

# RoaDyn® P/S: Multi-Component Measuring Hubs

## For Tire Characteristics Measurement



### RoaDyn P530: 5-/6-Component Measuring Hub for Car Tires



Technical Data		Type 9295B...
Measuring range $F_x$	kN	-20 ... 20
$F_y$	kN	-20 ... 20
$F_z$	kN	0 ... 30
$M_x$	kN·m	-7,5 ... 7,5
$M_y$	kN·m	-3 ... 3
$M_z$	kN·m	-1,3 ... 1,3
Rim sizes	Inch	≥13
Data sheet	No.	9295B_000-991

**Description** Measurement of wheel forces and moments for cars on tire test stands, measurement of non-uniformities, vibrations and determining tire characteristics.



### RoaDyn S5ST: 5-/6-Component Measuring Hub for Heavy Cars and Light Truck Tires



Technical Data		Type 9289A253
Measuring range $F_x$	kN	-60 ... 60
$F_y$	kN	-40 ... 40
$F_z$	kN	0 ... 60
$M_x$	kN·m	-29 ... 29
$M_y$	kN·m	-15 ... 15
$M_z$	kN·m	-9 ... 9
Rim sizes	Inch	≥16
Data sheet	No.	9289A_000-986

**Description** Measurement of wheel forces and moments for heavy cars and light trucks on tire test stands. Measurement and identification of tire characteristics and specifications. Also available as piezo-electric type.



### RoaDyn S5MT: 5-/6-Component Measuring Hub for Light and Medium Weight Truck Tires



Technical Data		Type 9289A263
Measuring range $F_x$	kN	-100 ... 100
$F_y$	kN	-50 ... 50
$F_z$	kN	0 ... 100
$M_x$	kN·m	-40 ... 40
$M_y$	kN·m	-30 ... 30
$M_z$	kN·m	-15 ... 15
Rim sizes	Inch	≥17,5
Data sheet	No.	9289A_000-987

**Description** Measurement of wheel forces and moments for light and medium weight trucks on tire test stands. Measurement and identification of tire characteristics and specifications. Also available as piezoelectric type.

## RoaDyn® P530

Type 9295B...

### Measuring Hub for Tire Test Stands

The RoaDyn P530 measuring hub is the ideal instrument for measuring the wheel force and torque on tire test stands in the laboratory as well as on mobile test vehicles. The system measures the orthogonal forces  $F_x$ ,  $F_y$ ,  $F_z$  and torques  $M_x$ ,  $M_y$ ,  $M_z$ . It is uniquely suited for the measurement of tire non-uniformity, tire vibration, and tire characteristics.

- Maximum measuring accuracy during high dynamic testing
- Fits to wheels with rim size 13 inches or larger; smaller rims may be mounted with a compatible adapter
- Fits to standard rims with interchangeable adapters; custom rims not required
- Bearings with oil lubrication and cooling for rotational speeds up to 3 000  $\text{min}^{-1}$  at full load
- Alternative grease lubrication for rotational speeds up to 2 000  $\text{min}^{-1}$  for short running periods available upon request

#### Description

The RoaDyn P530 measuring hub is a robust, high-precision instrument equipped with quartz sensors. Four 3-component force sensors are mounted with high preload between two plates. Inside, a rotating shaft with bearings holds the mounted wheel in place.

The path-independent measurement of the force components naturally result in a minimum crosstalk between the components and a resonant frequency of the complete measuring system. The end of the shaft is lead through the rear side of the dynamometer and is prepared for connecting a brake or driving device. It provides an oil circulation for lubrication and cooling of the bearings, resulting in perpetual heat conditions even when high loads are applied.

The mechanical interfaces for mounting on the tire test stand allow front or rear side mounting.

The dynamometer is protected against corrosion, splash water and dust. The measured signals are transmitted to the charge amplifier (with summing amplifier) via a robust high-insulation cable.



#### Application

- Measurement of force and moment resulting from tire non-uniformities, even at high speeds (non-uniformity tests)
- Quasistatic, dynamic and highly dynamic measurements of tire characteristics
- Tire vibration measurement
- Universal measuring tool for laboratory tire test stands in the fields of research, development and quality control

## Technical Data

Measuring range	F <sub>x</sub> , F <sub>y</sub>	kN	-20 ... 20
	F <sub>z</sub>	kN	0 ... 30
	M <sub>x</sub>	kN·m	-7,86 ... 7,86
	M <sub>y</sub>	kN·m	-3,00 ... 3,00
	M <sub>z</sub>	kN·m	-1,24 ... 1,24
	Overload	F <sub>x</sub> , F <sub>y</sub>	kN
F <sub>z</sub>		kN	0 ... 42
Calibrated range	F <sub>x</sub> high	kN	0 ... -20
	F <sub>x</sub> low	kN	0 ... -2
	F <sub>y</sub> high	kN	0 ... 20
	F <sub>y</sub> low	kN	0 ... 2
	F <sub>z</sub> high	kN	0 ... 30
	F <sub>z</sub> low	kN	0 ... 3
Force application point	R (tire radius)	mm	300
Force calibration	e (wheel offset)	mm	38
	e <sub>D</sub> (offset)	mm	62
	Active cell distance	mm	160
Nominal sensitivity	F <sub>x</sub>	pC/N	-7,7
	F <sub>y</sub>	pC/N	-3,9
	F <sub>z</sub>	pC/N	-7,7
Linearity	F <sub>x</sub> , F <sub>y</sub> , F <sub>z</sub>	%FSO	≤±0,5
Crosstalk <sup>1)</sup>	F <sub>x</sub> → F <sub>y</sub> , F <sub>z</sub>	%	≤±2 (≤±1)
	F <sub>y</sub> → F <sub>x</sub> , F <sub>z</sub>	%	≤±2 (≤±1)
	F <sub>z</sub> → F <sub>x</sub> , F <sub>y</sub>	%	≤±2 (≤±1)
Natural frequency freely suspended	f <sub>0</sub> (x, z)	Hz	≈2 400
Rotational speed	grease lubrication	1/min	≤2 000
	oil lubrication	1/min	≤3 000
Operating temp. range		°C	-20 ... 80
Temperature error	y <sup>2)</sup>	N/°C	≈15
	x, z	N/°C	≈5
Insulation resistance		Ω	>10 <sup>13</sup>
Ground insulation		Ω	>10 <sup>8</sup>
Degree of protection		EN60529	IP65
Output flange socket (ground-insulated)			Fischer, 9 pin neg.
Dimensions			see page 3
Weight (approx.)		kg	70

