

Condition monitoring using of AE method

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Application of Acoustic Emission Method during the press monitoring process is used to diagnose and evaluate crack initiation.. Simple method of permanently fixed AE sensors on the machine tools are described. During the cycling working process the AE signals are detected and compared with threshold level. Special electronic device - CoMo is used for determination crack detection in every cycle. Whole process is controlled automatically and as a results the bad and good parts are sorted.

1) Principle of Basic Single Level Detection

On Fig. 1 is schematically shown basic principle of signal detection. Practical shape of real signal RMS is shown on Fig. 2 which is done through converter.

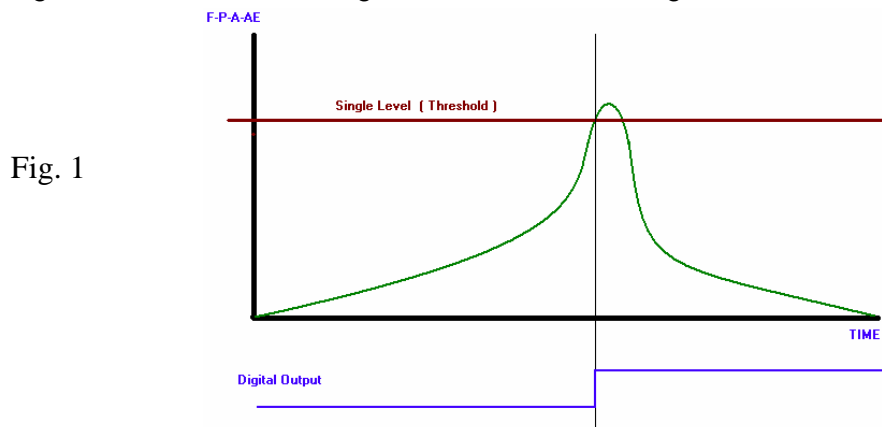


Fig. 1

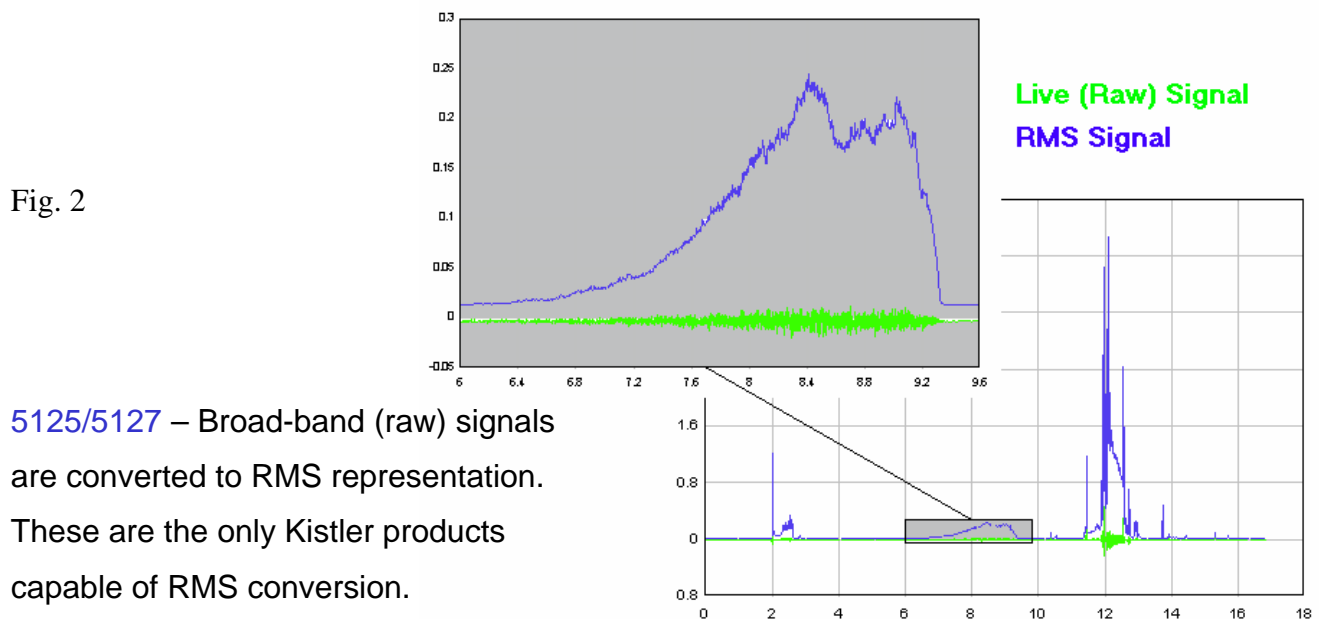


Fig. 2

5125/5127 – Broad-band (raw) signals are converted to RMS representation. These are the only Kistler products capable of RMS conversion.

RMS represents the amount of broadband AE “energy” present ...

- **RMS** signal is compared to a preset user defined voltage level
- When **RMS** Output exceeds preset level, an optocoupler will provide a digital output, and hold it until 1.3 seconds after signal returns below the pre-set level.

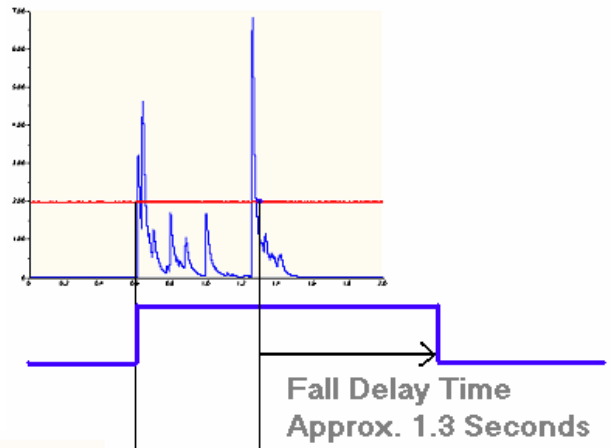
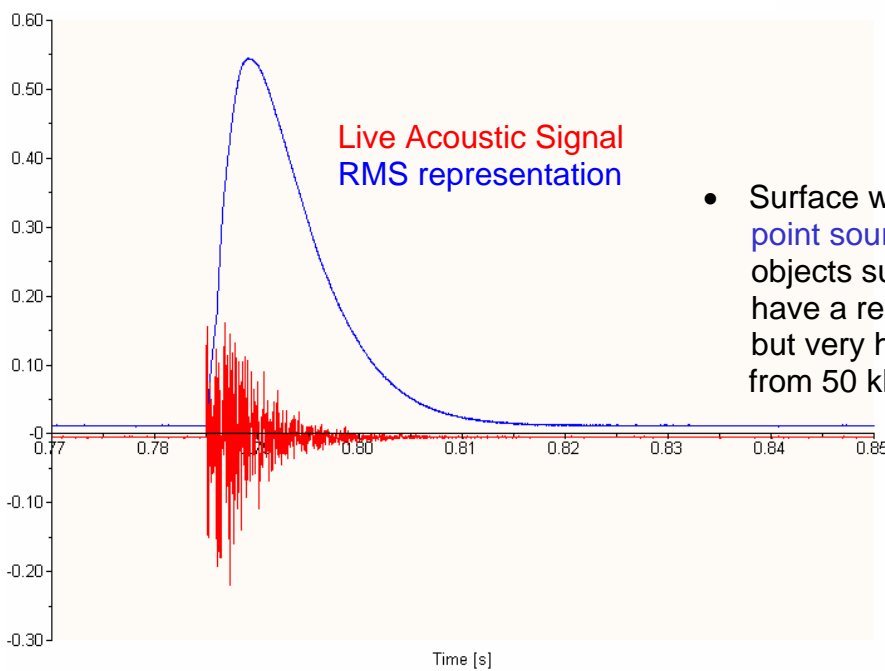


Fig. 3



- Surface waves propagating from a **point source event**, traveling along an objects surface. The waves have a relatively low signal intensity, but very high frequency, from 50 kHz to 1 MHz.

