

RoaDyn® S: Multi-Component Test Stand Hubs

For Durability Testing

RoaDyn S625 nsp: 6-Component Measuring Hub for Cars



Technical Data		Type 9266A2	
Measuring range F_x	kN	-20 ... 20	
F_y	kN	-15 ... 15	
F_z	kN	-20 ... 20	
M_x	kN·m	-4 ... 4	
M_y	kN·m	-4 ... 4	
M_z	kN·m	-4 ... 4	
Data sheet	No.	9266A_000-580	

Description Monitoring of loads and determination of transfer functions of road simulators for durability testing of cars.

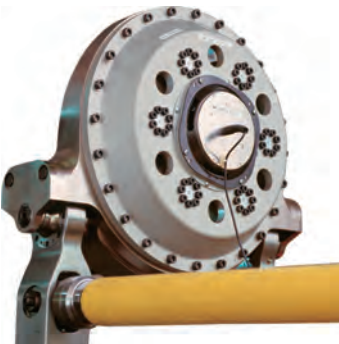
RoaDyn S635 nsp: 6-Component Measuring Hub for large Cars and light SUVs



Technical Data		Type 9267A2	
Measuring range F_x	kN	-35 ... 35	
F_y	kN	-20 ... 20	
F_z	kN	-35 ... 35	
M_x	kN·m	-5 ... 5	
M_y	kN·m	-5 ... 5	
M_z	kN·m	-5 ... 5	
Data sheet	No.	9267A_000-581	

Description Monitoring of loads and determination of transfer functions of road simulators for durability testing of large cars and light SUVs.

RoaDyn S650 nsp: 6-Component Measuring Hub for SUVs and Light Trucks



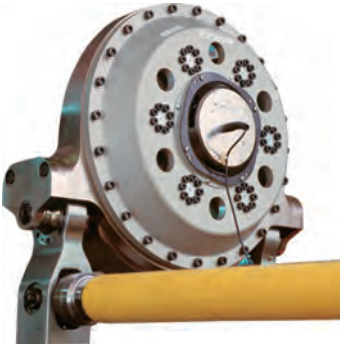
Technical Data		Type 9268A2	
Measuring range F_x	kN	-50 ... 50	
F_y	kN	-30 ... 30	
F_z	kN	-50 ... 50	
M_x	kN·m	-6 ... 6	
M_y	kN·m	-6 ... 6	
M_z	kN·m	-6 ... 6	
Data sheet	No.	9268A_000-582	

Description Monitoring of loads and determination of transfer functions of road simulators for durability testing of SUVs and light commercial vehicles.

RoaDyn® S: Multi-Component Test Stand Hubs

For Durability Testing

RoaDyn S660 nsp: 6-Component Measuring Hub for SUVs, NASCAR and Light Trucks



Technical Data		Type 9248A2
Measuring range 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
Data sheet	No.	9248A2_000-969

Description Monitoring of loads and determination of transfer functions of road simulators for durability testing of SUVs, NASCAR and light trucks.

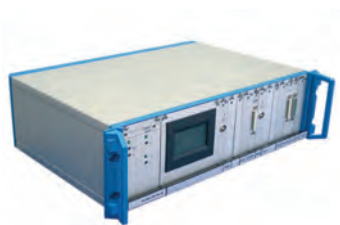
RoaDyn S6XT nsp: 6-Component Measuring Hub for Commercial Vehicles



Technical Data		Type 9262A2
Measuring range F_x	kN	-220 ... 220
F_y	kN	-100 ... 100
F_z	kN	-220 ... 220
M_x	kN·m	-40 ... 40
M_y	kN·m	-60 ... 60
M_z	kN·m	-40 ... 40
Data sheet	No.	9262A_000-864

Description Monitoring of loads and determination of transfer functions of road simulators for durability testing of commercial vehicles.

Control Room System 2000: Digital Electronics for RoaDyn S6xy on Test Stands



Technical Data		Type 9887A...
Dimensions, without handle (LxWxH) mm		450x315x140
Power supply	VDC	115 ... 230
Operating temperature range	°C	5 ... 50
Data sheet	No.	9891A_000-579

Description Control room electronics for non-spinning 6-component measuring hubs. Specially designed for test stand applications.

RoaDyn® S625 nsp System 2000

Type 9266A2

for Test Stand Measurement of Light Cars

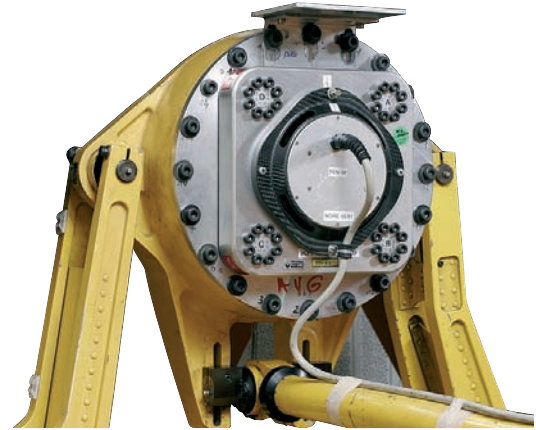
Wheel force sensor for measuring three forces and three moments on non-spinning wheel for operation on vehicle test stands.

