

## RoaDyn® S660 System 2000

Type 9248A1

### Wheel Force Transducer (WFT) for Heavy Pkw, SUV, Transporters and Light Trucks

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

- Modular design with replaceable measuring cells and components
- CAD/FEM supported design: optimization of local stresses
- High strength/low measuring wheel weight in combination with high rigidity
- Excellent signal quality due to digitization already in the wheel electronics
- Automatic identification of components by ID chip
- Calibration of the individual load cells as well as of the WFT assembly
- Tested structural fatigue strength e.g. to SAEJ328



#### Description

The RoaDyn S660 measuring wheel has a modular, versatile design for mounting on hubs and rim geometries. Six 3-component strain gage load cells are connected by adapter parts to a rim and to the vehicle hub. The signals are amplified immediately in the load cells and fed via short cables to the wheel electronics. Here they are filtered, digitized and coded. The data stream is transmitted via a rotor/stator pair to the wheel inner side, transformed in the on-board electronic unit and output to a data acquisition device.

This measuring wheel is designed for exceptionally high forces and moments associated with heavy vehicles such as SUVs, off-road and light commercial vehicles. Because of often large wheel offsets, the load on the wheels is particularly high, specially with regard to moments. The anticipated stresses are determined using FEM methods, and the design optimized with regard to strength, safety and weight. Vibration fatigue limit investigations on individual components and measuring wheels of various sizes make it possible to estimate the life of the measuring wheel structure.

Additional signals on the rotating wheel, such as tire pressure, temperature, etc. can be directly connected to the wheel electronics and transmitted along with the wheel signals. Kistler offers optional amplifier modules for this purpose. The wheel electronics is available in versions with 20 ... 24 channels. It can be used for all measuring wheel types S6.

Note: see data sheets 5240A\_000-561, 5248A\_000-562 and 9891A\_000-563 for the transmission units and the on-board electronics.

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## Technical Data

|                                      |                |      |              |
|--------------------------------------|----------------|------|--------------|
| Measuring range <sup>1)</sup>        | F <sub>x</sub> | kN   | -60 ... 60   |
|                                      | F <sub>y</sub> | kN   | -36 ... 36   |
|                                      | F <sub>z</sub> | kN   | -60 ... 60   |
|                                      | M <sub>x</sub> | kN·m | -7,5 ... 7,5 |
|                                      | M <sub>y</sub> | kN·m | -8,5 ... 8,5 |
|                                      | M <sub>z</sub> | kN·m | -7,5 ... 7,5 |
| Rotary angle accuracy                |                | °    | ≈0,1         |
| Weight measuring wheel <sup>2)</sup> | m              | kg   | ≈18,3        |

## Maximum Loads

|                             |   |     |      |
|-----------------------------|---|-----|------|
| Degree of protection        |   |     | IP64 |
| Operating temperature range |   |     |      |
| AI components               |   | °C  | <160 |
| Maximum speed               |   | mph | >180 |
| Max. impact accelerations   | x | g   | 50   |
|                             | y | g   | 50   |
|                             | z | g   | 50   |

## Accuracy

|            |  |        |      |
|------------|--|--------|------|
| Crosstalk  | F <sub>y</sub> → F <sub>x</sub> , F <sub>z</sub> | %      | ≤0,5 |
|            | F <sub>x</sub> ↔ F <sub>z</sub>                  | %      | ≤0,5 |
|            | F <sub>x</sub> , F <sub>z</sub> → F <sub>y</sub> | %      | ≤0,5 |
| Linearity  |  | % v.E. | ≤0,5 |
| Hysteresis |  | % v.E. | ≤0,5 |

Permitted alternating stress (rotating bending fatigue test)

The requirements according to SAE J328 are exceeded.

500 000 LW 5,5 kN·m

<sup>1)</sup> It is assumed that these extreme values do not occur simultaneously. The moments refer to the wheel center.

<sup>2)</sup> With 6x16" aluminum rim, rotor, wheel electronics, hub adapter, but without ET adapter, wheel bolts and tires

<sup>3)</sup> wit crosstalk compensation

- Overloads: The design of the wheel force sensor allows overloads to occur without restricting measurability. We will be pleased to provide you with information in this regard. The tolerance to overloads depends very much on their multi-axle situation; it is not possible to give an accurate estimate within a general description because of the many combination possibilities. A separate indication of overloads for individual force directions is not appropriate, since no single axle load conditions occur at the wheel. If the wheel force sensor is overloaded, its remaining service life may be reduced, even if no immediate damage is visible or detectable.

## 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-axle 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 (MKS, Adams)

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

At the same time as the measuring wheels, systems for wheel motion measurement or optical sensors (such as from Corrsys-Datron 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.

