ZUMBA CH Electronics was founded in 1957 in Orpund, Switzerland, where it is still headquartered. Here and in the USA, we have established our centres for research, development, and manufacturing.

The goal of the ZUMBA CH group is to offer industry the most complete line of measuring and monitoring instruments of the highest quality and technology. Worldwide support by competent advisors and reliable service is provided by 13 ZUMBA CH owned enterprises and by over 40 agencies.

Headquarters in Orpund, Switzerland, Facility 1

North American Headquarters in Mount Kisco NY, USA

ZUMBA CH subsidiaries in:

- Italy
- Brazil
- Spain
- Argentina
- Germany
- India
- China
- France
- Belgium
- Taiwan
- Great Britain

Quality and Technology

ZUMBA CH products are based on cutting edge technologies and on international patents. One hundred percent quality control and documentation of quality are part of our reputation.

- Telecom Cables
  - Extrusion
  - Singles
  - Jackets
- Power Cables
  - Extrusion
  - CV Lines
  - Rewinding
- Fibre Optic Cables
  - Drawing
  - Buffering
  - Jacket Extrusion
- Wire
  - Wire Drawing
  - Wire Rod
- Plastic
  - Extrusion
  - Pipes
  - Profiles
- Rubber
  - Extrusion
  - Hoses
  - Profiles
- Steel
  - Metal
  - Bar, Rod
  - Pipes
  - Profiles
- Steel
  - Metal
  - Bar, Rod
  - Pipes
  - Profiles
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<td>Diameter / Ovality / Shape</td>
<td>ODAC® Laser Gauges</td>
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<td>Diameter / Ovality</td>
<td>MSD – CCD-Technology &amp; Multiple Light Sources</td>
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<td>Width / Height / Length / Profile / Shape</td>
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<td>Wall Thickness / Eccentricity / Diameter</td>
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<tr>
<td>Concentricity/Eccentricity + Diameter</td>
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<td>Cross Section Measurement (X-Ray Technology)</td>
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<td>For Hot Rolling and Processes in Harsh Environments</td>
<td>ODAC® / STEELMASTER</td>
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<td>Cold Steel and Metal Industry and Various Applications</td>
<td>ODAC® / USYS SYSTEMS</td>
</tr>
<tr>
<td>Worldwide Sales and Service Network</td>
<td>Addresses: The ZUMBACH Group / Representatives</td>
</tr>
</tbody>
</table>
Over 90,000 ODAC® measuring heads have been in use successfully for over 55 years. From international conglomerates to the small manufacturing company, ODAC® instruments are being used in multiple industries, contributing to their success.

The ODAC® brand does not only represent non-contact dimensional measurement, but also unusual insensitivity to dirt, the highest precision, and a compact design.

Important Features
- Very robust, lasting design
- Extremely insensitive to dirt
- Highly developed optics and scanning
- Highest accuracy and permanent calibration

Your Advantage
- Seamless quality control
- Short payback period
- Easily integrated anywhere
- Reliable operation even under rough conditions

Typical Gauge Types
- ODAC® single axis, compact, modular, with or without rail
- ODAC® single axis, as components
- ODAC® 2 axis
- ODAC® 3 axis
**General Data**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
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</thead>
<tbody>
<tr>
<td>Measuring principle</td>
<td>High-tech laser scanning</td>
</tr>
<tr>
<td>Scan rate</td>
<td>240...2000/s</td>
</tr>
<tr>
<td>Laser</td>
<td>Laser diode red, class II</td>
</tr>
<tr>
<td>Measurable materials</td>
<td>Any material, opaque or transparent</td>
</tr>
<tr>
<td>Max. speed</td>
<td>Unlimited</td>
</tr>
<tr>
<td>Temperature range</td>
<td>Operating: 0...45°C (-32...113°F)</td>
</tr>
<tr>
<td></td>
<td>Transport storage: -20...50°C (-4...122°F)</td>
</tr>
</tbody>
</table>

**Key Data**

- **Diameter range**: 0.012...500 mm (0.0005...20 in.)
- **Resolution**: 1 µm (0.000039 in.)
- **Repeatability**: down to 0.05 µm (0.00002 in.)

**ODAC® Measuring Heads in Operation**

ODAC® systems are used for products in most any industries, like Wire & Cable, Plastics, Rubber, Steel and Metal.

**Typical Solutions**

- Measurement, control, display of diameter, ovality, position, curvature, width, etc.
- Measurement in CV-lines
- Measurement and control of extrusion
- Multiple measurement
- "Hot-Cold" control
- Individual or centralized display systems

**Typical Products**

- Cable and wire of any kind
- Singles, sector conductors, profiles
- Fiber optics, compound fibers
- Pipe, tubing, hose
- Steel, copper, aluminium rod

**Compact Intelligence**

New generation of laser heads with high scanning frequency and versions for serial communication or PROFBUS or ETHERNET TCP/IP make direct communication easy. Optional local display.

**3 Axis Laser Measurement – The New Solution for Accurate Diameter and Ovality Measurement Advantages**

- 3 synchronized measurement axes on 1 single plane
- Reliable detection of out of round condition, regardless of the orientation of the product ovality.
- Detects any deviation from roundness of oval and out of round with polygonal shape (multi-lobe).
- Yields highly accurate mean value, regardless of the orientation of the product ovality.
- Integrated fault detector offers 3 times higher detection certainty and sensitivity than 2 axis models.

**Possible Measuring Modes**

- **Diameter**: 
  - 2 axis
  - 3 axis

**Possible Configurations for**

- **Diameter**
- **Gap**
- **Penetration**
- **Thickness**
- **Position**
With the MSD Diameter Gauges, ZUMBACH introduces a new series of measuring heads for on-line diameter and ovality measurement and control. This new line complements the high-precision laser diameter measuring heads of the ODAC® series. The MSD models achieve their ideal efficiency in terms of price and performance specifically for applications in the cable and plastics industry. The experience of 55 years with on-line and off-line measurement and control technology has led to a product characterised by the most current and sophisticated technology and functionality as well as by the well-known ZUMBACH accuracy and reliability. Thanks to our new MSD* technology (pat. pend.) it was possible to build very compact yet accurate measuring heads.

