

User Manual

Version April 29, 2023

Thrust Load Meter BT

Portable device with data streaming via Bluetooth to a Windows PC

1 INTRODUCTION



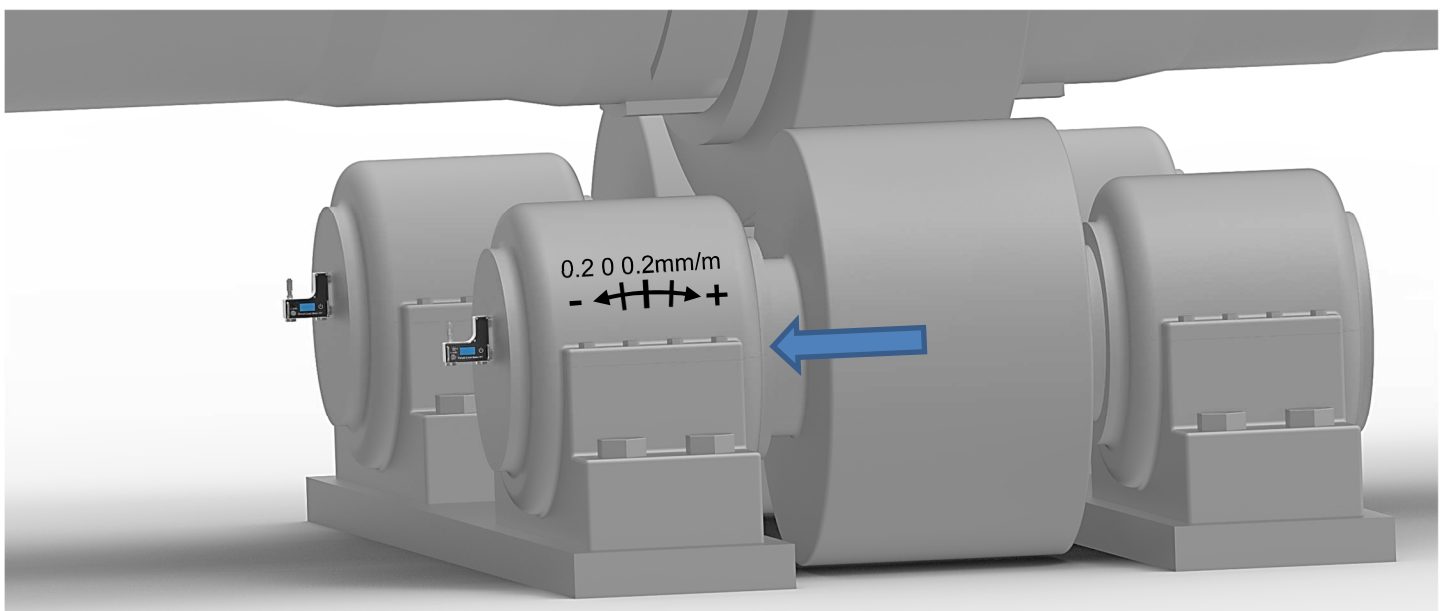
The Thrust Load Meter BT is a portable device to evaluate the axial load on support rollers on rotary kilns or dryers. It helps to easily identify axially high loaded or low loaded rollers and to counteract timely with adequate adjustment, the so-called roller skewing.

The Thrust Load Meter BT is equipped with an ultra-precise inclinometer and is specially made for the application on large bearing housings as on rotary kilns. The device simply needs to be attached by magnets to the bearing housing without opening it. The measured values are displayed on the screen directly on the Thrust Load Meter and also transferred by Bluetooth to a PC for further processing.

Measuring Principle

The axial load, the thrust load, coming from the kiln tires needs to be taken by the bearings of the support rollers. The axial load slightly deforms the bearing housing and tilts them to the side. This movement is very small, but big enough to be measured by the Thrust Load Meter. By comparing the different rollers, the one with the higher or lower load can be identified easily, which helps to adjust the skewing properly in a way that the load gets shared among all the support rollers evenly.

Fig. 1.0.1 Thrust Load Meter BT on bearings of support rollers



2 SAFETY

Rotary kilns and dryers, where this system typically is used, are huge rotating equipment with many pinch points and hot surfaces which can cause serious injuries. Therefore, only specialized and trained personnel shall work close to these machines. For installation, follow strictly the local safety rules given by the respective plant / factory / local authorities and discuss the application with the safety engineer in charge.

The tools provided by TomTom-Tools GmbH have proven their functionality in various applications; nevertheless TomTom-Tools GmbH does not take any responsibility for the application on site regarding safety or machine damage. The plant is responsible for the safety, according to the local law, in a way that nobody can be hurt or injured. The application and safety instructions below are guidelines and not exhausted which include the experience from previous installations. They might need to be adapted to the local circumstances and safety requirements.

Caution:



Pinch Points:

Do not put your hands nor any items close or into pinch points.
(e.g. girth gear / pinion, kiln tires / support rollers, ...)
Keep safe distance to avoid getting caught by moving parts
(e.g. switch flags on kiln shell and tires)



Magnetic Fields:

The magnets attached to some of the components are strong.
Be aware of the strong magnetic fields.
Keep the tool away from people with pace makers or any other sensitive item as credit cards or magnetic data carrier.



Hot Surfaces:

The kiln might be very hot, especially the shell of the kiln.
Do not touch it and keep safe distance.



Gloves:

Wear proper gloves to protect your hands from hot and rough surfaces and sharp edges.