## Requirements for Oil Lubrication

Supply pipe		number	2
Pipe diameter	di/da	mm	6/8
Oil pressure <sup>3)</sup>	p	bar	≤0,5
Flow/per supply each	$\dot{V}$	l/min	0,5 ... 1
Flow/total	$\dot{V}$	l/min	1 ... 2
Kinematic viscosity	v	mm <sup>2</sup> /s	20 ... 25
Return pipe		number	2
Pipe diameter	di/da	mm	8/12
Oil pressure	p	bar	pressure-free

<sup>1)</sup> typical values in brackets

<sup>2)</sup> after warm-up

<sup>3)</sup> pressure limiting valve recommended

**Dimensions**

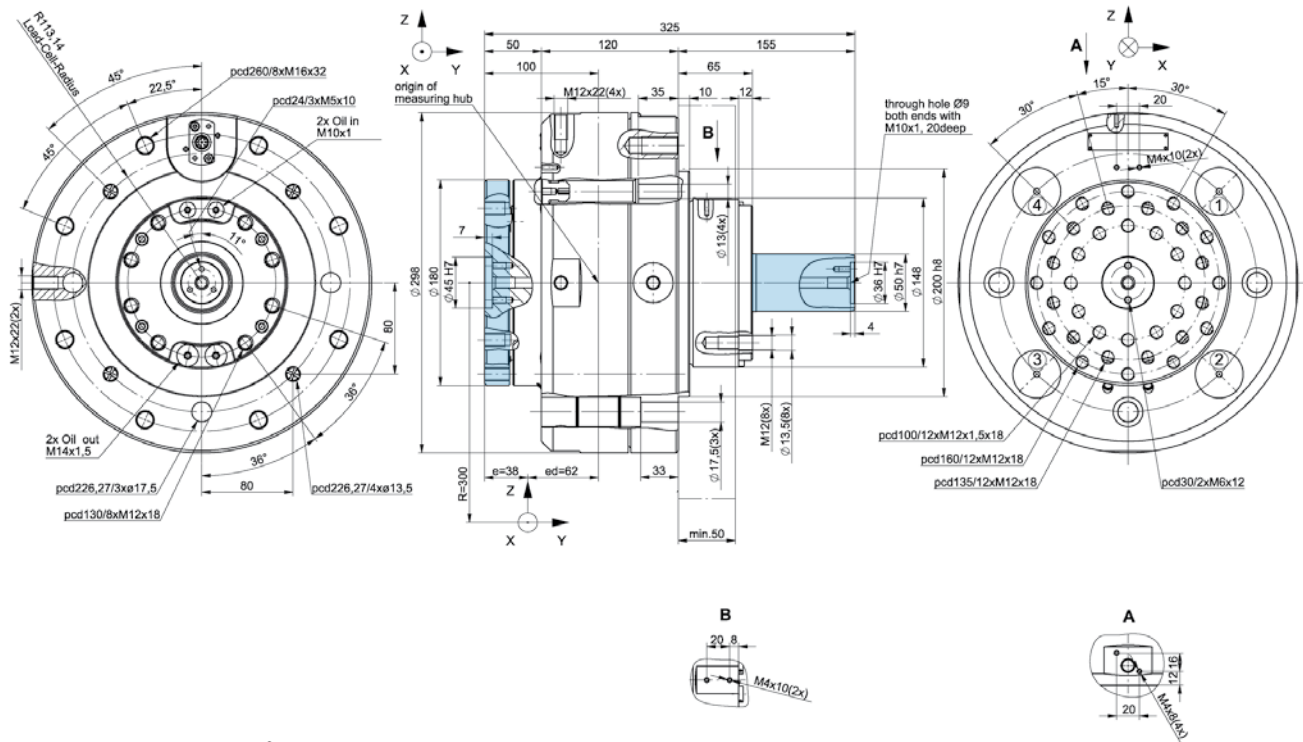


Fig. 1: Dimensions of RoaDyn® P530, Type 9295B1, oil lubricated (lubrication system not included); rotating parts are highlighted in blue

