

# STEELMASTER



Non-Contact In-line Dimension Measurement in the Steel Industry.  
Dependable Solutions for Hot Rolling and for Quality Control.



## Wire Rod, Bar, Rebar, Profile, Tube, Pipe – Hot, Cold, Quality Control

### WHAT THE MARKET DEMANDS

- Closer tolerances (1/2, 1/4 DIN)
- "Zero fault"
- 100% quality control
- Higher productivity
- Faster startup
- Less down time
- Less manpower

To remain competitive as a steel manufacturer, the latest and most advanced technologies are needed to ensure the best product quality and maximum output. Among others, one challenge is to obtain key data which allows to increase the productivity and improve product quality whilst remaining cost effective.

### OUR SOLUTIONS

STEELMASTER gauges and systems. They are based on latest technology and on the experience with more than 300 units in hot rolling and similar processes and they are backed by many thousand ODAC scanners, operating in cold processes.

#### Outstanding Advantages

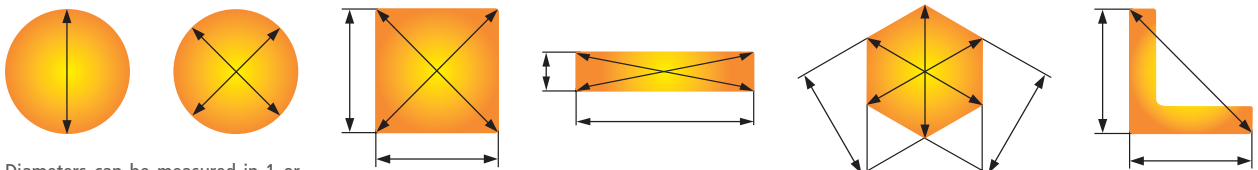
For easy integration, dependable operation, data processing and display:

- Hi-Tech laser scanners with utmost precision
- Up to 6000 measurements/s
- One single (fibre optic) cable between LPO and CPO
- Compact industrial PC with highest working reliability
- Highly developed STEELMASTER software
- Special software solutions for polygonal shapes
- Sophisticated mechanics and protection system
- Close to zero maintenance – quick and easy cleaning

### DIMENSION MEASUREMENT AND FAULT DETECTION

Modern in-line measuring systems not only provide accurate values for diameter, ovality, width, height etc., but they also detect shape deviations, rolling faults and other process problems instantly. STEELMASTER systems easily meet these requirements thanks to high measuring rates, intelligent software and oscillating or rotating measuring modes and others.

#### Dimension Measurement



Diameters can be measured in 1 or in up to 6 axes. Also combined with oscillation.

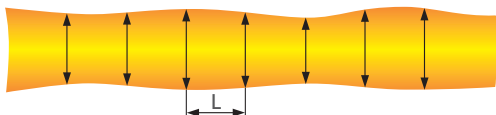
Outside dimensions and diagonals are measured accurately and independent of product orientation (twist).

#### Shape Deviations, Faults

##### Radial faults



##### Longitudinal faults



Up to 1000 measurements/s (optionally 2000 measurements/s)  
At 100 m/s → L = 100 mm / 4 in. (optionally 50 mm / 2 in.)

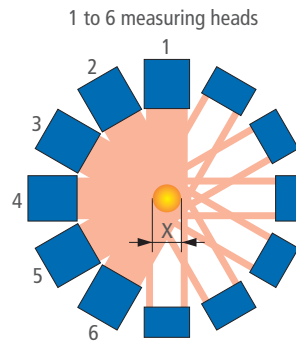
### SMS... Static Gauges

Simple, compact and primarily suited for round products. SMS units are of the same design as SMO systems, with the exception of the oscillation mechanism. They are extremely compact and easy to integrate.

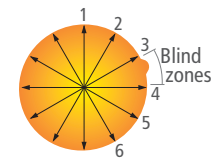
Depending on the model, the number of measurement axes (scanners) can be 2, 4 or 6; other models on request.

#### Outstanding Advantages

- Extremely compact
- Very high measuring rate
- No moving parts



Exact measurement of  $D_1...D_n$ , blind zones between measurement axes



### SMO... Oscillating Gauges

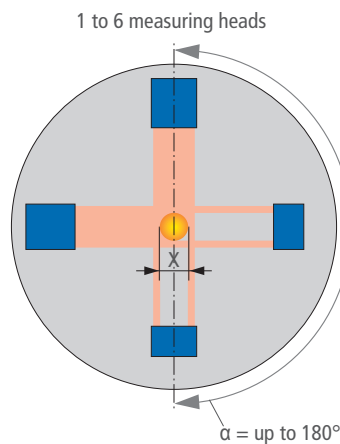
They are able to measure round and non-round products such as squares, hexagons, flats etc., independent of twist and twist angle. This is made possible through dynamic regression analysis with sophisticated software.