- Modular arrangement with interchangeable load cells and system components
- Used in conjunction with CAD/FEM aided design to minimize stress concentrations
- Standard version manufactured from aluminum alloy can be used during fatigue test monitoring
- Precise signal acquisition with individual calibrated strain gage load cells
- Independent identification of sensor components
- Capable of recognizing individual load cell calibration values

Description

The modular RoaDyn S625 nsp sensor is highly adaptable to suit different hub and test stand geometries. Four individual load cells are connected to the force application system of the test stand and to the vehicle hub with adapter components. In these cells the signals are amplified and passed on to the hub electronics Type 5243A... via short cables. There they are filtered, digitized and encoded. The stream of data is passed on to the control room electronics Type 9887A... via a cable Type 1700A88xx... and output to the test stand electronics or a data acquisition system. The control room electronics unit is described in datasheet 9887A_000-579.

Individual Type 9190A load cells are factory calibrated and output temperature-compensated, amplified measurement signals in the three spatial directions. Identification and calibration data of the individual forces is saved and allows systematic conversion into the vehicle coordinate system on the basis of the calibrated individual values. High measuring accuracy is retained during transmission, as digitization takes place on the wheel to avoid transmission interference. The fact that the measured individual signals are known allows rapid troubleshooting in the event of malfunctions. Individual cells can be replaced without impairing sensor operation.



12-channel Type 5243A12 and 18-channel Type 5243A18 versions of the hub electronics are available. The incoming signals are filtered and, after being digitized, sampled at 5 kHz and a resolution of 16 bits. The signal delay arising between the measuring time and signal output is less than 1 ms.

Application

The sensors are predominantly used as a multiaxial force measuring unit in road simulators. The test stand control data is determined with measuring wheels employing the same principle.

The sensors are mainly used in pairs, for example for testing a complete vehicle (4 wheels) or just one axle (2 wheels). Measurements with a single sensor are also used for component development. As subsequent test vehicles often necessitate adaptation to suit wheel and hub geometries, the modularity of the measuring wheels and expert support by Kistler Application Centers have proven invaluable.

Technical Data

Measuring range	F_x	kN	± 20
	F_y	kN	± 15
	F_z	kN	± 20
	M_x	kN·m	± 4
	M_y	kN·m	± 4
	M_z	kN·m	± 4

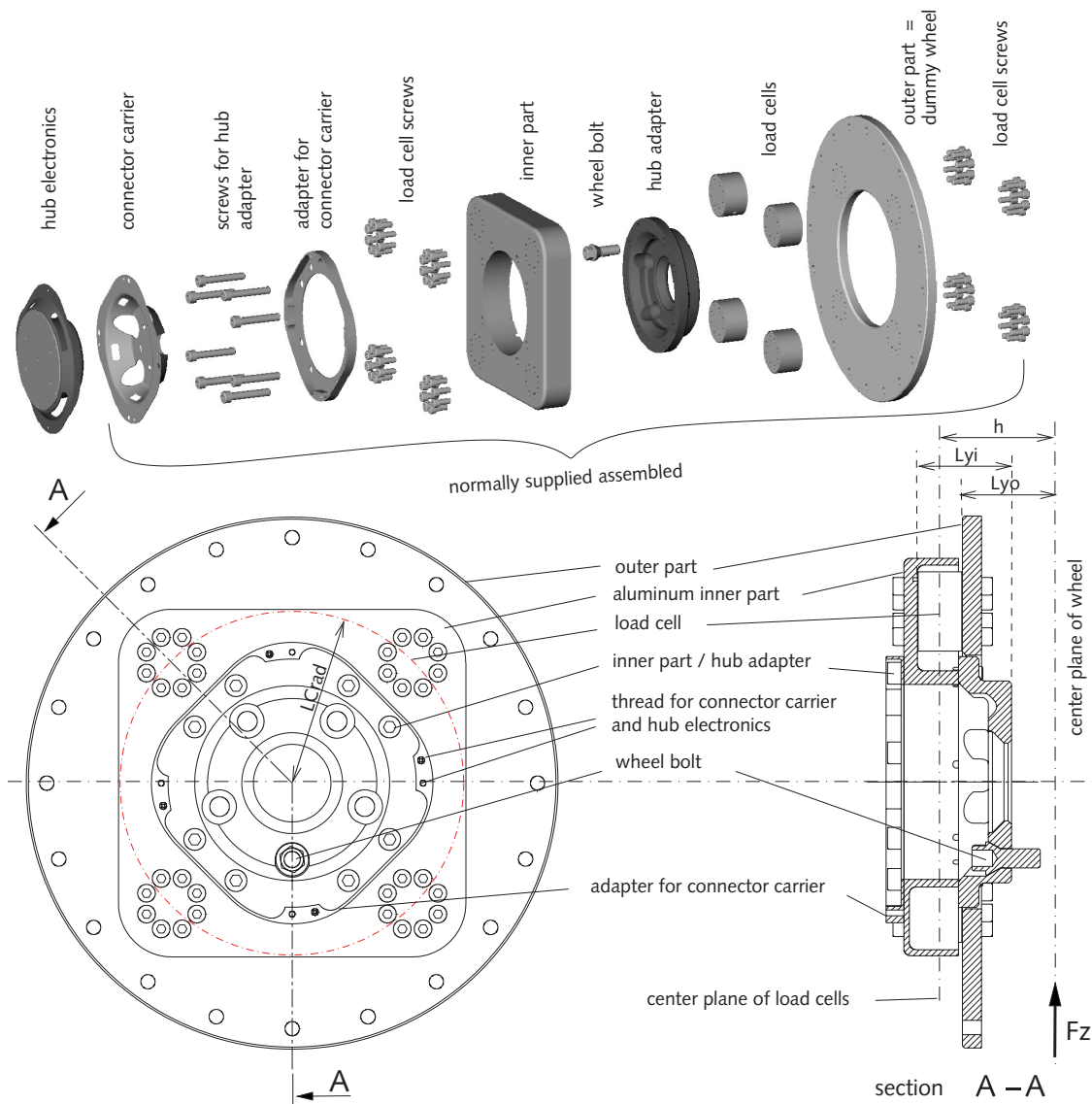
It is assumed that the extreme values do not act simultaneously.
The moments are specified relative to the center of the wheel.