* = Multi-Source-Device

Special Features
- Cost-effective measurement solutions thanks to an ideal ratio between technology, performance and application
- Intelligent and innovative design: With special floor stands, the measuring heads can be swivelled upwards, out of the production line
- LEDs of different colours provide the lighting of the axes. There is then no interference between measurement axes, even with simultaneous measurement – and not even with reflective products
- Built-in external light filters to prevent ambient light affecting the measurement
- Active redundant measurement by means of up to 8 LED sources
- KW function (detection of surface defects)

Options / Accessories
A comprehensive amount of options and accessories is available for the complete range of MSD gauges. It is therefore possible to offer the ideal solution for any application.
- Vertically adjustable stands
- Local display
- Air curtains
- Accessories for the length detection
- Additional analogue interface box
- Various cable lengths
Both figures only show the beam trajectory based on 4 light sources. Both the MSD 100 and MSD 200 models are equipped with 4 light source pairs. Thanks to the new and unique ZUMBACH concept of up to 8 light sources for the models MSD 100 & MSD 200, multiple shadows on each axis can be evaluated (1 shadow = 1 axis). This allows a multi-axis measurement of smaller products (pat. pend.). Therefore the product must be arranged within the measurement field:
- For MSD 100: within ø 20 mm (.8 in.)
- For MSD 200: within ø 54 mm (2.1 in.)

**Application**
The MSD models are suitable everywhere and can be used in all cable manufacturing lines for measuring all kinds of wires and cables. They are indispensable tools in tube and hose extrusion lines for measuring pressure, waste water, heating tubes, etc. as well as all kinds of hoses. MSD devices can also contribute to quality monitoring for cold applications in the steel and metal industry.

**Measuring Principle**
The measuring principle is based on the latest CCD technology with several point-like LEDs as light sources. The shadow of the object to be measured, originating from the various light sources, is projected on a line sensor. The line sensor calculates the position of the shadow, thus resulting in different measuring points. These points generate four fictitious shadow lines, which define a square enclosing the object to be measured.

Thanks to the new and unique ZUMBACH concept of up to 8 light sources for the models MSD 100 & MSD 200, multiple shadows on each axis can be evaluated (1 shadow = 1 axis). This allows a multi-axis measurement of smaller products (pat. pend.). Therefore the product must be arranged within the measurement field:
- For MSD 100: within ø 20 mm (.8 in.)
- For MSD 200: within ø 54 mm (2.1 in.)

**General Data**

<table>
<thead>
<tr>
<th>Model</th>
<th>MSD 25</th>
<th>MSD 50</th>
<th>MSD 100</th>
<th>MSD 200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of measuring axis</td>
<td>2</td>
<td>2</td>
<td>2 (4 *)</td>
<td>2 (4 *)</td>
</tr>
<tr>
<td>Number of LED sources</td>
<td>2</td>
<td>2</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Measuring field M</td>
<td>ø 25 mm (1 in.)</td>
<td>ø 50 mm (2 in.)</td>
<td>100 x 100 mm (4 x 4 in.)</td>
<td>200 x 200 mm (8 x 8 in.)</td>
</tr>
<tr>
<td>Min. object diameter</td>
<td>0.25 mm (.01 in.)</td>
<td>0.5 mm (.02 in.)</td>
<td>1 mm (0.04 in.)</td>
<td>2 mm (.08 in.)</td>
</tr>
</tbody>
</table>

All models are as J version (connected to USYS systems from ZUMBACH), RS-232/-422/-485, PROFINET, Ethernet or PROFINET version available.

**Ergonomic Design**
By fitment of the optional floor stands, each measuring head model can be swivelled upwards by 110°. This allows for easier working access when needed in confined spaces and simple removal of the measuring head from the production line.
Our proven USYS processors are at your disposal for further processing of the measurement data and display.

**ODAC®-JK and -JP Versions with Modular Emitter and Receiver**

Special optics and special signal evaluation make these versions suitable for measurement of width, height, depth, and profile. Emitter and receiver can be mounted at practically any distance in order to accommodate for the product. This approach is also used under extreme conditions, where considerable measuring distances are required due to heat radiation or dirt emission. By utilizing 2 measuring heads and synchronization techniques, even large diameters, lengths or widths can be measured with high accuracy.

**Pivoting Support DVW**

are mechanical oscillating devices for ODAC® measuring heads. In the adjusted angle of +/- 12.5 ° or +/- 25 ° (depending about model DVW 1 or DVW 2), the device oscillates the measuring heads (mounted on a disc) continuously around the product. Thanks to its rugged design, the DVW units can be easily installed and operated in each production line without additional reinforcement elements. The universal design of the DVW enables the use of numerous ODAC® models, qualifying the device for a wide range of applications where precise measurement of height and width is required.
PROFILEMASTER® – Accurate In-line Profile Measurement
Using Light-Section Principle and Machine Vision

PROFILEMASTER® systems measure and monitor profiles and other non-round products during the production process. The complete cross-section is graphically displayed on the screen, based on a sophisticated image processor.

Measuring Principle
One or multiple lasers (depending on the number of modules) project a visible laser contour on or around the product and this is then registered by a similar number of CCD cameras (light section principle). Relevant geometrical sizes, like lengths, width, height, radii, angles etc., are continuously displayed and an alarm will be triggered in case of tolerance excesses. Practically all materials are measurable, except for total transparent or total reflective objects.

A PROFILEMASTER® System for Any Requirement
When designing the PROFILEMASTER® system, concentration was focused on the most suitable solution in terms of price/performance ratio for the application.

