WALLMASTER

OD / ID / WALL
Measuring and Control Systems for Pipe

- PE
- PVC
- PEX
- CPVC
- Speciality Pipe

For You:
- On-Line Measuring and Control Solutions
- Benefits:
  - Reduced Start-up Time & Scrap
  - Reduced Material Usage with Closed Loop Control
  - Improved Quality Assurance & Production Management
- Data Acquisition, Processing and Display
- The Measuring Instruments
  - UMAC® – Ultrasonic Wall Thickness Scanners
  - ODAC® – Diameter and Ovality Measuring Gauges
- Worldwide Pre and Post Sales and Service Support
On-Line Measuring and Control Solutions

The demands for improved product quality and reporting on today’s plastic pipe manufacturers continue to escalate so that measuring and control systems are becoming increasingly necessary. Fortunately, the UMAC® WALLMASTER systems from Zumbach deliver the performance and capability to enable pipe manufacturers to exceed their industry quality requirements, while offering a process tool to improve their production control.

Reduced Start-up Time and Scrap

With measurements being taken directly after the sizing sleeve in Location “A”, the operator will get an immediate picture of the product’s centering. This quick response becomes invaluable when considering the amount of start up scrap produced on a typical production run. Although this start up scrap can be recycled in some cases, the cost of this processing becomes very expensive.

Without the ability to measure in the first vacuum chamber, the only options would be to do so after the first vacuum trough or most typically at the end of the line. In both cases, there is a significant delay in obtaining readings after each centering adjustment is made.

Assuming it takes five centering adjustments to get within specification, the left layout demonstrates that location “A” would yield 4 m of start up scrap, while location “B” would yield 154 m. This would result in savings of 150 m per line start.

On slower moving lines, the lost production time must also be considered. On a large diameter pipeline, it could take over 8 hours to produce 150 m of pipe.

Location “C” should be eliminated as a measurement option because the readings would be unreliable. Since ultrasound readings are subject to change with temperature, this location can see drastic temperature changes throughout the pipe’s profile. This is due to the cooling water’s temperature fluctuations and flow instability.

**Example Savings Calculation**

<table>
<thead>
<tr>
<th>Product</th>
<th>6” SDR11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>7.44 kg/m</td>
</tr>
<tr>
<td>HDPE cost</td>
<td>$ 1.35/kg</td>
</tr>
<tr>
<td>HDPE cost</td>
<td>$ 10.00/m</td>
</tr>
<tr>
<td>Savings per start based on above example (150 m saved)</td>
<td>$ 1.500 / start</td>
</tr>
<tr>
<td>Estimating two starts per week at 52 weeks the yearly savings would be</td>
<td>$ 156,000 / year</td>
</tr>
</tbody>
</table>
Reduced Material Usage with Closed Loop Control

When considering material savings beyond start up scrap reduction, one must look at the amount of material given away by running oversized product. There are two main reasons for this:

A. The product size is padded by the operator to ensure the minimum wall thickness is not violated during normal process fluctuations.

B. The standard deviation of the process is such that a higher wall nominal is necessary.

By measuring at the exit of the sizing sleeve, the controller can improve both scenarios listed above. Since the system is measuring so close to the extruder (or point of dimensional change), the system can react immediately to any normal process fluctuations. Zumbach’s Sigma Expert technology is key to reducing the standard deviation to a minimum.

With the ability to measure and react so quickly, we can vastly improve the standard deviation.

Once the standard deviation is reduced, our CPK pilot can then be put to use.

The CPK pilot will continually monitor this standard deviation and adjust the nominal set point on the line to a minimum setting that will ensure the minimum wall will not be violated. The direct result is a significant reduction in material usage.

Example Savings Calculation

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yearly HDPE use</td>
<td>1'800'000 kg</td>
</tr>
<tr>
<td>4% material reduction</td>
<td>72'000 kg</td>
</tr>
<tr>
<td>HDPE cost</td>
<td>$1.35 / kg</td>
</tr>
<tr>
<td>Savings per year for material usage reduction</td>
<td>$97,000</td>
</tr>
<tr>
<td>Savings per year for start-up scrap reduction</td>
<td>$156,000</td>
</tr>
<tr>
<td><strong>Total Savings per year</strong></td>
<td><strong>$253,000</strong></td>
</tr>
</tbody>
</table>

Improved Quality Assurance & Production Management

The on-board statistics and data collection make recording information about each reel or lot of pipe very useful. The data can be printed locally, saved to a USB storage device, and/or saved on the plant network system via our USYS Data Log software package.

