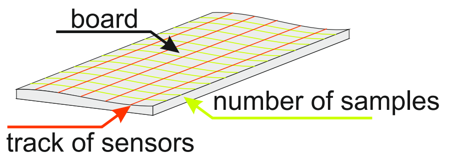
# Measuring thickness – boards, sheet metal, plastics and construction material

### Methods of evaluation

Deviation determined according to the selected method is compared with the limits for determining quality. The relay switches according to the settings of the facility.



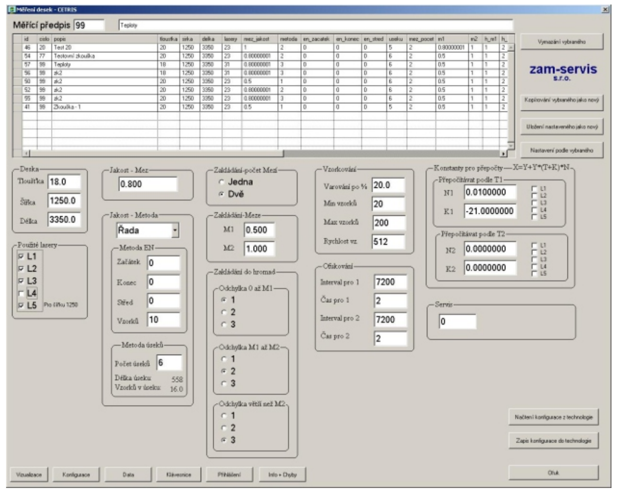

*Board*
The average of all samples from all rows is calculated.
The absolute deviation from the manufactured thickness is determined and this is further evaluated, as well as the deviation.

*Row*
This is calculated from the average of each row separately. Determined here is which of the averages has the largest absolute deviation from the manufactured thickness and this is further evaluated as the deviation.

*Segment*
The number of segments in the row in the configuration is determined, and these are evaluated separately. This number will be expressed in the taskbar as a percentage of the total length. The average is calculated from each segment of all the rows separately. Determined here is which of the averages has the largest absolute deviation from the manufactured thickness and this is further evaluated as the deviation.

*EN*
Sampling of the specified number of samples is performed on the outer rows and middle two rows at the beginning, middle and end. The average is calculated in each segment. So there are 12 segments, averages. Determined here is which of the averages has the largest absolute deviation from the manufactured thickness and this is further evaluated as the deviation.

Each method has adjustable parameters in the configuration table. Only a technologist with authorization has access to this table. The operator simply selects the type of manufactured board – its thickness and number of measuring regulation with measurement methods.

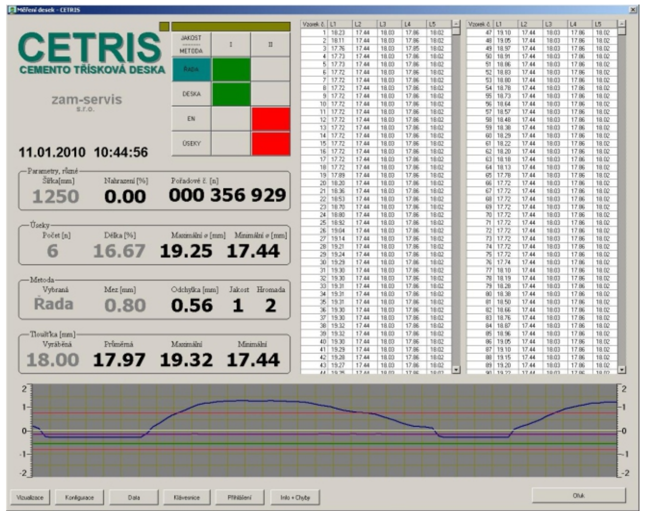



### Solution options

The system can be set up for different ways of measuring thickness, for example in two planes. The number of measuring lasers may be lower or higher. Certain restrictions may arise in determining the accuracy (number of samples) of the entire measuring system, which is dependent on the accuracy of the sensors used and the speed of processing the data.

### Conclusion

Thanks to the use of this type of measurement, the manufacturer has improved the quality of manufacturing cement boards and has saved costs on making non-conforming boards (scrap) and handling complaints. Also, it has increased its prestige on the market. The system can be deployed in other operations where the emphasis is on surface flatness. For example, in the glass industry, rubber industry, metallurgical industry or for manufacturing other types of construction material.




The catalogue has only those selected important parameters for your final decision. For project designs always ask for the user's guide for this product and any engineering consultation about possible uses.