- Due to the modularity of the PROFILEMASTER® system this goal could be achieved.
- The combination of 1 to 6 laser/camera modules allows the measurement of virtually all shapes, achieving an optimal measurement result with the smallest possible number of laser/camera modules.

Compact Efficiency
The PROFILEMASTER PMM 30/50/80 systems answers the demand for a compact, cost-effective and industrial proof model for all profiles, tubes, cables made of plastic, composites, rubber, metal, steel and other materials.

Benefits
- Increases the accuracy of your end product
- Improved process control
- Scrap reduction
- Savings on raw material and post processing costs
- Increased product quality = Higher customer satisfaction
- Quick and easy installation on existing production lines

Main Data
- Measuring field 1) Till 300 mm (11.8 in.)
- Light source Laser diode red, class 3R
- Operating system Windows® XP embedded

1) Depending on the model and on the product geometry and position; bigger fields on request.

Main data
- Measuring field Within ø 30/50/80 mm (1.18/2/3.15 in.)
- Min. product dimension 2 mm (.08 in.)
- Repeatability +/- 0.002 mm (.00008 in.)
UMAC® represents a line of ultrasonics based systems for wall thickness measurement and control of pipe, hose, tubing and cables. Each system consists of a highly developed UMAC® processor, interrogating up to 8 sensors at high speed. WALLMASTER systems process data from several ODAC® measuring heads and a UMAC® wall thickness measuring system. Automatic control of wall thickness and/or diameter is easily possible. Calibration can be automated by means of the DIACAL options.

Wall Thickness and Eccentricity Measurement
The UMAC® scanner measures the wall thickness at multiple points of the product. The sophisticated WALLMASTER processors display easy-to-understand information of product geometry and thickness values.

Measuring Solutions Made Possible with UMAC® WALLMASTER
- Diameters down to 0.3 mm (.01 in.)
- Wall thickness down to 0.05 mm (.002 in.)
- Multi-Layer up to 5 layers
- Pipe and hose up to 450 mm (17.7 in.)*
- Jackets on CAT 5, 6 ... 8 data cable
- Loose tube and thin jackets in general
- Plastic on plastic
- Insulation and jackets on cables
- Coatings over metal cores
- Continuous control of cable, thanks to measurement directly at the extrusion die head

* Bigger diameters upon request

Wall Thickness and/or Diameter Control
Pipe or tubing wall thickness or thickness of insulation or jackets of cable can automatically be controlled over the haul-off speed or the extruder rpm. Servo valves are available for control of the calibration vacuum or the support pressure.

UMAC® scanner versions

UMAC® A5 / 10 / 20  UMAC® R40 / R63  UMAC® RZ65  UMAC® Z50 / 100 / 180  UMAC® R for pipe
**Wall Thickness**

**Jacket Extrusion**
Remote display

**Tubing Extrusion**
Remote display

**Pipe Extrusion**
Remote display

**Data Acquisition, Processing and Display systems**
**USYS IPC 2 WALLMASTER / USYS IPC 8 WALLMASTER**
Modular multi sensor processors for one and multilayer products.

Display – 19” Touch-Screen to be mounted in 19” rack. Alternatively, desktop models are available.

**USYS IPC 2 / USYS IPC 8**
Multi sensor data acquisition and process control systems

**UMAC® CI**
High-tech measured value processors for ultrasonic wall thickness measurement

**Eccentricty**

**Diameter**

**DIACAL 8000 (Pat pend.)**
For Compensation and Automatic Calibration of the Wall Thickness. DIACAL 8000 is a smart method for the simplified calibration. Compensation of any wall thickness value (layer) through the wall thickness measurement of 2 diameter sensors (D2-D1/2). Max. 4 compensation controllers can be configured.

**Advantages**
- Precise wall thickness measurement of cable jackets
- Automatic calibration of the ultrasonic measurement through intelligent processing of the diameter measurement
- Economic solution because it employs the existing and essential diameter measuring instrument
- Optimises material consumption
- Generally improves the process
Magnetic/Optical Concentricity/Diameter Monitoring
For many years the inductive, rotating METREX® eccentricity gauges were considered the standard in the cable industry. Today, the high-tech ODEX® system is fast becoming today’s standard. It features full non-contact measurement and monitoring of eccentricity/concentricity, minimum wall, diameter and ovality and offers high precision.

ODEX® is the ideal solution for:
- Data cables (LAN, cat. 5...8)
- Telephone cables
- Automotive cables
- Electronic wire
- Building wire
- Special cables
- Coax, mini-coax

Your Benefits
- Material savings
- Increased production
- Better utilization of production lines
- Seamless process monitoring
- Problem-free adherence to standards
Concentricity / Eccentricity + Diameter

The ODEX® Concept (Pat. pend.)
ODEX® 10 utilizes the latest technology in laser optics and magnetic measurement. It's fully digital (DSP), extremely fast, stable and compact. ODEX® 10 is a novel concept from ZUMBACH for very accurate and reliable monitoring of insulation diameter and conductor eccentricity/concentricity during extrusion or other insulating processes of ferrous and non-ferrous conductors. The ODEX® measures eccentricity, diameter and ovality within microns (1µm = 0.001 mm [.00004 in.]). In applications of modern data cables cat. 5...8 and many other cable products, this often decides if the product passes or fails quality control requirements.

Distinctive Advantages ODEX® 10
• Very fast!
  – 4 x 1200 magnetic readings per second
  – 2 x 1200 optical readings per second
  – 1200 synchronized concentricity values per second
• For outside diameters as small as 0.08 mm (.003 in.)
• No recalibration
• As easy to operate as a diameter gauge
• Extremely compact only 110 mm (4.3 in.) wide
• No moving mechanics
• Measures also min. wall

Configurations for Any Budget
Integrated analog outputs, serial ports, and a modern bus system, PROFIBUS DP, allow for any imaginable configuration.

Measuring Head Only
With built-in processor and bidirectional communication to host computer or PLC.