Maximum Loads

Permissible reversed stress (rotating bending test); SAE J328 requirements are exceeded. 500 000 cycles of reversed flexure to 2,6 kN·m			
Max shock acceleration	x	g	40
	y	g	20
	z	g	40

Accuracy

Crosstalk	$F_y \rightarrow F_x, F_z$	%	≤ 1
	$F_x \leftrightarrow F_z$	%	≤ 1
	$F_x, F_z \rightarrow F_y$	%	≤ 2
Linearity		% v.E	$\leq 0,5$
Hysteresis		% v.E	$\leq 0,5$



9266A_000-580e-05.06

Fig. 1: Design and components of RoaDyn S625 nsp

Mounting

Special adapters have to be individually designed for mounting the sensors in a test stand. Kistler requires the corresponding dimensions of the test stand force application system and the hub of the tested vehicle in order to prepare a quotation.

Adaptation to Suit Hub

Today's vehicles encompass a considerable variety of hub geometries. They are described by the following parameters:

- Number of stay bolts or tapped holes
- Dimensions of the wheel bolts or stay bolts and nuts (thread diameter, pitch, length and threaded length)
- Wheel bolt connection pitch diameter
- Axle centering as a fitting dimension
- Wheel offset
- Brake contours
- Parts protruding from hub
- Miscellaneous

It is necessary to obtain precise details in order to prepare for fabrication of the adapter. The relevant Kistler Instruction manual (002-280) contains a checklist, which can be completely filled in to considerably speed up the process of clarification.

Accessories included

	Type/Art.-No.
• Precision (strain gage based) load cells fully encapsulated 1 set (4 pcs.) per wheel sensor	9190A44.6
• Inner part The pattern of holes must be defined 1 pc. per wheel sensor	9703A1
• Connector carrier for wheel electronics 1 pc. per wheel sensor	Z39904
• Load cell mounting screws 1 set per wheel sensor	Z30073

Optional Accessories

	Type/Art.-No.
• Outer part 1 pc. per wheel sensor incl. 1 set of load cell screws	9707Ax
• Hub electronics 1 pc. per wheel sensor	5243A...
• Special wheel-/hub electronics for combined use on test stand and vehicle	5443A...
• Hub adapter incl. Ti screws (adaptation for axle centering and wheel offset) 1 pc. per wheel sensor	9705A V100.0007
• Wheel bolts 1 set per wheel sensor	Z30076/77/78
• Carrying case for up to 2 sensors	V712.0004
• Load cell tester 1 pc. per measuring system	5984A

Ordering Code

	Type
• RoaDyn S625 nsp Wheel force sensor for test stand measurement of light cars	9266A2



Fig. 2: RoaDyn S625 System 2000 non-spinning on vehicle test stand

RoaDyn® S635 nsp System 2000

Type 9267A2

for Test Stand Measurement with Heavy Cars

Wheel force sensor for measuring three forces and three moments on non-spinning wheel for operation on vehicle test stands.

- Modular arrangement with interchangeable load cells and system components
- Used in conjunction with CAD/FEM aided design to minimize stress concentrations
- Standard version manufactured from aluminum alloy can be used during fatigue test monitoring
- Precise signal acquisition with individual calibrated strain gage load cells
- Independent identification of sensor components
- Capable of recognizing individual load cell calibration values

Description

The modular RoaDyn S635 nsp sensor is highly adaptable to suit different hub and test stand geometries. Four individual load cells are connected to the force application system of the test stand and to the vehicle hub with adapter components. In these cells the signals are amplified and passed on to the hub electronics Type 5243A... via short cables. There they are filtered, digitized and encoded. The stream of data is passed on to the control room electronics Type 9887A... via a cable Type 1700A88xx... and output to the test stand electronics or a data acquisition system. The control room electronics unit is described in datasheet 9887A_000-579.

Individual load cells Type 9190A are factory calibrated and output temperature-compensated, amplified measurement signals in the three spatial directions. Identification and calibration data of the individual forces is saved and allows systematic conversion into the vehicle coordinate system on the basis of the calibrated individual values. High measuring accuracy is retained during transmission, as digitization takes place on the wheel to avoid transmission interference. The fact that the measured individual signals are known allows rapid troubleshooting in the event of malfunctions. Individual cells can be replaced without impairing sensor operation.

