DITTEL

ACOUSTIC EMISSION SENSORS

FOR GRINDERS

MARPOSS

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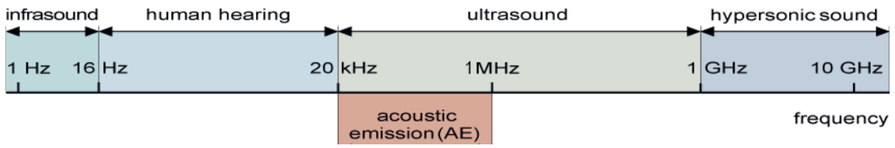
AE-Background & Working principle

When removing material from a workpiece during grinding, a noise is generated in the machine elements in the form of an acoustic emission. This acoustic emission consists of measurable frequencies mainly in the ultrasonic range. These frequencies are detected by AE sensors mounted in a location of interest, and are rapidly analyzed and acted upon by the connected electronics. Visualization is via integral or remote display, or machine HMI. The system allows for monitoring and control of the dressing and grinding processes that determine workpiece quality, tool wear and the condition of the machine itself. Whether a machine breaks down or stays in operation depends to a great extent on understanding when there is an issue and responding before a serious fault arises. For this purpose we offer a wide variety of highly sensitive static or rotating AE sensors (with non-contact signal transmission) that can detect even the slightest signal variation. This enables you to tap into the full production potential of your machine and consequently reduce costs.

The outstanding signal-to-noise ratio of AE sensors ensures that your processes are as stable as possible.



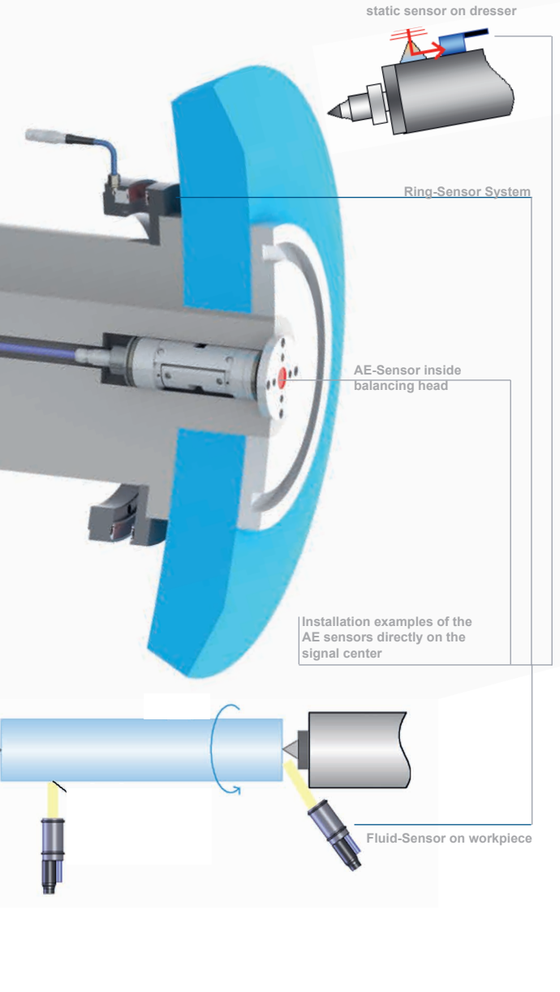
Acoustic emissions

(are inaudible, ultrasound signals. The electrical signals measured in this way consist of characteristic frequencies and amplitudes that are specific to cutting operations and can therefore be used to monitor the process)

The cutting process also generates vibrations at the point of contact between the tool and the workpiece. These vibrations manifest themselves as sound. These sound waves stress the material which leads to short-term plastic deformations / displacements in the nanometer range.

The dynamic displacements generate high-frequency vibrations known as acoustic emissions (AE) that can be detected beyond the point of direct contact between tool and workpiece with the aid of a piezo electronic sensor. They are measured as changes in electrical potential.

Dressing process with AE limit monitoring



Advantages

- Production control
- Grinding control and shorter cycle times
- Collision control reducing potential damage to the grinding wheel and machine
- Reduced maintenance costs and total costs
- Longer service life of the machine components

Acoustic Emission Sensors

DESCRIPTION

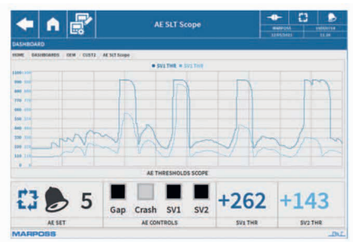
Acoustic emission monitoring technology analyses noise emitted when the grinding wheel touches the part or dresser. Noise is generated during the cutting action and propagates through the machine as ultrasound waves. As these waves pass through the various machine components, their frequency and amplitude change. By monitoring these waves, any changes during machining can be checked and corrective actions implemented automatically.

Effectiveness of the sensors is dictated by their positioning, as close as possible to the cutting point or area of interest.

Variation in acoustic emissions can indicate changes in cutting force due to the condition of the grinding wheel, and allow the cycle to be adapted, thus optimizing the production process.

