aim arnold intelligente messsysteme

# Wheel force transducer for (e-)bikes

## ROLS*bike*

## Overview

The wheel force transducer system **ROLS*bike*** has been specially developed for light two-wheelers, such as bikes and e-bikes, to carry out vehicle dynamics tests as well as acquiring operating loads. The development was optimized with regard to the special requirements of two-wheelers, such as limited space and low power consumption. Apart from the connection cable to the vehicle battery and the data logger, **ROLS*bike*** does not require any other external components. All control functions (angle and signal offset, configuration, etc.) as well as data output are carried out via the CAN interface.

## Design and Function

The wheel loads are detected in a one-piece measuring element ring, consisting of three or four strain gauge based three-component measuring elements. The complete force flow is introduced through the roadway via the tire, the rim and the spokes into the measuring element ring. The wheel hub, which contains all electronic components, is located in the center of the measuring element ring. The power supply and the data transfer takes place through a connector on the non rotating side.

The up to 12 bridge signals from the strain gauge measuring elements are amplified and digitally processed by the co-rotating electronics with an integrated powerful DSP. In this procedure wheel forces and wheel moments are calculated by means of calibration information and wheel geometry in physical units. In addition to the wheel forces and moments, the accelerations along the X and Z axes as well as the rotational acceleration are determined.

The transformation into the non-rotating coordinate system takes place using the angle of rotation determined from the signal of the integrated optical encoder. Output of the data with $16/32bit$ resolution takes place via a CAN(-FD) interface.

An additional line which can be operated in master or slave mode provides synchronization with further systems.

## Sensor ROLS*bike* (standard values)

| Measuring channel | Measuring range | Linearity error | Crosstalk* |
|---|---|---|---|
| Fx | 8 kN | $< 1\%$ | $< 1\%$ |
| Fy | 1 kN | $< 1\%$ | $< 1\%$ |
| Fz | 8 kN | $< 1\%$ | $< 1\%$ |
| Mx | 350 Nm | $< 2\%$ | $< 1\%$ |
| My | 600 Nm | $< 1\%$ | $< 1\%$ |
| Mz | 350 Nm | $< 2\%$ | $< 1\%$ |
| Angle encoder | 360° / 96.000 steps | $< 0,01\%$ | – |
| Temperature drift | – | $< 0,02\%$ FS/°C | – |
| * The calculation of the values takes place by the signals, normalized by FS of each channel. | | | |

## Measurement/Electronics ROLS*bike*

| Type | Unit | Value |
|---|---|---|
| A/D Converter | Bit | SAR 16 |
| Samping rate | MHz | 1, synchronous |
| Output format | - | CAN(-FD) 16/32bit, more on request |
| Output rate | Hz | 250...4000 |
| Output channels | - | Fx, Fy, Fz, Mx, My, Mz, Ang, Asp<br>ACCLx, ACCLz, ACCLrot, Prot |
| Signal processing | - | DSP<br>Control of sampling, digital filtering, calibration of input channels, calculation of wheel forces, coordinate transformation, output formatting, control of all functions via CAN |
| Supply voltage | V(DC) | 18...60 |
| Current consumption at 24V | mA | $\approx 150$ |
| Temperature range | °C | $-20...80$ |
| Weight rear wheel* | $kg$ | $\approx 2,8$ |
| Compatibility | | Freehub: all common manufacturers<br>Frame spacing: $\geq 135mm$ rear, $\geq 100mm$ front<br>Brake disk mount: 6-hole<br>Axle diameter: $\leq 15mm$ |
| *Exemplary measuring wheel with 12-speed sprocket set, 148 boost frame and 30-622 rim | | |

AIM Arnold Intelligente Messsysteme GmbH & Co. KG
Zeppelinstraße 19
D-72649 Wolfschlugen
+49 (0)7022 99471 80
info@aim-messtechnik.de http://www.aim-messtechnik.de