12-channel Type 5243A12 and 18-channel Type 5243A18 versions of the hub electronics are available. The incoming signals are filtered and, after being digitized, sampled at 5 kHz and a resolution of 16 bits. The signal delay arising between the measuring time and signal output is less than 1 ms.



Technical Data

Measuring range ¹⁾			
	F_x	kN	±35
F_y	kN	±20	
F_z	kN	±35	
M_x	kN·m	±5	
M_y	kN·m	±5	
M_z	kN·m	±5	

Maximum Loads

Permissible reversed stress (rotating bending test);

SAE J328 requirements are exceeded.

500 000 cycles of reversed flexure to 2,6 kN·m

Max shock acceleration	x	g	40
	y	g	20
	z	g	40

Accuracy

Crosstalk	$F_y \rightarrow F_x, F_z$	%	≤1
	$F_x \leftrightarrow F_z$	%	≤1
	$F_x, F_z \rightarrow F_y$	%	≤2
Linearity		% v.E.	≤0,5
Hysteresis		% v.E.	≤0,5

¹⁾ It is assumed that the extreme values do not act simultaneously. The moments are specified relative to the center of the wheel.

Application

The sensors are predominantly used as a multi-axial force measuring unit in road simulators. The test stand control data is determined with measuring wheels employing the same principle.

The sensors are mainly used in pairs, for example for testing a complete vehicle (4 wheels) or just one axle (2 wheels). Measurements with a single sensor are also used for component development. As subsequent test vehicles often necessitate adaptation to suit wheel and hub geometries, the modularity of the measuring wheels and expert support by Kistler Application Centers have proven invaluable.

Mounting

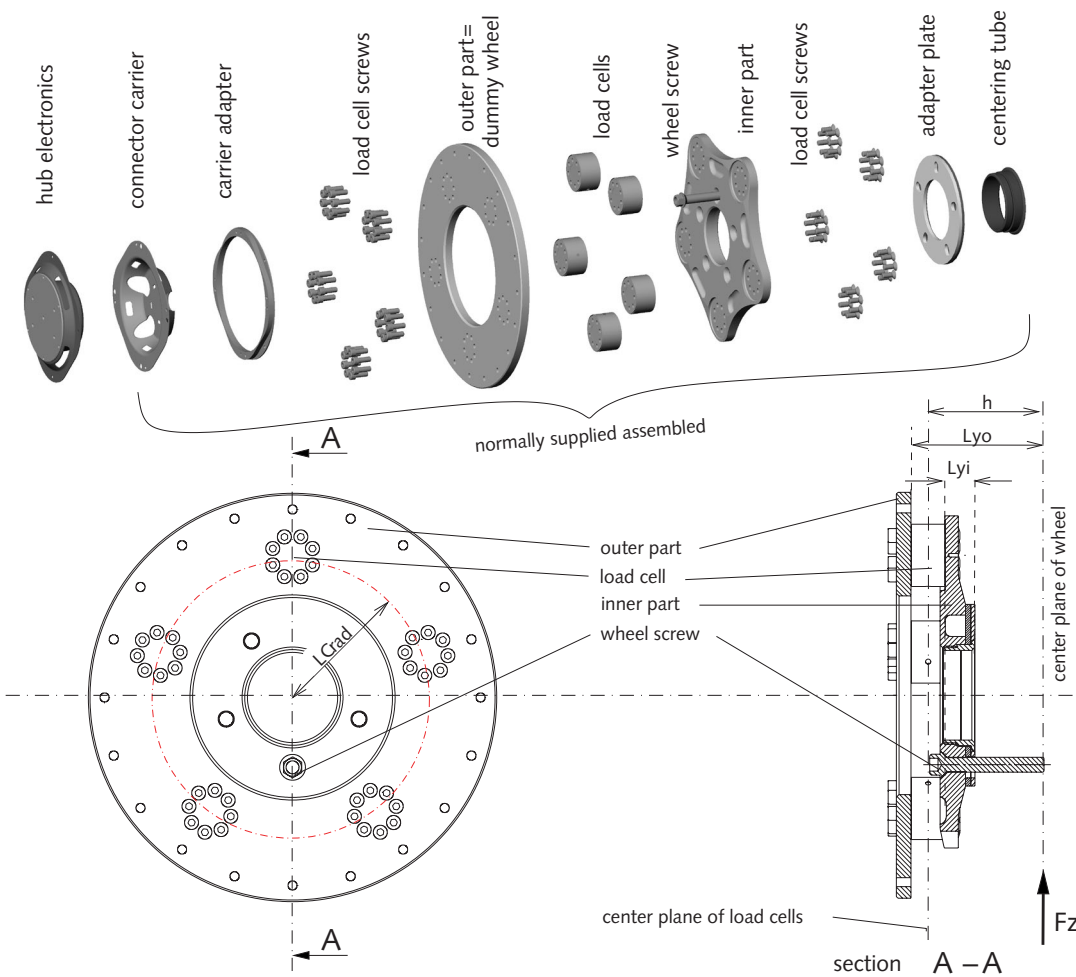
Special adapters have to be individually designed for mounting the sensors in a test stand. Kistler requires the corresponding dimensions of the test stand force application system and the hub of the tested vehicle in order to prepare a quotation.