The statistical graphs can be viewed on the local workstation or viewed through the local network by utilizing the USYS Web Server.

For example
- Quality control would view the SPC charts.
- Production manager would view the real time trends
- The forwarding department would view the reel reports

The USYS Web Server will allow multiple users to access the USYS screens on the plant floor by simply using the web browser on a PC.
**Data Acquisition, Processing and Display**

**USYS 8100 WALLMASTER**
Robust industrial data acquisition, processing and display unit. The USYS 8100 WALLMASTER offers a complete hardware solution in one package. It is offered with a touch screen or non-touch screen version with built in keypads, keyboard input, and USB ports (front and rear). Complete with Ethernet connection, RS-232/-422, and parallel printer port.

Various I/O modules are available for alarming control, process analog inputs, and analog outputs.

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**UMAC® CI**

**Advanced Signal Processing**
The Zumbach UMAC® CI also includes advanced signal processing capabilities for use when measuring more complex products including level and multi-trace noise filters and a special operating mode for ultra-thin wall thickness.

For specific applications, a high speed measurement mode (**SHR = Super High Rate**) may be employed sampling a product at a rate of 15’000 measurements per second.
Ultrasonic Measurement Principle

It is based on the "Pulse-Echo" principle. A piezoelectric crystal is excited by a short electrical pulse. The crystal converts electrical energy into mechanical energy, i.e. sound waves. When the sound waves encounter a difference in the propagation medium (for instance when passing from water to a synthetic material), a part of them is reflected to the crystal (echo).

\[ \text{Wall thickness} = \text{Sound velocity of material} \times t_2 \times \frac{1}{2} \]

Operator Friendly and Robust Software

Hard and robust software by utilizing an embedded operating system. We run our software from a flash disk to eliminate hard drives which fail in an industrial environment.

We also have full control over the system resources to prevent crashes often seen in other operating systems.

Zumbach SmartWall®

Zumbach ultrasonic wall thickness measurement utilizes the intelligent SmartWall® algorithm to dynamically analyze, configure and optimize all signal parameters during the set-up of each production run taking the guess work away from the operator.

Advantages
- Fully automatic signal optimization setting all key parameters to insure reliable ultrasonic wall thickness measurement.
- Advanced real time digital signal processing (DSP) and flexible trigger functions for best possible resolution and repeatability.
- True echo wave signal processing minimizes the effect of echo shape on accuracy.
- Dynamic signal analysis continuously monitors the quality of the signals being processed.

Operation
The system analyzes the raw echo trace to find and evaluate each echo position and polarity.

The velocity of sound in the material is calculated from the time between the echoes and the nominal wall thickness specification. The result is an approximate calibration of the measurements.

The signal gain is automatically determined for maximum accuracy and repeatability.
The Measuring Instruments
UMAC® – Ultrasonic Wall Thickness Scanners

UMAC® scanners measure the wall thickness at multiple points of the product. Numerous scanner models are available for specific products such as tubing, pipe, flexible hose, cable and more. The measured data is sent e.g. to the sophisticated WALLMASTER processor which displays easy-to-understand information of product geometry and thickness values.

<table>
<thead>
<tr>
<th>Model</th>
<th>No. of measuring points</th>
<th>Diameter range mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>UMAC R40-4K</td>
<td>4</td>
<td>1.5 ... 40</td>
</tr>
<tr>
<td>UMAC R40-6K</td>
<td>6</td>
<td>1.5 ... 40</td>
</tr>
<tr>
<td>UMAC R63-4K</td>
<td>4</td>
<td>2 ... 63</td>
</tr>
<tr>
<td>UMAC R63-6K</td>
<td>6</td>
<td>2 ... 63</td>
</tr>
<tr>
<td>UMAC R63-8K</td>
<td>8</td>
<td>2 ... 63</td>
</tr>
<tr>
<td>UMAC R63-8K2</td>
<td>8</td>
<td>20 ... 63</td>
</tr>
<tr>
<td>UMAC R90-4K (1)</td>
<td>4 ... 8</td>
<td>50 ... 90</td>
</tr>
<tr>
<td>UMAC R600-16K (1)</td>
<td>4 ... 16</td>
<td>400 ... 600</td>
</tr>
<tr>
<td>UMAC Z50-4K</td>
<td>4</td>
<td>5 ... 50</td>
</tr>
<tr>
<td>UMAC Z50-6K</td>
<td>6</td>
<td>5 ... 50</td>
</tr>
<tr>
<td>UMAC Z100-4K (2)</td>
<td>4</td>
<td>10 ... 100</td>
</tr>
<tr>
<td>UMAC Z100-6K (2)</td>
<td>6</td>
<td>10 ... 100</td>
</tr>
</tbody>
</table>

