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User Manual:

Inductive Distance Measurement (IDM) Tool Kit III

1. INTRODUCTION:

The Inductive Distance Measurement (IDM) Tool Kit is a multi-purpose measurement tool. Typically it is used to check the condition of rotating parts during operation (e.g. on Rotary Kilns, Dryers, Ball Mills). It measures variation of distances of moving metal surfaces without contact (typically steel surfaces) with high accuracy and high speed (up to 1000 measurements per second). It can be considered as a contactless dial gauge.

Typical applications:

- Run-out measurement of girth gears on rotary kilns, rotary dryers and ball mills
- Run-out measurement of kiln tires
- Roller shaft bending measurement of support rollers on rotary kilns
- Shaft movements in gear boxes and drives
- Roundness and run out check of trunnions on ball mills

More applications:

The IDM III Controller can be used for any kind of sensor with an output of 0...10V or 0...20mA (supplied from August 2022)

Hence there are much more applications possible. E.g.:

- High speed hydraulic pressure measurement on vertical roller mills and roller presses
- Shell deformation measurement on rotary kilns or ball mills with laser distance sensors
- Verification of values of any installed sensor output signal directly on site
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1.1 Safety:

Rotary kilns, dryers and mills, where this tool typically is used, are huge rotating equipment with many pinch points, they can cause serious injuries. Therefore only specialized and trained personnel shall work close to these machines. To use the tool, 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. 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 measurement campaigns and might need to be adapted to the local 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.

For gear run out measurements, **never place sensors on the side where the teeth are engaging**; place them always on the out running side, to avoid the items get caught between



Magnet Fields:

Be aware of the strong magnet field of the magnet stands.

Keep the tool away from people with pace makers or any other sensitive item as credit cards or magnetic data carrier.



Clamping:

Do not put fingers between the magnets and magnetic surface. There is the risk for clamping or pinching, due to the strong magnetic force.



Gloves:

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

1.2 Measuring Principle:

The Tool Kit is equipped with different inductive distance sensors. These sensors use the physical effect of the change of a resonance circuit, which is caused by eddy current losses in conductive materials. The losses depend on the distance between the coil in the sensor head and the conductive surface. The circuit measures the losses and converts them into a linearized 0...10V output signal.

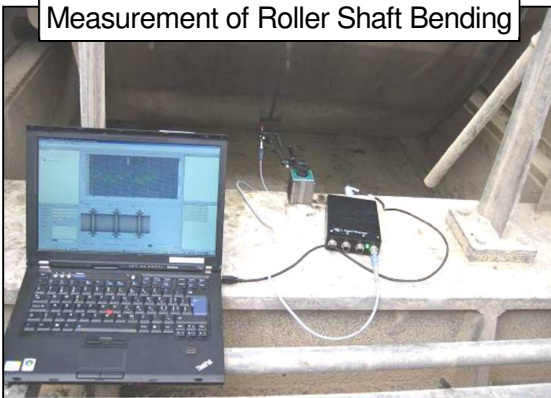
The signals of maximal six sensors can be measured by the IDM3 Controller, which converts them into numeric values and sends them via Bluetooth to a PC.

The software **TomTom-Tools Measurement Studio** (for Windows), which comes together with the measurement tool is made to receive, store and process the values from the IDM Controller.

There are already 4 types of applications available in the software:

- **Raw Data Acquisition:**
In this mode the data are one to one displayed in real time on the computer screen.
- **Roller Shaft Bending Measurement**
This application is used on rotary kilns with 3 or more stations. It calculates automatically the variation of shaft deflections, which are caused by a crank in the kiln shell.
- **Gear Run Out Measurement**
The application is calculating automatically the radial and axial run out (eccentricity and roundness) of rotating parts. (typically girth gears and mill trunnions)
- **Tire Run Out Measurement**
The application is calculating automatically the axial run out (wobble) of a kiln tire

