

RoaDyn® P: 1-Component Wheel Torque Transducers

For Rolling Resistance Measurement



RoaDyn P106: Wheel Torque Transducer for Cars and SUVs



Technical Data			Type 9294B...
Measuring range high	M_y	kN·m	-6 ... 6
(switchable) low	M_y	kN·m	-0,6 ... 0,6
Max. load	F_z	kN	-24 ... 24
Rim sizes		Inch	14 ... 20
Data sheet		No.	9294B_000-634

Description For measuring the torque and braking force of cars and SUVs in the fields of driving stability, traction control, ABS systems, force distribution, costing moment. Customized measuring ranges on request. Available with slip ring transmission BaseLine or PremiumLine and telemetry transmission.

RoaDyn P1HT: Wheel Torque Transducer for Trucks and Special Commercial Vehicles



Technical Data			Type 9299A
Measuring range high	M_y	kN·m	-50 ... 50
(switchable) low	M_y	kN·m	-5 ... 5
Max. load	F_z	kN	-120 ... 120
Rim sizes		Inch	$\geq 19,5$
Data sheet		No.	9299A_000-993

Description For measuring the torque and braking force of cars and SUVs in the fields of driving stability, traction control, ABS systems, force distribution, costing moment. Customized measuring ranges on request.
The P1HT can be retrofit into a S6XT by exchanging the load cells.

RoaDyn® P106

Type 9294B11

Wheel Torque Transducer up to $\pm 6\,000\text{ N}\cdot\text{m}$

The RoaDyn P106 wheel torque transducer is a universal sensor for measuring the traction torque M_y of small and large cars, SUVs, light trucks and high-performance vehicles up to a maximum of $\pm 6\,000\text{ N}\cdot\text{m}$.

- Two independent measuring ranges of 10 and 100 %
- Adapters for quick and easy mounting on different vehicles
- Setup time less than 15 minutes
- Low additional unsprung mass and low moment of inertia
- 4 additional temperature channels for simple connection of K-type sensors
- Data transmission via slip ring or telemetry
- Automatic identification of the wheel torque transducer (telemetry)
- Slip ring version PremiumLine with additional three resolver signals and three customized signal channels

Description

The measuring system has three main components: wheel torque transducer, data transmission module and on-board electronics (control unit). For data transmission from the rotating wheel to the on-board electronics, there are two analog slip ring systems with connecting cable or a wireless digital telemetry system available.

The RoaDyn P106 wheel torque transducer replaces the middle part of the rim, thus enabling an optimum integration into the suspension system, i.e. in the most effective position for acquiring wheel forces or torques. Mounting of the wheel torque transducer on the vehicle is comparable with changing a standard wheel.

The traction torque M_y is measured with piezoelectric quartz sensors. The two switchable measuring ranges make it possible to measure small as well as very large torques with a very high accuracy. The signals are amplified and processed in the electronics system integral with the wheel.

For transmission to the customer's data acquisition system two analog systems (slip ring) or one digital system with CAN bus (telemetry) are available. The transmission modules are quickly and easily exchangeable. The elementary analog slip ring system BaseLine (Type 9875) only transmits the traction moment M_y ; the digital telemetry system (Type 9811A) and the analog slip ring system PremiumLine (Type 9873) also transmit further signals. To monitor temperature, up to four K-Type temperature sensors can be connected to each wheel.



The slip ring version PremiumLine additionally transmits three resolver signals and three customized signals.

Application

The RoaDyn P106 wheel torque transducer (Type 9294B11) was designed and developed in close collaboration with the motor vehicle industry for practical and research applications. The main focus is on

- Rolling resistance measurements for reduction of CO₂ emission
- Research and development of ABS systems
- Research and development of dynamics control systems
- Vehicle performance measurements
- Determination of powertrain efficiency
- Recording load data for transmission development (simulation, validation)
- Analysis of fading effects on brakes

Other applications include the development of transmissions and chassis control systems, and preparation of government safety tests such as the American FMVSS 135.