Depending on the model, the number of measurement axes (scanners) can be 2, 3, 4 or 6.

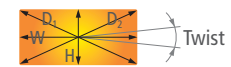
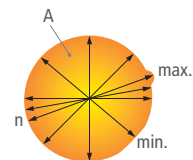
With an increasing number of axes, more data can be captured at the same time, and the measurement cycle per profile is shorter. SMO gauges can also be operated in static mode, in selectable orientation.

#### Outstanding Advantages

- Measures all types of products
- Independent of twist
- Very short measurement times
- Also computes cross section (area)



Exact measurement  $D_1...D_n$ , max., min.  
Computed area A



Exact measurement of  $W, H, D_1, D_2$

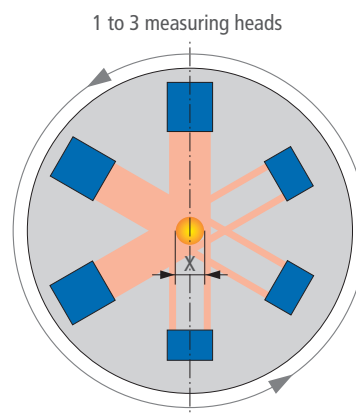
### SMR... Rotating Gauges

For round and non-round products such as squares, hexagons, flats etc. Specially designed for high production speed and short length. These gauges are based on the same well proven design as the oscillating SMO systems, however with a novel fully contactless transmission system for both power and signals. Thanks to this unique concept and the high rotational speed, the full profile is captured within fractions of a second, allowing thus to minimize scrap production and to guarantee tighter tolerances. Twist and twist angle do not affect the measuring result thanks to an integrated dynamic regression analysis in the software package.

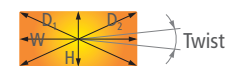
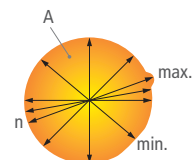
Depending on the model, the number of measurement axes (scanners) can be 1, 2 or 3.

#### Outstanding Advantages

- Significantly increased measuring rate per second
- Captures at least 3 profiles in less than 1 second
- Also computes cross section (area)
- High reliability thanks to the fully contactless transmission of power and signals
- Slim design



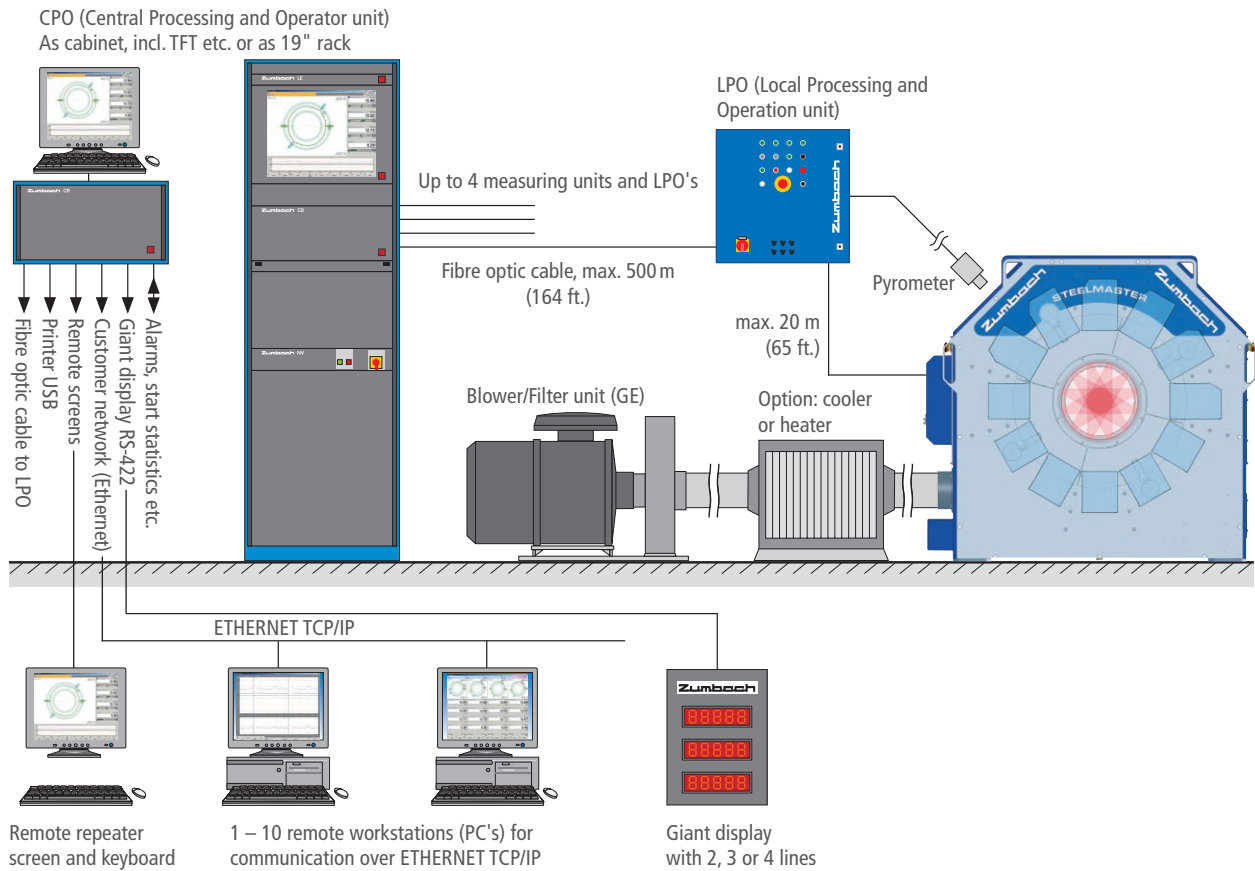
Exact measurement  $D_1...D_n$ , max., min.  
Computed area A