The measuring wheel system described above can also be used on a vehicle test stand. Its daily exclusive use on a test stand requires, among other things, special technical characteristics, which have led to the development of a special system. Further information is contained in the data sheet 9248A2\_000-696.

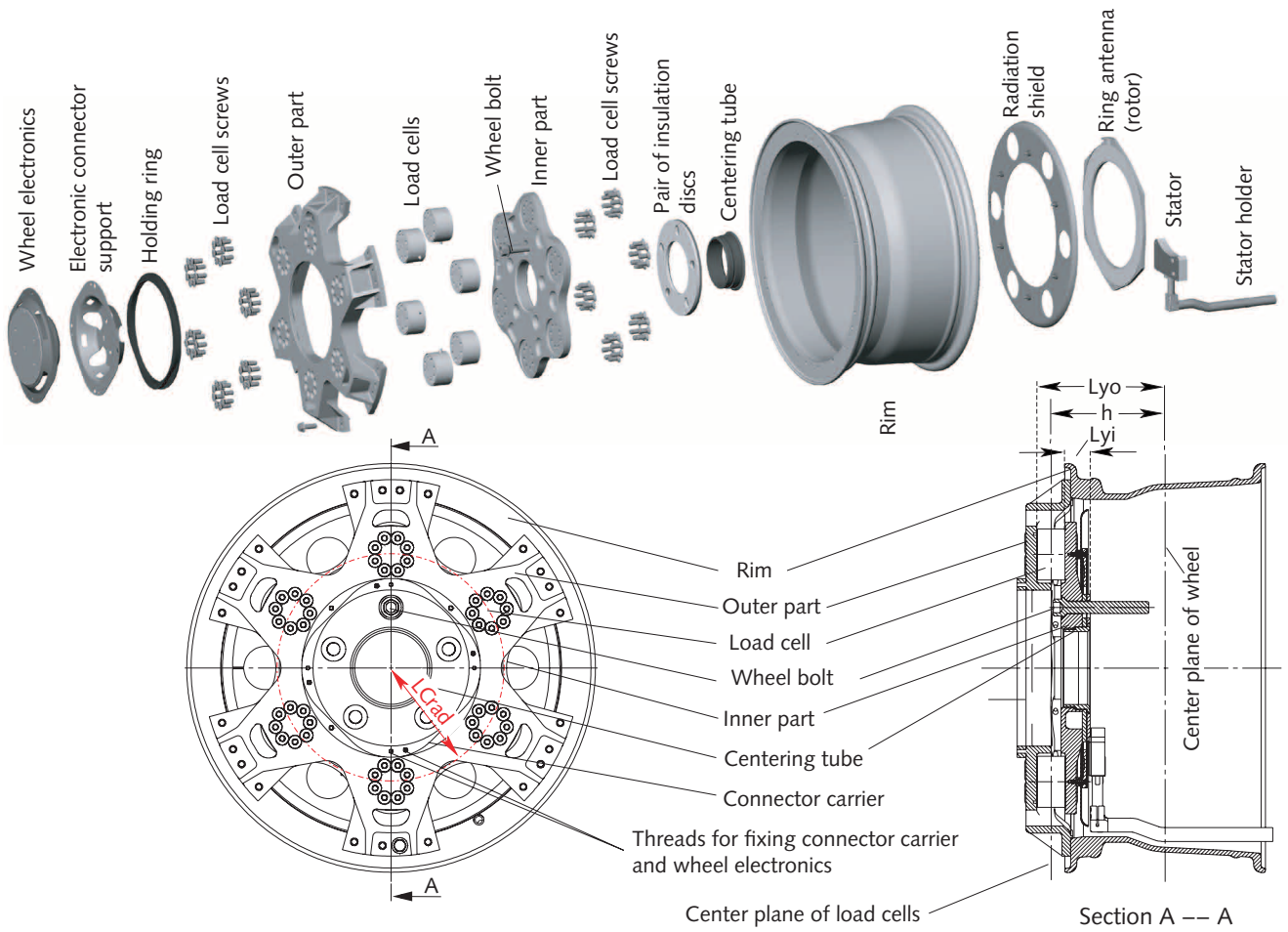


Fig. 1: RoaDyn® S650/S660 structure/components for standard applications with in-board transmission