Cycle time reduction is always a desirable goal. By detecting contact between wheel and part, feed rates can be increased with a resulting reduction in ‘air grinding’ . Thus optimum grinding performance is achieved as quickly as possible.

An envelope can be applied to the AE signal through the machining cycle to facilitate further analysis of the process. To avoid major damage to wheels, tools or spindles, provision is made for crash control monitoring . A collision is detected as quickly as possible and the machine stops immediately to reduce any possible damage and improve machine safety.



process control via AE envelope

Rotating AE-Sensors

M-Sensor/Rotary sensor

The sensor is positioned on the spindle, on the grinding wheel support flange or on the dresser disk. The stator is fixed to the protective cover or a correspondi-ng holder.

Applications for example:

Dressing rotating dressing tools:

- Form roller or Profile roller

Sensor position:

- On the grinding wheel spindle
- On the grinding wheel flange

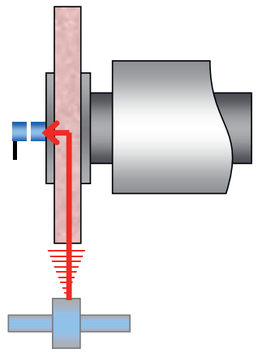
Additional functions:

- Monitoring of dressing and grinding processes

Customer benefits:

- Simple to assemble
- Measurements on the rotating shaft provide optimal signal to-noise ratio

TECH SPECS



Types	Dimensions [mm]	Thread/ Fastenings
Mini-M - Rotor	ø 14 x 9.6	M 4
Mini-M - Stator	ø 20 x 14	
M sensor (rotor)	ø 21 x 14.2 ø 25 x 11,5	M 6
M reciever (stator)	ø 21 x 18 ø 25 x 23	

Micro-Sensor/Internal spindle sensor

The rotary part is split and consists of the piezoelectric sensor and the elec-tronic signal transmission part. The dimensions of the sensor can be adapted to specific application requirements. The sensor is positioned on the grinding wheel or dresser spindle.

Applications for example:

Dressing rotating dressing tools:

- Form roller
- Profile roller

Sensor position:

- In the wheel spindle
- In the dresser spindle

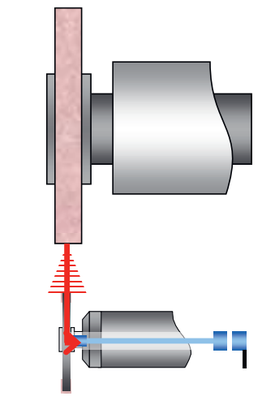
Additional functions:

- Monitoring of dressing and grinding processes

Customer benefits:

- Proximity to process and large signal recording area provide high signal quality

TECH SPECS



Types	Dimensions [mm]	Thread/ Fastenings
Micro-M Rotor	customer specific	customer specific
Micro-M Stator	customer specific	customer specific

Ring-Sensors

Ring-Sensor

The fixed and rotary part have a ring shape and are available in various dimensions and shapes so they can be installed externally on different models of grinding spind-les. The sensor is positioned on the flange of the grinding wheel, (dressing) spindle or on the workpiece support head.

Applications for example:

Dressing rotating dressing tools:

- Form roller
- Profile roller

Sensor position:

- On the chuck
- On the grinding wheel spindle
- On the grinding wheel flange

Additional functions:

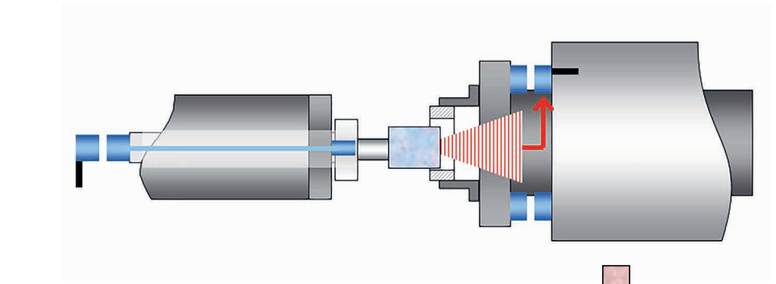
- Monitoring of dressing and grinding processes

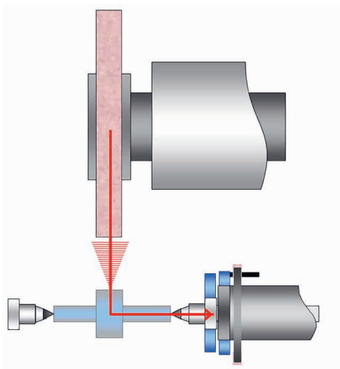
Customer benefits:

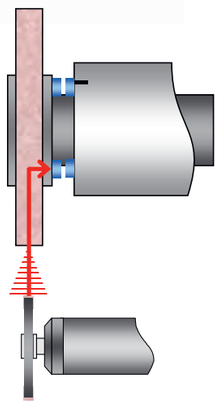
- Direct contact to dressing or grinding tool ensures highest signal quality