Exact measurement of  $W, H, D_1, D_2$

## SYSTEM ARCHITECTURE

STEELMASTER systems allow for optimum configuration and layout of the measuring unit(s), processor, auxiliary devices, networks and peripherals for each rolling mill.

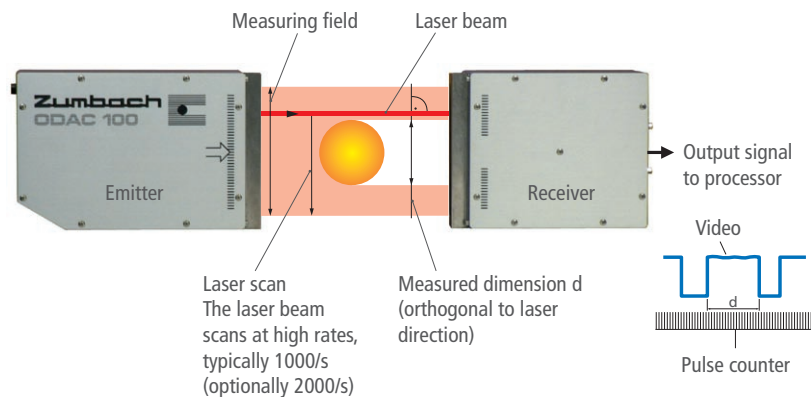


## THE SENSORS

ODAC<sup>®</sup> laser scanners with latest optical and laser technology are the heart of the STEELMASTER gauges. The field experience, gained from over 65'000 performing ODAC<sup>®</sup> scanners and systems, represents a solid base for design refinements and quality. ZUMBACH offers models with measuring fields from 2 up to 500 mm (.08 up to 19.68 in.); bigger models upon request.

### Outstanding Characteristics

- Extremely accurate
- Permanently calibrated
- High resolution
- High measuring rate of up to 1000/s/axis (optionally: 2000/s/axis); 6000/s for 6 axes
- High immunity to dirt
- Totally independent of position, vibration, temperature of rolled product, light intensity etc.
- Well proven, extensive lifetime



## STEELMASTER MEASURING UNITS

These units comprise the individual sensors (scanners), sealed from the harsh mill environment by means of a unique protection system. Reliable function is guaranteed thanks to an efficient air purging and cooling system and, if needed, by a water circulation system. Special service doors provide easy access to clean the windows from dust, however this is rarely needed, thanks to the efficient air purging system which is standard for all Zumbach gauges.

### SMS... Static Gauges

Especially suited for round products

- Up to 6 fixed axes
- No moving parts
- Extremely compact
- Practically no maintenance
- Extremely fast measuring rate, short measuring distances
- Most economic version



### SMO... Oscillating Gauges

For round and non-round products (squares, hexagons, flats, rebar etc.)