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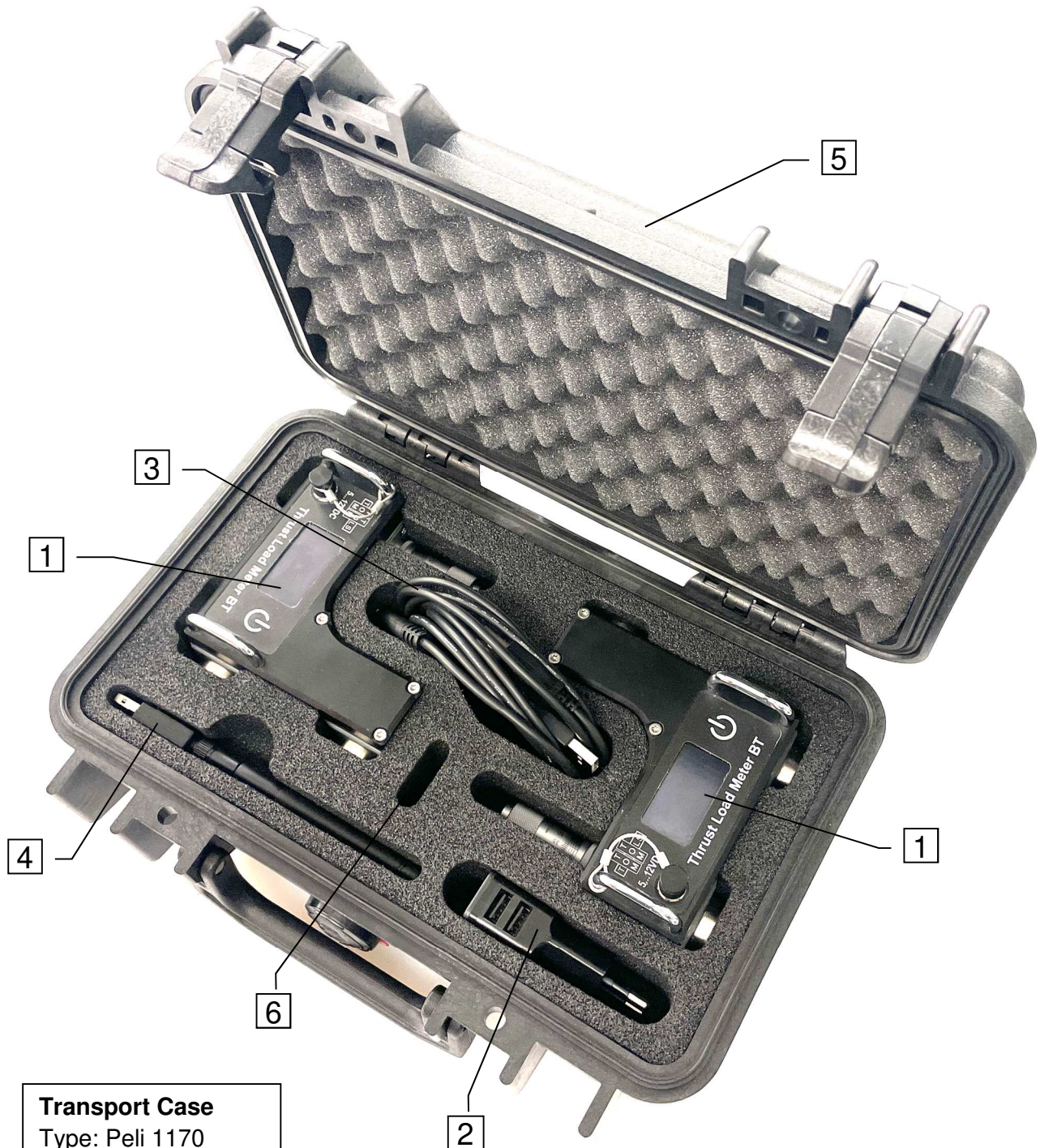
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3 FEATURES:

- Measures the tilting of the bearing housing, due to the side load
- Output value is in mm/m, permille, parts per thousand [‰] and degrees [°]
- Measurement range: -2.9...0...+2.9mm/m
- Value directly visible on the display and provided via Bluetooth to the Measurement Studio (software for Windows PC)
- Very low temperature drift
- L-shaped housing with magnets to be mounted on top of the bearing housing as well as on the side face
- Micro screw to adjust the sensor to the inclination of the kiln / dryer
- Battery powered, (rechargeable)

4 Tool Kit includes:

1. 2 Thrust Load Meter BT
2. Dual USB Wall Charger (100...240VAC)
3. 2 Adapter Cables USB to Power Jack (Barrel 5.5x2.5) 1m
4. Long-Range Bluetooth USB Adapter (ZEXMTE)
5. Transport Case with Foam Padding Peli 1170
6. Software (TomTom-Tools Measurement Studio) and manual on USB Flash Drive




Transport Case
 Type: Peli 1170
 29.6 x 21.2 x 9.6cm
 Weight total: 2.7kg

5 WHAT BEARING TYPES CAN BE MONITORED?

In general, it can be used on all bearing housings of support rollers, which tilt / deflect slightly due to side loads. On rotary kilns and dryers, that includes most of the bearings, regardless if they are made as slide bearings or bearings with rolling elements. Nevertheless, the following points need to be considered:

5.1 Only one bearing of each pair is taking axial load

There exist different designs of support roller assemblies. They use different ways to resist axial forces. But on all of them, only one of the two bearings is taking the axial load. Hence only one Thrust Load Meter per roller is required to monitor the load, but it has to be assured that it gets installed on the loaded bearing.

The following sketches show the most common designs where the location of the Thrust Load Meter is indicated with the following symbol: 

a. Axially loaded bearing at uphill side:

Fig. 4.1.1 Thrust Disc is attached to the shaft end



b. Axially loaded bearing at downhill side:

Fig. 4.1.2 Thrust Collar is located close to the roller

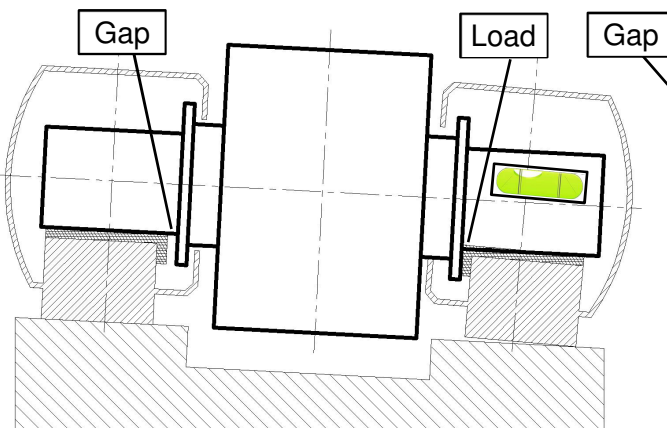
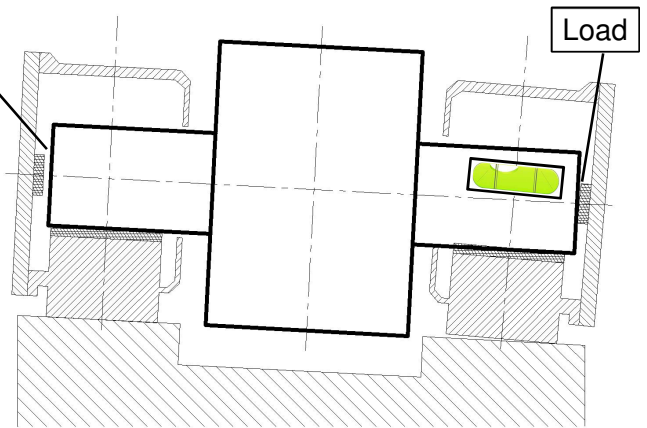


Fig. 4.1.3 Shaft runs against Thrust Disk in housing



Note: Whenever possible look for the gap on the thrust shoulder to know which bearing takes axial load.

5.2 Thrust Load Meter is not suitable for moveable support rollers

A small number of kilns is equipped with special support roller arrangements to improve the load distribution between the rollers and the tire; these rollers are following the wobbling of the tire. The movement, in this case, is much larger than the tilting of the bearing housing due to side load. That is why the Thrust Load Meter is not suitable on these systems, it would rather show the consequence of the wobble instead of the axial load.

