Disc Thickness Variation Measurement

V1.0.0
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1. Introduction

1.1 Symbols Used

The following symbols are used in the instruction manual.

- Indicates a user action.
- Indicates a user tip.
- Indicates a hardware or a button/menu in the software.

1.2 Measurement Principle Thickness Measurement

Disc Thickness Variation Measurement is a system for quality inspection of rotating disks e.g. of brake disks. The DTV application semi-automatically acquires thickness profiles of rotating disks with a DT6200 series controller. The thickness D1 and the 360° rotations are calculated automatically from the measurement values of the displacement sensors A1 and A2.

![Diagram of disc thickness measurement](image)

If the distance (measure C) between both the capacitive displacement sensors is known, the brake disk thickness is calculated as follows:

\[ D1 = C \cdot (A1 + A2) \]

Fig. 1 Principle of thickness measurement with opposite distance measurement

Fig. 2 Formula for thickness calculation
Introduction

Archived measurement data can be visualized and printed anytime in Offline Analysis.

1.3 Ethernet Connection

Connect the controller DT62x0 to a free LAN interface on your PC or to a network.

<table>
<thead>
<tr>
<th>Direct connection to a PC, controller with static IP (factory setting)</th>
<th>Network</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC with static IP</td>
<td>PC with DHCP</td>
</tr>
</tbody>
</table>

- Connect the controller (“Ethernet“ female connector) and PC to a Ethernet direct connection (LAN). Therefore use a LAN cable with RJ-45 plugs.

For direct connection the controller needs a fixed IP address.

- Start the program SensorFinder.exe.

Find this program at http://www.micro-epsilon.de/download/software/SensorFinder.zip

- Click on the button Find sensors. Choose the desired controller from the list. Click the button Change IP-Address to change the address settings.
  - Address type: static IP-Address
  - IP address: 169.254.168.150
  - Gateway: 169.254.1.1
  - Subnet mask: 255.255.0.0
  - Password: •••

- Click on the button Change to assign changes to the controller.

- Click on the button Start Browser to connect the controller with your standard browser.

Wait until Windows has established a network connection (connection with limited connectivity).

- Start the program SensorFinder.exe.

Find this program at http://www.micro-epsilon.de/download/software/SensorFinder.zip

- Click on the button Find sensors. Choose the desired controller from the list.

- Click on the button Start Browser to connect the controller with your standard browser.

Enter the controller in DHCP / report the controller to your IT department.

The controller is assigned a IP address from your DHCP server. You can request this IP address by using SensorFinder.exe.

- Start the program SensorFinder.exe.

Find this program at http://www.micro-epsilon.de/download/software/SensorFinder.zip

- Click on the button Find sensors. Choose the desired controller from the list.

- Click on the button Start browser to connect the controller with your standard browser.

\[1\] Presumes that the PC LAN connection uses e.g. the following IP address: 169.254.168.1.
1.4 Data Channels Used

Disc Thickness Variation Measurement software uses following data channels of the controller DT62x0 for quality inspection:

- Data channel 1
- Data channel 2

The math function enables scaling of a measurement channel and mathematical combination of individual measurement channels (\(= MK\)).

Data channel = Offset + Factor MK 1 + Factor MK 2 + Factor MK 3 + Factor MK 4.

Data channel = Digital values

Measurement channel = Analog value of a demodulator module

<table>
<thead>
<tr>
<th>Data channel</th>
<th>Offset</th>
<th>Value</th>
<th>Range of values max. (\pm 8\text{-facher MB})</th>
<th>Factor measurement channel</th>
<th>Value</th>
<th>Range of values -9.9 ... +9.9</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 / 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This is how you can find Math functions:

- Click on the button [Raw Data view...] in the main view to switch to Raw Data.
- Click on the button [Open Config Page in Web Browser...] in the Raw Data view to start the web interface of the controller DT62x0.
- Change to view Settings > Math functions and define measurement channels for thickness measurement.

Fig. 3 Linkage of data and measurement channel
2. Performing Measurement

2.1 Main View

The software automatically starts in the main view.

![Main view software](image)

The button `StartDAQ` starts automatic data recording and calculation of disk thickness.

The button `StopDAQ` ends measurement during ongoing measurement. Meanwhile gathered values are displayed in form of a graph.

Calculation of the statistic characteristic values of a measurement series is activated by starting measurement.

The statistic values display extreme values of a recognized rotation. If the evaluation range is changed by means of sliders in `Raw Data` view, statistic values are also adjusted.

The function `Create Protocol Print-Out` advises your standard printer to print statistic values and both graphs. Comments in the text box are also printed.
Performing Measurement

**Raw Data View:** Starts Raw Data view.

**Open Info:** This button displays the settings of the controller DT62x0 in a separate dialog. This dialog can also be used to register a product key.

**Use hole compensation:** This function suppresses nuts and drilled holes in the disk while analyzing.

**Use offline mode:** Plays back measurement values from a file that can be specified in the Raw Data view dialog. The buttons Load or Start DAQ start the Offline Analysis.

Measurement in process: The Plots for distance and thickness values display measurement values next to the dedicated position points.

Measurement ended: The known rotation is scaled to the main view from 0 up to 360°. If the evaluation range in Raw Data view was changed with sliders, graphs are also adjusted.

The area Status informs about the process of a measurement.
2.2 Raw Data View

Click in the main view on the button Raw Data View to start the Raw Data view.

Fig. 5 Raw Data view

Selection of controller whose measurement values are used for calculating disk thickness.

This function starts a routine to search for connected controllers.