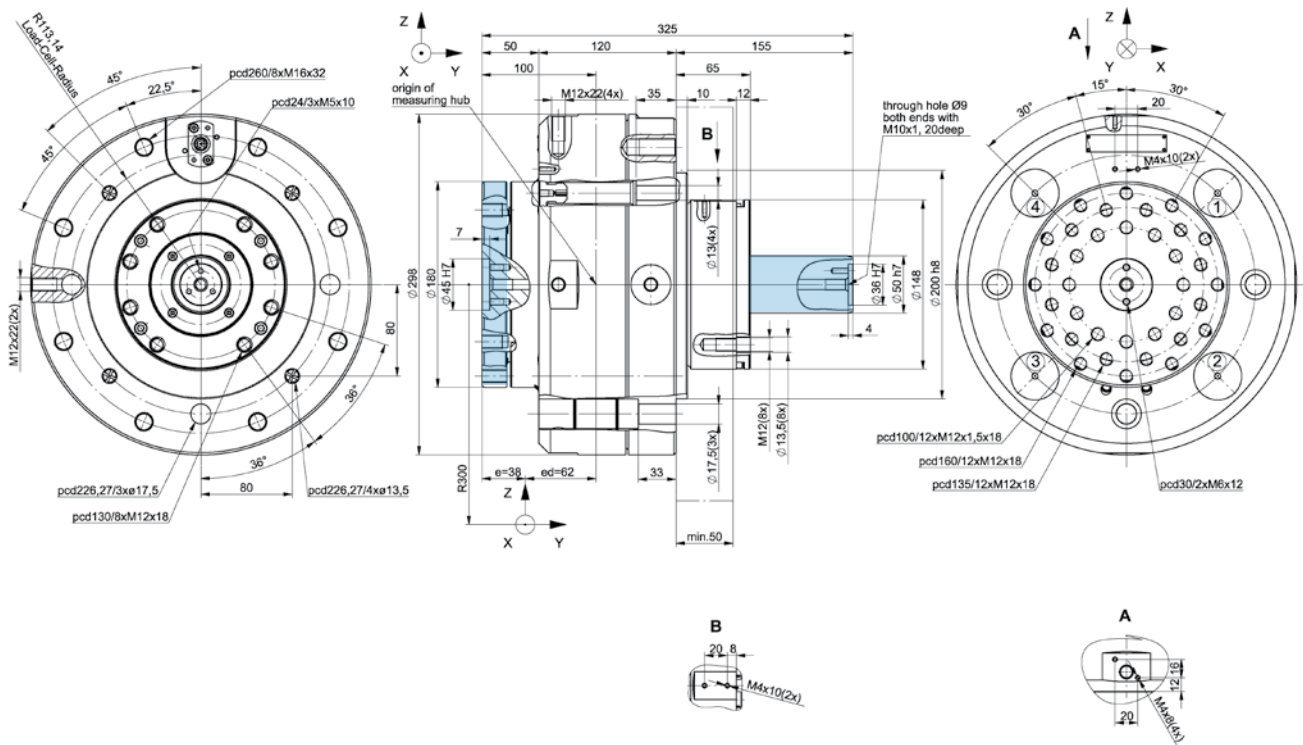


Fig. 2: Dimensions of RoaDyn® P530, Type 9295B2, grease lubricated; rotating parts are highlighted in blue

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**Test Stand Connection**

Measuring hubs of Type 9295B1 and Type 9295B2 can be connected at the front side using 3xM16 or 4xM12 screws, or at the rear side using 8xM16 screws (scope of delivery). Fig. 3 shows the corresponding geometry. When using the 90° angle plug, an additional slot must be cut (width 25 mm, depth 25 mm, length >80 mm).

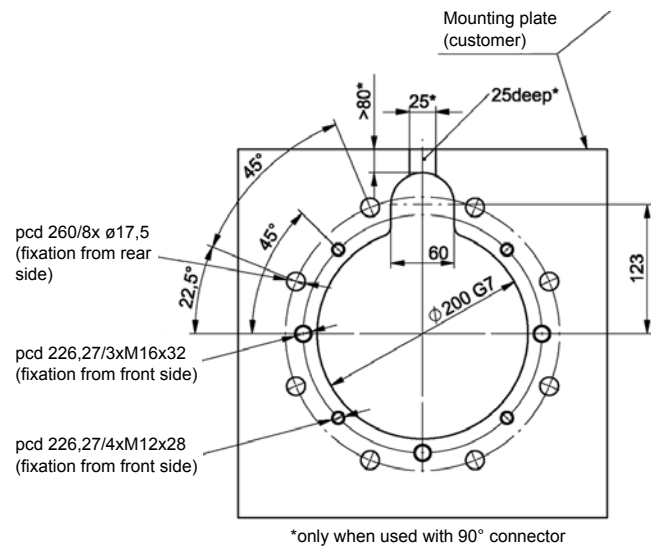


Fig. 3: Test stand connection - dimensions

**Mounting the Test Object**

The test object is mounted on the front side of the shaft, either directly or by using an appropriate adapter. The designated hole patterns are at 100, 135, and 160 mm on the pitch circle diameters.

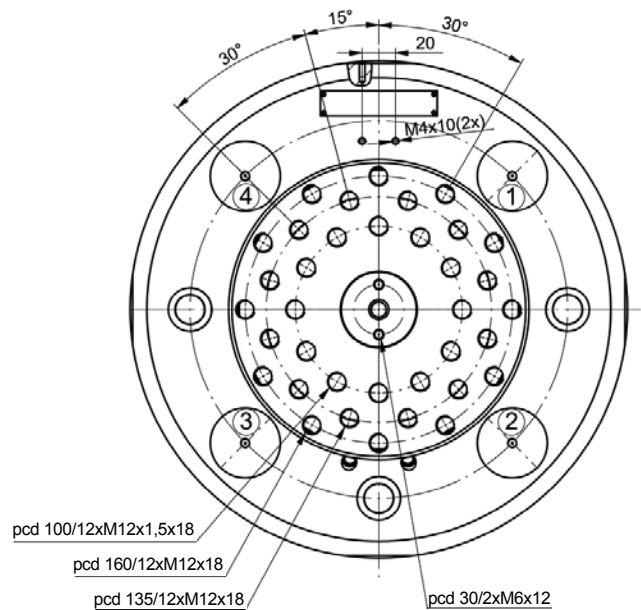


Fig. 4: Test object installation - dimensions

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**Wheel Centering**

If the test object is mounted directly on the shaft, it is possible to mount an additional centering pin on the front side of the shaft (ø45 H7, 2xM6). This configuration may also be used for centering an intermediate adapter (see Fig. 5).

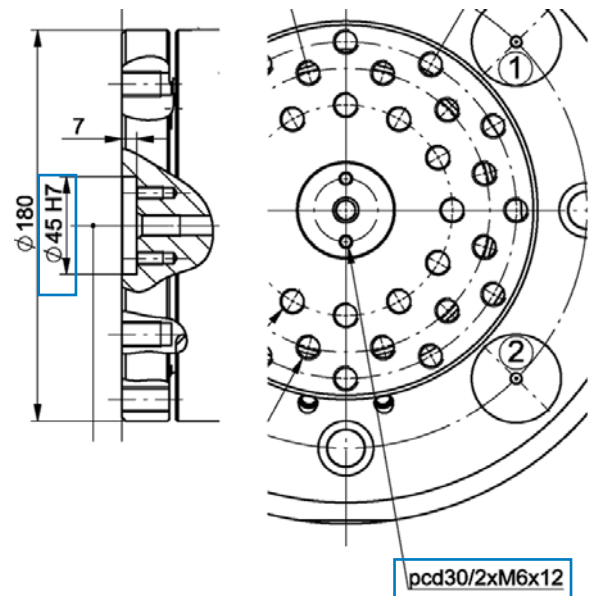


Fig. 5: Wheel centering - dimensions

**Mounting a Brake**

For mounting a brake, the rear side of the measuring hub provides 8xM12 on a pitch circle of 130 mm (see Fig. 6).

