

Instruction Manual

Mould Oscillation Measuring System



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1. Introduction

Dear customer,

thank you for choosing the Mould Oscillation Measuring System KS473/KHM from Metra.

This product was developed for quality control in a continuous cast process of a steel plant. While the liquid steel is poured in, the mould performs an up-and-down oscillation with a frequency of a few Hertz to keep friction between the strand surface and the mould walls under a critical limit. The oscillation of the mould weighing several tons is usually generated by a powerful eccentric drive. In case of wear, unwanted mould oscillations in transverse direction may occur which may affect the quality of the produced strand. Therefore it is important to measure in regular intervals mould oscillation in main (Z) and transverse direction (X/Y).

Monitoring and recording mould oscillation becomes particularly important in connection with ISO 9000 quality control systems.

The Mould Oscillation Measuring System was developed in close cooperation with production engineers from a steel plant. It has only the necessary features making its operation simple. Routine measurements can be carried out without special training.

The system displays the results clearly as X/Z and Y/Z oscillation curves. The measuring results are also shown as values.

The software generates printable measuring reports for your quality control records.

The measuring system can be supplied with a DKD calibration certificate on demand. We also offer a recalibration service.

2. Description

The Mould Oscillation Measuring System is easy to handle since it consists of two only components:

1. A high resolution triaxial seismic accelerometer with built-in signal conditioning
2. A robust industrial notebook PC with plug-in data acquisition board and software KS473/KHM.



Figure 1: System components

Sensor

The vibration sensor is a compact unit which is simply put onto the mould platform. It has three adjustable feet and a level for axis alignment. The sensing elements are piezoelectric shear type systems providing excellent resolution even at lowest vibration levels and low frequencies. The shear principle makes the sensor robust against temperature transients.

A built-in electronic circuit amplifies and filters the sensor output before it is transmitted to the data acquisition board inside the PC. The sensor electronics is powered by the PC. The sensor cable is connected via a seven pin circular socket.

Industrial Notebook PC

The PC sold with the Mould Oscillation Measuring System was especially selected for extreme environmental conditions as they occur close to the liquid steel strand. The PC provides optimum protection against dust, humidity and shock.

Setup and operation of the Windows based software are very easy. No settings are necessary on the site. Measurement can be started simply by clicking a button. The system measures for a certain time interval the vibration signal, calculates magnitudes and frequencies and displays the oscillation curves for X/Z and Y/Z directions.

Connection cable

The sensor cable has a length of 5 m. The PVC jacket withstands harsh conditions. If it should be necessary to replace the cable, please contact us.

3. Operation

Preparation

Switch on the PC and put the sensor in the place where you want to measure oscillation. Check proper axis alignment by the level and correct, if necessary, by means of the adjustable sensor feet. The software window appears as follows:

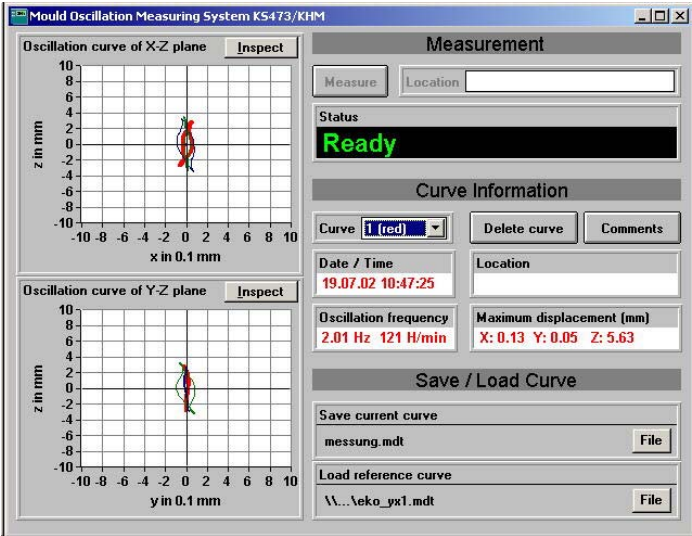


Figure 2: Main window of the software

Enter the measuring location

Before starting the measurement you may enter a short text describing the measuring **Location**. This text will appear later in the Curve Information display allowing better interpretation of the measured data.

Measurement

Start the measurement by clicking the **Measure** button. The **Status** display will inform you about the progress. One measurement takes approximately 30 seconds. This time is necessary to measure a sufficient number of mould oscillations with the required accuracy.

Graphic output

The measuring results are graphically displayed as a pair of X/Z and Y/Z curves. With some experience you will immediately recognize from these two curves wear or other problems causing excess mould oscillation.