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Technical Data

RoaDyn P106

Measuring range torque (upper range)	M_y	N·m	±6 000
Measuring range torque (lower range)	M_y	N·m	±600
Calibration range forces (upper range)	F_x	kN	0 ... 20
	F_y	kN	0 ... 12
	F_z	kN	0 ... 20
Calibration range forces (lower range)	F_x	kN	0 ... 2,0
	F_y	kN	0 ... 1,2
	F_z	kN	0 ... 0,2
Calibration range torque (upper range) (lever arm R = 300 mm)	M_y	N·m	0 ... 6 000
Calibration range torque (lower range) (lever arm R = 300 mm)	M_y	N·m	0 ... 600
Max. vehicle mass (Durability: SAE J328/Guidelines No. 287, §30 StVZO, Germany)	m	kg	3 500
Max. load for forces	F_x, F_z	kN	±24
	F_y	kN	±15
Max. load for torque	M_x	N·m	±6 000
	M_y	N·m	±7 200
	M_z	N·m	±6 000
Max. combined force vector	F_x, F_y, F_z	kN	25
Operating temperature range	T	°C	-25 ... 80
Max. speed (≈250 km/h)	n	min ⁻¹	2 200
Shock resistance		g	50
Thermal zero offset	$e_{TK0, My}$	N·m/K	≤2

Accuracy

Crosstalk, from F_y to M_y	Average	$e_{cross, My}(F_y)$	N·m/kN	≤±2
	Variation	$e_{cross, My}(F_y)$	N·m/kN	≤±2
Crosstalk, from F_z to M_y	Average	$e_{cross, My}(F_z)$	N·m/kN	≤±2
	Variation	$e_{cross, My}(F_z)$	N·m/kN	≤±1
Circumferential variation around circumference	S_{My}	% S_{My}		≤±1
Average linearity around circumference	$e_{Lin, My}$	%Range		≤±1
Average hysteresis around circumference	$e_{Hist, My}$	%Range		≤1

Other Technical Data

Rim size (other sizes on request)		Inch	14 ... 20
Temperature measuring element	Type		K(NiCr-Ni)
	Quantity		4
Mass of RoaDyn P106	m	kg	5,0
Natural frequency (free-free)	f_0	Hz	≈1 000
Moments of inertia (calculated)	J_x	kgm ²	26x10 ⁻³
	J_y	kgm ²	48x10 ⁻³
Degree of protection			IP65 EN60529
Conforms to following directives			89/336/EWG
EMC (interference)			EN61000-6-4: 2001 (EN55011 Class A)
EMC (immunity)			EN61000-6-2: 2001

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Fig. 1: RoaDyn® P106 with slip ring transmission PremiumLine



