

RoaDyn® S630 sp System 2000

Type 9279A1

Wheel Force Transducer (WFT) for Passenger Cars

Wheel force transducer for measuring three forces and three moments on a rotating wheel to determine road load data for passenger cars.

- Very light yet rigid design
- Customized adapters, weight and strength optimized
- Modular design based on five individual 3-component strain gage load cells
- Outstanding signal quality due to digitization on the wheel
- In-board and out-board telemetry
- High-precision measurement ensured by calibration of individual load cells and overall system
- Certified calibration procedure
- Excellent temperature stability
- Tested fatigue strength, e.g. to SAE J 328
- For 17 ... 22 inch rims



Description

RoaDyn S630 is a modular wheel force measuring system consisting of five 3-component strain gage load cells, carbon fiber reinforced polymer (CFRP) inner and outer part, wheel electronics, telemetry and on-board electronics. During measurement RoaDyn S630 replaces a standard wheel and measures the forces and moments applied through the tire contact patch in the three directions of the wheel coordinate system. The signals are converted into digital form in the wheel electronics. They are then transmitted by means of in-board or out-board near-field telemetry from the rotating wheel to a fixed stator and then via cable to the on-board electronics. In the latter the three forces and three moments relative to the car coordinate system are calculated online from the raw signals and output via analog and digital interfaces.

One important constraint on the use of wheel force transducers is the need to ensure they change the characteristics of the car and components to be tested as little as possible. For this reason the masses of the unsprung components and moment of inertia of the rotating system must correspond as closely to or differ as little as possible from those of the particular standard wheel. Kistler's consistent exploitation of lightweight materials (CFRP and Al) and computer-aided engineering (FEM) take account of this need without compromising durability.

Hence, for example, the inner part, which is bolted to the hub of the car, and the outer part, which provides the connection to the rim, are manufactured from a CFRP. The rims, whose weight has also been minimized, are generally manufactured from forged aluminum blanks, although depending on the application commercial aluminum rims can also be used. The outer part can be screwed to or laminated into the rim.

The individual strain gage load cells are interchangeable and can be used for all RoaDyn S6xy wheel force transducers for cars, SUVs and vans.

The RoaDyn S6xy family of wheel force transducers uses normalized separate Type 9190A load cells, which are individually calibrated after manufacture. Serial number, calibration data and zero of the individual forces are stored on an ID chip. The three measured signals are temperature-compensated. When the electronics are switched on, the components identify themselves and allow computation based specifically on the available individual values.

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The high measuring accuracy of the precision load cells is retained during transmission, since digitization takes place on the wheel to eliminate transmission interference.

Measuring separate signals with individual load cells also cut crosstalk. Knowledge of the original load cell signals allows rapid troubleshooting. Individual cells can be replaced without impairing the overall quality of the wheel force transducer.

Not just the individual load cells, but the entire system consisting of cells, inner and outer part, rim and tire is calibrated. This improves accuracy by factoring in the effect of these components on the sensitivity of the system as a whole. Cutting-edge digital transmission and data processing techniques ensure user-friendly system operation and reliable provision of measurement data free from interference.

The measured signals are filtered and digitized in the Type 5241A... wheel electronics. Pulse code modulation (PCM) generates a serial 2 Mbit/s data stream. As it offers major advantages for tests on both public roads and off-road, in-board transmission is standard.

The telemetric transmission unit consists of a Type 5242A3286Q5 rotor rotating with the wheel, and a Type 5240A stator for mounting on the car's spring/shock absorber system. For exact positioning and alignment of the stator a Type Z39911 alignment gage is included. Kistler offers the Type 5248A0 out-board transmission unit as an alternative if this form of transmission is required. The transmission units are described in greater detail on data sheets 5240A_000-561 and 5248A_000-562.

The on-board electronics Type 9891A... perform real-time conversion of the raw data from the rotating wheel coordinate system into a coordinate system relative to the car. The System 2000 on-board electronics are described on data sheet 9891A_000-563.

Application

In many areas of vehicle development wheel force transducers are used to obtain information about the force relationships at the tire contact patch. For example, they help record load spectra used as input variable for simulating durability on road simulators.



Fig. 1: RoaDyn® S630 System 2000 on a Pkw

In multibody simulation as well, the forces and moments on the wheel are needed for both modeling and validation of the computed results. Car design loads adopted in the initial design phase can be verified when a prototype becomes available and design errors detected in good time.

Data recorded with wheel force transducers is indispensable in determining characteristic parameters for tire models.

Optimal vehicle tuning is a compromise between agility and ride comfort. One aim of vehicle dynamics testing is objective measurement of the required kinematic characteristics. Important contributory parameters include the forces and moments on the wheel. Other key vehicle dynamics parameters include camber angle, slip angle, drift angle, speed and acceleration. As these measurands sometimes also have to be recorded on the wheel, adaptation of appropriate sensor systems to suit the wheel force transducer is possible.