Fig. 4

2) Practical Configuration of experimental equipment

There are two ways of fixing the AE sensors to the object surface: a) magnetic mounting
b) tapped hole mounting

Both configuration are shown on Fig. 5 and 6.

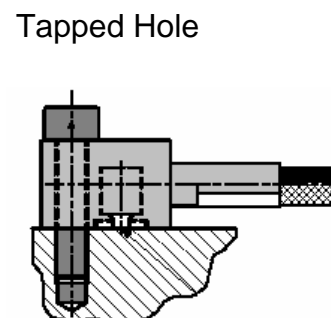
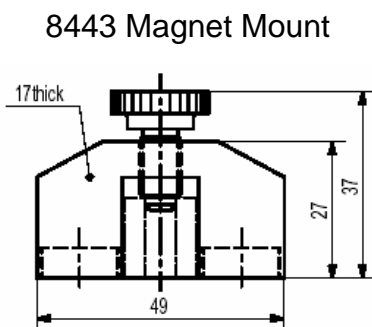


Fig. 5

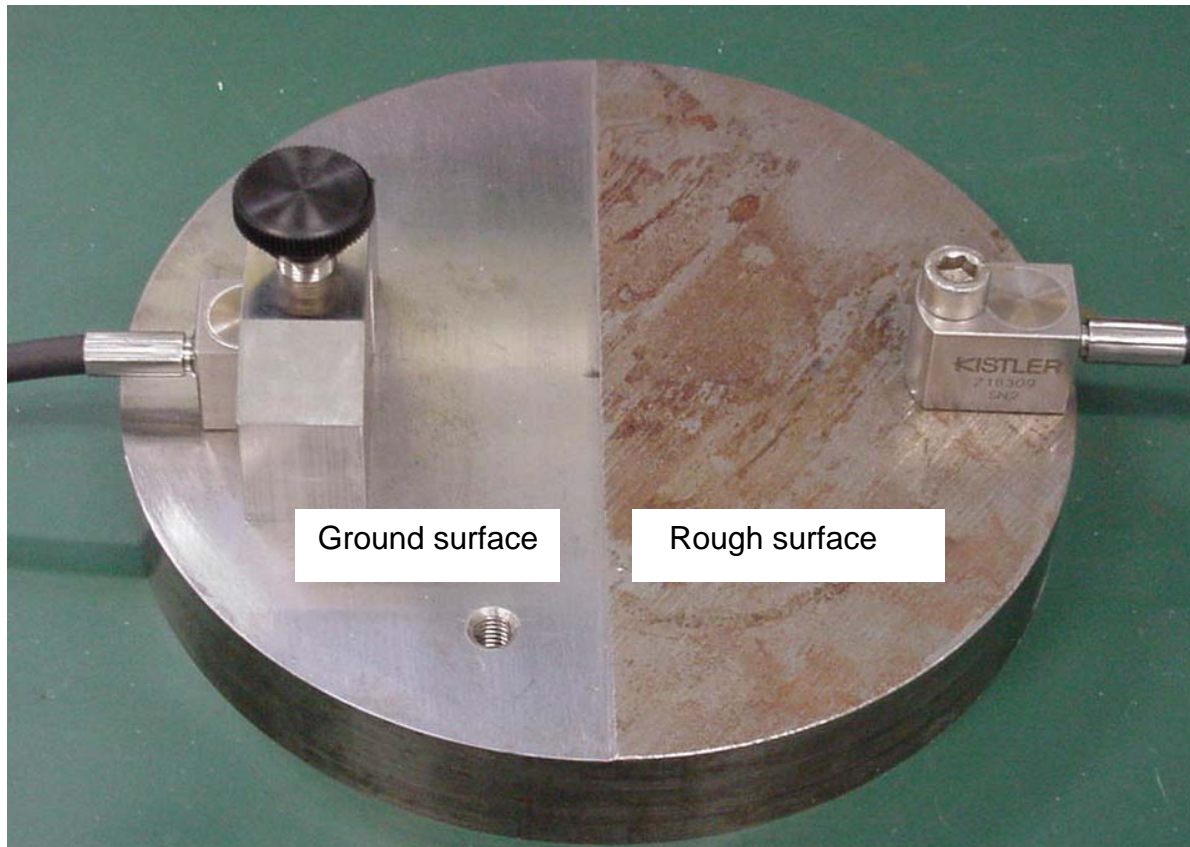