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### Use

The system is used to measure the thickness of boards, sheet metal, plastic and other construction material in production. The immediate result of this measurement is cost savings in material, as the required value cannot be more or less. This prevents producing rejects.

Recently, the emphasis has been on the exact dimensions of building material such as cement boards, bricks, plasterboard, etc. Builders usually require their building materials to be accurate. The quality of building materials in exact dimensions can save them significant costs on further processing, for smoothing surface unevenness caused by inaccurate building material.

The output information from the measuring system can be used to distinguish the quality of the products, to directly control presses or extrusion machines, and of course to document the quality of the manufactured materials.

The main economic benefit for the manufacturing facility is savings on the cost of material if the material thickness is greater than the desired value. Furthermore, whenever the thickness is smaller than the technical specifications of the product, the product is labeled or categorized as a non-conforming product. Of course, the direct consequence of this finding is to immediately conduct an inspection of the previous manufacturing machinery to determine the cause. The operator will then have to adjust or repair the production line in order to eliminate the cause of manufacturing a non-conforming product.

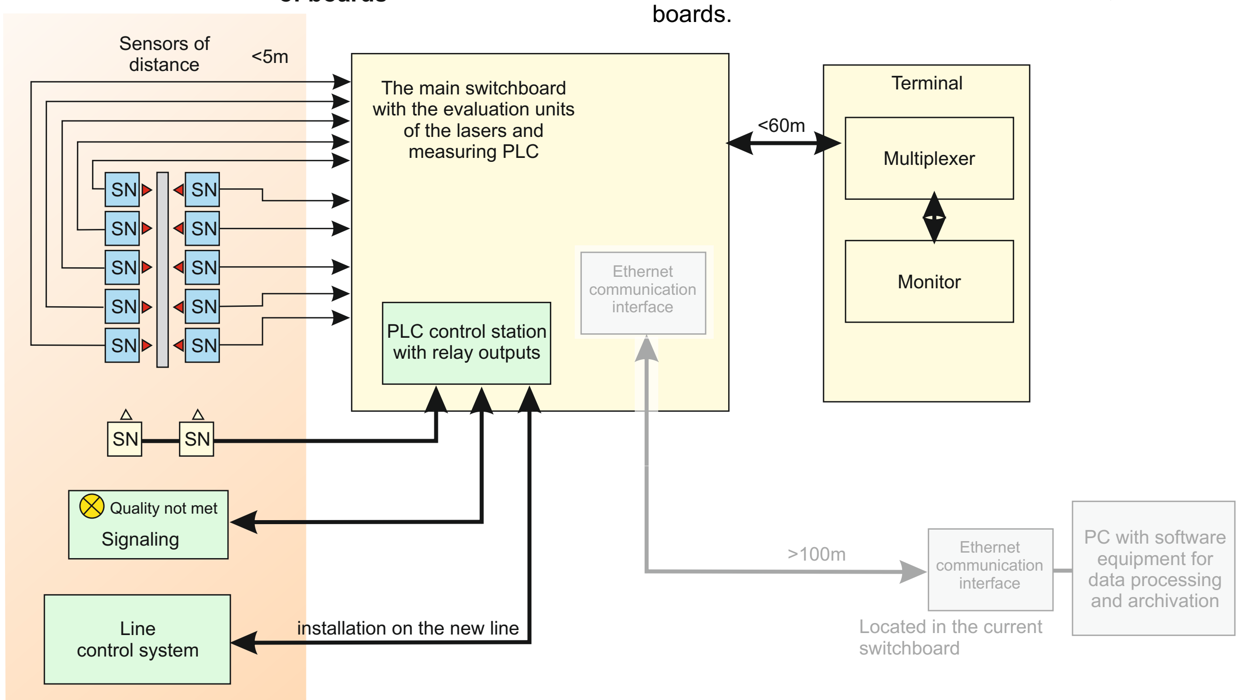
In some machines, the system can be used to automatically regulate the manufactured thickness of the material by e.g. adjusting the pressing cylinders.

The diversity of the thickness measurement system requires adapting the hardware and software to the local operating conditions. It is therefore a customized product. While engineering the material thickness system, our design team took into account the effects of the environment, of dust, temperature, vibration, type of material, its surface properties, and the desired precision. For each application, practical tests are conducted in the static mode and then under local operating conditions.

Preparing the system in this manner provides maximum comfort at minimal cost when compared to similar measurement systems of competing firms.