Adaptation to Suit Hub

Today's vehicles encompass a considerable variety of hub geometries. They are described by the following parameters:

- Number of stay bolts or tapped holes
- Dimensions of the wheel bolts or stay bolts and nuts (thread diameter, pitch, length and threaded length)
- Wheel bolt connection pitch diameter
- Axle centering as a fitting dimension
- Wheel offset
- Brake contours
- Parts protruding from hub
- Miscellaneous

It is therefore necessary to obtain precise details in order to prepare for fabrication of the adapter. The relevant Kistler Instruction manual (002-280) contains a checklist, which can be completely filled in to considerably speed up the process of clarification.



9267A_000-581e-05.06

Fig. 1: Design and components of RoaDyn S635 nsp

Accessories included	Type/Art.-No.	Ordering Code	Type
<ul style="list-style-type: none"> • Precision (strain gage based) load cells, fully encapsulated 1 set (5 cells) per wheel sensor 	9190A45.6	<ul style="list-style-type: none"> • RoaDyn S635 nsp Wheel force sensor for test stand measurement with heavy cars 	9267A2
<ul style="list-style-type: none"> • Inner part Pitch circle must be defined, 1 pc. per wheel sensor 	9729A6		
<ul style="list-style-type: none"> • Connector carrier for wheel electronics 1 pc. per wheel sensor 	Z39904		
<ul style="list-style-type: none"> • Load cell mounting screws 1 set (of 40 pcs.) per wheel sensor 	Z30073		
Optional accessories	Type/Art.-No.		
<ul style="list-style-type: none"> • Outer part 1 pc. per wheel sensor incl. 1 set of load cell screws incl. 1 adapter ring for connector carrier 	9707Ax Z30073 Z30151		
<ul style="list-style-type: none"> • Hub electronics 1 pc. per wheel sensor 	5243A...		
<ul style="list-style-type: none"> • Special wheel-/hub electronics for combined use on test stand and vehicle 	5443A...		
<ul style="list-style-type: none"> • Hub adapter kit (contains adapter washer, centering sleeve and wheel bolts) 1 pc. per wheel sensor 	9711A3 Z39900 Z39901		
<ul style="list-style-type: none"> • Wheel offset adapter 1 pc. per wheel sensor 	9713A...		
<ul style="list-style-type: none"> • Load cell screws, titanium, 16 pcs. per load cell 	Z30074		
<ul style="list-style-type: none"> • Carrying case for 1 or 2 sensors 	V712.0004		
<ul style="list-style-type: none"> • Load cell tester 1 pc. per measuring system 	5984A		
<ul style="list-style-type: none"> • Wrench for centering sleeve 1 pc. per measuring system 	Z39901 Z30205		

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RoaDyn® S650 nsp System 2000

for Test Stand Measurement with Light Trucks

Type 9268A2

Wheel force sensor for measuring three forces and three moments on non-spinning wheel for operation on vehicle test stands.

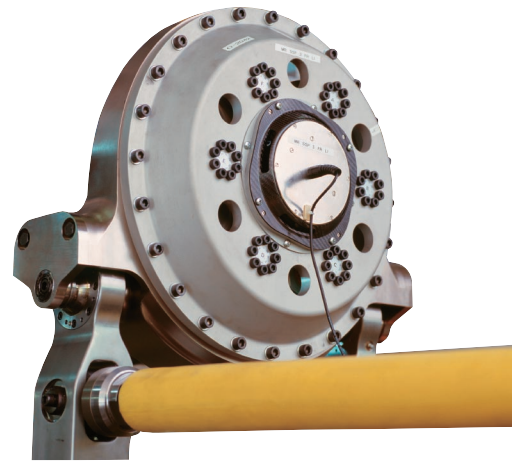
- Modular arrangement with interchangeable load cells and system components
- Used in conjunction with CAD/FEM aided design to minimize stress concentrations
- Standard version manufactured from aluminum alloy can be used during fatigue test monitoring
- Precise signal acquisition with individual calibrated strain gage load cells
- Independent identification of sensor components
- Capable of recognizing individual load cell calibration values

Description

The modular RoaDyn S650 nsp sensor is highly adaptable to suit different hub and test stand geometries. Six individual load cells are connected to the force application system of the test stand and to the vehicle hub with adapter components. In these cells the signals are amplified and passed on to the hub electronics Type 5243A18 via short cables. There they are filtered, digitized and encoded. The stream of data is passed on to the control room electronics Type 9887A... via a cable Type 1700A88xx... and output to the test stand electronics or a data acquisition system. The control room electronics unit is described in datasheet 9887A_000-579.

Wide brake components and different wheel/hub connections on large pitch circles and wheel offsets necessitate flexible sizing of mechanical components. Depending on the anticipated loads different designs may be required to achieve this. Adapter components manufactured from high strength aluminum connect the six load cells to rim and hub. The modular design offers maximum flexibility in adapting to a wide variety of hub geometries.

Individual load cells Type 9190A are factory calibrated and output temperature-compensated, amplified measurement signals in the three spatial directions. Identification and calibration data of the individual forces is saved and allows systematic conversion into the vehicle coordinate system on the basis of the calibrated individual values.