Fig. 2: RoaDyn® P106 on hybrid vehicle

Dimensions

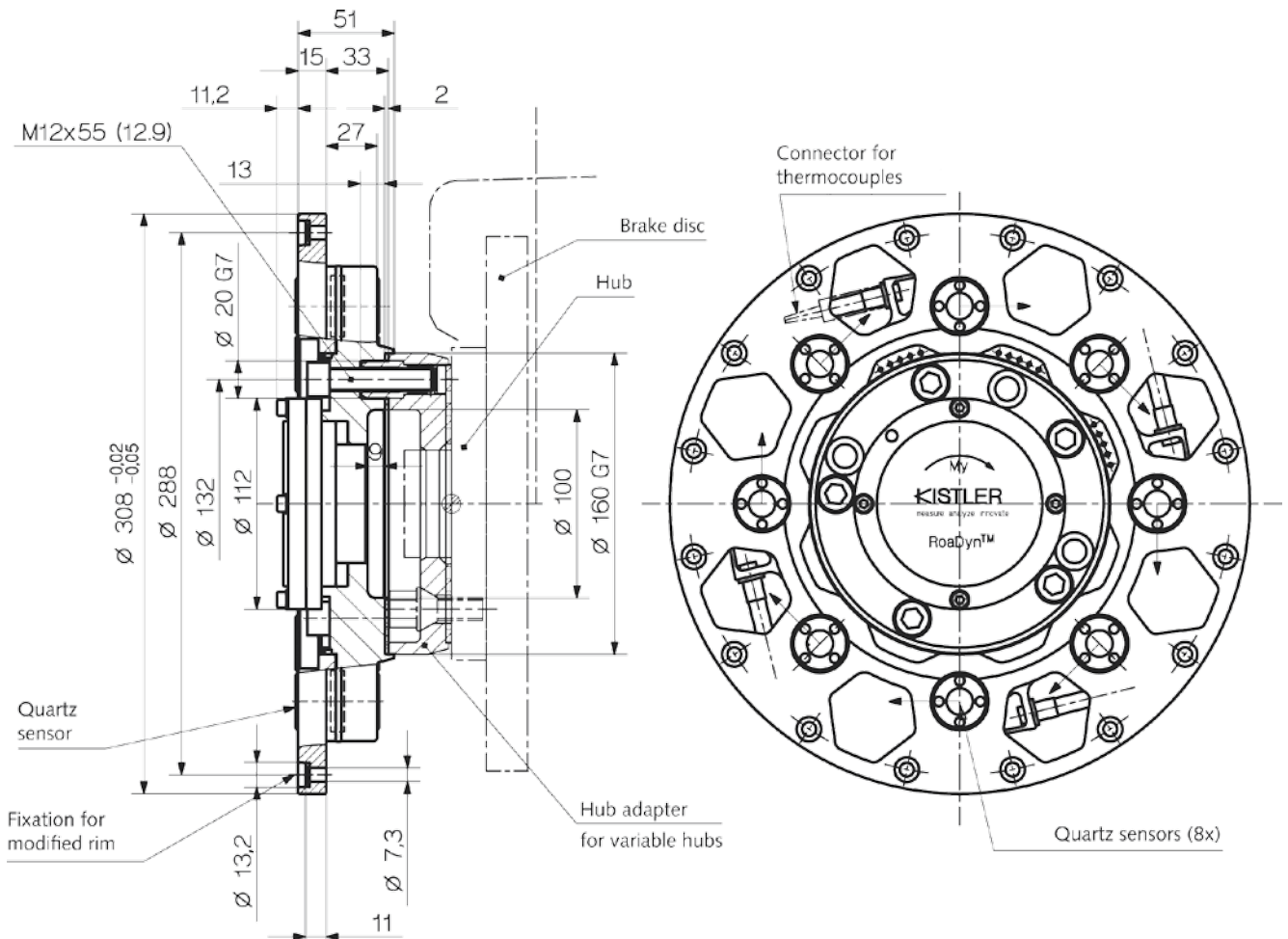


Fig. 3: Dimensions of RoaDyn® P106

Measuring Chains















	RoaDyn P106 Type 9294B11	Telemetry Type 9811A			Control Unit Type 9813A2	Available Measurement signals
Measuring chain RoaDyn P106 with telemetry transmission						Torque M_y 4 x Temperature on measuring wheel 1 x Temperature in hub electronics 1 x Battery voltage
	RoaDyn P106 Type 9294B11	Slip Ring PremiumLine Type 9873	Fixing Arm PremiumLine Type 9881	Connection Cable PremiumLine Type 1763B7	Control Box PremiumLine Type 5683	Available Measurement signals
Measuring chain RoaDyn P106 with slip ring transmission PremiumLine						Torque M_y 4 x Temperature on measuring wheel 3 x Resolver signals 1 x Temperature in hub electronics 3 x customized signals
	RoaDyn P106 Type 9294B211	Slip Ring BaseLine Type 9875	Fixing Arm BaseLine Type 9899	Connection Cable BaseLine Type 1767A7	Control Box BaseLine Type 5693	Available Measurement signals
Measuring chain RoaDyn P106 with slip ring transmission BaseLine						Torque M_y



Fig. 4: RoaDyn® P106 with slip ring transmission

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Included Accessories

- | | |
|-----------------------|-----------------------------------|
| • Mounting screws M12 | Type/Art. No.
6.120.147 |
| • Mounting screws M7 | 5.210.327 |