Fig. 4.2.1
“Semi-Rigid” Support Roller
(supported on elastomer elements)

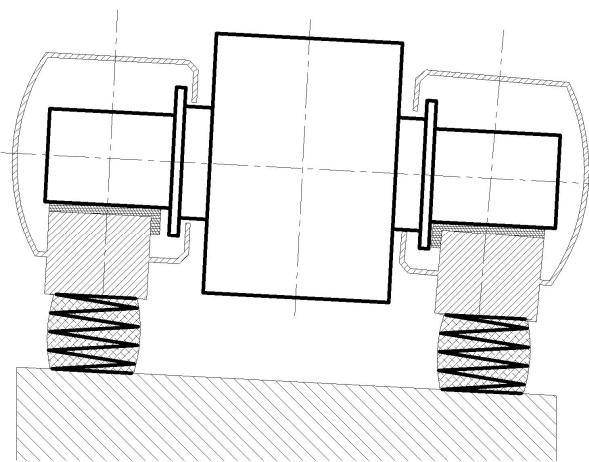
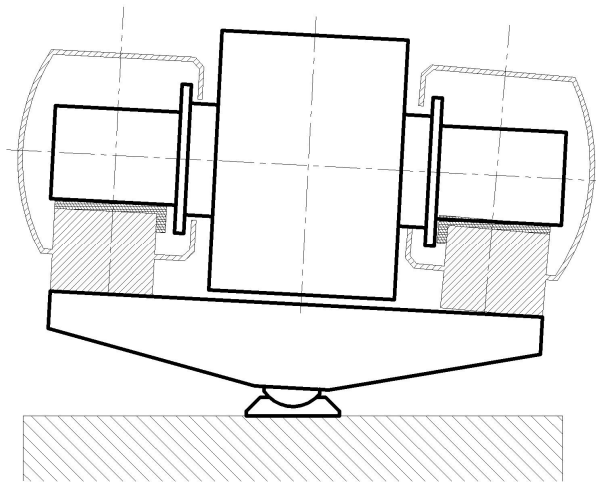


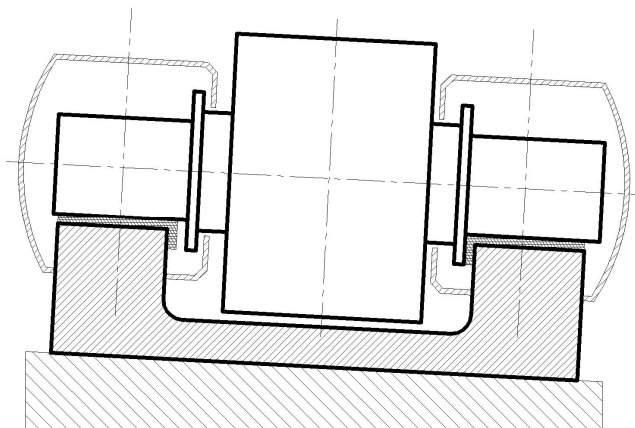
Fig. 4.2.2
“Self-Aligning” Support Roller
(supported on a rocking structure)



5.3 The thrust cannot be measured on single housing design

There exist support roller assemblies, where both bearings are incorporated into one single housing. This design has the advantage that the bores of the bearings are always nicely matching, but the axial load can not be measured by the Thrust Load Meter due the high stiffness of the housing.

Fig. 4.3.1 Single Bearing Housing Design



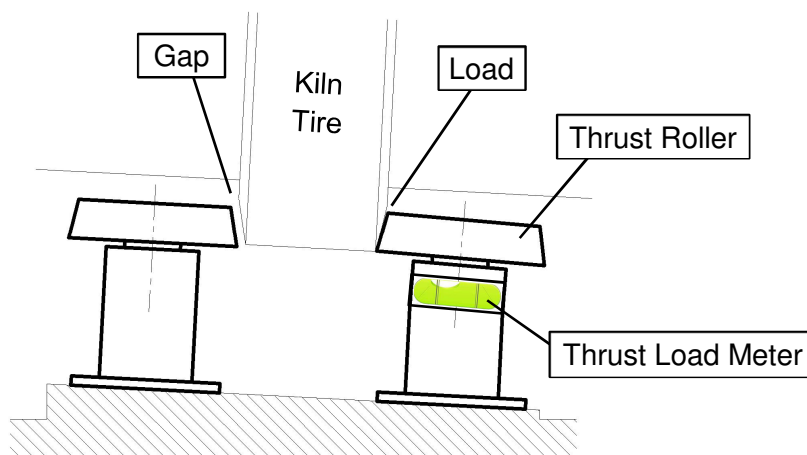
6 THRUST LOAD METER ON FIXED THRUST ROLLERS

Modern rotary kilns are equipped with hydraulic thrust rollers where the hydraulic pressure indicates the load which is easily measurable. But older kilns or smaller units sometimes have fixed thrust rollers without the possibility to monitor the load. Here the Thrust Load Meter might be useful too; depending on the stiffness of the roller pedestals.

6.1 Thrust Rollers with high pedestals

On thrust rollers which flex slightly due to the forces from the tire, the Thrust Load Meter can be used to monitor the load changes. It has to be attached to the upper part of the pedestal to catch the deflection behavior properly. Usually only the lower thrust roller needs to be monitored, because the upper roller should not get loaded much.

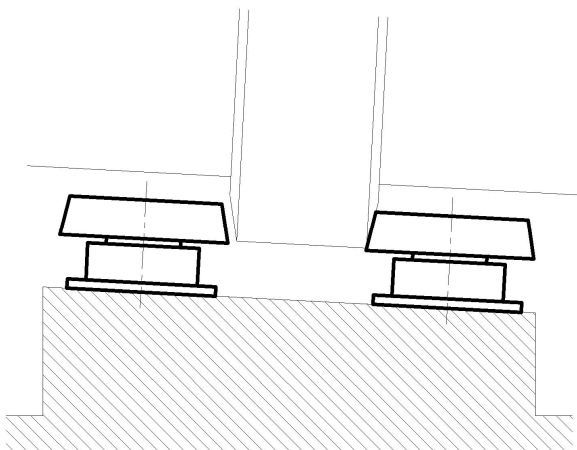
Fig. 5.1.1 Thrust Load Meter on Thrust Roller



6.2 Short Thrust Rollers

Thrust rollers which are mounted close to the foundation will not get tilted sufficiently by the side load, hence the Thrust Load Meter can not be used in this case.

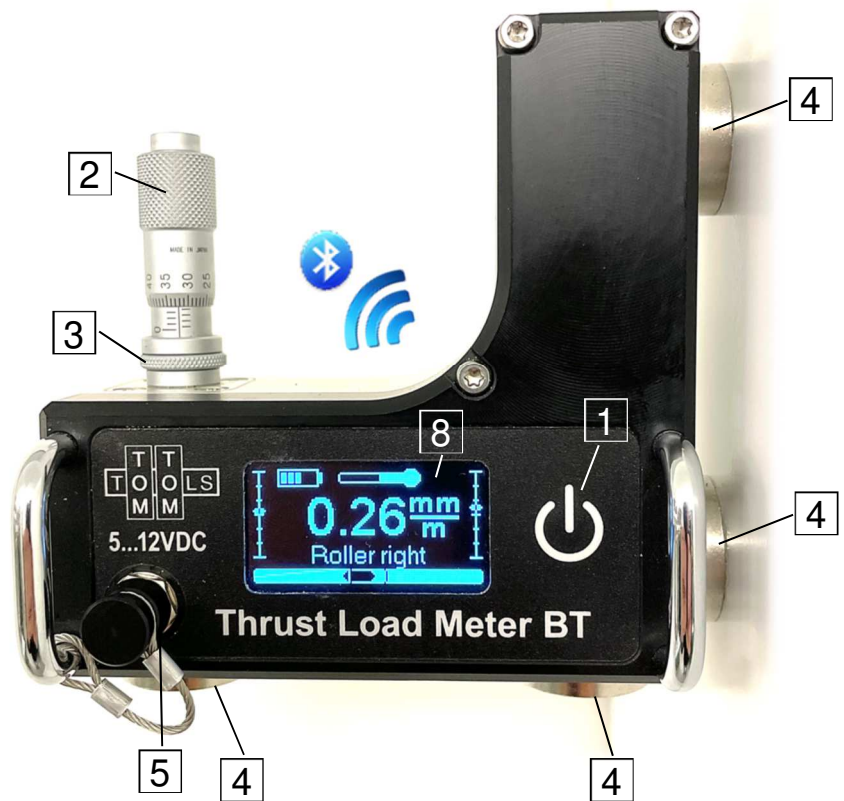
Fig. 5.1.1 Short / Stiff Thrust Roller Arrangement