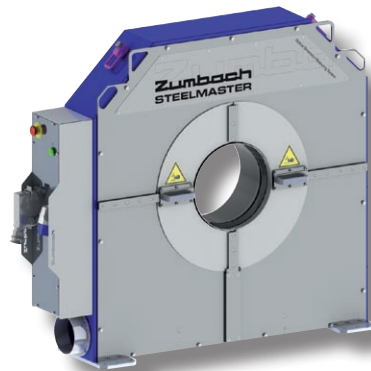
- Up to 6 measuring axes
- Seamless 360° coverage
- No blind zones
- Measurement independent of twist
- Computes also cross section
- Oscillating or static operation



### SMR... Rotating Gauges

For high-speed productions of round and non-round products (squares, hexagons, flats, rebar etc.)

- Up to 3 measuring axes
- High-speed seamless 360° coverage
- Up to 100 rpm (min. 3 full profile measurements/s)
- High reliability (fully contactless power and signal transmission)
- Rotating or static orientable operation



## STEELMASTER DATA ACQUISITION, PROCESSING, DISPLAY

A local processing and operation unit "LPO" is installed at max. 20m (65 ft.) from the measuring unit. It pre-processes and filters the measured values in real time. The data is sent via one single fibre optic connection to the central control and operating unit "CPO". The heart of the "CPO" is an industrial embedded PC, featuring all necessary inputs and outputs for display units, printer or other peripherals, Ethernet (TCP/IP) for customer (see "System Architecture").

An optional optical pyrometer can be used to provide the product temperature; this input is used to correct the hot dimensions into cold corrected values before being displayed, allowing thus rapid judgements by the operator for any mill adjustments required.



## STEELMASTER SOFTWARE

This is a highly developed software, proven and refined over many years. A basic package offers all functions needed for round products.

For all non-round products, such as squares, hexagons, flats, rebar as well as for polygonal shape deviations (3-roll blocks), additional software modules are available.

Also for additional functions such as network communication, data archiving, remote workstations, SPC statistics etc., optional modules are readily available.

**Unique: There is only one hardware and software for all STEELMASTER versions, which can be upgraded any time.**

The main data such as measuring rate, accuracy, measuring parameters and all optional upgrades are the same.

High flexibility allows for individual configuration of the screens with section and trend displays, (numeric and graphic), printing reports, statistics etc. as per specific needs, and operating methods. Several programmable access levels and passwords allow for optimum use and data safety.

### Basic Software Package



#### STEELMASTER

All functions for round products

- Display of mean value, min., max., ovality
- Hot and/or cold values
- Min./max. alarm limits
- Personalized screen
- Section screen
- Split screen in case of MULTIGAUGE
- Trend graph
- Head and tail scrap length indication
- Product recipe
- Product table / memory
- Statistics
- Printing reports
- Maintenance, calibration

### Sub-Modules



#### STEELDATA

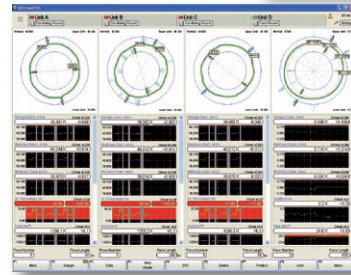
Data filtering, preprocessing, computation



#### STEELGAUGE

System configuration

The state-of-the-art software allows an almost unlimited selection for the graphical and numerical display of the numerous parameters:



MULTIGAUGE display of 4 measuring units

### Software Options



#### PROFILES

For squares, hexagons, flats, special profiles



#### POLYGON / EPM / FPS

EPM software for rounds and hexagons, for special asymmetric shapes and for the determination of out of round conditions



#### REBAR

For rebar with various geometries



#### SPC

For SPC statistics, configurable



#### STEELHOST

Standard protocol for ETHERNET TCP/IP



#### STEELDATABASE

For post production viewing and archiving (to be installed on external PC's)



#### REMOTE STEELMASTER

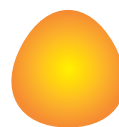
For networking via ETHERNET TCP/IP, with up to 10 independent PC workstations

### EPM, the new Method and Software for Special Product Geometries

ZUMBACH developed a novel method, EPM (Enhanced Profile Measurement, pat. pend.) for geometries with irregular or asymmetric shape aberrations (e.g. asymmetric overfill or underfill). In particular it is also able to capture and calculate polygonal shapes, which can occur in certain rolling processes or after subsequent peeling/grinding operations.