Fig. 6

3) Influence of mounting conditions on RMS AE signal

On Fig. 6 is shown mode of mounting the sensors on ground and rough surface. On Fig. 8 are graphs showing influence of different mode of sensor fixing on level of output signal.

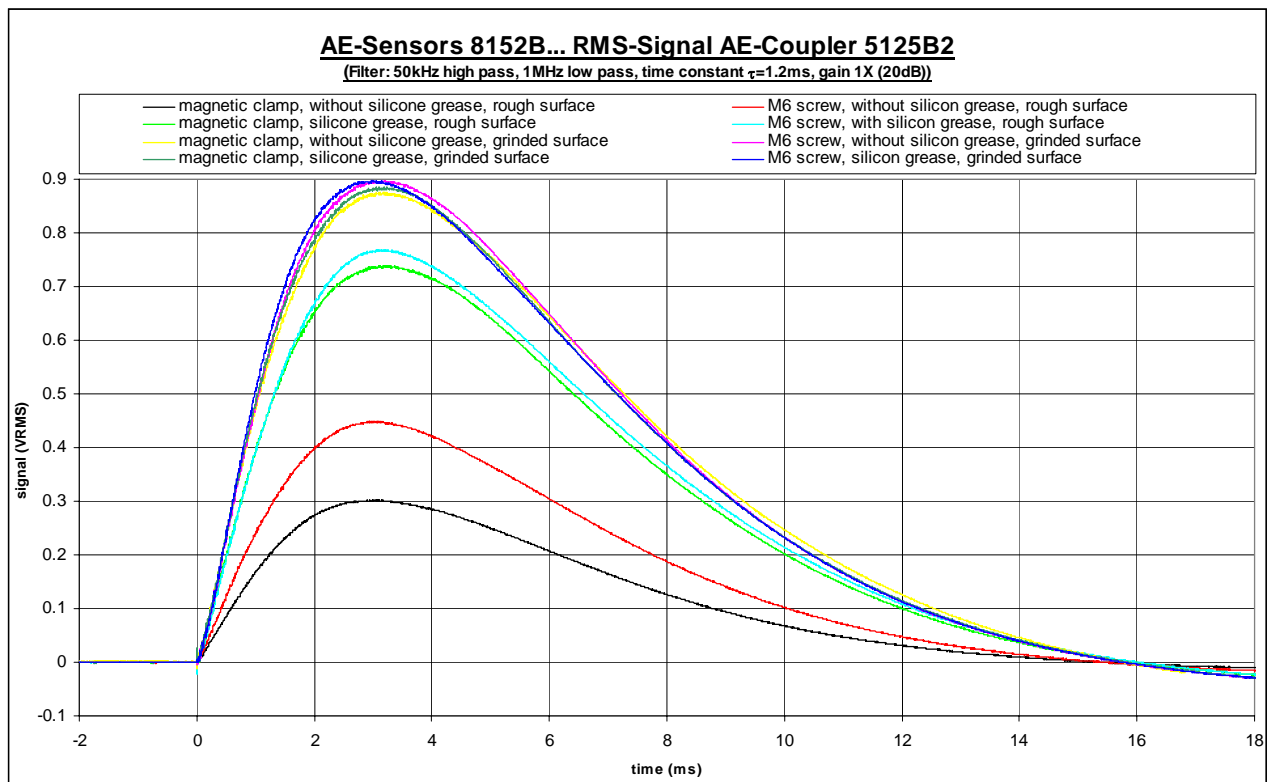


Fig. 7

Set DC level to provide output if RMS exceeds set level ...