Optional Accessories

Transmission Modules

- | | |
|---|-------------------------------|
| • Wireless transmission module for für RoaDyn P1xy, power supply by rechargeable battery | Type/Art. No.
9811A |
| • Slip ring transmission module PremiumLine for RoaDyn P1xy (incl. 3 additional channels and angle information) | 9873 |
| • Slip ring transmission module BaseLine for RoaDyn P1xy | 9875 |

Elektronics

- | | |
|---|----------------------------------|
| • On-board electronics for RoaDyn P1xy f or usewith wireless transmission module Type 9811A, serves up to 4 RoaDyn P1xy (digital/analog output) | Type/Art. No.
9813A... |
| • Control box PremiumLine for RoaDyn P1xy for use with slipring transmission modules Type 9873 and Type 9875, serves 1 RoaDyn P1xy | 5683 |
| • Control box BaseLine for RoaDyn P1xy for use with slipring transmission module Type 9875, serves up to 4 RoaDyn P1xy | 5693 |

For Slip Ring Transmission Modules

- | | |
|---|--------------------------------|
| • Cable PremiumLine, l = 7 m, for connecting the slip ring PremiumLine with control box Type 5683 | Type/Art. No.
1763B7 |
| • Fixing arm PremiumLine | 9881 |
| • Cable BaseLine, l = 7 m, for connecting the slip ring BaseLine with control box Type 5693 | 1763A7 |
| • Fixing arm BaseLine | 9899 |

Further Optional Accessories

- | | |
|---|------------|
| • Rim with rim adapter (customized) | 9877A... |
| • Hub adapter 4-, 5-, 6-hole (customized) | 9869A... |
| • Transportation box for one RoaDyn P106 | 7.070.070 |
| • Transportation box for on-board electronics PremiumLine Type 9867A... | 7.070.071 |
| • Maintenance and service toolbox for RoaDyn P106 | Z18475 |
| • Basic tool service kit for RoaDyn P106 | Z20608 |
| • Wheel balancing adapter | Z18432 |
| • Distance ring for wheel balancing adapter for offset compensation | Z17984Q... |

Ordering Key

- | | |
|---|---------------------|
| • RoaDyn® P106
Wheel torque transducer
up to ±6 000 N·m | Type 9294B11 |
|---|---------------------|

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RoaDyn® P1HT

Wheel Torque Transducer up to ± 50 kN·m

Type 9299A

Patent No. US7784336

The RoaDyn P1HT wheel torque transducer is an universal sensor for measuring the traction torque M_y of utility vehicles up to a maximum vertical wheel load of 120 kN. The maximum traction moment is ± 50 kN·m.

- Two independent measuring ranges of 10 % and 100 %
- Easy and quick assembly on various vehicle types with appropriate adaptations
- Short setup times
- Low additional unsprung mass and low moment of inertia
- Hub and rim adapters can also be used for RoaDyn S6XT
- Data transmission via slip ring or telemetry
- Automatic identification of the wheel torque transducer (telemetry)
- Slip ring version PremiumLine with three further resolver signals and three customized signal channels
- Available as single, super-single and twin wheel

Description

The measuring system has three main components: wheel torque transducer, data transmission module and on-board electronics (control unit). For data transmission from the rotating wheel to the on-board electronics, there is an analog slip ring system with connecting cable or a wireless digital telemetry system available.

The RoaDyn P1HT wheel torque transducer replaces the middle part of the rim, thus enabling an optimum integration into the suspension system, i.e. in the most effective position for acquiring wheel forces or torques. Mounting of the wheel torque transducer on the vehicle is comparable with changing a standard wheel.

The traction torque M_y is measured with piezoelectric quartz sensors. The two switchable measuring ranges make it possible to measure small as well as very large torques with a very high accuracy. The signals are amplified and processed in the electronics system integral with the wheel.

For transmission to the customer's data acquisition system an analog system (slip ring) or a digital system with CAN bus (telemetry) are available. The transmission modules are quickly and easily exchangeable.



The digital telemetry system (Type 9811A) and the analog slip ring system PremiumLine (Type 9873) also transmit further signals. The slip ring version PremiumLine additionally transmits three resolver signals and three customized signals.