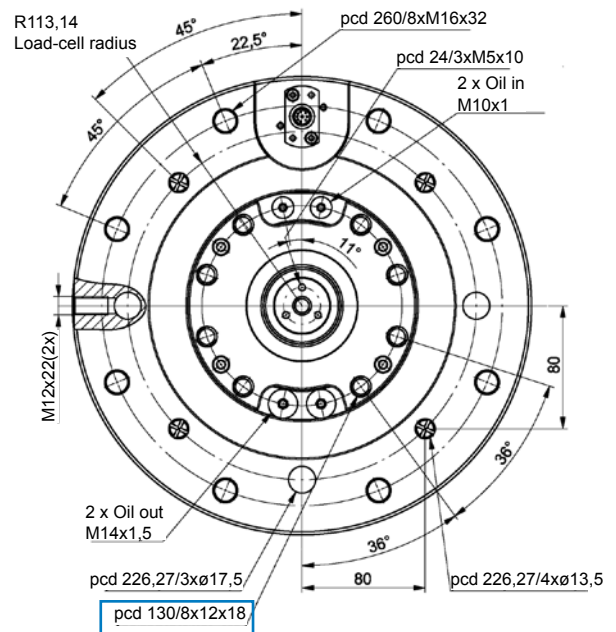


Fig. 6: Brake installation - dimensions






**Other Mechanical Interfaces**

The shaft provides a through-going bore (M10x1 at the ends), which can be used for feedthrough of cables or compressed air (see Fig. 2). It is possible to mount a rotary encoder or a slip ring for compressed air or additional signals on the rear side of the shaft (centering ø36 H7, 3xM5 pcd 24 mm).

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**Measuring Chain**

<b>Measuring hub</b> <b>RoaDyn P530</b> Type 9295B...	<b>Connection cable (straight plug)</b> Type 1677A5 (l = 5 m) Type 1677Asp (l = 1 ... 20 m)	<b>Extension cable</b> Type 1678A5 (l = 5 m) Type 1678A10 (l = 10 m) Type 1677Asp (l = 1 ... 20 m)	<b>Charge amplifier</b> Type 5070A...1.	<b>Customer data acquisition</b>
				not included
	or			
	<b>Connection cable (90° plug)</b> Type 1679A5 (l = 5 m) Type 1679Asp (l = 1 ... 20 m)			
				

**Included Accessories**

- Ring bolts, 2 pcs. M12 **Type/Art. No.** 65013149
- Oil connection adapter, 2 pcs M10x1 **Type/Art. No.** 65003244\*
- Oil connection adapter, 2 pcs M14x1,5 **Type/Art. No.** 65003245\*
- Sealing ring, 2 pcs. 10,2/15,9x1 **Type/Art. No.** 65007701\*
- Sealing ring, 2 pcs. 14,5/17,9x1,5 **Type/Art. No.** 65007703\*
- Hoisting block, 1 pc **Type/Art. No.** 55088555
- ISK screw for hoisting block, 1 pc M12x45 **Type/Art. No.** 65012849
- Fixing screw, 8 pcs M16x70 **Type/Art. No.** 65012819
- Fixing screw, 4 pcs M12x45 **Type/Art. No.** 65012789

\* only for 9295B1

**Ordering Key**

RoaDyn P530, oil lubricated	<b>1</b>
RoaDyn P530, grease lubricated	<b>2</b>

Type 9295B

**Ordering Example**

Measuring hub RoaDyn P530, oil-lubricated

Type 9295B1

**Optional Accessories**

- Connection cable, 8-core with flexible stainless steel hose, straight plug **Type/Art. No.** 1677A5/Asp
- Connection cable, 8-core with flexible stainless steel hose, 90° plug **Type/Art. No.** 1679A5/Asp
- Extension cable **Type/Art. No.** 1678A5/A10/Asp
- Multichannel charge amplifier ±600 ... 600 000 pC **Type/Art. No.** 5070A...1.

**Additional Kistler Products for this Application**

- RoaDyn S220 measuring hub for rolling resistance measurement of car tires on tire test stands **Type/Art. No.** 9289A103
- RoaDyn S260 measuring hub for rolling resistance measurement of truck tires on tire test stands **Type/Art. No.** 9289A113
- RoaDyn S5ST (60 kN) measuring hub for measurement of truck tires on tire test stands **Type/Art. No.** 9289A253
- RoaDyn S5MT (100 kN) measuring hub for measurement of truck tires on tire test stands **Type/Art. No.** 9289A263

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# RoaDyn® S5ST Measuring Hub

Type 9289A253

## for Durability and Tire Characteristics Measurements on Tire Test Stands (Commercial Vehicles)

The 5(6)-component RoaDyn S5ST measuring hub is ideally suited to measure durability and tire characteristics of commercial vehicles on tire test stands. It measures the longitudinal, transverse and vertical forces  $F_x$ ,  $F_y$  and  $F_z$  and the corresponding moments  $M_x$ ,  $M_y$ <sup>2)</sup> and  $M_z$  acting at the tire contact area.