1) These UMAC R scanners are mostly custom made, due to the different sizes of the bulk heads. Solutions to fit bulk heads with a clearance of up to 600 mm are standardly available; engineered solutions for larger sizes available upon evaluation.
2) UMAC Z scanners for bigger diameters or customer specific solutions upon request.

UMAC® scanners for products with an OD between 50 up to 600 mm. Fixed transducer holder for 4, 8 or 16 measuring points. Ring shaped transducer mounting fixture custom configured for installation into existing vacuum tank. This UMAC R scanner is installed inside the vacuum tank on to the bulk head separating the first and second vacuum chamber.

Novel UMAC® Z scanners for cable jackets, insulation, tube, hose. Two quick hand adjustments to suit new product diameter within a few seconds. Large measuring range with the same scanner.

Ultrasonic Diameter Measurement

For larger pipes the Zumbach ultrasonic system will utilize the transducers to measure the outside and inside diameter of the pipe. For systems with four transducers, a two-axis measurement is provided. For systems with eight transducers, a four-axis measurement is provided.

Installation / Transducer Fixtures for UMAC® R

A very important aspect of utilizing ultrasonics in pipe is to utilize proper fixturing for the transducers. Zumbach Electronics has engineered solutions for mounting the transducer fixture at the front / hot end of the line.

Vacuum tank fixturing

Since mounting in the vacuum tank is preferred for fast product centering, and optimum control, we have developed a fixture that is customized to fit your specific tank designs. Our most common fixture is manufactured to align with the first “bulk head” seal. By doing this, the fixture utilizes the existing seals for the line, making product change over simple.

The UMAC® R-series holder utilizes the existing bulk head bolt pattern. Using the existing seal arrangement, the product change-over is made easy by the operator.

The design is such that the holder can be utilized in flooded or spray cooled tanks. Even in the extreme vacuum environment, the holder is immune to air bubbles and turbulence ensuring the extremely stable measurements.
ODAC® – Diameter and Ovality Measuring Gauges

The Zumbach WALLMASTER system also offers outside and inside diameter measurement and control by varying the level of vacuum. Depending upon the size of the pipe and the accuracy required, we have two methods for measuring the outside diameter: with UMAC® ultrasonic scanners or ODAC® laser scanners. In both cases, the inside diameter is calculated by aligning the wall measurements with the diameter measurements.

ODAC® Laser Diameter Measuring Gauges
1-, 2- or 3-axis measurement

<table>
<thead>
<tr>
<th>1-axis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring field</td>
</tr>
<tr>
<td>Min. product diameter</td>
</tr>
<tr>
<td>Repeatability</td>
</tr>
<tr>
<td>Scanning frequency</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2-axis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring field</td>
</tr>
<tr>
<td>Min. product diameter</td>
</tr>
<tr>
<td>Repeatability</td>
</tr>
<tr>
<td>Scanning frequency</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3-axis (ODAC TRIO)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring field</td>
</tr>
<tr>
<td>Min. product diameter</td>
</tr>
<tr>
<td>Repeatability</td>
</tr>
<tr>
<td>Scanning frequency</td>
</tr>
</tbody>
</table>

3-Axis Measurement
3-axis measurement is the perfect solution for accurately measuring the ovality of the pipe. This is very important when considering the connector requirements for pipes such as PEX and CPVC.

Comparison of 3- and 2-axis measurement:

By using a 3-axis arrangement the ability to detect faults in the pipe is vastly improved.
Why Choose ZUMBACH?
- Over 20 years of Ultrasonic Measuring System Experience
- Over 60,000 ODAC Laser Scanners sold Worldwide
- High Precision, robust Systems
- Global Presence in 13 Company-Owned Subsidiaries
- Vast line of products to support future needs

Worldwide Pre and Post Sales and Service Support

ZUMBACH Companies

ZUMBACH Agencies

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