FORCE MODULE – TECHNOLOGICAL MONITORING

Product sheet

Is it crucial for you to have control over the manufacturing process? Through innovations, we have created a simple tool that will give you the control over the course of forming forces.

Advancing automation and constantly improving technical parameters bring new challenges in the field of process capability. The Force Module gives technologists and machine operators a tool that utilizes not only the value of maximum stroke force, but also courses of machine forces or individual operation forces.

Main benefits of the module:
Reducing the number of nonconforming products is achieved both by higher process capability and by taking nonconforming products out after the forming process is completed. This leads to a reduction in complaints in subsequent manufacturing process or from customers.

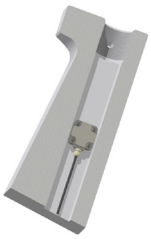
The protection of the tool is carried out by checking the course of forces and detection of deviations, which the operator removes either himself/herself or in cooperation with other parts of the company, and thus prevents overloading and damage to the tool. The average life span of the tool can be prolonged this way.

The protection of the machine against frame breakage, damage to the ram and other parts allows the machine to stop automatically when it detects conditions that would overload the machine in the next cycle.

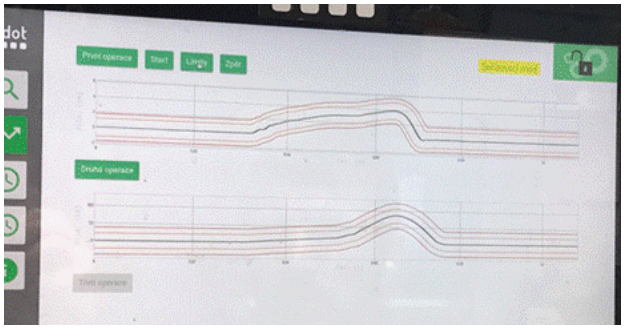
Ensuring the stability of the process enables the existence of reference courses, their trends and trends in the distribution of forces, with which technologists work in relation to the materials, tools and changes in technological processes. Technologists can evaluate the entire process during production and implement technological changes and development faster. Technologists are thus not dependent on the subsequent measurement of products.

The Force Module is suitable for all force machines such as presses, rolling machines of all types and sizes.

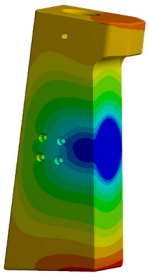
Wedge cross-section with piezoelectric strain gauge to measure the force of a given operation.



Wedge cross-section of a Hatebur press with SM type strain gauge. Fastening with M5 screws allows quick installation.



Visualization of data on the display panel.



Simulation of wedge deformation during the design of a technical solution.

SM type 4dot sensor used to measure the force of a vertical forging press.

Instalation

The sensors used are sensitive strain gauges, specially developed for forming machines, installed on each leg of the machine frame or under individual operations. Furthermore, the machine is equipped with a monitoring unit that acquires and evaluates data, and a display panel.

It is not necessary to obtain RAW data in advance to set up analyses. Force evaluation analyses are defined in general and are not adjusted according to the machine and the type of production. The monitoring implementation itself consists of setting the cyclic signal cutout and

limits. The monitoring implementation itself consists of setting the cyclic signal cutout and limits. The cutout is set by 4dot technicians, and the limits are then set by users themselves.

Numerical calibration (FEM simulation) is carried out for comparative measurement and monitoring of process stability. If the system is used for absolute measurement, a physical calibration (via hydraulic cylinders) must be carried out after the sensors have been installed. Once the analyses are set, the training of technologists and operators for the display panel manipulation begins. Technologists are also trained in the IDA web application, which allows remote access to force measurement.

Working with Force Measurement

Before starting the autonomous inspection, it is necessary to set the product type, release the first piece and teach the system the correct process. At the beginning of the learning process, the operator checks the machine, starts production, releases the first piece, and starts the learning algorithm. After learning the process, the operator sets the size of the two limit levels and saves the process for further production. During repeated production, the operator already proceeds from the saved course.

As soon as the autonomous check starts, the Force Module takes over the check of the process and the monotonous mental work. If a problem occurs such as not reaching the required force, the system sends a signal to take the product out of production. Conversely, if the force exceeds the machine shutdown limit, the system stops the machine, protecting the machine, tool, and production quality.

Example: A Piece of Material Stuck on a Tool

With multi-operation presses forging from a bar or wire, a smaller volume of material may stick to the knife and move it to the first operation, instead of taking this material out of production. This smaller volume of material will go through the first operation; however, the collets will not be able to transfer it to the next operation. At this point, the Force Module stops production. If the control would not be engaged, there would be two pieces of material in the next measure, which would damage the dies and overload the machine

Maintenance

If the system is designed for absolute measurement, a physical calibration must be carried out at regular intervals. If it is only used for relative measurement and process monitoring, the system is maintenance-free.

Edge Variant

Data processing takes place on the monitoring unit itself. Within the module, the following analyses are carried out in real time during each stroke:

- Course of forming force
- Maximum forming force during stroke
- Maximum strength of each operation or maximum strength of individual sides
- Axis course, point of application of force and point of application at maximum force
- Forming energy

The Edge Variant enables machine shutdown, visualization of analyses on the display panel and data transfer to the internal information system. The unit can control the data and to respond appropriately in milliseconds. This makes it possible to shut down the machine immediately in the event of a process error.

RAW Variant

Extension of the Edge Variant by RAW data sending, which is used by 4dot technicians to develop and set up more advanced analyses. This data will allow extended technical support.

Engineering Variant

If the manufacturing process exceeds the product rejection rate specified during system implementation, our engineers will check the cutout settings and limits. If they find discrepancies in the system settings, they will correct them and inform the system users.

	Edge	RAW	Engineering	
Initial setting of analyses and limits	✓	✓	✓	Instalation
API monitoring units	✓	✓	✓	
RAW data sending	—	✓	✓	IT
On-line application	—	✓	✓	
Notifications	—	—	✓	
Analysis and envelope check	—	€	P	Engineering work
Analysis of the cause of process deterioration	—	€	€	
Extended engineering support	€	€	€	

✓ *Yes* — *No* € *Posibility to buy* P *Periodically*

Extended Engineering Support

Service RAW data and MUSA analyses allow 4dot technicians to almost look inside the machine. RAW data allows you to perform an unlimited number of analyses, even retrospectively. Thanks to simultaneous signal processing, MUSA analyses make it possible to separate signal and noise, for example information about the manufacturing process and the condition of the tool. In the case of problems in the manufacturing process or on other parts of the machine than the force part of the machine, extended technical support may be used to gain insight into the behaviour of the machine during the manufacturing process.