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RoaDyn® P650 Analog

Type 9298B...

Wheel Force Transducer (WFT) for Heavy Passenger Cars, Light Trucks or SUVs

Spinning wheel force transducer to measure 3 forces and 3 moments, which are acting in the contact patch to the road surface, directly at the wheel during driving. The load capacity of this quartz based instrument allows operation with passenger cars, heavy passenger cars, light trucks or SUVs over their full speed range up to 250 km/h. The wide frequency range and very good linearity allow measurement of either small up to maximal forces or moments as well as structural behavior of tires and vehicle components.

- One instrument for passenger cars, heavy passenger cars, light trucks or SUVs
- Fast and easy installation onto the vehicle
- Two measuring ranges for maximum signal resolution
- Highest available frequency response due to the quartz sensing elements
- Patented triple flange design for optimum temperature compensation
- Rugged military grade slip ring with low profile extension from the wheel
- IP65 sealing allows use in any weather condition
- Durability tested acc. to SAE J328

Description

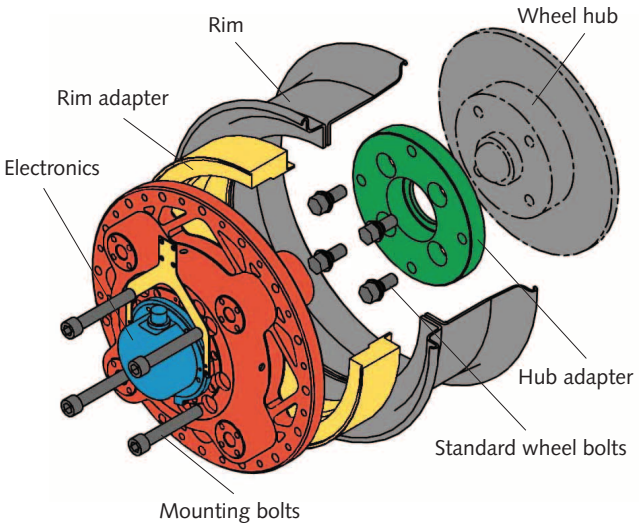
RoaDyn P650 is a high-performance tool for use on test tracks and on all types of rolling-road test stands. The data provide a reliable basis for both determining and optimizing tire characteristics or suspension tuning, and also for the design of active suspension, traction and braking control systems. The sensor replaces the central part of a rim and can with this be easily mounted to a vehicle without modifications of the wheel hub or the suspension strut. Adapters, which are available for nearly every hub and rim, ensure that the unit can be easily fitted to any car under test.

Quartz force sensors measure three orthogonal force components. These sensors are arranged in a patented triple-flange design with two sensors in push-pull arrangement. This ensures that the unit is insensitive to temperature changes.

Signal amplification and first data processing is done with a wheel-integrated electronics module, that is positioned in the center of the wheel force transducer. Three forces F_x, F_y, F_z, and three moments M_x, M_z, M_y, as well as the angle of rotation are provided as output signals. They are transmitted through slip rings and cable to the on-board electronics, which is positioned inside of the vehicle. A fixation arm, which is attached to the suspension strut or the chassis, keeps the stationary part of the angular encoder steady in order to define the reference point for the angular position of the wheel. It also holds the stationary part of the slip ring assembly and carries the cable, which connects the wheel with the on-board electronics.

The combination of piezoelectric quartz force sensors and highly integrated built-in electronics makes the unit rugged, easy to use and gives the highest possible measuring performance.

A complete instrumentation of a car consists of up to four wheel force transducers, a on-board electronics and optionally a data acquisition system. The system is usually powered by 9 … 18 VDC.



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Application

The RoaDyn P650 is suited for measurements of wheel forces and -moments during all kinds of driving manoeuvres for research and development purposes in the automotive- and tire industries as well as tier one suppliers. The design is specially made for flexible use with various cars or rims as well as on tire or vehicle test stands. The availability of mechanical adaptations to various measurement systems offer additional flexibility for the use of RoaDyn P625 and an ideal base for a combined use.