S625

S635

S650/S660

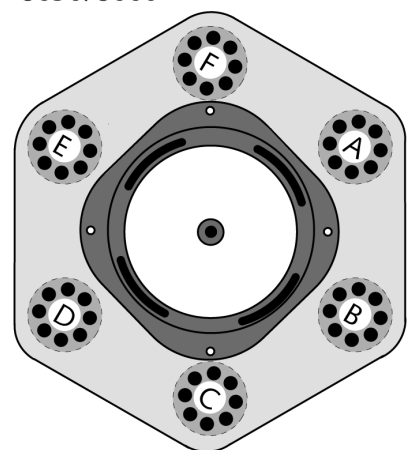
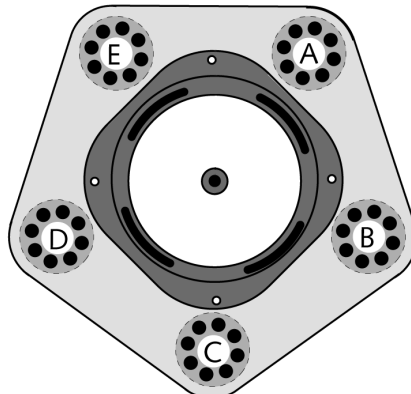
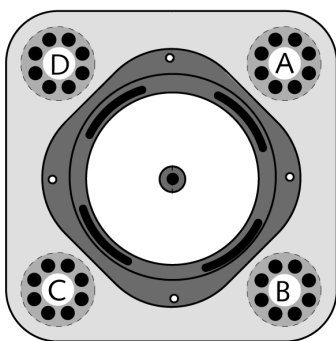












Fig. 2: Expandability of the RoaDyn® S wheel force transducer system. The wheel force transducer can be adapted for lower load ranges or a test rig by altering the number of load cells and the mechanical adaptations

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Configuration of the RoadDyn® S660 System 2000

|   |   |   |  |   |
|---|---|---|--|---|
| <p>Measuring Wheel with Wheel Force Sensor, Wheel Electronics, Outer Part, Rim and Tires</p> <p>Type 9248A1 with 9731A6, Z39913A..., 5241A...</p>  | <p>In-Board Transmission Unit consisting of Rotor and Stator</p> <p>Type 5242A..., 5240A...</p>  | <p>Extension Cable</p> <p>Type 30430Axx<br/>Connection between Stator and On-Board Electronics</p>  | <p>On-Board Electronics</p> <p>Type 9891A...</p>  | <p>Remote Control for On-Board Electronics with Connecting Cable</p> <p>Type 5685A2</p>  |
|---|---|---|--|---|

|   |   |   |  |   |
|---|---|---|--|---|
| <p>Measuring Wheel with Wheel Force Sensor, Wheel Electronics, Outer Part, Rim and Tires</p> <p>Type 9248A1 with 5141A..., 5248A0, 9731A6, Z39913A...</p>  | <p>Out-Board Transmission Unit</p> <p>Type 5248A0</p>  | <p>Extension Cable</p> <p>Type 30430Axx<br/>Connection between Stator and On-Board Electronics</p>  | <p>On-Board Electronics</p> <p>Type 9891A...</p>  | <p>Remote Control for On-Board Electronics with Connecting Cable</p> <p>Type 5685A2</p>  |
|---|---|---|--|---|

**Mounting**

Kistler offers weight and strength optimized mechanical structural parts to adapt to the customer's vehicles.

**Mounting the Stator with In-Board Transmission**

With in-board transmission, a suitable mounting device is mounted on the wheel carrier or suspension strut for the stator. The position of the stator and the location of the support is then established with a gauge.

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

With out-board transmission, a support arm must additionally be included in the vehicle setup, to which the cable to the on-board electronics is fixed.

**Optional Accessories**

- Transport case for 1 measuring wheel with tires, 1 per measuring wheel Type/Art. No. V712.0004
- Precision spirit level, 1 per measuring system Z30208
- Adjuster gage for stator mounting, 1 per system Z39911Q
- Load cell tester, 1 per measuring system 5984A
- Tire mounting tool, 1 per measuring system Z30210
- Key for centering sleeve Type Z39901, 1 per measuring system Z30205
- 3-channel strain gage bridge amplifier (SGAM) 2237A1
- 3-channel thermocouple amplifier (TCAM) 2237A2

**Included Accessories**

- |  |            |
|--|------------|
| • 3-component strain gage load cells, completely encapsulated, 6 per wheel                 | 9190A876   |
| • Internal part, 1 per wheel   | 9729A6     |
| • Connector holder for wheel electronics, 1 per wheel                                      | Z39904     |
| • On-board electronics   | 9891A...   |
| • External part, 1 per measuring wheel   | 9731A6...  |
| • Rim, 1 per measuring wheel   | Z39913A... |
| • Ring antenna (rotor), 1 per measuring wheel  | 5242A6     |
| • Wheel electronics, 1 per measuring wheel   | 5241A2...  |
| • Hub adapter package, containing heat absorbing washers, centering sleeve and wheel bolts | 9711A3     |
| • Wheel offset adapter, 1 per wheel  | 9713A...   |

**Ordering Code**

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