For practical reasons the X and Y axis have a ten times higher resolution than the Z axis.

In case of a mould movement which is free of transverse components, the diagrams would display a vertical line along the Z axis which is symmetrical around zero.

A movement along the Z axis with additional transverse X/Z oscillation components will produce either a tilted line or an ellipse curve.

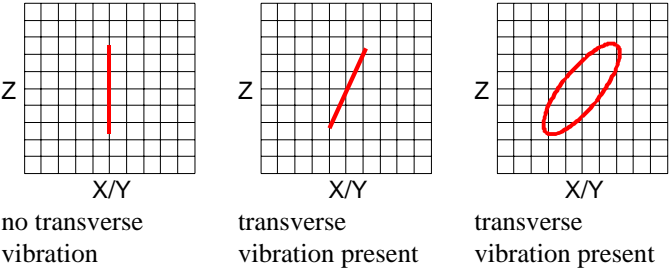


Figure 3: Typical vibration curves (idealized)

Numerical Output

Belonging to the displayed pair of curves, the software shows under **Curve Information** the text measuring **Location** the **Maximum displacement** (stroke) for each direction in mm, the **Oscillation frequency** in Hz and strokes per minute (H/min) and the **Date / Time** of measurement.

Save data	<p>Click under Save current curve the File button to open a file dialog. Measured data is saved on hard disk in the selected folder with the entered file name. Please do not change the standard file name extension *.mdt. The software will additionally create a *.kab file, as described later.</p> <p>The created *.mdt file includes the information you have entered about the measuring location, time and date and the measured real-time sensor data.</p> <p>For subsequent processing by the Report Generator the *.kab file type is used. It includes measuring location, time and date and the curve data as a compressed image of the real-time signal.</p>
Displaying several curves in one diagram	<p>The software can display up to four curves in one diagram. The source data for these curves may be both measured data from the current session or loaded *.mdt files from hard disk of another session.</p> <p>Diagrams showing several curves simultaneously allow to compare conditions and to detect deterioration over time.</p> <p>To add a new pair of curves to the diagrams select a Curve number for the curve to be added. To each curve number belongs a different color. The numeric data will also be displayed in this color. Now you can either produce a new pair of curves by clicking the Measure button or load data from hard disk by means of the file dialog under Load reference curve. An already displayed pair of curves with the same number (and color) will be overwritten.</p> <p>To remove a pair of curves, select its number and click the button Delete curve. The curves will disappear from the diagram but not be deleted from hard disk.</p>
Comments	<p>If you want to save accompanying remarks with a pair of curves, click the button Comments. This will open the Windows Notepad editor. If a comment to the selected curve file already exists, it will be displayed in the Notepad. Otherwise you will be asked to create a new *.txt file. The file name is derived from the *.mdt file.</p> <p>Each time you click the Comments button, a new Notepad window will be opened.</p>
Zoom Function	<p>Click the Inspect button of the diagrams to open a separate diagram window. The menu bar of this window features a Zoom function which allows you to enlarge the curve.</p>

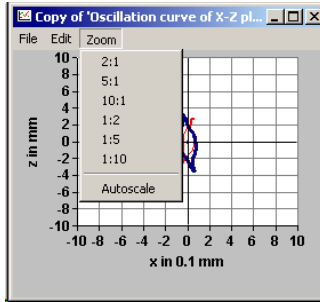


Figure 4: Zoom function in the Inspect window

Copy and Print

Under **Edit** you also find a **Copy** function which copies the diagram into the Windows clipboard. The diagram now can be copied into other Windows applications, for example office software. To insert the diagram into another document, use the Insert Contents command. If you use instead the Paste function, a text table with the curve data will be imported.

The Inspect window also features a **Print** function. It prints the diagram without additional information using your standard printer.

Report Generator/ Viewer

The **Report Generator / Viewer** is a separate program belonging to your KS473/KHM software. It can be used to display measured curves from the hard disk and to print reports.