The high measuring accuracy is retained during transmission, as digitization takes place on the wheel to avoid transmission interference. The fact that the measured individual signals are known allows rapid troubleshooting in the event of malfunctions. Individual cells can be replaced without impairing sensor operation.

An 18-channel Type 5243A18 version of the hub electronics is available. The incoming signals are filtered at 1 500 Hz and, after being digitized, sampled at 5 kHz and a resolution of 16 bits. The signal delay arising between the measuring time and signal output is less than 1 ms.

Application

The sensors are predominantly used as a multiaxial force measuring unit in road simulators. The test stand control data is determined with measuring wheels employing the same principle.

The sensors are mainly used in pairs, for example for testing a complete vehicle (4 wheels) or just one axle (2 wheels). Measurements with a single sensor are also used for component development. As subsequent test vehicles often necessitate adaptation to suit wheel and hub geometries, the modularity of the measuring wheels and expert support by Kistler Application Centers have proven invaluable.

Technical Data

Measuring range ¹⁾	F_x	kN	±50
	F_y	kN	±30
	F_z	kN	±50
	M_x	kN·m	±6
	M_y	kN·m	±6
	M_z	kN·m	±6

Maximum Loads

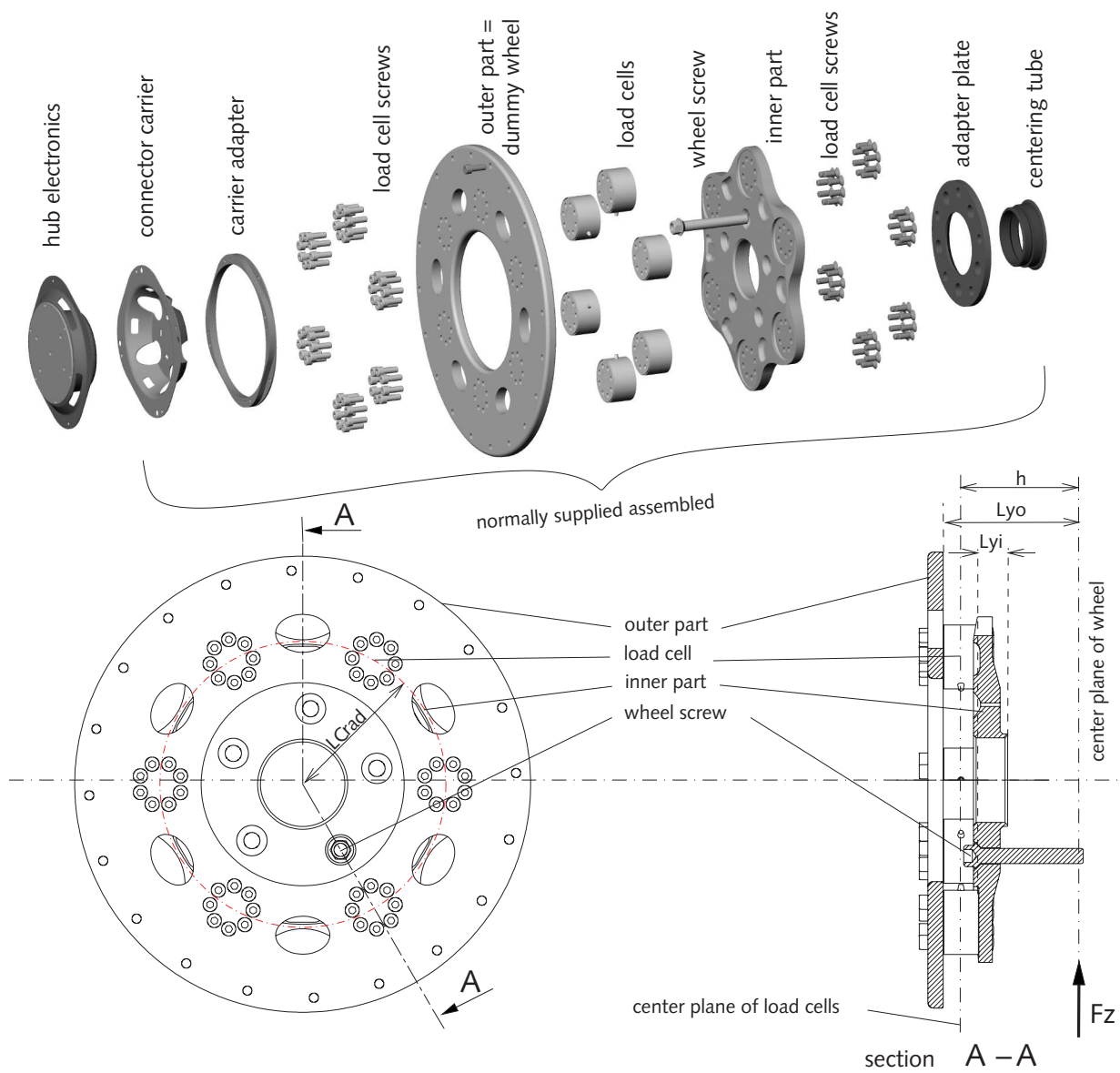
Max shock acceleration	x	g	40
	y	g	20
	z	g	40

Accuracy

Crosstalk	$F_y \rightarrow F_x, F_z$	%	≤1
	$F_x \leftrightarrow F_z$	%	≤1
	$F_x, F_z \rightarrow F_y$	%	≤2
Linearity		% v.E.	≤0,5
Hysteresis		% v.E.	≤0,5

Permissible reversed stress (rotating bending test);
 SAE J328 requirements are exceeded.
 500 000 cycles of reversed flexure to 5,5 kN·m

¹⁾ It is assumed that the extreme values do not act simultaneously. The moments are specified relative to the center of the wheel.