- High precision tire characteristics measurements with commercial vehicle tires
- Best suited for rim sizes >16" (smaller rims with appropriate adapter possible)
- Strain gage load cell technology for static and dynamic tire measurements
- Static measurement of vertical force  $F_z$  enables tire test stand controlling (no additional force sensors necessary)
- Modular design
- High rigidity
- Factory calibrated
- Prepared for oil lubrication

### Description

The RoaDyn S5ST measuring hub is a robust, high-precision measuring tool, equipped with four oval strain gage load cells which are mounted between base and top plate. The measuring hub is stationary, i.e. base plate, top plate and load cells are mounted non-rotating at the tire test stand. The measuring hub incorporates a rotary axis (shaft) with predefined hub hole patterns on which the test tire/rim combinations are mounted. This setup guarantees optimum power flow with minimum cross talk between the individual force components and a high natural frequency of the complete measuring system. The shaft end is lead through the back side of the measuring hub and is prepared for installation of a driving or braking device. The inlet and outlet ports for the oil circuit on the back of the measuring hub are intended for lubricating and cooling of the bearings in order to achieve constant heat conditions even with large loads and increased rotational speeds.

### Application

Typical areas of use are measurements of tire characteristics on tire test stands in the laboratory as well as on mobile test vehicles in the fields of durability, non-uniformities, vibrations, braking characteristics, adhesion etc.



### Technical Data

#### General Technical Data

Measuring range <sup>1)</sup>	$F_x$	kN	-60 ... 60
	$F_y$	kN	-40 ... 40
	$F_z$	kN	0 ... 60
	$M_x$	kN·m	-29 ... 29
	$M_y$ <sup>2)</sup>	kN·m	-15 ... 15
	$M_z$	kN·m	-9 ... 9
Calibration range <sup>3)</sup>	$F_x$	kN	0 ... 60
	$F_y$	kN	0 ... 40
	$F_z$	kN	0 ... 60
Linearity	$F_x, F_z, F_y$	%FSO	$\leq \pm 0,5$
Crosstalk <sup>4)</sup>	$F_y \rightarrow F_x, F_z$	%	$\leq \pm 1,0$
	$F_x \leftrightarrow F_z$	%	$\leq \pm 1,0$
	$F_x, F_z \rightarrow F_y$	%	$\leq \pm 1,0$
Natural frequency	$f_n (x, y, z)$	Hz	$\approx 800$
Maximum rotational speed		min <sup>-1</sup>	1 850
Operating temperature range		°C	+5 ... 70
Degree of protection (DIN40050)			IP65



**Technical Data (Continuation)**

**Dimensions**

Diameter	mm	445
Length	mm	530
Weight	kg	196
Standard pitch circles		
10 pcs. M16x22	∅	195
12 pcs. M16x22	∅	160
5 pcs. M14x1,5x35	∅	112

**Requirements for Oil Lubrication**

Feed pipe, 1 x	"	"	1/2
Oil pressure <sup>3)</sup> , feed pipe	p	bar	≤0,5
Flow rate	$\dot{V}$	l/min	1 ... 2
Return pipe, 1 x	"	"	3/4
Oil pressure, return pipe	p	bar	pressureless
Oil specification	Type	ISO VG	68
Kinematical viscosity (@40°)	n	mm <sup>2</sup> /s	65 ... 75
Pump type <sup>5)</sup>			non-pulsating

- <sup>1)</sup> It is assumed that the extreme values do not occur simultaneously
- <sup>2)</sup>  $M_y$  can only be measured when a brake is installed at the test stand, otherwise  $M_y = 0$
- <sup>3)</sup> Standard force application point at tire radius  $R = 500$  mm and press-in depth  $e = 0$  mm
- <sup>4)</sup> In combination with signal post-processing in customer's data acquisition and Kistler supplied algorithm
- <sup>5)</sup> e.g. gear-wheel pump

