The requirements expected from the in-line measurement technology during manufacturing are getting increasingly stringent with all power cables, from installation cables to EHV cables. The thickness, diameter and centricity tolerances of the insulation layers and sheaths are getting increasingly tighter, due to technical and economical factors. At the same time, there is a steady increase in the cable dimensions, in insulation thickness and in the outside diameter. Faulty spots on the surface and in the insulation must be reliably detected and documented.

The instruments are based on the following technologies:
- X-ray, dynamic or static for CV lines
- Ultrasonic for sheaths
- Laser scanning for diameter and ovality
- Image processing for surface defects
- Spark testing for dielectric

Zumbach solutions for nearly all processes and cable types:
- Extrusion of insulation and jackets for round and sector cables
- CV lines, CCV, VCV
- Silane lines
- Rewinding and test lines

Diameter, ovality, wall thickness, eccentricity
Diameter, ovality
Wall thickness, eccentricity
Lumps, neckdowns
Insulation testing
Surface Quality
Process control & display
The ever-increasing transmission rate and number of participants allowed by the worldwide networks require tighter specifications for communication and data cables.

This however causes manufacturing difficulties, especially in the in-line measurement of critical parameters such as diameter, centricity and capacitance. It is also necessary to reliably detect faulty spots. With the in-line FFT (Fast Fourier Transform) it is even possible to predict the Structural Return Loss or detect process problems.

With very small cable dimensions and high speeds, the requirements from the process and from the measuring technique become even higher.

Zumbach solutions for measurement, process, control and data communication:
- Conductor extrusion, solid or foamed
- Sheath extrusion of LAN cables
- Sheath extrusion, telecommunication cables
- Rewinding and test lines

Diameter, ovality
Diameter, ovality, eccentricity
Wall thickness, eccentricity
Lumps, neckdowns
Insulation testing
Capacitance
Temperature
Conductor preheating
Process control & display
Special cables are to be found in the fields of high temperature, safety engineering, chemistry, automotive, aeronautics, shipbuilding, robotics, superconductivity, medical technology miniaturization and many more. They also require specific in-line measuring solutions taking geometry and materials into account.

Also special shapes such as flat cables, ribbon cables, figure 8 cables, etc., must be tested. Drawn or enameled conducting wires made of copper, tungsten or from special alloys, with diameters down to 10 microns, require the utmost accuracy while drawing and during the enamelling process.

Zumbach solutions for typical processes such as:
- Conductor insulation
- Sheath extrusion
- Rewinding and test units
- Wire drawing
- Enamelling, multiline

- Diameter, ovality
- Diameter, ovality, eccentricity
- Wall thickness, eccentricity
- Lumps, neckdowns
- Insulation testing
- Profile, shape
- Multiline configurations
- Process control & display
Fibre optic cables make very particular demands on the in-line measuring technique. This is due to the extremely small dimensions of the fibre itself, with tolerances in the sub-micron range when drawing and coating.

A high accuracy must also be maintained with the next processes such as “Loose Tubing” and external jacketing.

In addition, local faulty spots must be recognised at every stage.

Zumbach solutions for nearly all steps of fibre optic manufacturing:

- Diameter, ovality, position when drawing the fibre
- When coating
- With the Loose Tubing process
- When extruding the external jacket
- For manufacturing tensile elements made of steel or “Kevlar” etc.

Diameter after the first and second coating and after curing

Lumps, neckdowns

Process control & display
ZUMBACH Electronics was founded in 1957 in Orpund, Switzerland, where it is still headquartered. Zumbach has pioneered many achievements for the Wire and Cable market, including:

- **ODAC®** laser scanners with HLF-High accuracy Large Field technology, CSS-Calibrated Single Scan technology, and fast measurement rates.

- **EX** Eddy Current Eccentricity and Wall thickness scanners were the industry’s first systems to provide in-line measurements of these dimensions and have served as the experience for the development of today’s ODEX® system.

- **CAPAC®, CDR-1** capacitance monitors, and foam control systems has enabled the development of today’s CELLMASTER® with build-in FFT and SRL analysis utilized by the communication cable sector.

- **UMAC® WALLMASTER** systems have evolved to be suitable for complex geometric shapes such as multi-layer cables, corrugated cables, concentric neutral cables, and more.

### ODAC® Laser Diameter and Ovality Measurement
- Individual scan calibration
- Integrated Lump & Neck detection on every ODAC®
- Extensive measurement features, including: Gap Penetration, Position etc.

### RAYEX®
**X-Ray Diameter, Wall Thickness & Eccentricity Measurement**
- Unique low radiation micro-focus pencil beam
- Highest accuracy and stability, due to non-ceramic coated beryllium protection system and pencil beam technology for dynamic and static models
- Simultaneous high measuring rates in X and Y

### ODEX®
**Combined Diameter and Eccentricity Measurement**
- Fully integrated solution. (Outer Diameter and Concentricity)
- Insensitive to wire vibration thanks to high speed scanning
- Automatic inductor control allows for installation in tight areas

### UMAC®
**Ultrasonic Wall Thickness Measurement**
- Novel concentric transducer adjustment
- Super High Rate mode enables up to 15,000 measurements/s
- SmartWall algorithm

### KW
**Surface Fault Detection**
- Immune to stray ambient light
- Highest detection accuracy thanks to unique measuring principle and complex optics solution
- All axes operate independently of each other

### Spark Tester
**Dielectric Fault Detection**
- One of the most extensive range of solutions in the industry
- One of the highest capacitive loading capability in the market
- Electrode solutions specific to market, according IEC, UL a.o.

### CAPAC®
**Capacitance Measurement**
- Ultra short measuring tubes: 10 mm (0.4 in.) only
- Very low noise level
- 600Hz bandwidth of the measuring system
THE COMPLETE SOLUTION FROM ZUMBAH

The goal of the Zumbach Group is to offer the Industry the most complete line of measuring, process control and data acquisition systems of the highest quality and technology, providing solutions for your entire process.

AUTAC
Non-contact Temperature Measurement & Control
- Slotted – no threading required
- Fast response
- Protected by wire break guard

WST TEMPMASTER
Conductor Preheating
- Variable frequency = Uniform heating
- Wire break detection
- Easy access and threading

SIMAC®
Surface Inspection with Machine Vision
- Up to 35’000 scans/s
- Min. fault size = 0.1 x 0.1 mm (0.004 x 0.004 in.)
- Length related scanning and fault detection

PROFILEMASTER®
In-Line Profile & Shape Measurement
- Light section principle
- Direct import of nominal values from CAD design
- 100% geometry control

USYS
Data Acquisition, Processing, Display & Process Control
- Extensive network integration capability (available also as black box)
- Data acquisition solutions
- Multiple sensor integration

DVW 1
Pivoting Measuring Device for 1 & 2 Axis Laser Gauges
- Economic solution for width and/or height measurement
- Very accurate readings, independent of position and twist
- Minimal value detection of the relevant dimension
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All technical data are subject to change without notice.