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Fig. 1: Design and components of RoaDyn S650 nsp

Mounting

Special adapters have to be individually designed for mounting the sensors in a test stand. This requires the corresponding dimensions of the test stand force application system and the hub of the tested vehicle in order to prepare a quotation.

Adaptation to Suit Hub

Today's vehicles encompass a considerable variety of hub geometries. They are described by the following parameters:

- Number of stay bolts or tapped holes
- Dimensions of the wheel bolts or stay bolts and nuts (thread diameter, pitch, length and threaded length)
- Wheel bolt connection pitch diameter
- Axle centering as a fitting dimension
- Wheel offset
- Brake contours
- Parts protruding from hub
- Miscellaneous

It is therefore necessary to obtain precise details in order to prepare for fabrication of the adapter. The relevant Kistler Instruction manual (002-280) contains a checklist, which can be completely filled in to considerably speed up the process of clarification.

Accessories included

- | | |
|--|-----------------------------------|
| • Precision (strain gage based) load cells, fully encapsulated
1 set (6 cells) per wheel sensor | Type/Art.-No.
9190A46.6 |
| • Inner part
Pitch circle must be defined,
1 pc. per wheel sensor | 9729A6 |
| • Connector carrier for wheel electronics
1 pc. per wheel sensor | Z39904 |
| • Load cell mounting screws
1 set (of 40 pcs.) per wheel sensor | Z30073 |

Optional accessories

- | | |
|---|--|
| • Outer part
1 pc. per wheel sensor
incl. 1 set of load cell screws
incl. 1 adapter ring for connector carrier | Type/Art.-No.
9707Ax
Z30073
Z30151 |
| • Hub electronics
1 pc. per wheel sensor | 5243A18 |
| • Special wheel-/hub electronics for combined use on test stand and vehicle | 5443A... |
| • Hub adapter kit
(contains adapter washer,
centering sleeve
and wheel bolts)
1 pc. per wheel sensor | 9711A3
Z39900
Z39901 |
| • Wheel offset adapter
1 pc. per wheel sensor | 9713A... |
| • Carrying case for 1 or 2 sensors | V712.0004 |
| • Load cell tester
1 pc. per measuring system | 5984A |
| • Wrench
for centering sleeve Type Z39901
1 pc. per measuring system | Z30205 |

Ordering Code

- | | |
|--|------------------------------|
| • RoaDyn S650 nsp
Wheel force sensor for test stand measurement with light trucks | Type
9268A2 |
|--|------------------------------|

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RoaDyn® S6XT nsp System 2000

Type 9262A2

6-Component Measuring Hub for Commercial Vehicles

Measuring hub for measuring three forces and three moments on axle test rigs and road simulators.

- Modular design with interchangeable strain gage load cells and system components
- Reduction of local stress concentrations by means of CAD/FEM
- Robust design suitable for fatigue strength tests
- High-precision measurement ensured by calibration of individual load cells and overall system
- Outstanding signal quality due to digitalization in hub electronics
- Online diagnostics, crosstalk and lever arm compensation

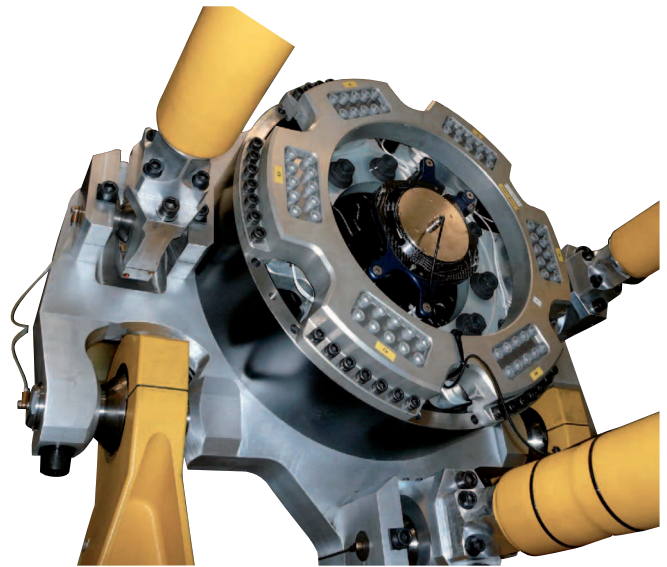
Description

RoaDyn S6XT nsp Type 9262A2 is a modular wheel force measuring system consisting of six 3-component heavy duty strain gage load cells, inner part for connecting sensors to the hub and outer part which connects to the test stand.

Strain gage signals are amplified in the load cell and passed on via short cables to hub electronics. Via a cable data are transmitted to control room electronics, which provides the calculated wheel forces and moments to analog and digital interfaces.

Application

RoaDyn S6XT nsp is used as a multiaxial force measuring unit in road simulators for physical simulation of loads in durability tests. They are used for iteration (determination of the transfer function) and for monitoring of axle test benches.



