



Real Time Punch Press Monitoring for the Prevention of Machine and Part Damage

... Real-Time Product Quality Control with Acoustic Emission

The Punch Press Monitoring System (PPMS), from Physical Acoustics Corporation (PAC), was designed for real time quality control and tool failure detection of punch press processes. The PPMS uses acoustic emission (AE) technology to detect very high frequency (>100 kHz) signals that are generated due to plastic deformation or cracks in the materials (tool, part and die) during punch processes. An ideal production process monitoring system, the PPMS provides early detection of tool or die failure and deterioration of production quality due to the tool failure, part crack and other irregular process conditions. The system helps to prevent catastrophic failure that may result in damaging important components or shutting down the punch press for major repair. The PPMS saves both time and money and increases the productivity and production quality for users.



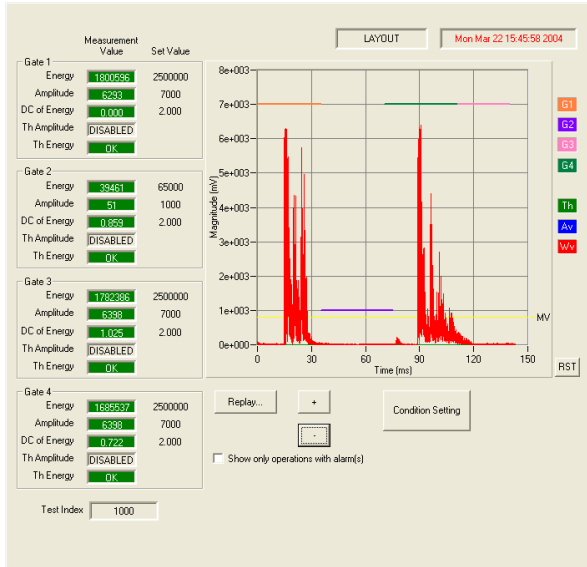
A Punch Press Machine

Applications of PPMS for Detecting:

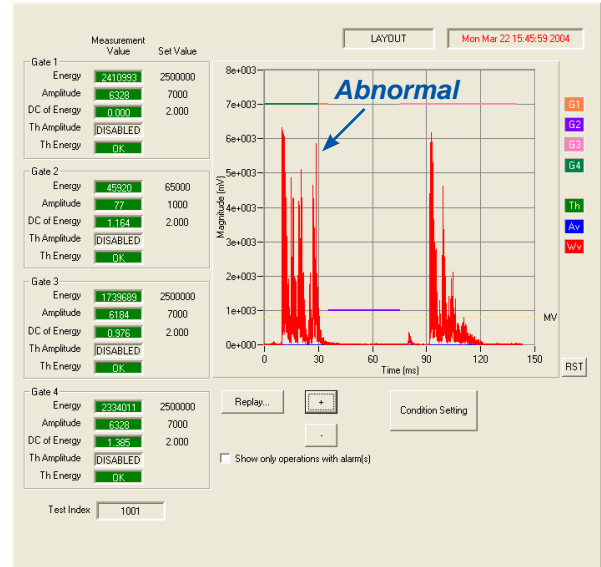
- Broken Punches
- Miss Cuts
- Double Hits
- Misaligned Punches
- Part Cracks
- Tool Wear and Breakage
- Die Wear and Cracks
- Lack of Lubrication

Featuring:

- Real time monitoring for detecting an abnormal condition in any single punch for a process of over 100 strokes per minute.
- Computer controlled monitoring process that is synchronized by the punch press control system.
- Alarm relay output to be able to stop the punch process in case abnormal condition is detected.
- Windows software and very well designed graphic user interface making the operation very user friendly and convenient.
- Touch screen panel for convenient and robust application in the workshop environment.
- High frequency sensor and band-pass filter making the system immune to machine vibrations and background noises.
- Full digital system built upon standard PCI bus with high speed (10 MHz) and high resolution (16 bits) data acquisition.
- Intelligent algorithms and software to allow very reliable process monitoring.
- Self-adjustable monitoring criteria to adapt to the condition change of long term punch processes.
- Permanent storage and replay of punch conditions and data to allow review of the process and the production quality.
- Four adjustable time gates (width and origin) to make the PPMS adjustable to various punch press production processes.
- Automatic trigger compensation to eliminate the trigger delay jitter of the control system.
- Internet interface to allow remote monitoring, central control and on-line support



Normal Punch

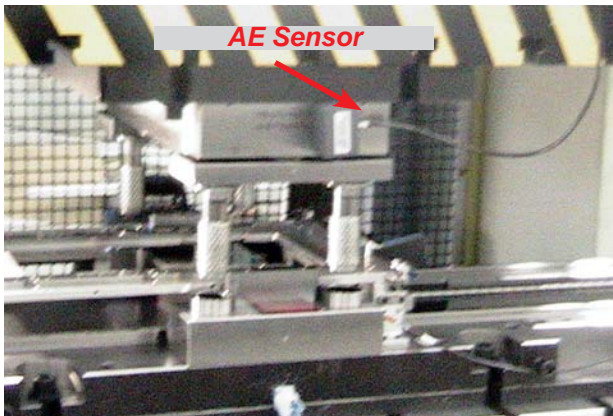


Abnormal Punch

System and Working Principle

The PPMS is composed of an AE sensor, which is a very sensitive device that detects non-audible high frequency (>100 kHz) acoustic signals, a preamplifier which may be either integrated into the sensor or stand alone, a high speed and high performance AE data acquisition/processing card installed in a computer chassis with a touch screen panel monitor, and software implemented with the intelligent algorithms.

The system is synchronized to the process by a relay output of the punch press in each punch stroke. It detects the baseline signal and automatically updates the baseline during normal punch process. AE signals detected can be partitioned on to four time windows that can monitor particularly interesting time periods of a punch stroke. AE features, e.g. Amplitude, RMS and Energy, are extracted from each time window and compared to the baseline data as well as the data obtained in the last punch stroke. Any abnormal punch, (broken punches, missed cut, tool wear, misaligned punch and double hits etc.) generates AE signals that deviate from the features obtained from the baseline and last punch stroke data, triggering the alarm to stop the punch process.



AE Sensor Installed in a Punch Press



AE Processing Card for PPMS

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