The instrument is suitable for both, analyses on active safety, comfort or handling and also structural analyses on tires or suspension-/vehicle components.

Technical Data

Measuring range forces (range high)	F_x	kN	–45 … 45
	F_y	kN	–24 … 24
	F_z	kN	–45 … 45
Measuring range forces (range low)	F_x	kN	–15 … 15
	F_y	kN	–8 … 8
	F_z	kN	–15 … 15
Measuring range torques	M_x	kN·m	–10 … 10
(range high)	M_y	kN·m	–10 … 10
	M_z	kN·m	–4,4 … 4,4
Measuring range torques	M_x	kN·m	–3,3 … 3,3
(range low)	M_y	kN·m	–3,3 … 3,3
	M_z	kN·m	–1,5 … 1,5
Measuring range temperature sensors	Tlv, T1, T2	°C	–40 … 125

Maximal Loads

Combined force vector	F_x, F_y, F_z	kN	45
Max. loads for forces and torques		%FS	120
Durability (SAE J328), half axle weight		kN	11,2
Operating temperature range	T	°C	–25 … 80
Max. speed (≈250 km/h)	n	min^{-1}	2 200
Shock resistance		g	50

Accuracy

Crosstalk [typical]	F_x, F_z –> F_y	%	<±2,5 [2]
	F_x <–> F_z	%	<±1 [0,5]
	F_y –> F_x, F_z	%	<±1 [0,5]

Linearity and Hysteresis

Linearity (around circumference) all channels	% Range		typ. <±1
Hysteresis (around circumference) all channels	% Range		typ. ≤±1

Thermal Behaviour

Electrical drift			
F_x/F_z [1]	$e_{Drift,Fxz}(T)$	N/min	
T = 20° (typical)	$e_{Drift,Fxz}(20°)$	N/min	0,4
T = 50° (typical)	$e_{Drift,Fxz}(50°)$	N/min	3,4
F_y	$e_{Drift,Fy}(T)$	N/min	
T = 20° (typical)	$e_{Drift,Fy}(20°)$	N/min	0,2
T = 50° (typical)	$e_{Drift,Fy}(50°)$	N/min	1,6

Other Physical Data

Additional mass of fully equipped wheel [2]	m	kg	≈5
Mass of RoaDyn P650 analog	m	kg	≈9,1
Max. weight measuring wheel [3]	m	kg	≈16,5
Natural frequency (free-free)	f_0	Hz	≈2 190
Degree of protection	EN60529		IP65
Number of mounting screws on wheel			
Type 9298B1			4/5
Type 9298B2			6
Rim size		inch	14 … 20

Slip Ring

Lifetime	L_{10}	cycles	>10 Mio
Shock resistance	a_{max}	g	<50
Max. additional mass for optional equipment mounted to the slip ring housing	m_{max}	kg	<2,5

[1] In rotational situation the electrical drift causes an oscillation with an amplitude of the given values
[2] Reference: 7x16"
[3] incl. 7x16" rim, rim adaption, hub adaption and P650 analog

The instrument is according to EG regulation 89/EWG CE conform and complies the EMC regulation for industry and laboratory EN50081-1 (emission) and EN61000-6-2 (immunity).