**Dimensions**

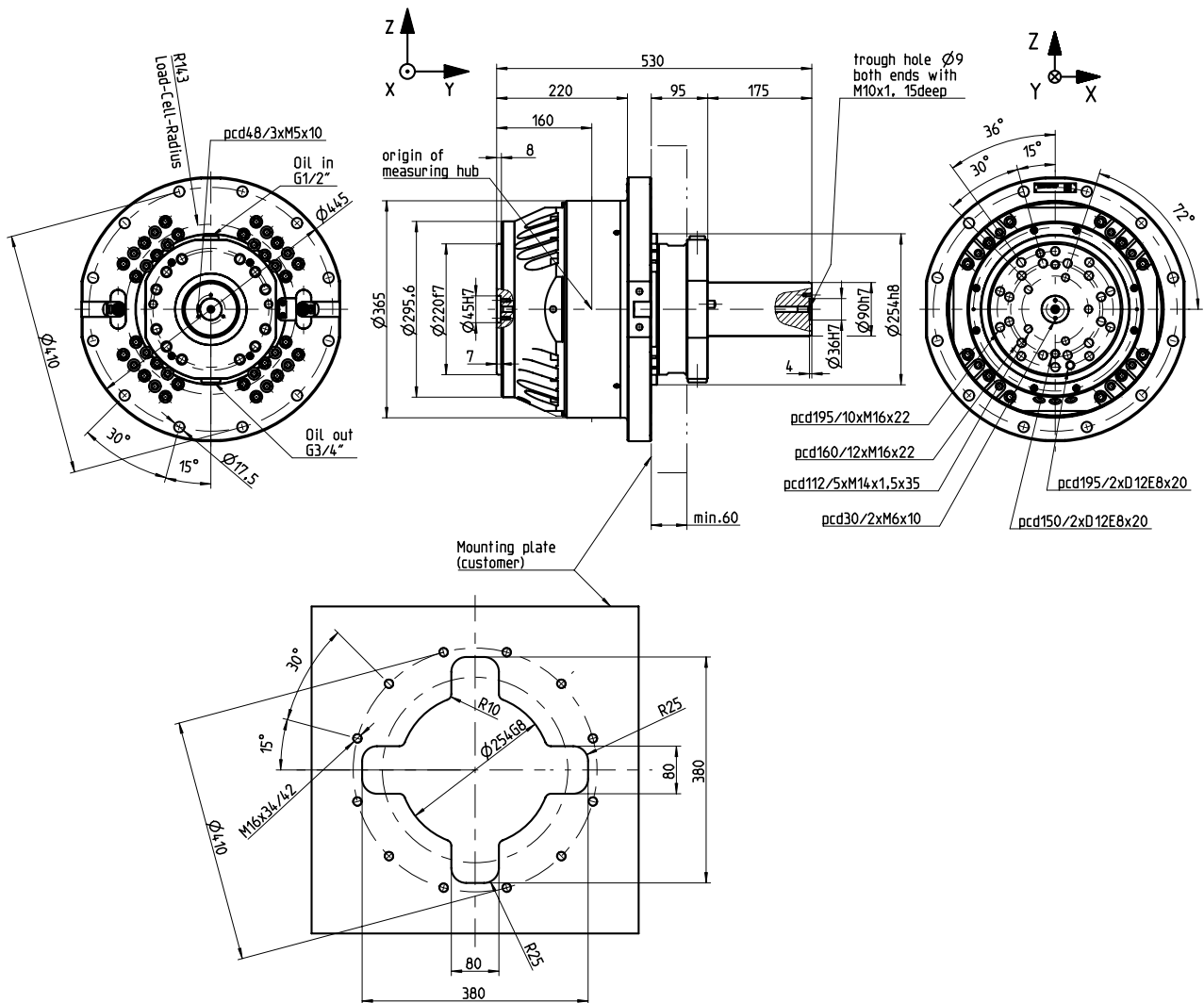


Fig. 1: Assembly drawing RoaDyn® S5ST

**Measuring Chain**

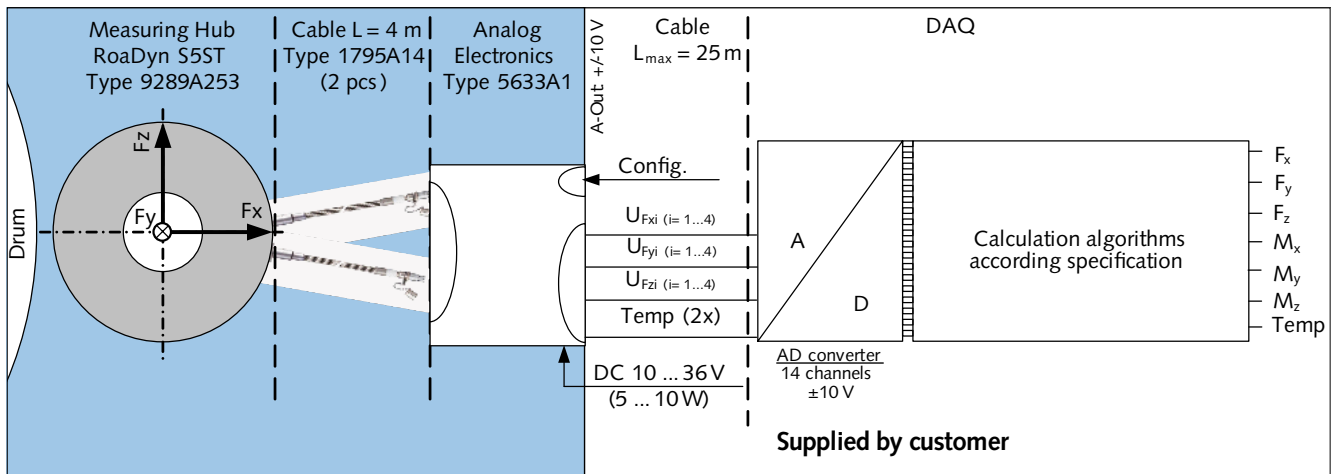


Fig. 2: Analog measuring chain RoaDyn® S5ST

**Mounting**

The RoaDyn S5ST measuring hub is mounted on the standard pitch circle  $\varnothing 410$  mm on the tire test stand using twelve M16 bolts. The rim/tire combinations are mounted either directly onto the shaft flange with predefined pitch circle diameters or with an adapter flange. Rim centering is done with a customized centering pin (not included in the scope of delivery).

**Included Accessories**

	<b>Type/Art. No.</b>
• 12 pcs. cylinder head screw with hexagon socket M16x60	65017330
• 12 pcs. washer D25/M16x3	65017328
• 1 pcs. eye bolt	6.170.008
• 2 pcs. allen set screw M16x80	6.160.108

**Optional Accessories**

	<b>Type/Art. No.</b>
• Connecting cable measuring hub length = 4 m, straight connector (2 pcs. required)	1795A14
• Connecting cable measuring hub length = 4 m, angle connector (2 pcs. required)	1795A24
• Analog electronics for tire test stands	5633A1
• Triaxial accelerometer $\pm 5$ g	8762A5

**Supplied by Customer**

- Hydraulic oil pump lubrication system (non-pulsating)
- DAQ

**Ordering Code**

- RoaDyn S5ST measuring hub for durability and tire characteristics measurements on tire test stands (commercial vehicles)

**Type**

9289A253

**Other Kistler Products for this Application**

• RoaDyn S220 measuring hub (20 kN) to measure tire rolling resistance of passenger car tires on tire test stands	9289A103
• RoaDyn S260 measuring hub (60 kN) to measure tire rolling resistance of truck tires on tire test stands	9289A113
• RoaDyn P530 measuring hub (30 kN) to measure tire characteristics on tire test stands (passenger car)	9295B...
• RoaDyn S5MT measuring hub (100 kN) for durability and tire characteristics measurement on tire test stand (truck)	9289A263

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# RoaDyn® S5MT Measuring Hub

Type 9289A263

## for Durability and Tire Characteristics Measurements on Tire Test Stands (Truck and Bus)

The 5(6)-component RoaDyn S5MT measuring hub is ideally suited to measure durability and tire characteristics of trucks and busses on tire test stands. It measures the longitudinal, transverse and vertical forces  $F_x$ ,  $F_y$  and  $F_z$  and the corresponding moments  $M_x$ ,  $M_y$ <sup>2)</sup> and  $M_z$  acting at the tire contact area.

