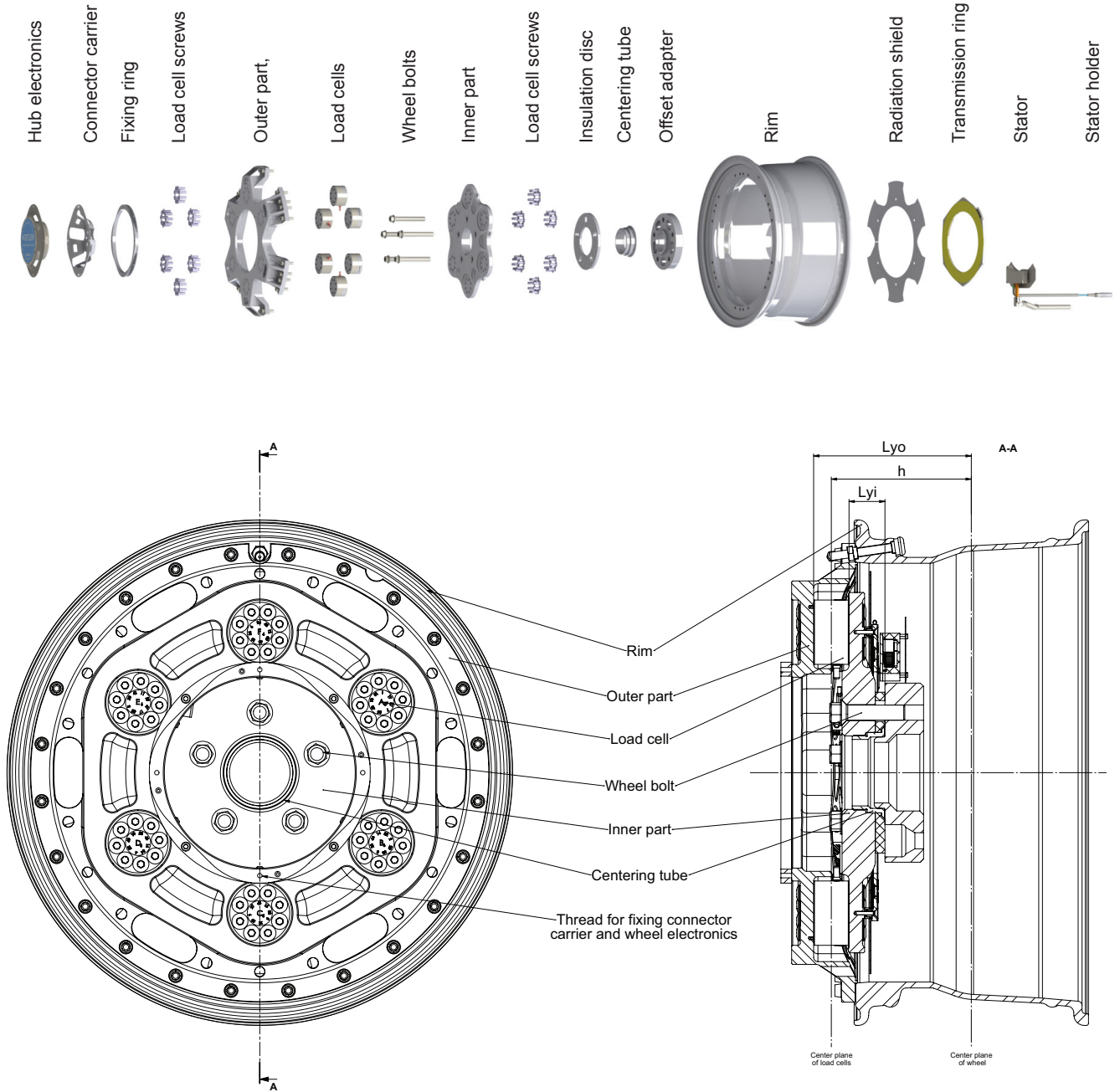

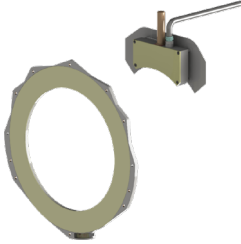


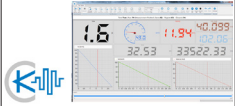







Fig. 1: Structure/components of the RoaDyn S660 WFT for standard applications with in-board transmission

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RoaDyn S660 measuring chain configurations

Wheel force transducer	Data transmission	Connecting cable	On-board electronics	
Type 9248A1 with wheel electronics Type 5241A2 and rim Type Z39913A...	Type 5240A..., 5242A... In-board transmission unit consisting of rotor and stator	Type Z30430A... Connection between stator and on-board electronics	Type 9817A.. KiRoad Performance	Type 18025602 KiCenter
				

Wheel force transducer	Data transmission	Connecting cable	On-board electronics	
Type 9248A1 with wheel electronics Type 5241A2 and rim Type Z39913A...	Type 5248A... Out-board transmission unit	Type Z30430A... Connection between stator and on-board electronics	Type 9817A.. KiRoad Performance	Type 18025602 KiCenter
				

Mounting the in-board transmission

In the case of in-board transmission, a suitable mounting device for the stator is mounted on the wheel carrier or suspension strut. An adjustment gauge is then used to determine the position of the stator and the position of the mounting bracket.

With the stator installed, mounting a WFT is comparable with that of a standard wheel. The stator can also remain mounted on the vehicle if this is running with standard wheels. When the WFTs are remounted, measurements can be made again immediately.

Mounting the out-board transmission

The out-board transmission is mounted together with the torque support on the outside of the wheel.

For out-board transmission, the vehicle setup needs to be extended with an additional support arm to which the on-board electronics cable is fixed.

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Included accessories

• 6 load cells (strain gauge basis)	Type/art. no.
• Inner part	9190A8B6
• Connector carrier	9729A6
• Outer part	Z39904
• Rim	9731A6...
• Wheel electronics	Z39913A...
• Hub adapter package, including insulation disc, centering sleeve and wheel bolts	5241A2...
• Offset adapter	9711A3

Optional accessories

• Precision spirit level,	Type/art. no.
• Adjusting gauge for stator mounting,	Z30208
• Tire mounting ...	Z39911Q
• 3-channel strain gauge bridge amplifier (SGAM)	Z30210
• 3-channel thermocouple amplifier (TCAM)	2237A1
	2237A2

Ordering code

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