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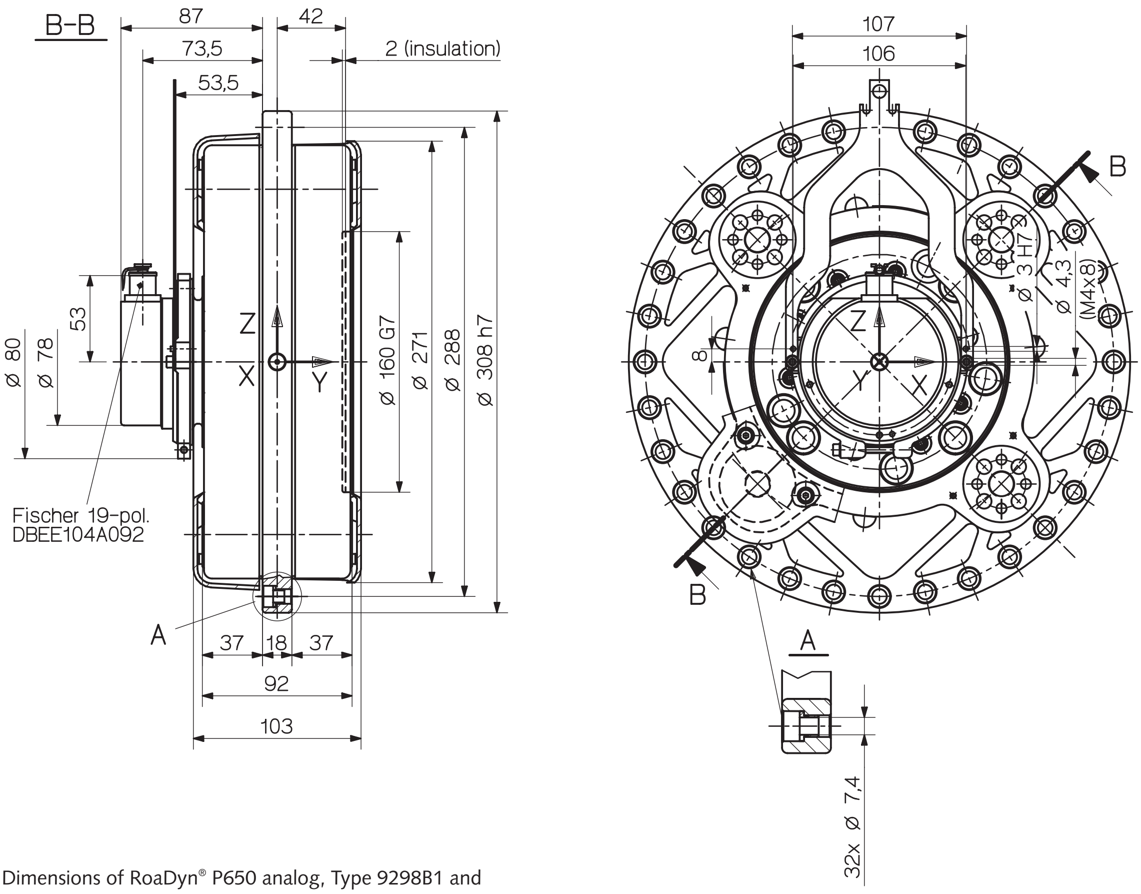

Fig. 1: Dimensions of RoaDyn® P650 analog, Type 9298B1 and 9298B2

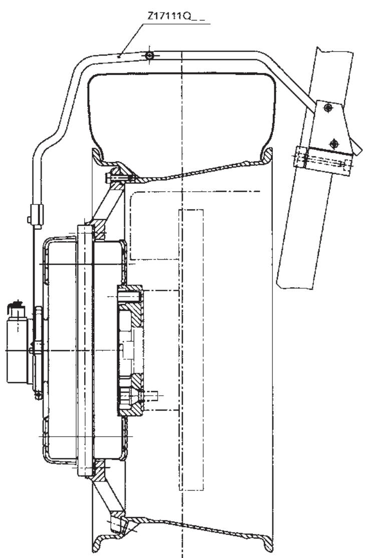

Fig. 2: Mounting example at front axle

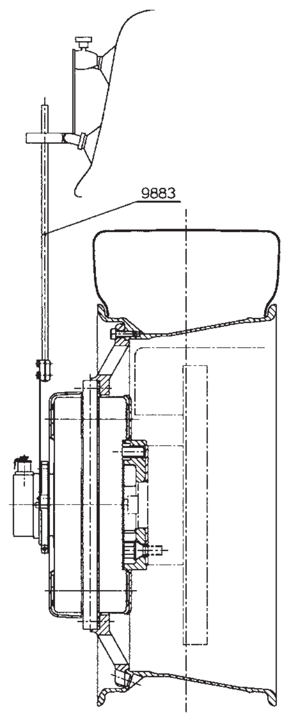

Fig. 3: Mounting example at rear axle

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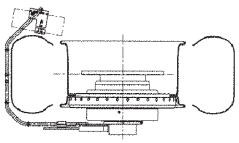
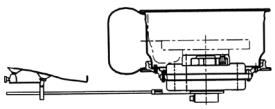
RoaDyn® P650 Analog Configurations