Technical Data

Measuring range	F_x	kN	± 30
	F_y	kN	± 18
	F_z	kN	± 30
	M_x	kN-m	± 5
	M_y	kN-m	± 5
	M_z	kN-m	± 5
Rotary angle accuracy		$^\circ$	$\approx 0,1$
Max. weight* wheel force transducer	m	kg	≈ 13

Maximum Loads

Durability (SAE J328)		kN-m	4
Degree of protection			IP64
Operating temperature range			
Al components	$^\circ\text{C}$		< 120
CFK components	$^\circ\text{C}$		< 110
Temperature at the hub	$^\circ\text{C}$		< 125
Maximum speed			
In-board transmission	min^{-1}		2 300
Out-board transmission	min^{-1}		4 000
Max. impact accelerations		g	
x		g	≤ 40
y		g	≤ 20
z		g	≤ 40

Accuracy

Crosstalk (without compensation)	$F_y \rightarrow F_x, F_z$	%	≤ 1
	$F_x \leftrightarrow F_z$	%	≤ 1
	$F_x, F_z \rightarrow F_y$	%	≤ 2
Linearity		%FSO	$\leq 0,5$
Hysteresis		%FSO	$\leq 0,5$

* with "18" x 8,5 rim, inner and outer part, hub electronics, stator and cable, without tire

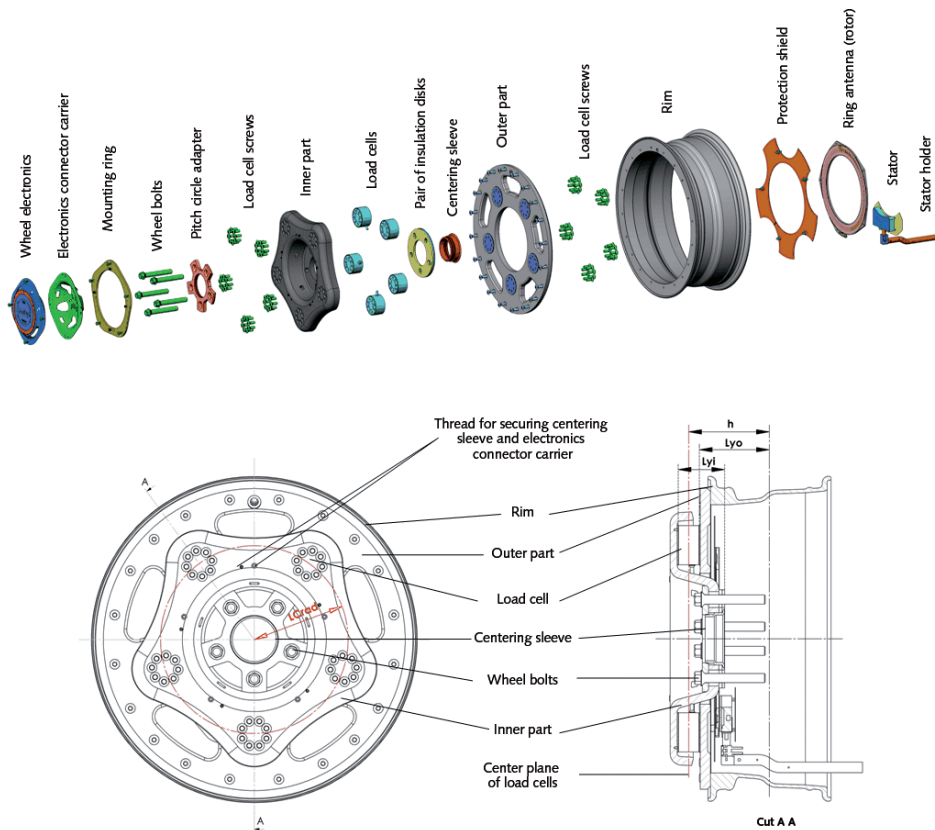


Fig. 2: Assembly/components of RoadDyn® S630 with in-board transmission

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Configuration of RoadDyn® S630 System 2000

<p>Sensor</p> <p>Type 9279A1</p> 	<p>In-board transmission unit consisting of rotor, stator and connection cable to on-board electronics System 2000</p> <p>Type 5242A..., 5240A..., Z30430A...</p> 	<p>On-board electronics System 2000</p> <p>Type 9891A...</p> 	<p>Remote control for on-board electronics System 2000</p> <p>Type 5685A...</p> 
<p>Sensor</p> <p>Type 9279A1</p> 	<p>Out-Board Transmission Unit for System 2000 with connection cable</p> <p>Type 5248A..., Z30430A...</p> 	<p>On-board electronics System 2000</p> <p>Type 9891A...</p> 	<p>Remote control for on-board electronics System 2000</p> <p>Type 5685A...</p> 

Included Accessories

- Adjustment gage for stator mounting

Type/Art. No.

Z39911

Ordering Code

- RoaDyn S630 sp System 2000 wheel force transducer for passenger cars

Type 9279A1

Optional Accessories

- Load cell screws, titanium
16 per load cell
- Adjustment gage for mounting stator
1 per measuring system
- Case for on-board electronics,
1 per measuring system
- Case for accessories,
1 per measuring system
- Case for one wheel force transducer
with tire
- Precision spirit level
- Spirit level, electronic with holder
- Load cell tester
- Tire mounting tool
- Universal adapter for balancing machine
- Key for centering sleeve, Type Z39901
- Timber facing,
1 per wheel force transducer
- Strain gage bridge amplifier (SGAM)
1 per wheel force transducer
- Thermocouple amplifier (TCAM)
1 per wheel force transducer
- DSP firmware, Version 4.01
- 4-channel analog input card
1 per measuring system
- CAN interface card for System 2000
1 per measuring system
- RoaDyn System 2000 Ethernet interface,
1 per measuring system
- Driver for Ethernet interfaces for
DAQ software
- RoaDyn System 2000 UDP SCoUT,
1 per measuring system
- RoaDyn System 2000 software for
correcting angular error
- RoaDyn DAQ software

Type/Art. No.

Z30074

Z39911

V712.0005

V712.0002

V712.0004

Z30208

Z31840

5984A

Z30210

V035.0000

Z30205

Z39909

2237A1

2237A2

2889A4.01

5293A31

5621A4

5621A6Q1

2837A01

2885A4.01

2889A2

2837A10

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