7 THRUST LOAD METER BT

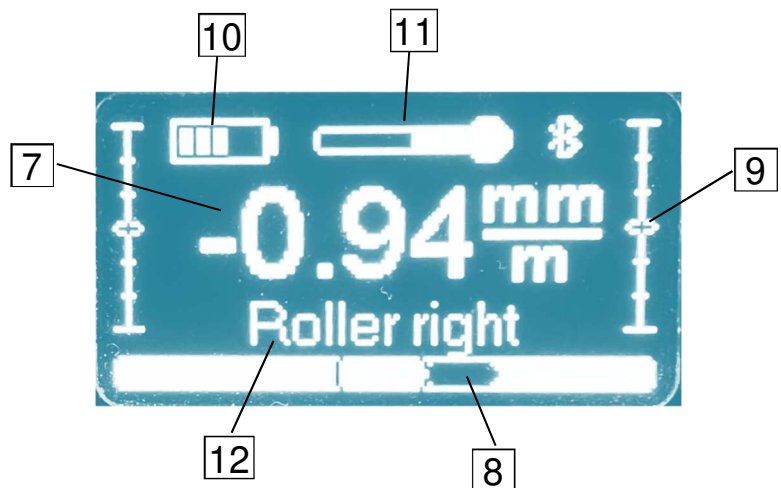
7.1 Main Components:

1. ON/OFF Button
2. Micrometer Screw
3. Lock Ring
4. Magnets
5. Charger Plug (5...12VDC)
6. OLED Display



7.2 Display

7. Tilt Value [mm/m, %, °]
8. Virtual Air Bubble
9. Virtual Horizon
10. Battery Status
11. Temperature Indicator
12. Measurement Allocation



8 Software:

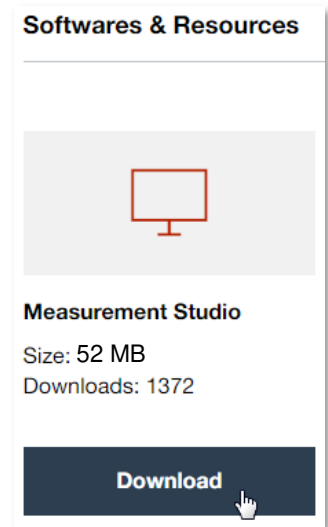
8.1 Software Installation:

The software (**TomTom-Tools Measurement Studio**), which is used for the Thrust Load Meter BT and for all others of our portable tools, comes along with the tool kit on an USB memory stick.

Nevertheless, it is recommended to **install the software from www.tomtom-tools.com**, where always the latest version is available.

During any start of the Measurement Studio, it is checking for updates if the computer is connected to the internet. In case of available upgrades, the user gets asked if they should be downloaded and installed.

Please keep your PC up to date.



9 Start the Tool:

9.1 Connect Thrust Load Meters with Laptop

To connect a tool for the first time it has to be paired with the computer. To do so, follow this sequence:


- Start the Measurement Studio
- Make sure a Bluetooth connection is activated on the PC
- Switch on the one of the Thrust Load Meter BT by pushing the on/off button 
- On the PC, click on “Tools / Bluetooth Devices / Add a device”
- Wait until the tool got found
Note: Depending on the search speed of the computer, it might take up to 30 seconds
- Select the device, which has to be connected; (here the Thrust Load Meter BT) and click “OK”
- Switch on the second Thrust Load Meter and connect it the same way

Fig. 8.1.1 (Add Device)

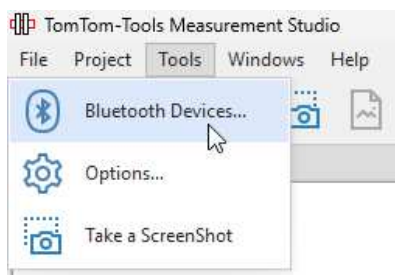
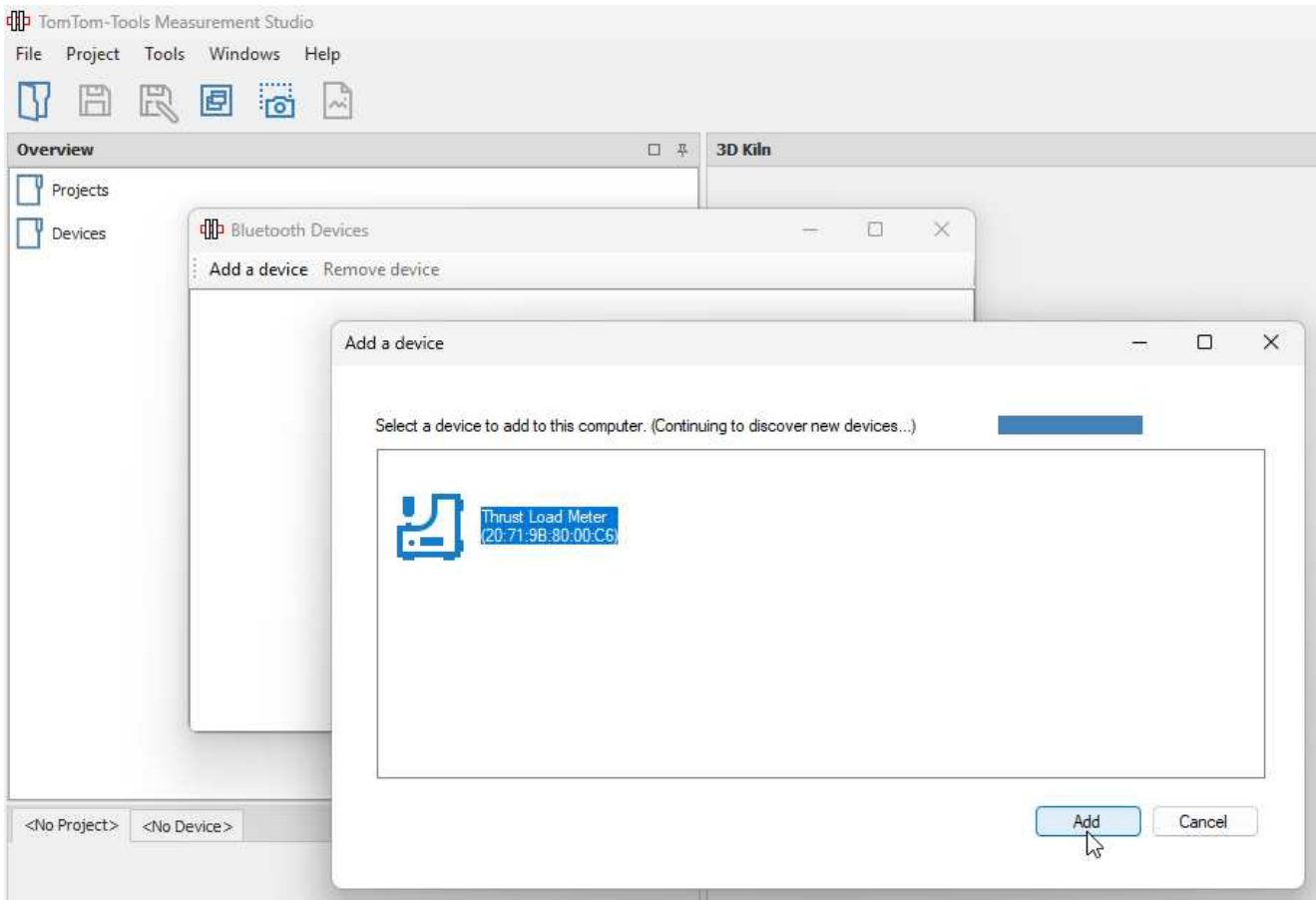
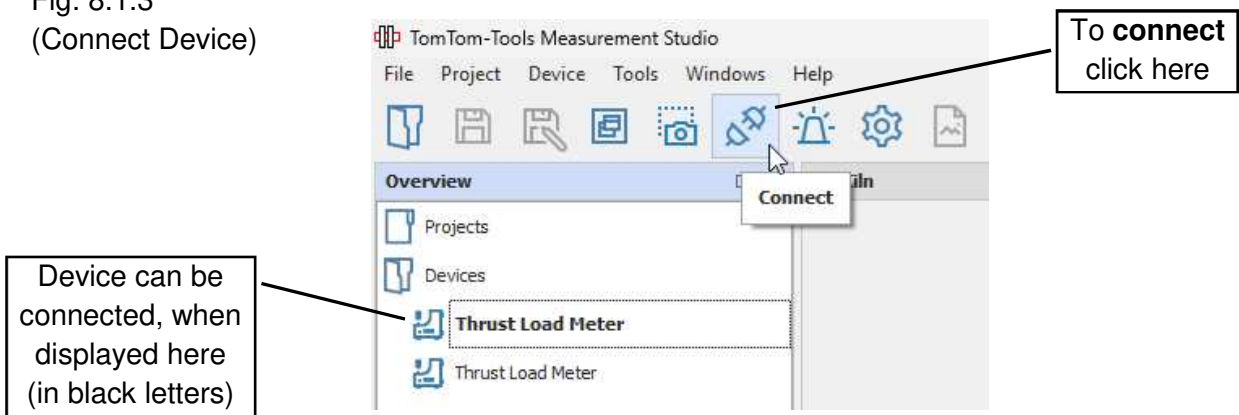