Application

The RoaDyn P1HT wheel torque transducer (Type 9299A) was designed and developed in close collaboration with the motor vehicle industry for practical and research applications. The main focus is on:

- Driving resistance measurements for reduction of CO₂ emission
- Research and development of ABS systems
- Research and development of dynamics control systems
- Vehicle performance measurements
- Determination of powertrain efficiency
- Recording load data for transmission development (simulation, validation)
- Analysis of fading effects on brakes

Other applications include the development of transmissions and chassis control systems, and preparation of government safety tests such as the American FMVSS 135.

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Technical Data

Measuring Range RoaDyn P1HT¹⁾

Torque			
Upper range	M _y	kN·m	±50
Lower range	M _y	kN·m	±5

Maximum Loads

Max. load for forces ^{1), 2)}	F _x , F _z	kN	±120
	F _y	kN	±90
Max. load for torques ^{1), 2)}	M _x , M _z	kN·m	±25
	M _y	kN·m	±50
Operating temperature range	T	°C	-25 ... 80
Max. speed ¹⁾	v	km/h	200
Shock resistance		g	50

Nominal Sensitivities RoaDyn P1HT¹⁾

Torque (upper range)	S _{My, high}	N·m/V	17 000
Torque (lower range)	S _{My, low}	N·m/V	1 700

Accuracy

Crosstalk, F _y to M _y	e _{cross,My} (F _y)	N·m/kN	≤±2
Crosstalk, F _z to M _y	e _{cross,My} (F _z)	N·m/kN	≤±2
Linearity ³⁾ , lower range			
Typical value	e _{Lin,My}	%FS	≈0,1
Guaranteed value	e _{Lin,My}	%FS	≤±1
Linearity ⁴⁾ , upper range			
Typical value	e _{Lin,My}	%FS	≈0,1
Guaranteed value	e _{Lin,My}	%FS	≤±1

Hysteresis			
Typical value	e _{Lin,My}	%FS	≈0,1
Guaranteed value	e _{Lin,My}	%FS	≤1

RoaDyn P1HT, without Tires

Single wheel			
On 9,00x22,5"		kg	80
On 11,75x22,5"		kg	82
Compared with standard wheel (steel)		kg	52
Twin wheel			
On 2x9,00x22,5"		kg	106
Compared with standard wheel (steel)		kg	106

Other Technical Data

Degree of protection (cable mounted)	IP65
Conforms to directives	89/336/EWG
EMC (emission)	EN61000-6-4: 2001 (EN55011 Class A)
EMC (immunity)	EN61000-6-2: 2001

- ¹⁾ base: Rim diameter 22,5", load cell diameter 494 mm, 6 load cells
- ²⁾ it is assumed that the maximum forces and torques do not act simultaneously; the torques are specified relative to the center of the wheel
- ³⁾ calibrated range = ±5 kN·m
- ⁴⁾ calibrated range = ±10 kN·m

Available Rim Sizes (for Single and Dual Wheel)

Standard sizes	22,5"	7,50x22,5"	8,25x22,5"	9,00x22,5"
Other sizes on request				
Smallest diameter	19,5"			
Largest diameter (manufactured to date)	28"			

Available Rim Sizes (for Super Single Wheel)