TECH SPECS

Types	Dimensions [mm]	Thread/ Fastenings
Ring Rotor	customer specific	customer specific
Ring Stator	customer specific	customer specific







Fixed AE-Sensors

Fixed installed acoustic sensors
Static sensor in compact design.
Signal transmission via the housing.
The sensor is placed on the workpiece / tailstock or attached to the dressing system.

fixed AE-Sensors:
Micro-S-Sensor, Mini-S-Sensor, Mini-Magnetic, S-Sensor & SF-Sensor

Applications for example:
- Stationary dressing tools:
- Single point diamond
- Blade type diamond

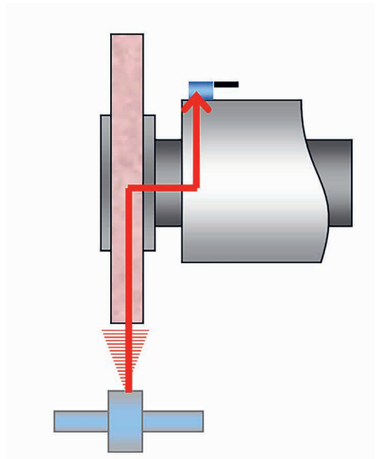
Appropriate sensor position:
- On the workpiece headstock
- On the tailstock
- On the machine´s headstock

Additional functions:
- Monitoring of dressing and grinding processes

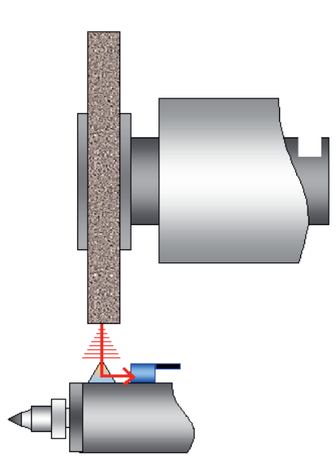
Customer benefits:
- Easy to assemble
- High signal quality

TECH SPECS

Types	Dimensions [mm]	Thread/ Fastenings
S-Sensor	ø 21 x 24.5	M 6
Mini-S-Sensor	ø 15 x 23	M 4
Mini-Magnet	ø 21 x 34.5	Magnetic
Micro-S-Sensor	ø 8 x 20	M 3
SF-Sensor	45 x 30 x 17 D 45 x 30 x 15 M	2 x M 5
Mini-SF-Sensor	29,5 x 20 x 10	
Magnetic Sensor	ø 40 x 40	Magnetic



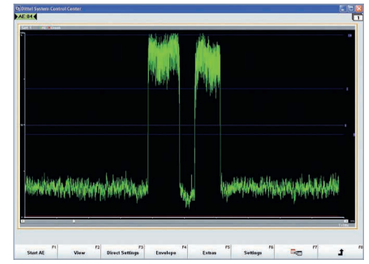
Static sensor on the housing of a hydrostatic spindle



Static sensor on static dressing tool

Fluid-AE-Sensor

Fluid acoustic sensor:
Ultrasonic acoustic emissions sensor with surface propagation and signal transmission via cable. The signal is transmitted through the machine lubricant/ coolant.



Dressing AE-signal
with AE-Fluid-Sensor

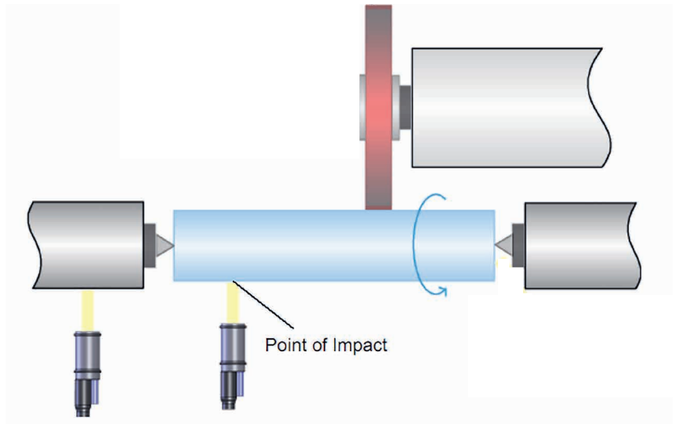
Applications for example:
- Dressing and process monitoring on rotating and static coupling surfaces

Signal transmission:
- From the workpiece
- From the tool
- From the workpiece headstock
- From the workpiece holder

Customer benefits:
- Easy to assemble & suitable for retrofitting
- Unsusceptible to the electromagnetic interference generated by the machine itself
- Connects all AE evaluation systems without additional preamplifier

TECH SPECS

Types	Dimensions [mm]	Thread/ Fastenings
Fluid Sensor	ø 15 x 30 ø 20 x 40	mounting bracket



Suggestions for sensor positions for grinding or dressing applications

The acoustic emission flows through the coolant stream to the AE fluid sensor. By electrically and acoustically isolating the AE fluid sensor from the machine tool, the machine's background noise is suppressed.