Fig.8.1.2 Add a device



The Thrust Load Meter BT gets added to the Device List
To connect it, click on the “Connect” Button

Fig. 8.1.3
(Connect Device)



9.2 Bluetooth Adapter (optional)

To use the Thrust Load Meters, the inbuilt Bluetooth of a normal Laptop PC is usually strong enough to establish a reliable connection, because only short distances are required.

By using the new Panasonic Tablet PC (FZ-G2) with the integrated Long-Range Bluetooth, large distances (>100m) can be reached easily.

It is also possible to reach large distances (>100m) with a regular PC, by using the Long-Range Bluetooth adapter (Sena UD100 or ZEXMTE), which comes along with the tool kit.

Note:

- To force the PC to connect via the Long-Range Bluetooth Adapter, the integrated Bluetooth needs to be disabled in the Device Manager as shown below. The Bluetooth Adapter communicates **only with the generic Windows Bluetooth Stack**. If there is another Bluetooth software installed (e.g. Intel, Toshiba, Widcomm, ThinkPad,...), **deactivate it**.

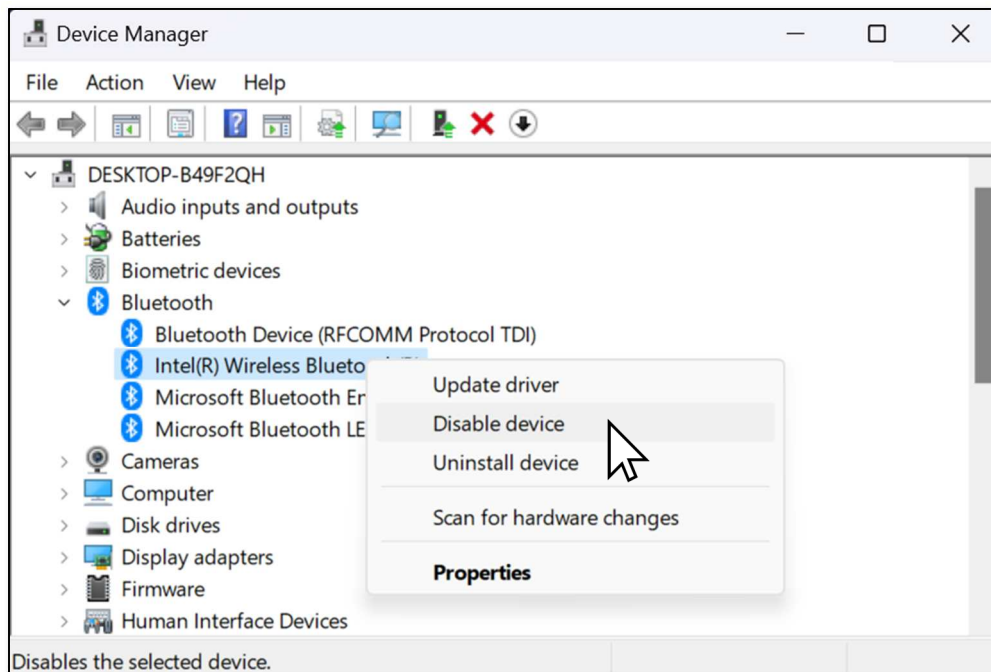
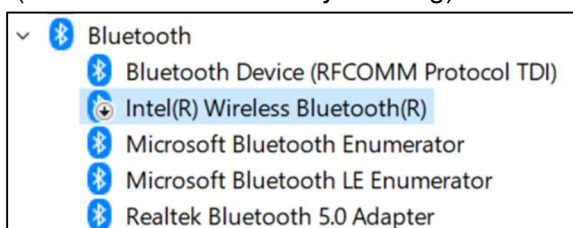


Fig.8.2.1 Device Manager

- Then plug the Bluetooth adapter ZEXMTE or Sena UD100. Windows will recognize the new hardware and automatically install the suitable Windows drivers
- The Device Manager will show the following:
 - Generic Bluetooth Radio
 - Microsoft Bluetooth Enumerator
 - the not required Bluetooth is down (indicated by the small arrow at the Bluetooth icon)



Fig.8.2.2 Device Manager (USB Bluetooth correctly working)



ZEXMTE Bluetooth Adapter Specifications:

- Bluetooth 5.1 and EDR Class 1 (dual mode)
- USB-A 3.0
- Frequency Range: 2.402 ~ 2.480GHz
- Antenna: RP-SMA