Here the application is set up to determine the thickness of cement boards at the end of the manufacturing line, where the system is making measurements and evaluations in accordance with the standards and quality of individual boards.

**Block diagram of measuring the thickness of boards**

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**Description of the system**

The system consists of a measuring part, an evaluation part and display terminal.

The measuring part consists of a height-adjustable frame containing measuring lasers located at defined intervals. The auxiliary optical sensor is used to determine the beginning and end of the board. The measurement starts and stops according to these sensors. The frame is optimally secured to the floor by special grips, which allow the frame to expand and eliminate floor vibration.

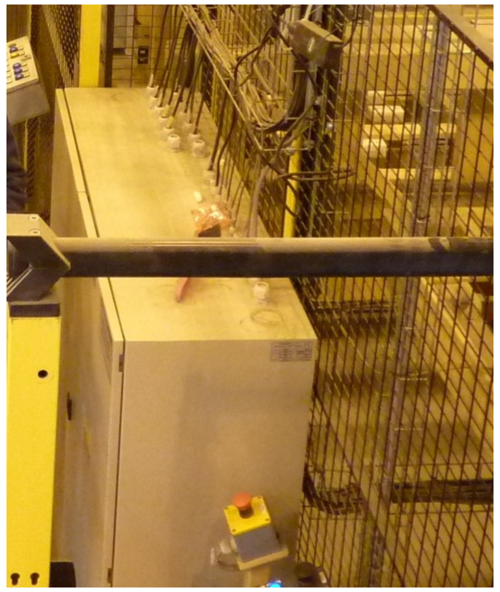
A properly designed frame structure is the main prerequisite for repeated measurements with minimal deviation. The material of the frame components has been chosen with regard to the temperature difference of the local environment. In an incorrectly designed frame, just one degree can change the resulting measurement on the gauge by millimeters.

A key part of the measuring system consists of precise laser sensors measuring distance. They are chosen in accordance with the desired final precision. The accuracy ranges from 1 mm to 0.001 mm. With required accuracy, price naturally increases. The type of measurement surface also has an impact on precision and price, such as transparency, structure, whether it is glossy or matted, etc.

Ambient temperature also has an impact on the precision of the laser sensor. In an environment with a small temperature difference within the working temperature range of the sensor, an automatic calibration method of temperature compensation is used from a generated calibration table. At ambient temperatures that exceed the operating temperature of the laser sensor, a special air conditioning box is used.

Cabling is run from the sensors to the PLC evaluation unit.

The evaluation unit has the shape of spacious switchgear in highly protected casing. In order to increase the speed of measurement, and thus the accuracy, the evaluation unit is placed in the vicinity of the measuring frame. The evaluation unit contains a backup power source for the system, output PLC, evaluation PLC, measurement units and terminals. The size of the housing is calculated with regard to ambient temperature and cooling for the internal electronics.



A touch display is used for visualizing the measured values. The touch display can be connected to an auxiliary keyboard and mouse. The distance between the evaluation unit and display depends on the means of communication.

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A touch display is usually located on the control console in the operator cabin of the machine.

The display shows the measured values in a table readout, which is shown in the graph. The graph in this case does not show the profile of the board, rather its thickness. The median value is the desired "ideal" value of thickness. The left side of the program shows the calculated values of average, maximum and minimum, desired value and measurement methods. The resulting quality indicator is shown in a table with colored boxes. The rows of tables are set up according to the measuring methods and the columns determine category of quality.

The output data with the resulting information can be exported to disk via USB or LAN connections over the internal network.

The data is sorted according to user requirements. It usually consists of two types. The first type is a detailed set of measurements for each manufactured piece. The second type is used to record statistics and provide documentation for production meetings. It includes sum totals, quantities for a certain period, the manufactured type, quality expressed in quantity and percentages, and other values, all from a preset period of time.

Another output of the measurement system is a group of output contacts for connecting to the machine control system, which performs its own sorting of the manufactured pieces.


**Example of the system working**

More than 2500 samples of a three-meter board are chosen in a very short time. The samples are collected simultaneously from five measured series. The passing board is immediately evaluated during the sampling. The results are displayed at the same time on the operator touch panel. The operator can immediately see on the panel the course of the measurement on the graph and table readout. The resulting values, including inclusion in the defined quality groups, are displayed for each board separately. The total values are stored in memory for further processing.

Various measuring methods were given for these boards. Each method uses a different calculation for determining the quality of the board. The calculated results of individual methods are stored in memory.

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