

Measurement of railway vehicle/tram wheel diameters

SPIDER



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SPIDER is an electronic device designed to measure rise values and to make subsequent calculations of wheel diameters of railway and tram vehicles.

Practical applications of the SPIDER are as follows:

- Wheel checking for operational wear (wheel diameter),
- Wheel testing before re-profiling.

Meter Description

SPIDER is an electronic measuring device designed to precisely determine the wheel diameters of the railway or tram vehicles. The wheel diameter is being determined indirectly, by calculation based on the rise measured on a three-point symmetrical chord having 300 mm in length. The rise results from a contact measurement at the distance of 70 mm (for railway vehicles), or 45 mm (for tram vehicles) away from the internal surface of the wheel rim. The measuring tip is lowered/raised manually. The meter consist of a base plate with the bearing-fitted arms at its ends, making the two end points of the symmetric chord. A MITUTOYO sensor is at the mid point of the chord. Precise meter positioning on the wheel rim inner surface is assured by a triple of arms with their ground, hardened contact points. The bearing chord end points are fitted so that the measuring device could be slightly be moved along the wheel being measured. A rise amount is then measured in more points to eliminate any local extremes.

The values measured are shown on the LCD display of the MITUTOYO absolute digital sensor able to remember the calibration zero setting, even when being turned off and on in the meantime. The other function is the setting itself, applicable to zero and output polarity. A sensor tip is spring-mounted, held in transport position by a turnable stop. The sensor is fitted so that it could be turned by 180° . Due to this arrangement the wheel can be measured from its inner and outer side. With its sensor turned, the meter must be re-calibrated on a calibrating stand (supplied complete with the meter). The calibration rests in mounting the meter on a calibration stand, insertion of a respective a precise gauge (included in the kit) under the measuring tip and zero value recording with the ORIGIN button. The 10mm

precise gauge is to be applied with the wheel diameters between 640 mm and 2250 mm while the 20mm one is for the wheel diameters greater or equal to 500 mm, but less than 900 mm. Of course, a respective precise calibration gauge value (10/20 mm) has to be added to the rise value measured.

Measurement Ranges and Preciseness

Rise measurement range is given by the sensor dynamic range being 0 - 27 mm. Rise measurement preciseness is 0.01 mm. The corresponding wheel diameter calculation preciseness is 0.2 mm. Preciseness of the calibration stand and precise calibration gauges (0.001mm – 0.002 mm) is subject to reviews by the Czech Metrological Institute.

Scope of assessed wheel diameters (d): In theory, the *wheel maximum diameter* d can be assessed up to $d_{\max} = \infty$. In practice, however, the maximum wheel diameter $d_{\max(10)} = 2250$ mm can be assess after calibration with the 10mm precise gauge. With calibration by the 20mm precise gauge, the maximum wheel diameter $d_{\max(20)} = 900$ mm is assessable. *The minimum wheel diameter* again depends on the calibration gauge used (whether 10 mm or 20 mm). With the 10mm precise gauge calibration the minimum wheel diameter is $d_{\min(10)} = 640$ mm, while the $d_{\min(20)} = 500$ mm applies for the precise calibration gauge sized 20 mm.

Parts of SPIDER Meter

MITUTOYO absolute digital metering indicator: sized 207.3x38x23mm, weight 0.124kg, IP 42, operational temperature from 0°C to +40 °C, storage temperature from -10°C to +60 °C, dynamic range is mm- 25,4 mm= 1", measurement precision 0.01 mm, carbide measuring tip (M2.5x0.45), tip hold-down force 1,8N, battery SR44, battery life 20,000 hours.

Mechanical Section : Base plate, arms with SKF ϕ 19mm bearings, three arms with ground, hardened contact points, sensor holder with its sensor locks and stops, calibration stand, precise gauge sized 10x20x30 mm, a stowage case for the meter and its calibrator.

Main Technical Characteristics of the SPIDER Meter:

The electronic circuitry is powered from: SR44 battery with its life span covering about 20,000 hours of measurement.

SPIDER meter weight: approx. 1.20 kg.

Weight of the suitcase with the meter and its calibrator: approx. 3.0 kg.

Operating staff: One person.

Profile meter mounting on a wheel: held down with hand.

Meter main dimensions: (width x height x depth), 322 mm x 225 mm x 115 mm.