Complete System
ODEX® measuring system with USYS processor.
Can be used together with other sensors (see also page 24/25).
According to choice:
  – USYS 200
  – USYS 2100
  – USYS IPC 1/2/8
RAYEX® is a State-of-the-Art X-Ray Measuring and Control Systems for Wall Thickness (3 layers), Eccentricity, Diameter/Ovality (Patents US 5 518 681, US 5 795 531 and CH 685 336 A5).

During the extrusion process, RAYEX® measures the wall thickness, eccentricity, diameter, and ovality of multi-layer cables with XLPE and EPR insulation, multi-layer pipes with foam core, composite pipes, and multi-layer hose. RAYEX® systems have been in use for years on various production lines and processes with great success:

- Steam – or steam/nitrogen lines
- Catenary lines
- Vertical lines
- Horizontal MDCV lines ("long die")
- In Silane, Sioplast/Monosil processes
- In foam core pipe extrusion

Your Advantages

- RAYEX®’s unique low radiation pencil beam enables an ultra short outer tube. Important for cold end position applications.
- Higher measuring accuracy, due to efficient non-ceramic coated beryllium protection system and pencil beam technology
- Unique pencil beam and protection system allows an ultra short measuring tube segment
- Simultaneous high measuring rates in X and Y axis
- User friendly operation thanks to an open, yet fully protected, and space-saving design
- Enhanced measuring accuracy without absorption parameter entry

Typical Display Screens

Cross-section of single-layer cables, e.g.:
- Foamed coax cables
- CATV-antenna feeder cables

Cross-section of Multi-layer Cables, e.g.:
- Medium voltage
- High voltage
- Special cables

Cross-section of Pipes, e.g.:
- Foam core multi-layer pipes
- Multi-layer hose
Cross-Section Measurement (X-ray Technology)

Safety
The radiation intensity is far below all international limitation standards and, therefore, does not represent a safety problem.

Accuracy Check
Thanks to a special verification system, function and repeatability can be tested and proven any time.

RAYEX® on CV Lines
Specific RAYEX® versions are available for use on CCV and VCV lines operated with nitrogen and/or steam. Conductor diameter and ovality can be measured in addition by placing an ODAC® laser measuring head in front of the extruder.

Depending on product and quality strategy, any RAYEX® system can be complemented with the following instrument to be installed at the end of the line:
- Additional RAYEX® with “hot-cold” function for automatic shrinkage compensation and monitoring of the drop effect.

Installation Possibilities

RAYEX® in Silane Extrusion
Even medium voltage cable, single or multi-layer, manufactured with Silane, Sioplast or similar processes, can be measured directly at the extruder very accurately.

RAYEX® S (static) in the Tube Extrusion
For foamed, multi-layer tube, rubber and other products, where conventional ultrasonic methods are not applicable.

<table>
<thead>
<tr>
<th>Process / Product</th>
<th>RAYEX® Model</th>
<th>Max. Diameter</th>
<th>Max. Wall Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCV</td>
<td>160 D</td>
<td>110 mm (4.3 in.)</td>
<td>40 mm (1.6 in.)</td>
</tr>
<tr>
<td></td>
<td>220 D</td>
<td>140 mm (5.5 in.)</td>
<td></td>
</tr>
<tr>
<td>VCV</td>
<td>220 D</td>
<td>160 mm (6.3 in.)</td>
<td>40 mm (1.6 in.)</td>
</tr>
<tr>
<td>Silane</td>
<td>220 D</td>
<td>80 mm (3.2 in.)</td>
<td>20 mm (.8 in.)</td>
</tr>
<tr>
<td>Tubes, Cables</td>
<td>160 S</td>
<td>60 mm (2.4 in.)</td>
<td>30 mm* (1.2 in.)</td>
</tr>
</tbody>
</table>
* Depending on material
On-line Capacitance Measurement with CAPAC® Systems
The measurement is based on the unique and patented principle of the “active measuring tube”. This system offers outstanding accuracy and stability. The measurement is not influenced by the water quality (pH value, etc.) or the line speed.

Important Features
• Precise continuous measurement of the capacitance of singles and cables
• "Pinhole" function. Detection of pores and tears in the insulation
• Direct connection of SRL/FFT Systems

Your Benefits
• Communication with host computers
• Statistical monitoring and documentation
• Distance between sensor and processor up to 200 m (650 ft.)

Electronic Units

<table>
<thead>
<tr>
<th>Main data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring Range (selectable)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Bandwidth analogue output</td>
</tr>
<tr>
<td>Ground potential analogue output</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Accuracy</td>
</tr>
</tbody>
</table>

* IA = Isolation Amplifier

Ultra Short, Low Noise Measuring Tubes
For mini-coax, coax and LAN cables. Advantages with a single 10 mm (.39 in.) measuring segment:
• High length resolution with low noise level
• SRL prediction up to 6.5 GHz
• 600 Hz bandwidth of measuring system
• High absolute accuracy
• Compact and robust design
Capacitance Measurement

Systems Configurations
The basic system consists of a MR measuring tube and an electronic unit in water resistant compact housing, protected as per IP 65. The compact box offers the user all modern data ports for connection to processors and display systems from ZUMBACH or to host computers and to local area networks.

Data processing and display units from ZUMBACH (USYS 20/200/2100, USYS IPC CELLMASTER®) or customer systems, such as PLC’s and Host computers.

In-Line Analysis (FFT) of Structural Return Loss (SRL)
This optional software allows the prediction of structural return loss, SRL, during manufacturing of the product. All standard systems are equipped with a very fast analog output, making short capacitance variations available. This signal is fed into a processor for fast “Fourier” analysis (Fast Fourier Transform, FFT) and the change of cable impedance is displayed on the screen in real time.