- High precision tire characteristics measurements for commercial vehicle tires
- Best suited for rim sizes >17,5" (smaller rims with appropriate adapter possible)
- Strain gage load cell technology for static and dynamic tire measurements
- Static measurement of vertical force  $F_z$  enables tire test stand controlling (no additional force sensors necessary)
- Modular design
- High rigidity
- Factory calibrated
- Prepared for oil lubrication

### Description

The RoaDyn S5MT measuring hub is a robust, high-precision measuring tool, equipped with four oval strain gage load cells which are mounted between base and top plate. The measuring hub is stationary, i.e. base plate, top plate and load cells are mounted non-rotating at the tire test stand. The measuring hub incorporates a rotary axis (shaft) with predefined hub hole patterns on which the test tire/rim combinations are mounted. This setup guarantees optimum power flow with minimum cross talk between the individual force components and a high natural frequency of the complete measuring system. The shaft end is lead through the back side of the measuring hub and is prepared for installation of a driving or braking device. The inlet and outlet ports for the oil circuit on the back of the measuring hub are intended for lubricating and cooling of the bearings in order to achieve constant heat conditions even with large loads and increased rotational speeds.

### Application

Typical areas of use are measurements of tire characteristics on tire test stands in the laboratory as well as on mobile test vehicles in the fields of durability, non-uniformities, vibrations, braking characteristics, adhesion etc.



### Technical Data

#### General Technical Data

Measuring range <sup>1)</sup>	$F_x$	kN	-100 ... 100
	$F_y$	kN	-50 ... 50
	$F_z$	kN	0 ... 100
	$M_x$	kN·m	-40 ... 40
	$M_y$ <sup>2)</sup>	kN·m	-30 ... 30
	$M_z$	kN·m	-15 ... 15
Calibration range <sup>3)</sup>	$F_x$	kN	0 ... 100
	$F_y$	kN	0 ... 50
	$F_z$	kN	0 ... 100
Linearity	$F_x, F_z, F_y$	%FSO	$\leq \pm 0,5$
Crosstalk <sup>4)</sup>	$F_y \rightarrow F_x, F_z$	%	$\leq \pm 1,0$
	$F_x \leftrightarrow F_z$	%	$\leq \pm 1,0$
	$F_x, F_z \rightarrow F_y$	%	$\leq \pm 1,0$
Natural frequency	$f_n(x, y, z)$	Hz	$\approx 700$
Maximum rotational speed		min <sup>-1</sup>	1 000
Operating temperature range		°C	+5 ... 70
Degree of protection (DIN40050)			IP65

**Technical Data (Continuation)**

**Dimensions**

Diameter	mm	480
Length	mm	630
Weight	kg	245
Standard pitch circles		
22 pcs. M16x22	∅	205
16 pcs. M16x22	∅	150
5 pcs. M14x1,5x35	∅	112

**Requirements for Oil Lubrication**

Feed pipe, 1 x		"	5/8
Oil pressure <sup>3)</sup> , feed pipe	p	bar	≤0,5
Flow rate	$\dot{V}$	l/min	1 ... 2
Return pipe, 1 x		"	1
Oil pressure, return pipe	p	bar	pressureless
Oil specification	Type	ISO VG	68
Kinematical viscosity (@40°)	n	mm <sup>2</sup> /s	65 ... 75
Pump type <sup>5)</sup>			non-pulsating

- <sup>1)</sup> It is assumed that the extreme values do not occur simultaneously
- <sup>2)</sup>  $M_y$  can only be measured when a brake is installed at the test stand, otherwise  $M_y = 0$
- <sup>3)</sup> Standard force application point at tire radius  $R = 500$  mm and press-in depth  $e = 0$  mm
- <sup>4)</sup> In combination with signal post-processing in customer's data acquisition and Kistler supplied algorithm
- <sup>5)</sup> e.g. gear-wheel pump