Measurement of Roller Shaft Bending



Measurement of Girth Gear Run-Out

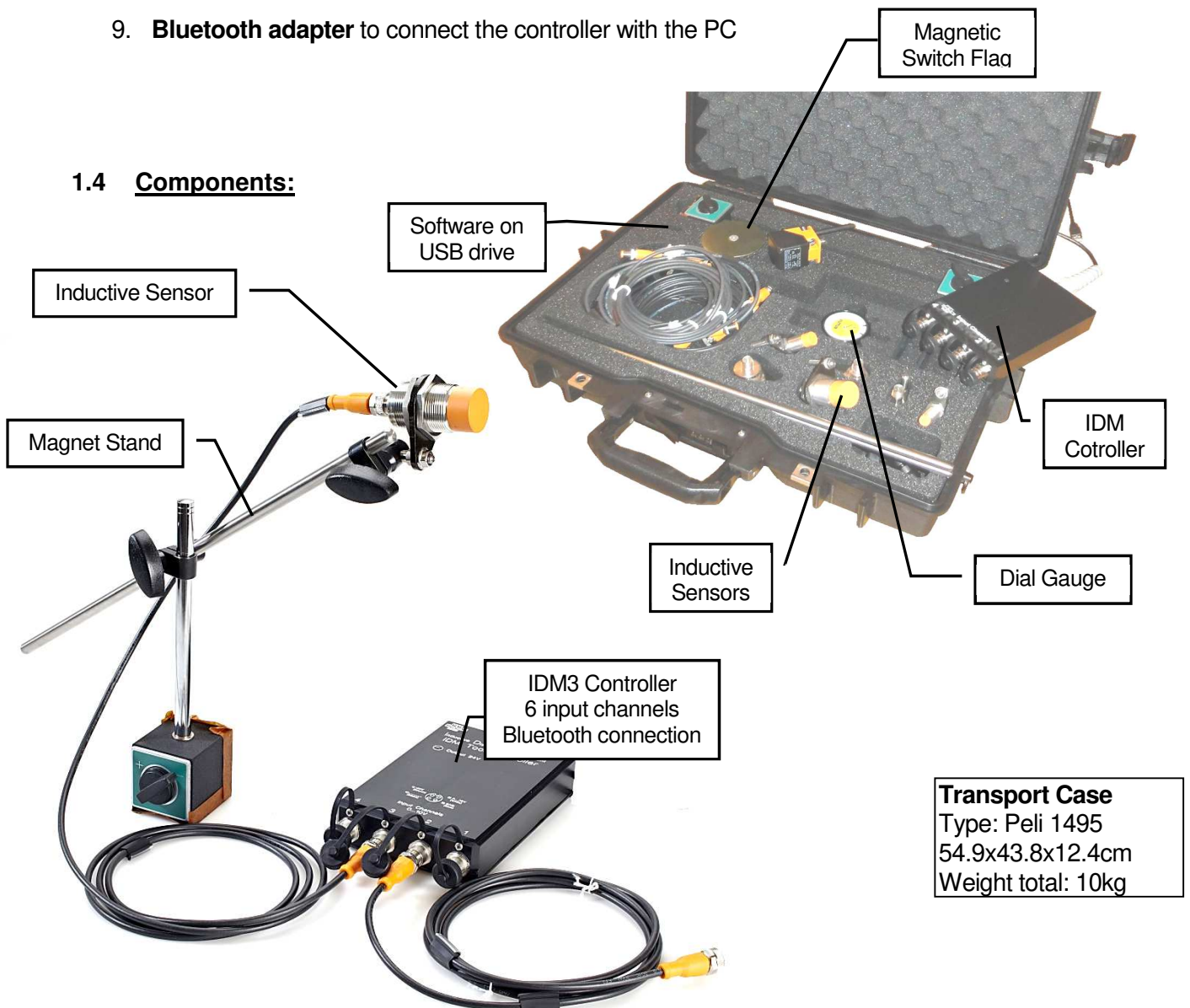


Measurement of Girth Gear Run-Out

1.3 Tool Kit includes:

1. **IDM3 Controller**
With six input channels 0...10V or 0...20mA, integrated battery and 24VDC power supply for the sensors, Bluetooth connection to PC
2. **Inductive Sensors**
2 Sensors Ø12mm, 2 Sensors Ø18mm, 2 Sensors Ø30mm, 1 Sensor 40x40mm, 1 Sensor 30x14mm
3. **Sensor Cables** with 2m and 5m length
4. **Magnetic Stands**
Including connectors, extension rods and sensor holders
5. **Dial Gauge** for reference measurements
6. **Magnetic switch flag** with heat resistant magnet (up to 300°C) and extension rods
7. **Transport Case** with foam cushioning extra tough, water and dust seal (suitable for air cargo)
8. **Manual** and **Software** for Windows on USB memory
TomTom-Tools Measurement Studio
9. **Bluetooth adapter** to connect the controller with the PC

1.4 Components:



Transport Case
Type: Peli 1495
54.9x43.8x12.4cm
Weight total: 10kg

2. THE SENSORS

Any sensor with 0...10V or 0...20mA output can be connected to the IDM controller (maximal power consumption of all connected sensors together: 400 mA @ 24VDC)