Standard sizes	22,5"	11,75x22,5"	12,25x22,5"	13x22,5"	14,0x22,5"	17,0x22,5"
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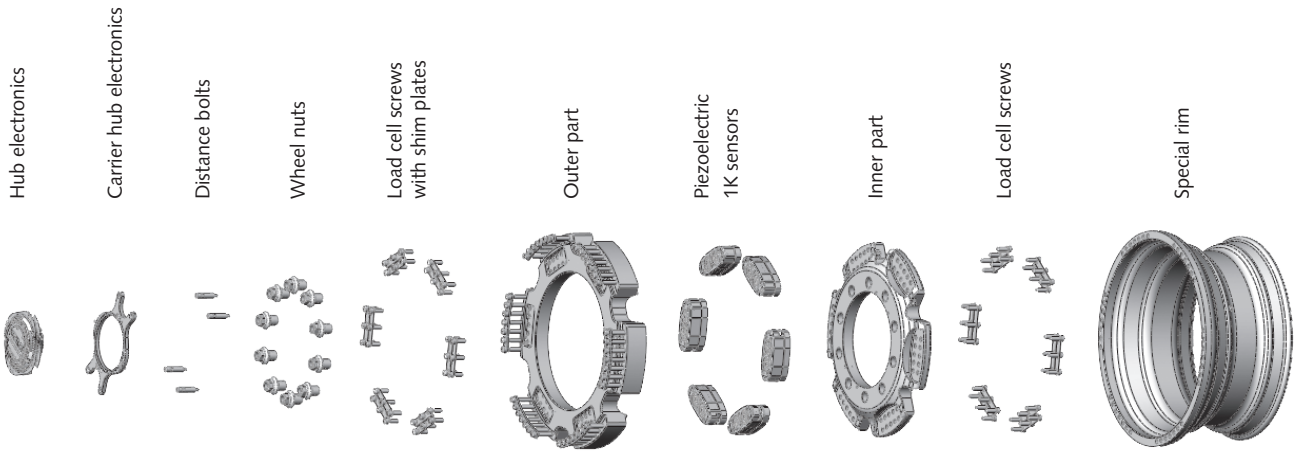
Hub Connection

Standard	Number of hub studs	Pitch circle diameter in mm
EU standard	10	335
US standard	10	285,75
JPN standard	8	285
Other hub geometries on request		

Built-in Components of RoaDyn P1HT

	Type/Art. No.
1-component PE forcelink oval	55049088
Hub electronics (1 800 000 pC)	55086381
Connection between the forcelinks	1670A10,4 / 18000600
Connection cable forcelink to hub electronics	1670A20,5 / 18000602

Sensor Design



- Also available as twin wheel version
- Adaption parts are compatible with 6-component RoaDyn S6HT/S6XT wheel force transducers

Measuring Chains

	RoaDyn P1HT Type 9299A	Telemetry Type 9811A			On-board Electronics Type 9813A	Available Measuring Signals
Measuring chain RoaDyn P1HT with telemetry transmission						Torque M_y 1 x temperature in hub electronics 1 x battery voltage
	RoaDyn P1HT Type 9299A	Slip Ring PremiumLine Type 9873	Fixing Arm Type 9881	Connection Cable PremiumLine Type 1763B7	Control Box PremiumLine Type 5683	Available Measuring Signals
Measuring chain RoaDyn P1HT with slip ring transmission PremiumLine						Torque M_y 1 x temperature in hub electronics 3 x resolver signals 3 x customized signals

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Optional Accessories

Transmission Modules

- | | Type/Art. No. |
|---|----------------------|
| • Wireless transmission module for
for RoaDyn P1xy, power supply by
rechargeable battery | 9811A |
| • Slip ring transmission module
PremiumLine for RoaDyn P1xy (incl. 3
additional channels and angle information) | 9873 |

Electronics

- | | Type/Art. No. |
|---|----------------------|
| • On-board electronics for RoaDyn P1xy,
for use with wireless transmission module
Type 9811A, serves up to 4 RoaDyn P1xy
(digital and analog output) | 9813A |
| • Control box PremiumLine for RoaDyn P1xy,
for use with slipring transmission modules
Type 9873 and Type 9875, serves 1
RoaDyn P1xy | 5683 |

For slip ring transmission modules

- | | Type/Art. No. |
|---|----------------------|
| • Fixing arm | 9881 |
| • Cable PremiumLine, l = 7 m, for connecting
the slip ring PremiumLine with the control
box Type 5683 | 1763B7 |

Adaptations

- | | Type/Art. No. |
|----------------------------------|----------------------|
| • Outer part of RoaDyn S6XT/P1HT | 9747A... |
| • Inner part of RoaDyn S6XT/P1HT | 9745A... |
| • Wheel offset adapter | 9746A... |
| • Special rim | 9749A... |
| • Wheel nuts | 9727A... |
| • Shim plates | 55088257 |
| • Distance bolts | Z32092A... |

Ordering Code

- | | |
|---|-------------------|
| • RoaDyn® P1HT
Wheel torque transducer up to ± 50 kN·m | Type 9299A |
|---|-------------------|

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