8125B211 AE sensor with 5125 coupler.

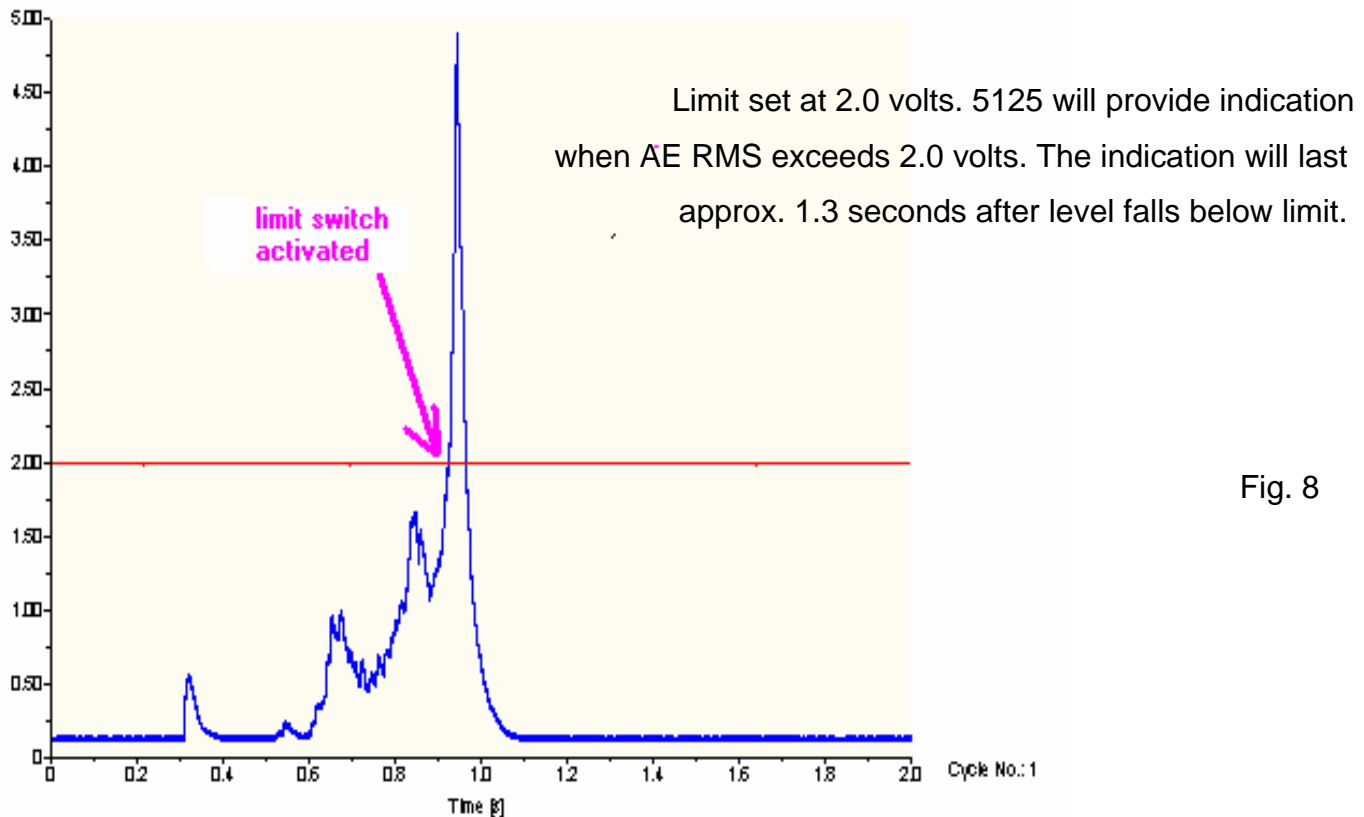
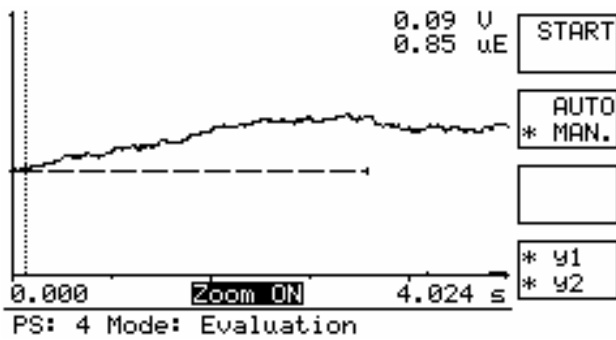