9.3 Device Window

Fig.9.3.1

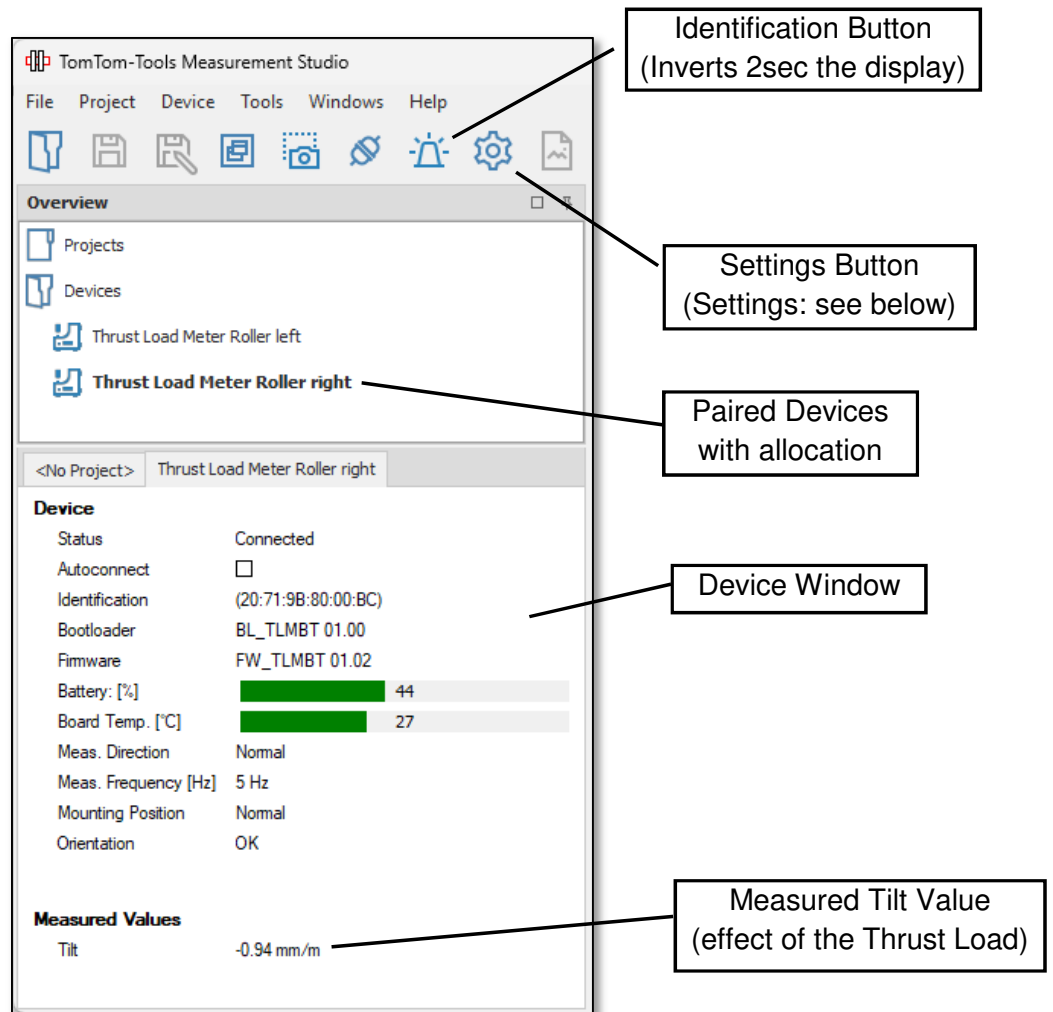
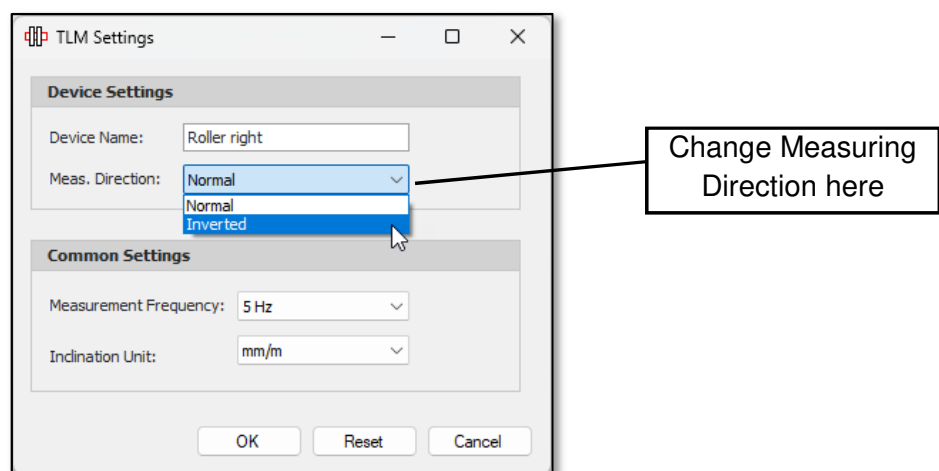