Applications
- Data cable cat. 5, 6...8 Up to 1200 MHz at 2500 m/min. (820 ft/min.)
- Coax, CATV Cable Up to 6 GHz at 500 m/min. (164 ft/min.)
Fault Detection, Surface Inspection

Your demands for a reliable and flawless detection of extrusion faults and surface defects are ever increasing. This applies to extrusion, jacketing, enamelling, drawing, and many other areas. For this reason, the use of optical fault detectors ("lump detectors") is very popular. These photometric detectors are able to detect small lumps, neck-downs, and other defects on wires, cable, tubing, etc., without being influenced by product parameters, line speed, vibration, etc.

Conventional Detectors

1 axis system 2 axis system 3 axis system

Significantly improved detection with the KW-TRIO principle
- 3 times higher detection reliability than conventional 2-axis systems
- Theoretically unlimited life expectancy
- Not sensitive to stray light
- Flexible mounting concept
- Integrated air curtains for cleanliness of windows

Surface Quality Inspection System

The SIMAC® is a modern surface inspection system for extruded products, like pipe, cable, and hose, where machine vision technology is used consistently. Mechanical design and software are the result of years of experience and refinement. The system takes into account the most diversified surfaces and colours, which exist in case of extrusion of plastic or rubber products. The SIMAC® system spots the smallest surface defects anywhere on the product, even at the periphery, with certainty.
Applications where SIMAC® Inspection Pays for Itself Quickly

- Hot water pipes
- Composite pipes
- Gas pipes
- Automotive plastic tubing
- Automotive rubber hose
- Multi-layer pipe and hose
- “Off-shore” products
- High voltage cable
- Fibre optic cable

Important Features

- Easy operation (human machine interface)
- Recording of faults DIS
- Digital Image Storage
- Fault classification
- Summary printout

SIMAC® … Detection with Machine Vision System/CCD Camera

KW – Highest detection accuracy with Photometric Lump Detectors

KW 13TRIO

- 3-axis model with powerful micro processor and full digital signal processing DSP
- Unique measuring principle and complex optics solution provide the highest detection accuracy and ensure immunity to stray and intense light
- Very compact design

Main Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of measuring axes</td>
<td>3</td>
</tr>
<tr>
<td>Measuring field</td>
<td>13 mm (0.5 in.)</td>
</tr>
<tr>
<td>Tolerance range setting</td>
<td>0.01...3 mm (0.0004...0.12 in.)</td>
</tr>
<tr>
<td>Tolerance range solution</td>
<td>0.001 mm (0.00004 in.)</td>
</tr>
<tr>
<td>Minimum fault length</td>
<td>0.2 mm (0.008 in.)</td>
</tr>
<tr>
<td>Smallest detectable fault (height)</td>
<td>0.01 mm (0.0004 in.)</td>
</tr>
</tbody>
</table>

KW 32TRIO & KW 32MONO

3- and 1-axis models can be installed in any position, standing up, suspended in up-side-down position, horizontally, etc. A mobile compact control and display unit KW 32 BAE can be installed in a flexible manner.

KW 32 BAE

- Illuminated graphic module to display values and messages
- Red, yellow and green tolerance indicators for signalling operating states
- Keyboard with function keys and numeric keypad for manual instrument setting
- Fixation at the operator station by means of the included wall mounting bracket (swivelling)

KW 32TRIO (3 axes)  KW 32MONO (1 axis)

Operating and Display Unit BAE 2-KW

KW 32TRIO & KW 32MONO

3- and 1-axis models can be installed in any position, standing up, suspended in up-side-down position, horizontally, etc. A mobile compact control and display unit KW 32 BAE can be installed in a flexible manner.

KW 32 BAE

- Illuminated graphic module to display values and messages
- Red, yellow and green tolerance indicators for signalling operating states
- Keyboard with function keys and numeric keypad for manual instrument setting
- Fixation at the operator station by means of the included wall mounting bracket (swivelling)

KW 32TRIO (3 axes)  KW 32MONO (1 axis)

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- Red, yellow and green tolerance indicators for signalling operating states
- Keyboard with function keys and numeric keypad for manual instrument setting
- Fixation at the operator station by means of the included wall mounting bracket (swivelling)
Dielectric Testing with the Spark Test Principle (Dry Test)
In-line fault testing on single conductors and jackets during the extrusion or rewinding process has become standard procedure today.

ZUMBACH Spark Testers can be used to test the most diverse range of cable products as per international standards, like IEC 62230, UL 1581, thanks to the multitude of electrodes, test voltages, and frequencies available. Data ports allow for easy integration with quality control systems (e.g. USYS).

Important Features
- Robust, durable
- Accurate, repeatable
- In compliance with standards
- Selective
- Optimum operation
- Available in all sizes

Vital for Quality Assurance and ISO 9000
is the CALIBRATOR SP. It is used for periodic verification and calibration of AC, AC-HF, DC, and Impulse Spark Testers of any model and any make. Complies with all Spark Tester standards.
- Test voltage and short circuit current measurement can be certified

Important Features
- Measures all existing categories of test voltages
- Measures test voltage, short circuit current, frequency, fault sensitivity
- Easily accessible on the line, thanks to compact and ergonomic design
Dielectric Testing / Spark Test

Thousands of ZUMBACH Spark Testers have been detecting blank spots and faults in processes like:

- Insulating lines
- Jacketing lines
- Rewind / Confection lines

Control and Display

Several operating units may be connected to the various electrodes for display of the test voltage, number of faults, alarms etc.

All spark testing systems can be interfaced directly or via existing data port to a central processor, PLC or to a USYS processor and, therefore, can be controlled remotely.

**AST-HF** and **DST** electrode units can also be controlled directly through PROFIBUS DP or serial RS connections. An additional control unit (RI) offers this option for the **AST L Spark Tester** as well.