Fig. 8

4) AE – Application Types

- **Crack detection** - Detect cracks when they form ...
- **Fatigue testing** – collect data and give notification to a cyclic fatigue event occurrence. (plastic deformation)
- **Chip detection** - Detect the presence of a chip in a tool... also detect chipping as it occurs...
- **Tool Breakage Detection** - Instantly shut down a process when the tooling breaks ...
- **Deep Drawing** – determine defects when they occur during drawing, stop draw press during “necking”.
- **Stamping** - Determine **Good** vs. **Bad** stamping operation ...
- **Piercing** - Indicate the presence of a missing or malfunctioning punch ...
- **Scoring** - detect scratches and gouges as they occur in metal ...

No Cracks ...



Many micro – cracks...

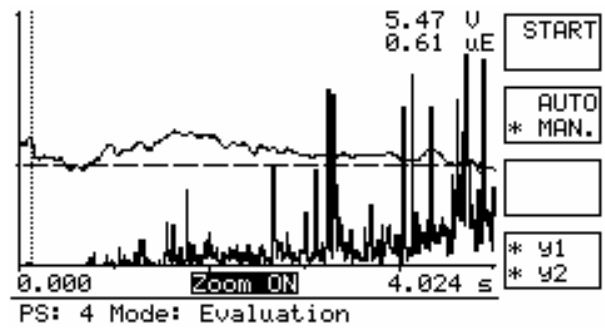
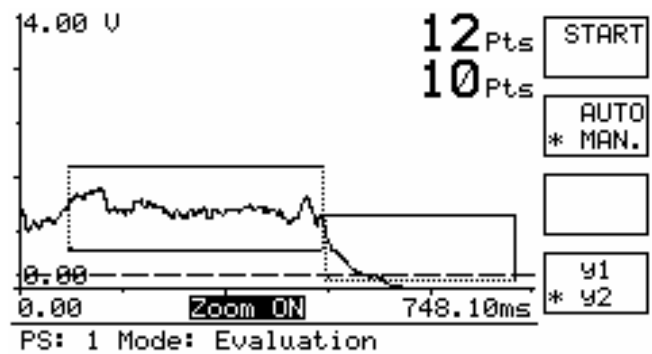
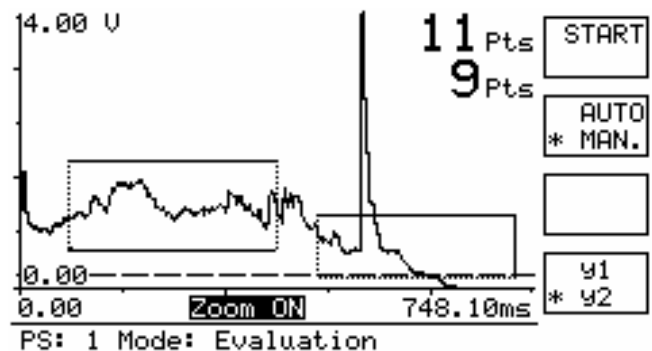


Fig. 9

5) Application Example: Detect a housing crack as occurs in a press fit operation.



No crack occurred ... RMS Output ...



Crack occurred during assembly ...

Fig. 10

6) Conclusion:

In the presented paper is shown one simple monitoring method using AE technology. As stated the main field of this application is in production process like stamping, fitting, forming, etc. AE method used in these monitoring processes conduce to improve product quality and to decrease costs by scraps elimination. Another advantage is based on simple installation without changes of the production machine.