Technical Data

Standard Measuring Range¹⁾

F_x	kN	±220
F_y	kN	±100
F_z	kN	±220
M_x	kN·m	±40
M_y	kN·m	±60
M_z	kN·m	±40

Maximum Loads

Max. shock acceleration	x	g	40
	y	g	20
	z	g	40

Accuracy

Linearity	% FS	≤1
Hysteresis	% FS	≤1
Crosstalk forces	%	≤1

¹⁾ It is assumed that the maximum forces and torques do not act simultaneously. The torques are specified relative to the center of the wheel (Offset = 0).

Assembly and Components of RoaDyn® S6XT nsp System 2000

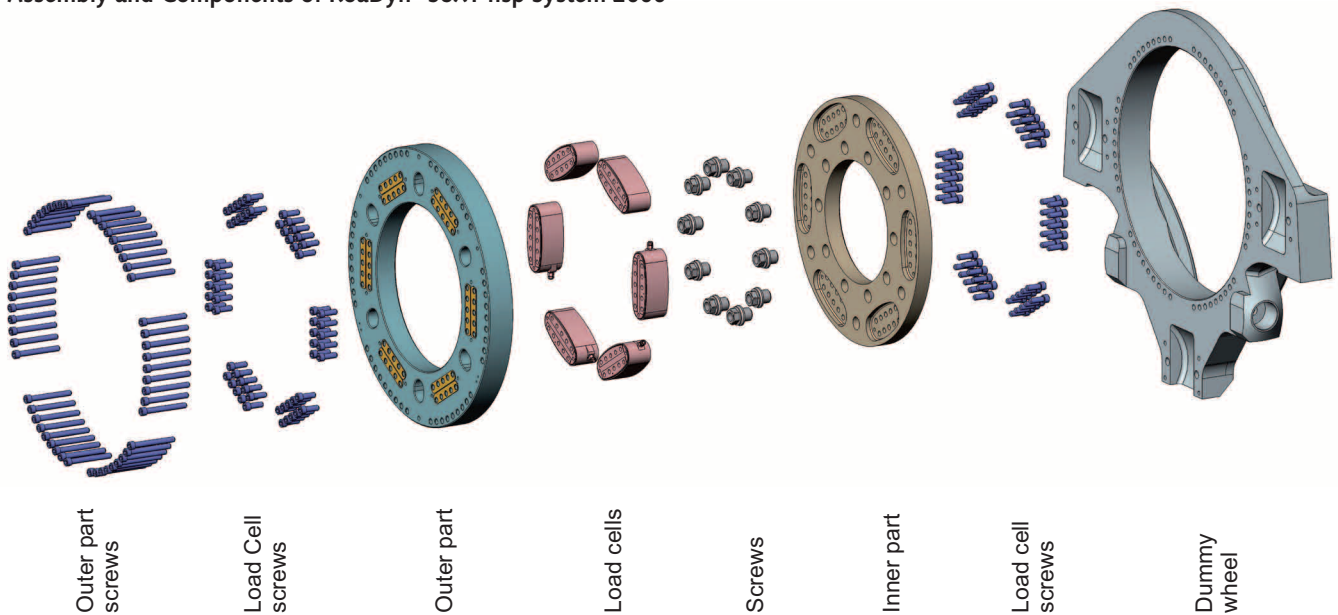


Fig. 1: Assembly and components of RoaDyn® S6XT nsp

Mounting

Kistler supplies weight and strength optimized customized adapters for mounting the sensor to the test rig.

**Typical Configuration of Wheel Force Hub
RoaDyn® S6XT System 2000**

- | | |
|---|-----------------------------|
| • Precision load cells (strain gage based), fully encapsulated, 6 pieces per wheel sensor | Type/Art. No.
9190A76... |
| • Outer part for RoaDyn S6HT/S6XT
1 piece per wheel sensor | 9737A6Q |
| • Inner part for RoaDyn S6HT/S6XT
adapts to one particular bolt pattern,
1 piece per wheel sensor | 9745A6Q |
| • Electronics connector carrier for wheel electronics, 1 piece per wheel sensor | Z39904 |
| • Hub electronics
1 piece per wheel sensor | 5243A18 |
| • Connection cable for tire test machine digital or analog, 1 piece per wheel sensor | 1700A88... |
| • Control room electronics for ½ axle System 2000 | 9887A1000Q... |
| • Control Room Electronics for 1 axle, System 2000 | 9887A2000Q... |

Optional Accessories

- | | |
|--|----------------------------|
| • External hub electronics | Type/Art. No.
5277A2120 |
| • Adapter ring for offset compensation
1 piece per wheel sensor | Z39918A |
| • Interface for digital tire test machines (IST) | 5623A2 |
| • Interface cable for digital tire test machines (IST) | Z30904A1 |
| • Interface for digital tire test machine (MTS) | 5623A3 |
| • Interface box for digital tire test machine (MTS) | Z31232 |
| • RoaDyn UDP SCoUt, version 4.01 | 2885A4.01.1 |

Ordering Code

- | | |
|--|--------------------|
| • RoaDyn S6XT nsp System 2000
6-component measuring hub for commercial vehicles | Type 9262A2 |
|--|--------------------|

9262A_000-864e-10.10