<table>
<thead>
<tr>
<th>Model</th>
<th>Test Voltage (kV)</th>
<th>Max. Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AST L Standard</strong></td>
<td>15, 25</td>
<td>50, 90 mm</td>
</tr>
<tr>
<td><strong>AST L Heavy Duty</strong></td>
<td>15, 25, 40</td>
<td>130, 150 mm</td>
</tr>
<tr>
<td><strong>AST.40.FE200.100</strong></td>
<td>40</td>
<td>60...200 mm</td>
</tr>
<tr>
<td><strong>AST-HF</strong></td>
<td>15</td>
<td>12, 30 mm</td>
</tr>
<tr>
<td><strong>DST</strong></td>
<td>25</td>
<td>20, 40, 75 mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of current</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternate Current</td>
<td>50/60 Hz</td>
<td></td>
</tr>
<tr>
<td>Alternate Current</td>
<td>50/60 Hz</td>
<td></td>
</tr>
<tr>
<td>Alternate Current</td>
<td>50/60 Hz</td>
<td></td>
</tr>
<tr>
<td>Alternate Current</td>
<td>50/60 Hz</td>
<td></td>
</tr>
<tr>
<td>Neg. direct Current</td>
<td>3kHz</td>
<td></td>
</tr>
</tbody>
</table>

Electrode Units

AST.40.FE200.100
AST L Heavy Duty
AST L Standard
AST-HF
DST
Inductive Conductor Preheaters

ZUMBACH WST TEMPMASTER

Extrusion lines producing communication wire require optimum and repeatable conditions in order to produce valuable product at the highest speeds. Inductive preheating is clean and reliable. The adhesion is improved, humidity and other residues are removed from the conductor of data transmission cables (coax, Category 5 and higher). Many insulating materials can not be extruded successfully without preheating of the conductor. Cellular insulating materials require a uniform conductor temperature in order to produce a uniform cell structure and accurate electrical properties.

Important Features

• Appropriate preheater for any application
• Micro processor based
• Automatic self-checking feature
• Network ready
• Display of all relevant data
• Temperature measurement and control

Main Benefits of Wire Preheating

• Better product quality and improved consistency
• Higher line speeds are possible thanks to lower stress within the insulation material
• Shorter start-up times = less scrap
• Dielectric properties of the insulation material are more uniform and the process conditions are reproducible (important for data wires Category 5, 6, and beyond)
• Improved cell structure in case of foamed and foam/skin insulating material
• Preheating allows control of the bonding of the insulation material to the conductor
• Uniform conductor temperature maintained even during ramping phases
• Lasting improvements of the CpK value
• The aging characteristics of the insulation are improved substantially through better uniformity (reduced risk of insulation cracking due to mechanical stress, e.g. bending of the wire)
• Oil and water residues on the conductor surface are cleaned away by evaporation
Conductor Preheating / Temperature Control

Operating Principle of an Inductive Preheater
The wire to be heated is looped around the heaves (pulleys) of the preheater and forms a resistive loop. Based on the resistance of the conductor material, on the line speed and on ambient and preheat temperature, a specific voltage is supplied to this loop by an inductor which induces a current. This heating current is applied and without any contact to the product.

Preheater In-Line with Other ZUMBACH Measuring Instruments
All ZUMBACH preheaters can easily be integrated into existing lines. Existing data ports allow networking with host systems and can be configured for “multi-drop” applications. Numerous other ZUMBACH measuring instruments offer comprehensive solutions for process monitoring and automatic optimization.

WST TEMPMASTER 206
Key Features
• Energy efficient
• Industrial long life design
• Dependable – Compact
• Easy access and threading
• Wire break detection
• Variable frequency = Uniform heating

Main Data
- Power: 8.5 kW
- Diameter range: 0.32 ... 1.63 mm (28 ... 14 AWG)
- Line speeds: 37 ... 1707 m/min (120 ... 5600 ft/min)

AUTAC 250S – Reliable Temperature Control System
AUTAC 250S allows for a precise control of the conductor temperature immediately before the wire enters the crosshead of the extruder. Direct digital temperature display. The instrument can be used independently or a full integration into the TEMPMASTER processor of the preheater is possible. The proven control software SIGMA-EXPERT provides for a continuous optimization of the heat output of the preheater or of the annealer module of a tandem line (wire drawing/insulating).

Main Data
- Temperature measuring range: Up to 160°C (320°F)
- Wire diameter: 0.32 ... 4 mm (.012 ... .16 in.)
- Line speed: Unlimited
Total On-Line Quality Control

ZUMBACH has the solution for all quality parameters. USYS systems process measurement data from a variety of sensors and communicate with the user and with host computers. USYS processors also control extrusion lines or other manufacturing lines with intelligent self-adapting controllers, SIGMA-EXPERT and Cpk-Pilot.

Communication and Networking

Today, the ability of sensors or processors to communicate with other computers or networks is essential. Therefore more and more ZUMBACH sensors have direct communication ports. For all other cases ZUMBACH offers a variety of interface units and USYS software to satisfy almost any need and concept.

CI Interface Boxes

Wherever a sensor has to communicate directly with a PC or PLC, ZUMBACH offers compact boxes with data ports, RS-232/422/485, PROFIBUS DP, Ethernet.

USYS Data Log

Windows™ based software for easy data collection from one or several ZUMBACH processors and for saving the data in text or Excel™ files.

USYS Web Server

This optional software enables the display of information from USYS processors at remote terminals. Communicates via LAN. Viewing with an Internet Explorer or other.