Fig.9.3.2: Settings

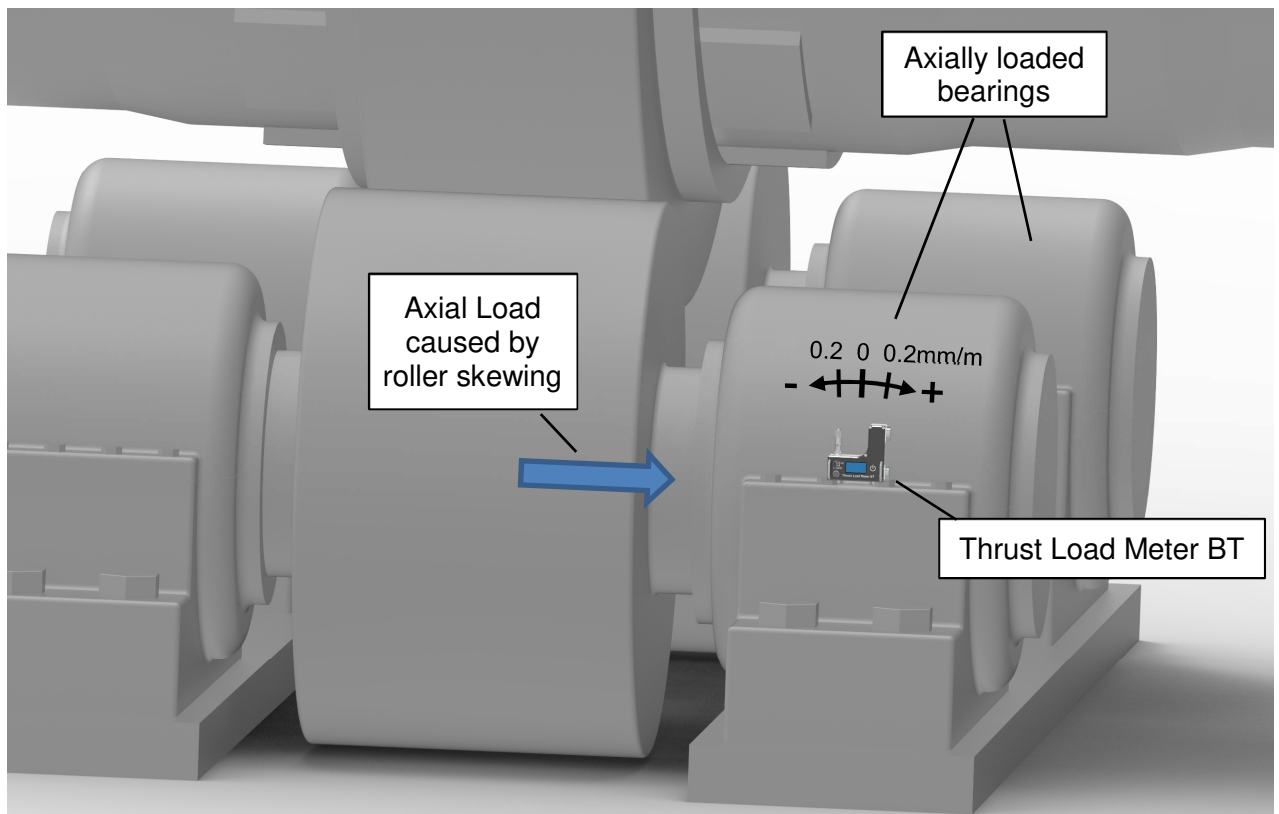


10 MOUNTING

The Thrust Load Meter BT is water and dust tight, and made to be placed close to the kiln. Nevertheless, make sure it is not exposed directly to the radiation from the kiln. Do not leave the instrument unnecessary long attached; remove it when the measurement is finished. The Thrust Load Meter must be attached straight and firmly by the magnets to the bearing housing. Assure that it does not change its position during the measurement campaign and that it gets not hit accidentally.

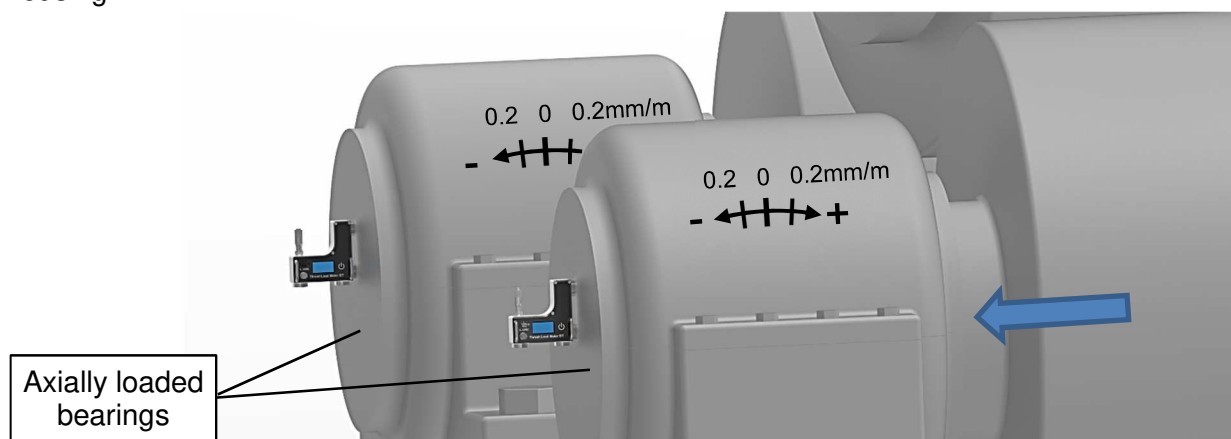
10.1 Top Mounting

Fig. 10.1.1 shows the option to attach it on top of a straight surface on the bearing housing.



10.2 Side Mounting

Fig. 10.2.1 shows the option to attach the Thrust Load Meters to the side face of the bearing housing.



11 Measurements

11.1 Adjust to zero

After attaching the Thrust Load Meter, the main sensor is usually out of range, which is indicated on the display. Adjust the sensor to zero (or close to zero) by turning on the micrometer screw. The virtual air bubble helps to understand what correction is required.

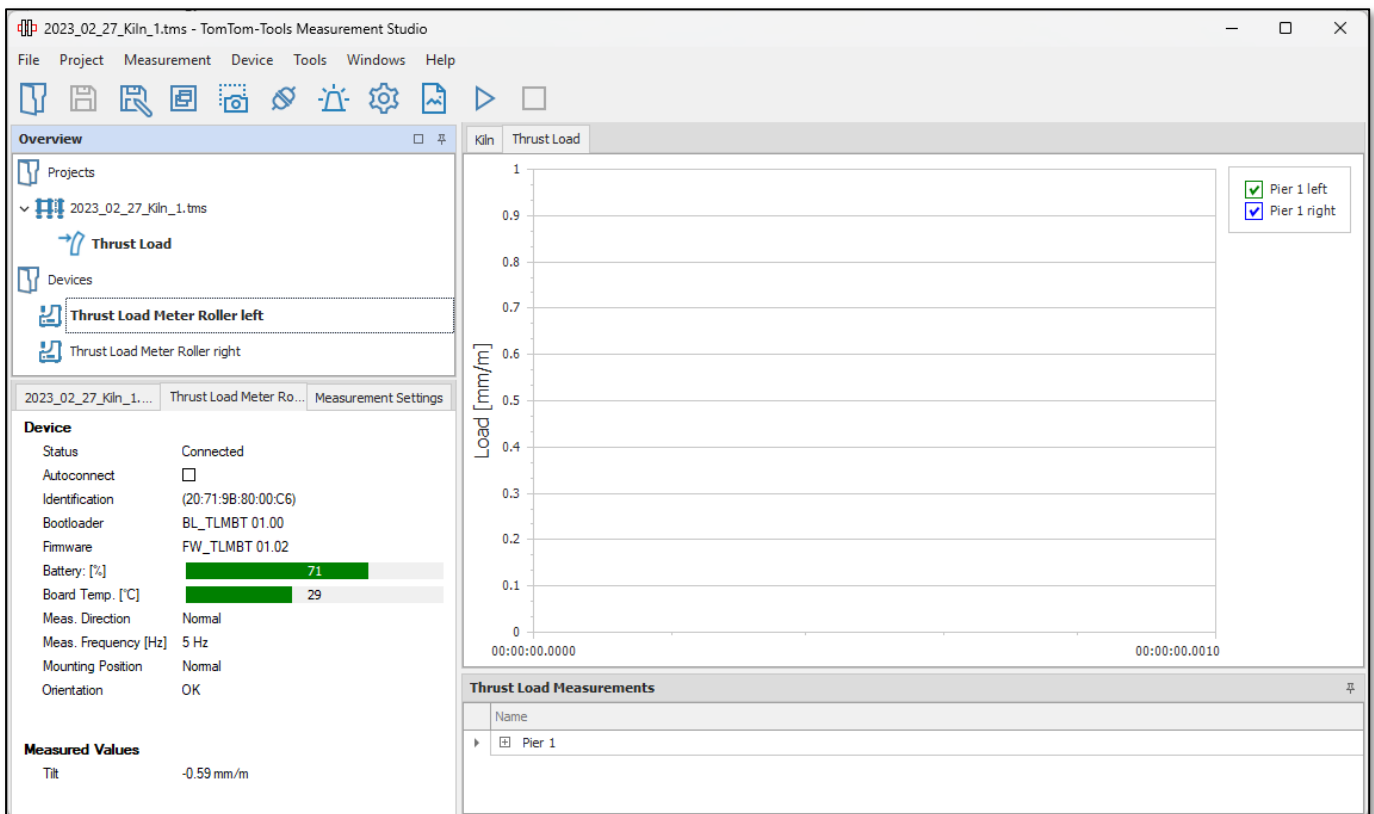
11.2 Set Up the Measurement Window

When the Thrust Load Meters are installed and the values are close to zero, the measurement can start.