Sensor Name:	IFM D12 (0.4...4mm)	IFM D18 (0.8...8mm)	IFM D30 (1...15mm)	IFM 40x40 (1...25mm)	Turck 30x14 (3...8mm)
Dimension:	Ø12mm	Ø18mm	Ø30mm	40x40mm	30x14mm
Operating Range	0.4...4mm	0.8...8mm	1...15mm	1...25mm	3...8mm
Slope (gradient)	0.36 mm/V	0.72 mm/V	1.4 mm/V	2.4 mm/V	0.5 mm/V
Y-Intercept	0.4mm	0.8mm	1mm	1mm	3mm
Minimal Target	12x12mm	24x24mm	45x45mm	90x90mm	40x40mm
Linearity Error	±3% of UA max	±1% of UA max	±1% of UA max	±3% of UA max	±3% of UA max
Repeatability	±2% of UA max	±1% of UA max	±1% of UA max	±2% of UA max	±1% of UA max
Temp. Coefficient	±10% of UA max	±5% of UA max	±5% of UA max (-25...70°C) ±10% of UA max (70...80°C)	±10% of UA max (-25...70°C)	±10% of UA max (-25...70°C)
Response Time	< 10 ms	< 10 ms	< 20 ms	< 20 ms	7 ms
Operating Temperature	-25...80°C				-25...70°C
Output	0...10VDC (analog)				
Operating Voltage	15...30VDC				
Current Consumption	< 20 mA				
Protection	IP 67				
Correction Factors	Mild Steel = 1 Stainless Steel = approx. 0.5 Aluminum = approx. 0.4 Copper = approx. 0.3				
Display	Within operating range: yellow (permanently lit) Outside the operating range: yellow (flashing)				
Mounting:	Non-flush mountable				Flush mountabl.
Wiring					Special adapter cable required (M8 → M12) with pin change (pin4→pin2)

2.1 Features:

The IDM II controller is equipped with a Li-Ion Battery pack and a power convertor to supply the sensors with 24VDC.

The battery gets charged by the charger, which is included in the tool kit or by USB or any other power source from 5 to 12VDC (center pin positive).

With the power switch, the controller is switched on and off.

The light (LED) indicates the condition of the controller.






A **constant green** light shows that the tool is switched on and is in **normal operation**.

Slowly green blinking indicates battery **charging**

Slowly yellow blinking indicates a **warning** as increased temperature or low battery status. If the tool is connected to the PC, a warning window will appear on the screen as well. Ongoing Measurements can be completed without problems.

Fast red flashing shows an **alarm** as dangerous high temperature or battery completely empty. In case of temperature alarm, the tool has to be removed immediately for cooling to prevent damage. It creates also an alarm window on the PC screen.

A **constant blue light** indicates that the tool is **measuring**.

LED (Tool Condition)	
OK	
Battery charging	
Measurement	
Warning	
Alarm	

The sensors* are also equipped with LEDs near their plugs, which indicate the function of the sensor. A **constant light** indicates that the sensor is working and is in normal range. A **blinking light** shows that the sensor is out of range. This means, that the surface to measure is too far away or too close to the sensor. *(except low profile sensor)

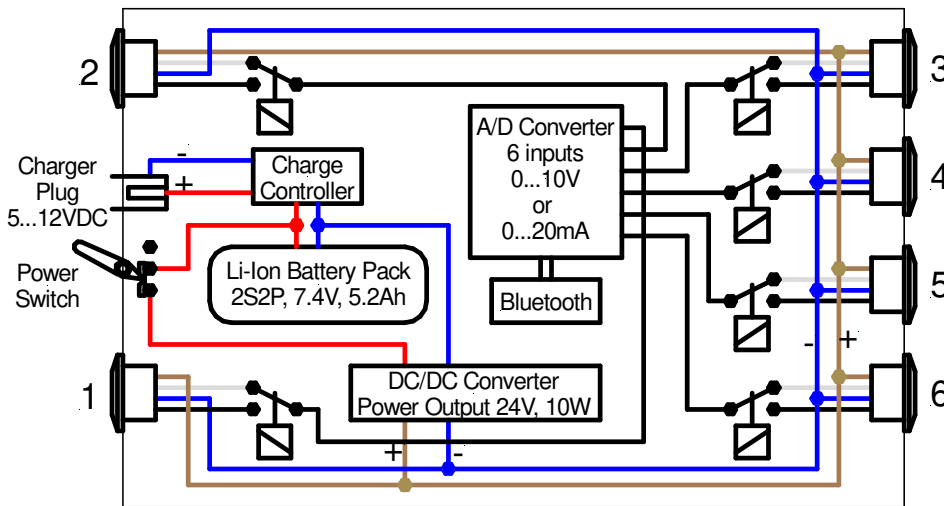
3. IDM3 CONTROLLER:

The following schematic shows the main components and wiring of the IDM Controller.