If checkbox Search for controllers... is activated, the software automatically searches for connected controllers after start.

Known sensor to sensor distance: The distance between both sensors is known, see Fig. 1 variable (C). The software calculates out of both distance values the thickness of the disk, see Fig. 2.

Known reference disc thickness: Measures the variation of the disk. The distance between both the displacement sensors needs not to be known.
Performing Measurement

**Current value:** States the last measured distance value resp. the last calculated thickness value.

**Position max start, Value max start:** States maximum values and the dedicated position values at the beginning of a recognized rotation.

**Position max stop, Value max stop:** States maximum values and the dedicated position values at the end of a recognized rotation.

**Position min start, Value min start:** States minimum values and the dedicated position values at the beginning of a recognized rotation.

**Position min stop, Value min stop:** States minimum values and the dedicated position values at the end of a recognized rotation.

**Rotation detection:** Switches from Scan to Found pos, while measurement if a related rotation is recognized.

**Start threshold min:** Change of thickness value so that a stagnant disk can be distinguished from a rotating disk.

**Thickness tolerance max:** Maximum allowed thickness deviation (delta D) between the start and the end point of a rotation, see figure. This parameter is used for the detection of a complete rotation.

**Distance tolerance max:** Distance deviation of both sensor values to the disk.

**Rotation time min:** Minimum time to detect a complete rotation of the disk.

**Rotation time max:** Data recording ends when reaching rotation time max independent of recognizing a complete rotation. If maximum time is achieved, a related rotation could not be recognized or the maximum time is smaller than the rotation time.

**Median filter size:** Filter is adapted to both sensor distance signals.

**Smooth length:** The recursive filter is adapted to the thickness value.
Performing Measurement

**Start pos, Start val, Stop pos, Stop val:** Displays position values of the cursor and the dedicated thickness values of the disk.

**Use quick search mode:** If the checkbox is set, the software executes only two plausibility checks. As standard three plausibility checks are executed.

Manual selection for rotation: Set the slider to a rotation’s beginning and end and click on the button **Use Selection for Rotation.** The chosen area is scaled in the main view from 0° up to 360° and the dedicated values are displayed in area **Statistics.**

The button **Recalculate Positions** resets the cursors to their original beginning and end of a rotation of the disk defined by the software if they have been moved manually.

**Open Config Page ...:** This button starts the web interface of the controller DT62x0.

Display: With these check boxes you choose measurement results to be displayed in graphical representation.

The button **Restore Defaults** resets the parameters of the application to their factory settings, see Chap. 4. This includes the IP address, the basis for disk thickness and the settings in area **Rotation detection parameters.**

Determines the path for storing measurement series resp. chooses data for Offline Analysis.

Storage of measurement series is not possible in demo version.
3. Demo version, Full version
The Disc Thickness Variation Measurement software is limited to a duration of 30 days in demo version. If you want to use the software beyond this period, you need a valid Product key. It is not possible here neither to save nor to print.

<table>
<thead>
<tr>
<th>Controller DT6200</th>
<th>Controller DT6229</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Request a valid product key.</td>
<td>The controller is already equipped with a valid product key.</td>
</tr>
</tbody>
</table>

☐ Click on the button **Open Info** in the main view.

![Disc Thickness Variation Measurement - Info](image)

☐ Copy the valid product key in to the space available for **Product key**.

☐ Click on the button **Write Product Code**.

4. Factory Settings

<table>
<thead>
<tr>
<th>TCP/IP address</th>
<th>169.254.168.150</th>
</tr>
</thead>
<tbody>
<tr>
<td>Known sensor to sensor distance (µm)</td>
<td>10000</td>
</tr>
<tr>
<td>Known reference disc thickness (µm)</td>
<td>0</td>
</tr>
<tr>
<td>Start threshold min (µm)</td>
<td>0.2</td>
</tr>
<tr>
<td>Thickness tolerance max (µm)</td>
<td>0.6</td>
</tr>
<tr>
<td>Distance tolerance max (µm)</td>
<td>4.0</td>
</tr>
<tr>
<td>Rotation time min (s)</td>
<td>1.0</td>
</tr>
<tr>
<td>Rotation time max (s)</td>
<td>30.0</td>
</tr>
<tr>
<td>Median filter size</td>
<td>0</td>
</tr>
<tr>
<td>Smooth length (samples)</td>
<td>0</td>
</tr>
<tr>
<td>Use known distance</td>
<td>0</td>
</tr>
</tbody>
</table>

1 = absolute thickness is defined according to sensor distances
0 = the thickness of the measuring object is known resp. irrelevant. Only relative thickness deviations are calculated.

Quick search mode | 0 |
5. Warranty
All components of the device have been checked and tested for perfect function in the factory. In the unlikely event that errors should occur despite our thorough quality control, this should be reported immediately to MICRO-EPSILON.

The warranty period lasts 12 months following the day of shipment. Defective parts, except wear parts, will be repaired or replaced free of charge within this period if you return the device free of costs to MICRO-EPSILON. This warranty does not apply to damage resulting from abuse of the equipment and devices, from forceful handling or installation of the devices or from repair or modifications performed by third parties.

No other claims, except as warranteed, are accepted. The terms of the purchasing contract apply in full. MICRO-EPSILON will specifically not be responsible for eventual consequential damages. MICRO-EPSILON always strives to supply customers with the finest and most advanced equipment. Development and refinement is therefore performed continuously and the right for design changes without prior notice is accordingly reserved. For translation in other languages the data and statements of the German language instruction manual are to be taken as authoritative.