- a. To start a new measurement, click on “Project / Add Thrust Load” as shown here.
- b. Enter the required information while going through the setting wizard

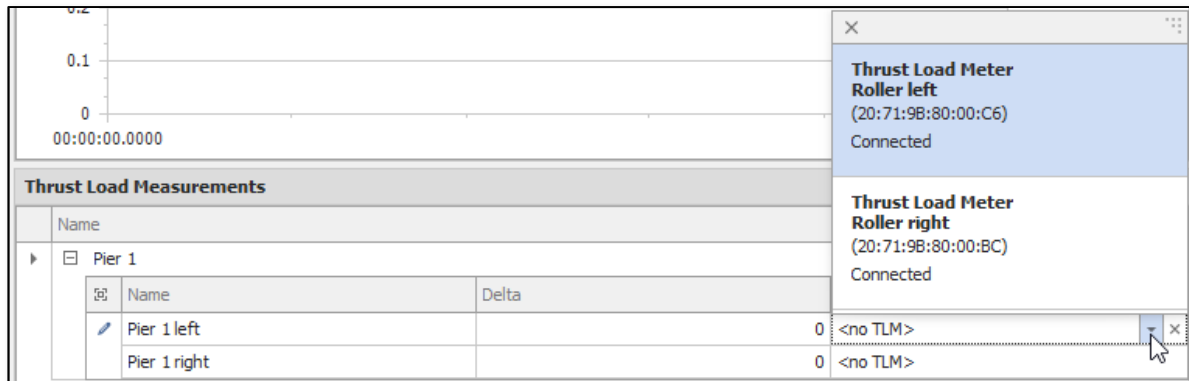


Fig.11.2.1 Measurement Window



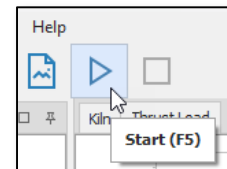
11.3 Device Allocation

Select the available Thrust Load Meter and allocate it to the support rollers to be measured. To do so, click on the small arrow in the table and the drop-down menu with the selection will open as shown in Fig. 11.3.1



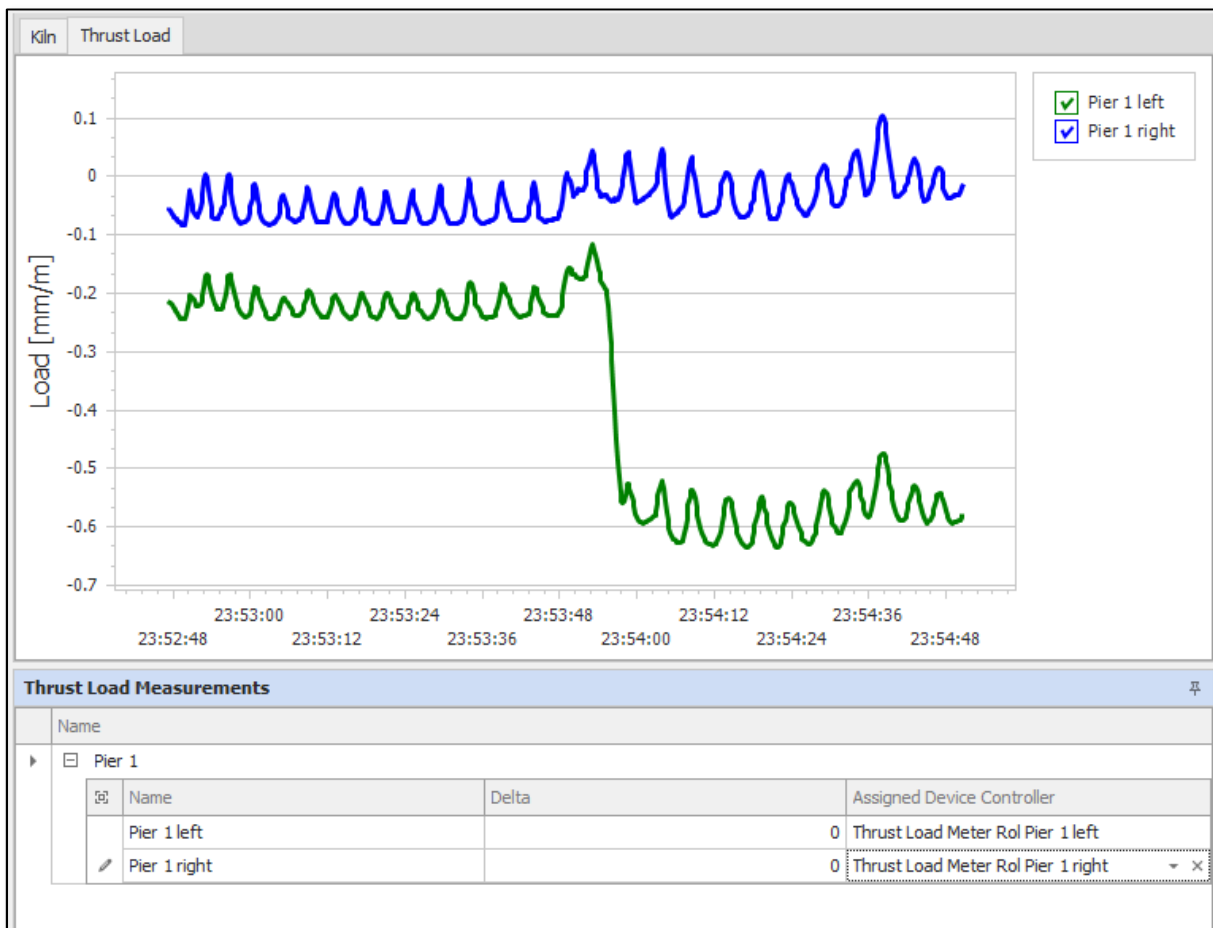
11.4 Start the Measurement

Click on the Start Button or F5 to start the measurement. The values of the connected Thrust Load Meter are displayed.



11.5 Identify the high loaded roller

Let the measurement continue for a while, e.g. approximately 20 kiln turns without touching them. Then apply soap to the roller surface: Hold a soap block against the roller surface; it reduces drastically the friction factor between the tire and the roller. In case there is axial load, caused by skewing, it will be significantly reduced, as shown in the example below. Fig.11.5.1:



12 THE RESULT

To quantify the tilt of the bearing, caused by the thrust load, compare the tilt or inclination value before and after the application of the soap.

1. Click on the field you like to get the value to get the option to select the relevant areas
2. Pull the highlighted field by the mouse to get two well separated areas, one before and one after the soap application
3. The Measurement Studio calculates first the average of the two selected areas and then the difference between them.
4. The difference between the two averages represents the impact of the change of the friction factor.
5. Here in the example, the blue curve (right roller) remains almost same, hence there is almost no axial load present (no skewing = neutral).
6. The green curve (left roller) shows a significant change in the thrust load. That means this roller is highly loaded in axial direction due to skewing

Fig.12.0.1. Result of thrust load measurement