For any shape it will measure at high accuracy not only min., max. and mean diameters but also the true out-of-round deviation RONT as defined by ISO/TS 12181-1 as well as the inscribed circle MICI and the circumscribed circle MCCI.

An optional module named FPS, especially for 3-roll blocks, is available for calculating accurate values for min., max., mean diameter and ovality, corresponding to the values which would be found by manual 3-point micrometer screws (if both readings are related to room temperature). This FPS module additionally calculates the "Touch" and "Gap" diameters which are essential for the initial roll setting.



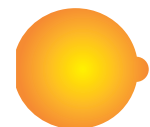
3-lobed



6-lobed



Irregular



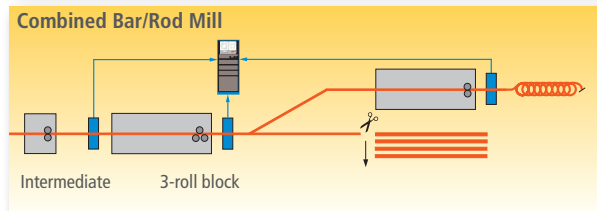
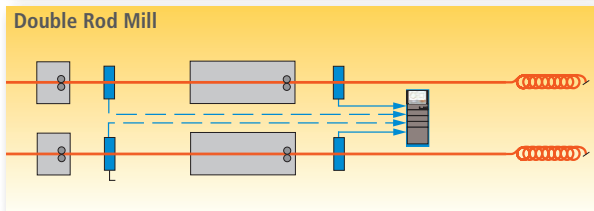
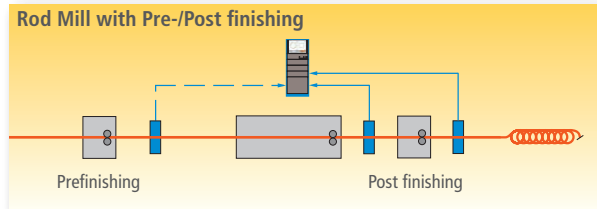
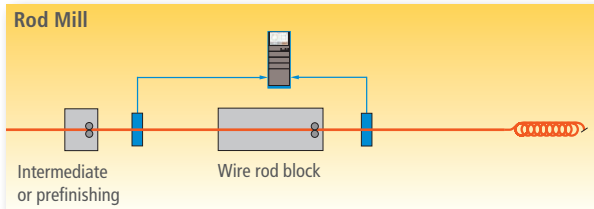
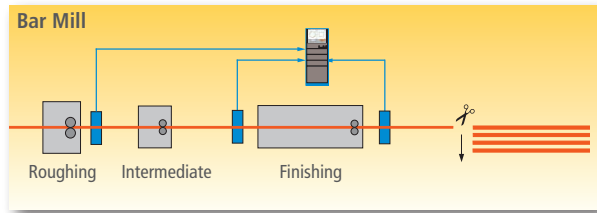
Asymmetric

# MULTIGAUGE CONFIGURATIONS

The STEELMASTER hardware and software permits to connect up to 4 measuring units to the central PC and to process and display all systems simultaneously. This configuration has proved highly successful over many years because:

- It provides a better and quicker overview and full process transparency
- It is economical
- Substantially smaller investment

The illustrations show some typical configurations that have all proven their efficiency.



## General Data of the Measuring Units

Measuring principle	Laser scanning tangential (shadow)
Measuring rate	Up to 1'000/s (optionally 2'000/s) per axis*
Laser	Laser diode red, class II
Number of measuring axes	1...6 (depending upon model)
Resolution	0.001 mm (.00004 in.)
Repeatability	Typically $\pm 0.01$ mm* (.0004 in.)
Measuring times (depending upon model)	SMS: 1 measurement (all axes simultaneously) in 1...20 ms* SMO: 1 complete profile in 0.4...4 s SMR: 1 complete profile in 0.1...0.3 s
Oscillation angle	Programmable up to 180° *

\* Depending upon model and version

## Standard Models

Model	Measuring field		Max. product diameter <sup>1)</sup>	
	mm	Inches	mm	Inches
SMS/SMO/SMR 100-SX <sup>2)</sup>	100	4.00	80	3.2
SMS/SMO/SMR 160-SX <sup>2)</sup>	160	6.30	135	5.3
SMS/SMO 310-SX <sup>2)</sup>	310	12.20	280	20.0
SMS/SMO 550-SX <sup>2)</sup>	550	21.65	500	20.0
SMS/SMO XXX-SX <sup>2)</sup>	Special ranges upon request			