**Dimensions**

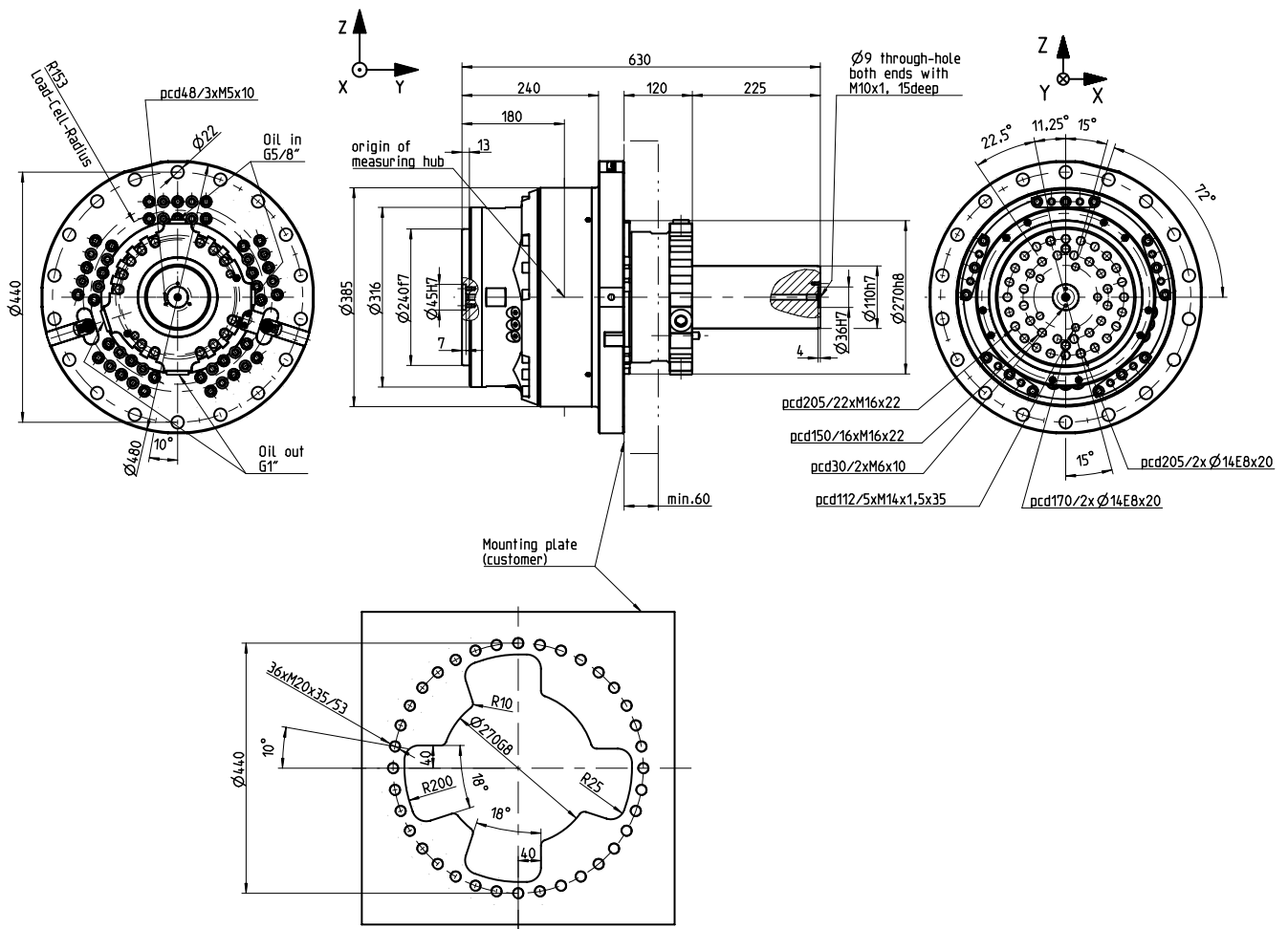


Fig. 1: Assembly drawing RoaDyn® S5MT

**Measuring Chain**

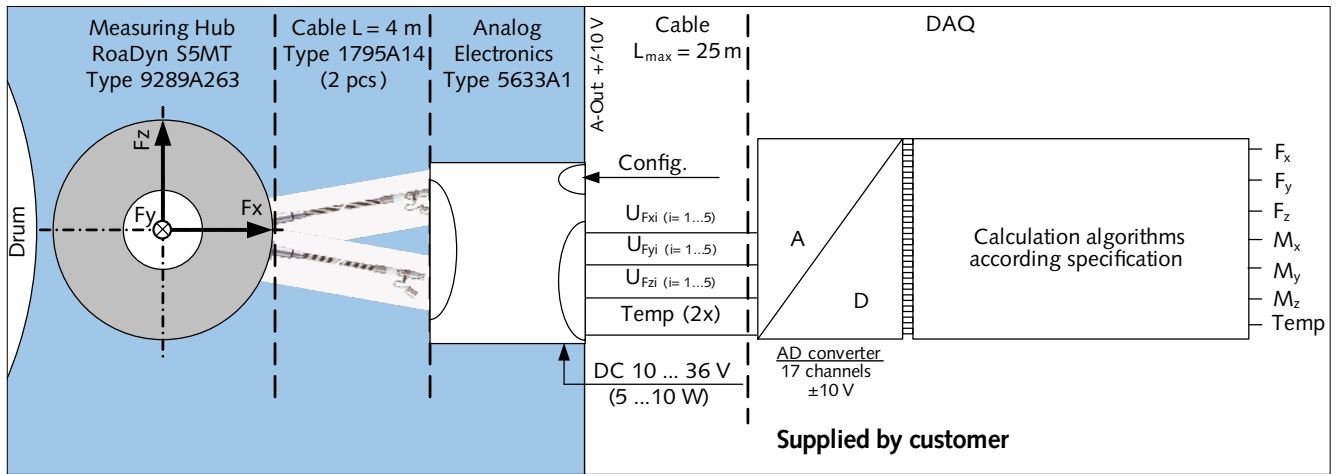


Fig. 2: Analog measuring chain RoaDyn® S5MT

**Mounting**

The RoaDyn S5MT measuring hub is mounted on the standard pitch circle  $\varnothing 440$  mm on the tire test stand using eighteen M20 bolts. The rim/tire combinations are mounted either directly onto the shaft flange with predefined pitch circle diameters or with an adapter flange. Rim centering is done with a customized centering pin (not included in the scope of delivery).

**Included Accessories**

	Type/Art. No.
• 18 pcs. cylinder head screw with hexagon socket M20x80/53	6.120.287
• 18 pcs. washer D37/M20x8	6.220.074
• 1 pcs. eye bolt	6.170.008
• 2 pcs. allen set screw M20x50	6.160.087
• 1 pcs. lifting tool 292x192x60 mm	3.710.229
• 2 pcs. cylinder head screw with hexagon socket M16x30	6.120.225
• 1 pcs. cylinder head screw with hexagon socket M12x30	6.120.217

**Optional Accessories**

	Type/Art. No.
• Connecting cable measuring hub, l = 4 m straight connector (2 pcs. required)	1795A14
• Connecting cable measuring hub, l = 4 m angle connector (2 pcs. required)	1795A24
• Analog electronics for tire test stands	5633A1
• Triaxial accelerometer $\pm 5$ g	8762A5

**Supplied by Customer**

- Hydraulic oil pump lubrication system (non-pulsating)
- DAQ

**Ordering Code**

- RoaDyn S5MT measuring hub for durability and tire characteristics measurements on tire test stands (truck and bus)

**Type**

9289A263

**Other Kistler Products for this Application**

• RoaDyn S220 measuring hub (20 kN) to measure tire rolling resistance of passenger car tires on tire test stands	9289A103
• RoaDyn S260 measuring hub (60 kN) to measure tire rolling resistance of truck tires on tire test stands	9289A113
• RoaDyn P530 measuring hub (30 kN) to measure tire characteristics on tire test stands (passenger car)	9295B...
• RoaDyn S5ST measuring hub (60 kN) for tire characteristics measurement on tire test stands (commercial vehicles)	9289A253

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