Sensor	Fixation		Connecting Cable	On-Board Electronics
Type 9298B1 (RoaDyn P650, 4-/5 hole) Type 9298B2 (RoaDyn P650, 6 hole)	Type Z17111A... (front axle)	Type 9883 (rear axle)	Type 1763B7	Type 9867A...
				

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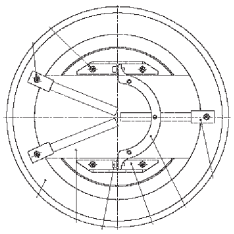
Accessories

Balancing Adapter (for Rim)	Distance Ring (for Balancing Adapter)	Hub Adapter	Rim with Rim Adapter	Service Toolbox
Type Z18432	Type Z17984Q...	Type 9869A...	Type 9877A...	Type Z17019
				

Sensor Adaptation (Correvit®)	Additional Channel Kit	Slip Ring Fixation (Half Axle Test Rig)	Zimmer Mirror Adaptation	RV3
Type Z18618 (without fixation plate)	Type Z18249	Type Z18588	Type Z17332Q01	t.b.d.
				

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Mounting

The RoaDyn P650 features low mass, high rigidity and low temperature dependence. The modular design allows the original rim size and offset to be maintained by using vehicle-specific adapters and standard rim components.
Rim adapters, which are used to attach BBS rims of various sizes and offsets, also allow to exchange pre-mounted, inflated and balanced tire/rim-base assemblies very quickly.

Hub adapters can be designed to accommodate both 4 and 5 screw fixations, special adaptations for 6 screw fixations are available on request. A second RoaDyn P650 version, which adapts to 6 screw fixations on a standard base is alternatively available, special 4 or 5 screw fixations are also available on request for this type.
The hub adapter is fastened to the hub before the measuring wheel is attached. Rim adapters and hub adapters are matched to give the desired in- or outset. The assembly therefore, replaces the standard rim.

Fig. 4: RoaDyn® P650 analog mounted at front axle

Included Accessories	Type
• Fixation screws	–

Optional Accessories	Type/Art.No.
• Transportation suitcase	7.070.069
• On-board electronics for up to 1 … 4 measuring wheels (incl. remote control box)	9867A…
• Cable for connecting the RoaDyn P6xy with the on-board electronics, length 7 m to on-board electronics	1763B7
• Rim with rim adapter (pre-balanced) according to customer specification	9877A…
• Hub adapter for 4- or 5 hole fixation according to customer specifications	9869A…
• Hub adapter for 6 hole fixation according to customer specifications	9869A60…
• Fixing arm for front axle	Z17111A…
• Fixing arm for rear axle	9883
• Service toolbox	Z17019
• Tire (dis-)mounting tool	Z30210
• Balancing adapter for rim	Z18432
• Distance ring for balancing adapter	Z17984Q…
• Data acquisition	individual
• Correvit® SL sensor adapter	Z18618
• Corrsys RV3 adapter	on request
• Krypton Wheeltracker adaptation	Z20250
• Additional channel kit	Z18249
• Zimmer Autokollimator mirror adaptation	Z17332Q01
• Slip ring fixation for RoaDyn P625/P650 use on half axle rigs	Z18588

Ordering Key

Type 9298B☐

RoaDyn P650 analog for standard 4 and 5 hole fixation	**1**
RoaDyn P650 analog for standard 6 hole fixation	**2**

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