USYS Report Manager

Historical storage of all printed reports, trends and SPC. Simple XML viewer for traceability and re-print possibility (ISO 9000 focussed).
Common to all ZUMBACH processors is:
- Very easy to use
- Robust and stable
- No data loss or crashes
- Flexible, upgradeable

Depending on version, USYS fulfills a number of tasks, e.g.:
- Graphic/numerical display of all quality parameters
- Tolerance alarms
- Large product library
- Summaries of all kind
- SPC statistics
- SIGMA-EXPERT control and CpX-Pilot

### PC based USYS Processors

<table>
<thead>
<tr>
<th>Processor</th>
<th>USYS 200</th>
<th>USYS 2100</th>
<th>USYS IPC 1/2/8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor</td>
<td>Processor for 1 ODAC sensor or 1 CAPAC or ODEX system plus auxiliary functions: alarms, controller, statistics, interfaces.</td>
<td>Processor for 1 or 2 ODAC sensors or CAPAC systems or ODEX systems plus auxiliary functions: alarms, controller, statistics, interfaces.</td>
<td>Processor for 1 to 6 ODAC sensors, 2 CAPAC systems, ODEX systems, UMAC scanners, 4 controllers, plus auxiliary functions: alarms, controller, statistics, interfaces.</td>
</tr>
<tr>
<td>Display</td>
<td>6.4” TFT LCD</td>
<td>8.4” TFT LCD</td>
<td>Option: 19” Touch Screen</td>
</tr>
<tr>
<td>Graphics, trends</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. number of measuring systems</td>
<td>1 ODAC sensors</td>
<td>1 ODAC sensors</td>
<td>6 (USYS IPC 8)</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CAPAC systems</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>ODEX systems</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Spark tester, fault detector (KW)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serial ports</td>
<td>2</td>
<td>2 (option + 4)</td>
<td>2 (option 4 + 4)</td>
</tr>
<tr>
<td>Analog outputs</td>
<td>1</td>
<td>Up to 4</td>
<td>Up to 10</td>
</tr>
<tr>
<td>Printer ports</td>
<td>USB, Parallel</td>
<td>USB, Parallel</td>
<td>USB, Parallel</td>
</tr>
<tr>
<td>Controllers</td>
<td>1</td>
<td>1 (option Hot-Cold)</td>
<td>4 (option Hot-Cold)</td>
</tr>
<tr>
<td>SPC statistics</td>
<td>Option</td>
<td></td>
<td></td>
</tr>
<tr>
<td>USYS Data Log software</td>
<td>Option</td>
<td>Option</td>
<td>Option</td>
</tr>
<tr>
<td>USYS Web Server software</td>
<td>Option</td>
<td>Option</td>
<td>Option</td>
</tr>
<tr>
<td>USYS Report Manager software</td>
<td>Option</td>
<td>Option</td>
<td>Option</td>
</tr>
</tbody>
</table>

### Simple, Low Cost Processors

<table>
<thead>
<tr>
<th>Processor</th>
<th>AT 4</th>
<th>WIREMASTER</th>
<th>USYS 20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor</td>
<td>Low cost display and alarm unit.</td>
<td>Economic processor with various display and alarm functions. Especially for wire drawing or extrusion.</td>
<td>Economic and universal processor in various versions. For extrusion and other processes, including controller, mini statistics, alarms, interfacing.</td>
</tr>
<tr>
<td>Display</td>
<td>LED</td>
<td>LED</td>
<td>4.2” LCD monochrome</td>
</tr>
<tr>
<td>Max. number of measuring sensors</td>
<td>1 ODAC sensor or CAPAC system</td>
<td>1 ODAC sensor or CAPAC system</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Serial ports</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Analog outputs</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Printer ports</td>
<td>Serial</td>
<td>Serial</td>
<td></td>
</tr>
<tr>
<td>Controllers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USYS Data Log software</td>
<td>Option</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Multi-Sensor Process Control Systems with USYS 2100 or USYS IPC Processors

For all extrusion processes or other operations, from wire drawing to the finished cable, and for all instrumentation configurations there is a suitable USYS processor and software package. Depending on the application and customer requirements, these USYS processors are grouped in JACKETMASTER, WALLMASTER and CELLMASTER® systems. All USYS processors can easily be networked.

**JACKETMASTER**
For Single and Tandem Extrusion.
Based on USYS 2100 and USYS IPC.
- Up to 6 ODAC diameter sensors
- ODEX concentricity
- Up to 4 controllers
- Spark tester, fault detectors etc.

**WALLMASTER**
For Single and Tandem Extrusion.
Based on USYS IPC.
Especially suited for jacketing.
- Up to 6 ODAC diameter sensors
- UMAC wall thickness/eccentricity scanner
- Up to 4 controllers
- Spark tester, fault detectors etc.

**Single Extrusion**
JACKETMASTER or WALLMASTER systems.

With basic instrumentation.

With extended instrumentation:
- **ODEX** eccentricity/concentricity and diameter gauge (insulation) or
- **UMAC** wall thickness gauge (jacketing)

**Tandem Extrusion** — JACKETMASTER or WALLMASTER systems.

With basic instrumentation.

With extended instrumentation:
- **ODEX** eccentricity/concentricity and diameter gauge (insulation) or
- **UMAC** wall thickness gauge (jacketing)
- Fault detectors etc.

Due to the number of application possibilities, we are unable to show all line configurations.
CELLMASTER®

For the control of “foam” and “foam skin” as well as solid insulation. Based on USYS 8100, these 3-loop systems measure, monitor, and control simultaneously in real time diameter, capacitance and degree of expansion.

- Data cable, cat. 5, 6…8
- Telephone singles
- Coax and other communication cable
If needed, a "hot-cold" control for capacitance and/or diameter is also available.

Important Features

- Easy operation
- Sophisticated software and 3 controllers (2 static) for:
  - screw rpm or line speed
  - position of telescopic cooling trough/quench point
  - temperature of the heat zone(s)
- Retrofit onto existing lines without problem
- Total communication with host or PLC, thanks to comprehensive protocol, USYS Data Log*, USYS Web Server* USYS Report Manager*
- Available as OEM version

*Ask for detailed data sheets

Control Algorithms

USYS systems work with sophisticated control software for efficient material saving.

SIGMA-EXPERT Control and CpK-Pilot

Intelligent, self-adapting system for dynamic control. With CpK-Pilot the target value will automatically be optimized to the lower specification limit.