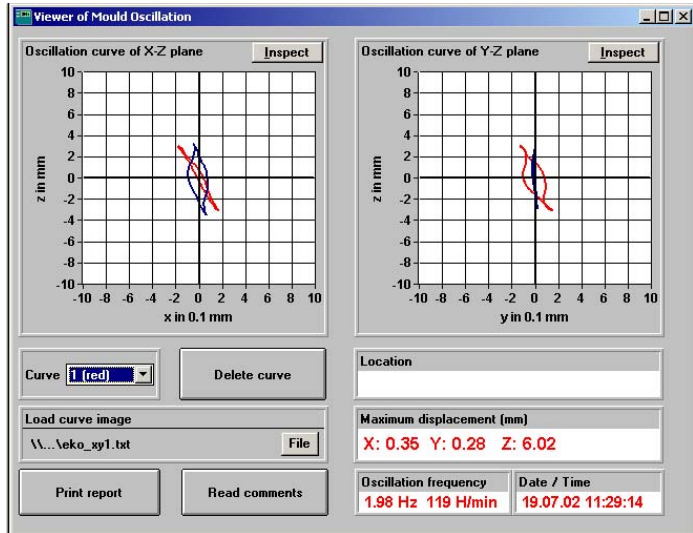


Figure 5: Report Generator / Viewer

After selecting a curve number (and color), load a curve file (*.kab) by clicking the **File** button. The pair of curves will appear in the diagram with the selected color. The **Read comments** button opens the Notepad editor showing the saved comment file belonging to the loaded *.kab file, if there is any on hard disk. Otherwise this button will be disabled.

Clicking the **Print report** button produces a paper document using your standard printer. The report includes the following information:

- Date and time of printing
- Date and time of the measurement
- Measuring location
- Maximum displacement values for X/Y/Z direction
- Oscillation frequency
- Two oscillation curve diagrams.

For printing diagrams with more than one curve a color printer is recommended.

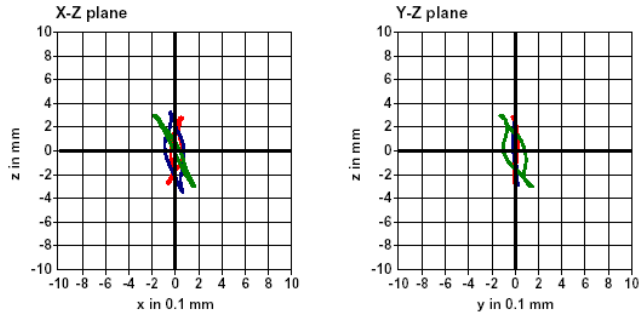
Report of Mould Oscillation
generated on:16:23:59 20/01/05

Curve 1 Location :
Date / Time: 19.07.02 10:47:25
Displacements: X: 0.13 Y: 0.05 Z: 5.63
Oscillation frequency: 2.01 Hz 121 H/min

Curve 2 Location :
Date / Time: 19.07.02 10:50:33
Displacements: X: 0.17 Y: 0.05 Z: 5.63
Oscillation frequency: 2.01 Hz 121 H/min

Curve 3 Location :
Date / Time: 19.07.02 11:29:14
Displacements: X: 0.35 Y: 0.28 Z: 6.02
Oscillation frequency: 1.98 Hz 119 H/min

Graph of Mould Oscillation



Curve 1: red Curve 2: blue Curve 3: green Curve 4: purple

Figure 6: Example of a test report

4. Technical Data

Measuring ranges	Vibration displacement (peak-to-peak values)	
	X axis	0 ... 4 mm
	Y axis	0 ... 4 mm
	Z axis	0 ...16 mm
	Vibration frequency range 0.75 Hz ... 4 Hz	
Accuracy	< 5 %	
Transverse sensitivity	< 5 %	
Sensor type	Triaxial piezoelectric shear-type accelerometer	
Filtering	Low pass / anti-aliasing filter inside the sensor: 20 Hz adaptive software filter	
Sensor output	± 10 V	
Dimensions of sensor	120 x 180 x 142 mm ³ (l x b x h)	
Weight of sensor	2.5 kg	
Sensor cable length	5 m	
Operating temperature range	PC: see specification Sensor: 0°C .. 60°C	
Data acquisition board	Keithley KPCI 3101, 8.5 inches card slot required	
Supported operating systems	Windows XP and Windows 2000	



Declaration of Conformity

Product: Mould Oscillation Measuring System

Model: KS473/KHM

It is hereby certified that
the above mentioned product
complies with the demands
pursuant to the following standards:

- EN 50081-1
- EN 50082-1

Responsible for this declaration is the producer

Metra Mess- und Frequenztechnik

Meißner Str. 58

D-01445 Radebeul

Declared by

Manfred Weber

Radebeul, 11th of March, 1999

Limited Warranty

Metra warrants for a period of

24 months

that its products will be free from defects in material or workmanship and shall conform to the specifications current at the time of shipment.

The warranty period starts with the date of invoice.

The customer must provide the dated bill of sale as evidence.

The warranty period ends after 24 months.

Repairs do not extend the warranty period.

This limited warranty covers only defects which arise as a result of normal use according to the instruction manual.

Metra's responsibility under this warranty does not apply to any improper or inadequate maintenance or modification and operation outside the product's specifications.

Shipment to Metra will be paid by the customer.

The repaired or replaced product will be sent back at Metra's expense.