Further models are available, depending on product and measurement range

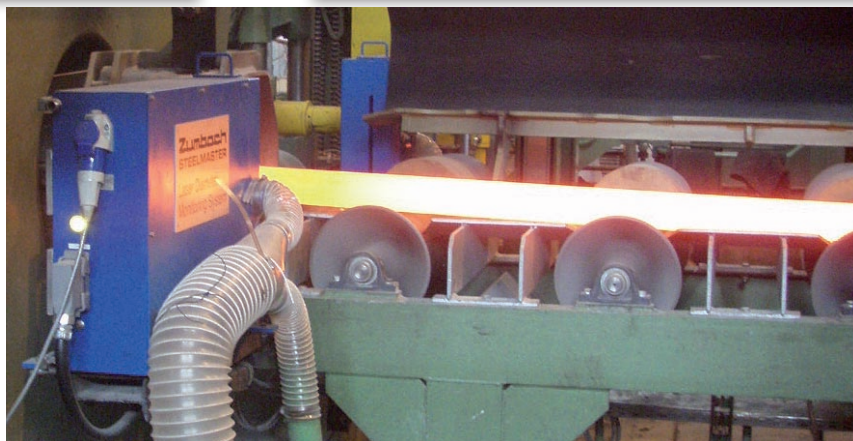
<sup>1)</sup> Max. diameter = depending on the guiding and vibration

Min. diameter = approx. 1 mm (.04 in.)

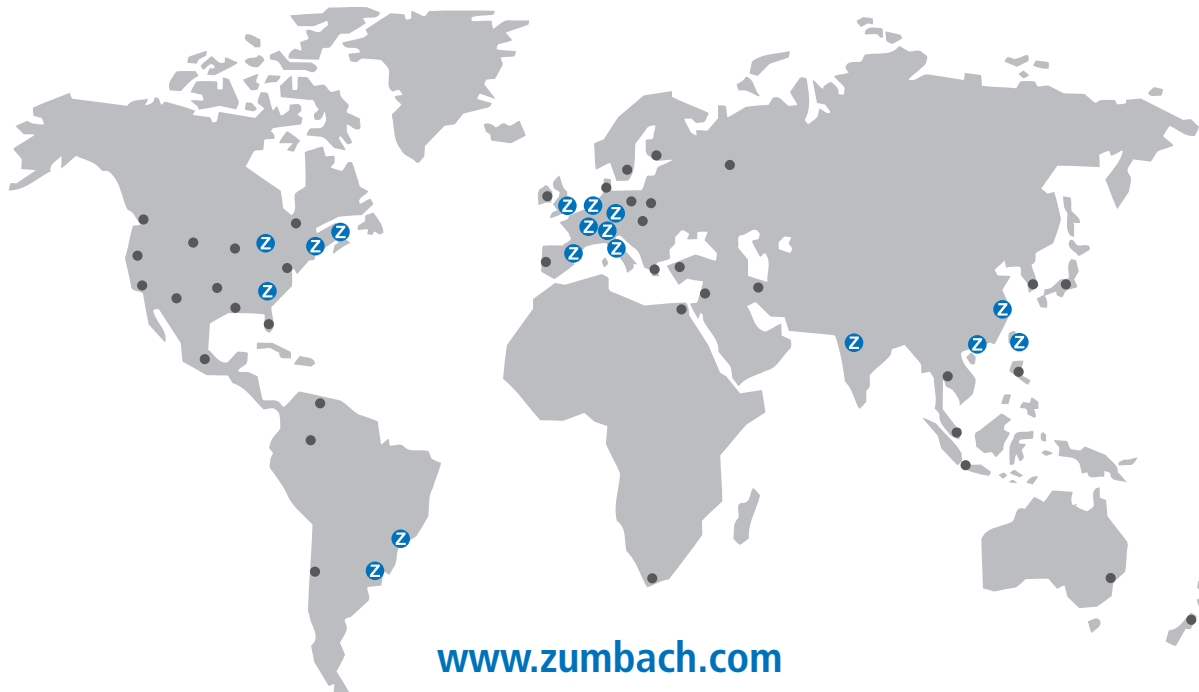
<sup>2)</sup> X = Number of measuring axes

► Please ask for detailed literature about data and dimensions of the individual models.

- Technical specifications are subject to change without notice



## Worldwide Zumbach Customer Service and Sales Offices



[www.zumbach.com](http://www.zumbach.com)

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