This means important material savings!
(Only available for JACKETMASTER systems)

Hot-Cold Control

ZUMBACH systems with one measuring head each at the beginning and at the end of the cooling trough use SIGMA-EXPERT control software in order to compensate automatically for the shrinkage from “hot” to “cold” diameter. This function can be used individually or in combination with diameter and capacitance sensors for compensation of the “hot-cold” variations (control of expansion).
Typical Displays of the STEELMASTER System

- **Round**
- **Hexagon**
- **Simultaneous display of 4 measuring units**

### Key Data

<table>
<thead>
<tr>
<th>Product dimensions</th>
<th>0.1...1000 mm (.004...39.4 in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material, colour</td>
<td>Any</td>
</tr>
<tr>
<td>Principle</td>
<td>Laser scanning</td>
</tr>
<tr>
<td>Scan rates</td>
<td>Up to 1200/s/axis</td>
</tr>
<tr>
<td>Repeatability</td>
<td>Up to 0.002 mm (.00008 in.)</td>
</tr>
<tr>
<td></td>
<td>depending on gauge type</td>
</tr>
</tbody>
</table>


A combination of ODAC® laser measuring heads, proven by the thousands, USYS real-time processors and PCs with application specific STEELMASTER software, offers a solution to practically any measuring problem. Highly developed protection and motion devices guarantee reliable measurements, even under the most severe conditions.

In MULTI GAUGE mode, 1 STEELMASTER PC can process and monitor data of up to 4 gauges, depending on the configuration. Additional STEELDATABASE software is available for extensive data archiving and re-viewing.

Typical Solutions for Temperatures up to 1200°C

- Hot rolled products:
  - Wire
  - Steel Rod
  - Rebar
  - Steel Profiles
  - Seamless Pipe
- Continuous casting – rolling
- Forging (also Off-line)
- Extrusion of steel
- Glass, casting/drawing
Measuring Systems for Hot Processes basically consist of the following elements:
- Multiple ODAC® laser measuring heads
- Protection unit for measuring heads
- Cooling systems water and/or air
- Filter/blower unit for air purging of laser openings
- Remote displays and giant displays
- Mobility hardware

Depending on requirements, dictated by product and process, the system is assembled from standard components in optimal fashion.

<table>
<thead>
<tr>
<th>Systems</th>
<th>Typical for</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static, single-axis ECOGAUGE systems</td>
<td>• Continuous casting</td>
</tr>
<tr>
<td>with modular laser, emitter and receiver</td>
<td>• Billets</td>
</tr>
<tr>
<td></td>
<td>• Steel rod</td>
</tr>
<tr>
<td></td>
<td>• Pipe</td>
</tr>
<tr>
<td></td>
<td>• Glass</td>
</tr>
<tr>
<td></td>
<td>• Quartz</td>
</tr>
<tr>
<td></td>
<td>• Plasma</td>
</tr>
<tr>
<td>Static STEELMASTER SMS systems with 2, 3, 4 or 6 measuring axes. Integrated, compact design.</td>
<td>For measurements of several diameters over the total length, e.g.:</td>
</tr>
<tr>
<td></td>
<td>• Steel rod after finishing</td>
</tr>
<tr>
<td></td>
<td>• Pipe after calibration stand</td>
</tr>
<tr>
<td>Oscillating STEELMASTER SMO systems or multi-mode systems oscillating-static with 1, 2, 3, 4 or more measuring axes. Integrated, compact design.</td>
<td>For cases, where the complete diameter profile has to be covered.</td>
</tr>
<tr>
<td></td>
<td>• Steel wire and steel rod after final stand</td>
</tr>
<tr>
<td></td>
<td>• Seamless pipe after calibrator</td>
</tr>
<tr>
<td>Rotating STEELMASTER SMR systems with up to 3 measuring axes. Novel, highly compact device with revolutionary rotational measurement technology and unique, fully contact-free transmission of both power and measurement signals.</td>
<td>For fastest measurement of hot and cold rolled steel. Captures up to 10 complete profiles/second.</td>
</tr>
<tr>
<td></td>
<td>• For all high speed rolling mills with 2- and 3-roll technology</td>
</tr>
<tr>
<td></td>
<td>• Also suitable for short product lengths</td>
</tr>
</tbody>
</table>

By using one or several ODAC® measuring heads in combination with a USYS processor and application specific software, practically every measuring problem can be solved in an optimum way. Where needed, optional protection devices are available for reliable operation.

QC MASTER
Off-line laser gauging systems for cold samples, rolled, machined, rectified etc. Also for 3-lobe or 6-lobe shapes. Accurate and quick measurement of cold samples with usual tools is often a problem and time consuming.

Benefits
- Excellent repeatability
- Only one measuring tool needed
- No subjective and no tool errors
- 100% correlation with Zumbach in-line gauge
- Time-saving method
Cold Steel and Metal Industry and Various Applications

Precise Diameter Measurement and Control in all Processes
There are a few application problems where ODAC/USYS combinations do not allow for continuous measurement and control, while guaranteeing maximum accuracy and quality of the end product.

Advantages
- Dimensions continuously in control
- Faster start-ups, less scrap
- Automatic control
- Instant recognition of anomalies
- Trend display
- Statistics, SPC charts
- 100% Quality control
- Documented quality

For Each Process and Each Product the Optimal System
For each process, each product, and each budget, the required components are available, including:
- Measuring heads – 1, 2, 3 or more axes
- Processor for 1 or several sensors
- Specific software
- Protection, cooling etc.
- Peripherals, networking

Solutions for Special Processes
Unprotected or partially protected systems at a reduced cost are available for cold processes or where only medium temperatures are present.
- Continuous casting/rolling of copper and aluminium rod
- Extrusion of Aluminium, Brass, Lead
- Thermal treatment, cooling
- Cold rolling and drawing
- Quality control lines (NDT)
Worldwide Sales and Service Network

The ZUMBACH Group

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• All technical data are subject to change without notice