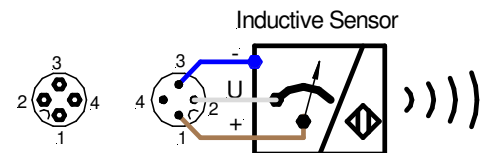
The pins 1 and 3 supply the 24VDC for the sensors

The analog signal from the sensor is fed back to the controller either via pin 2 or 4; depending on the sensor. The sensors, which are included in the tool kit, have a 0...10V output on pin 2. (Sensors with orange heads from IFM)

In case a sensor with mA output or with the signal on pin 4 is used, configure the respective channel accordingly via Measurement Studio.



- 1 brown: sensor power supply (+24VDC)
- 2 white: default sensor input (0-10V, 0...20mA)
- 3 blue: GND (-)
- 4 black: optional sensor input (0-10V, 0...20mA)



4. SOFTWARE:

The software (**TomTom-Tools Measurement Studio**), which is used for the IDM Tool Kit and for all others of our tools, comes along with the tool on a USB memory stick. Nevertheless, it is recommended to **install the software from www.tomtom-tools.com**, where always the latest version is available for download.

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.

Softwares & Resources



Measurement Studio

Size: 70 MB

Downloads: 1372

[Download](#)

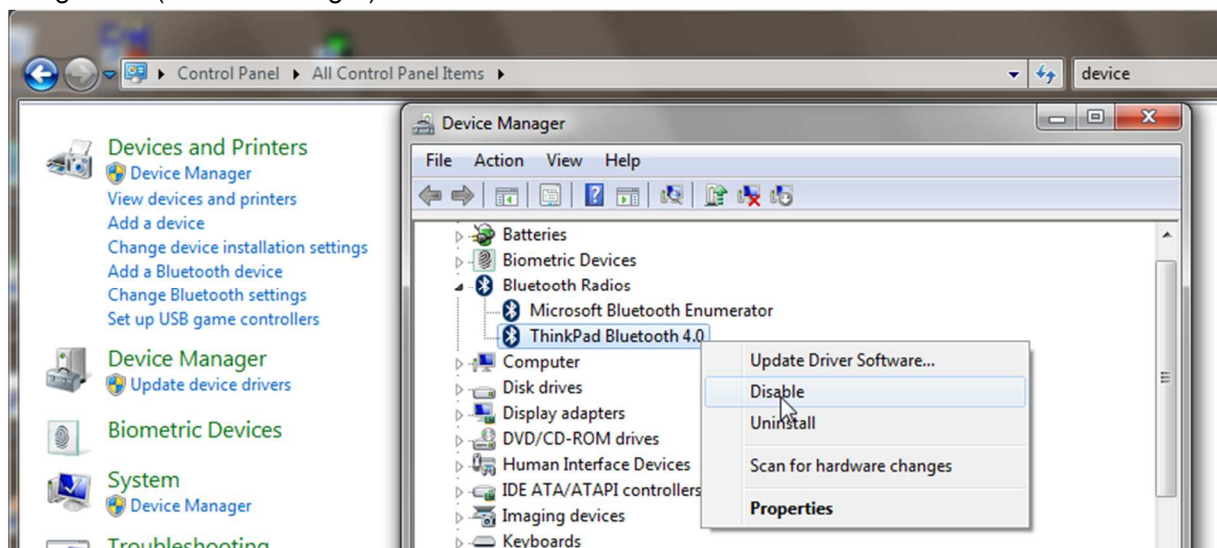
4.1 Bluetooth Adapter

To ensure, the data connection between the Ovality Sensor and the PC is reliable, even in difficult industrial environment, a Long-Range Bluetooth adapter (Sena Parani UD100) comes along with the tool kit.

Note:

- The TomTom-Tools are designed to communicate **only with the generic Windows Bluetooth Stack**. If there is another Bluetooth software installed (e.g. Toshiba, Widcomm, Intel, ThinkPad,...), **deactivate it in the Device Manager** as shown below:

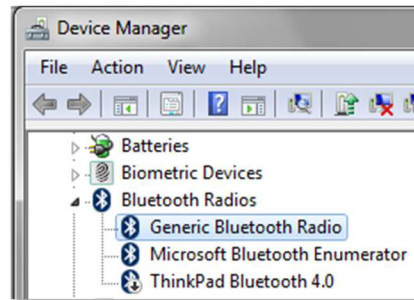
Fig. 4.1.1 (Device Manager)



- Then plug the Bluetooth adapter UD100. Windows recognizes the new hardware and automatically install the suitable Windows driver (Windows generic Bluetooth)
- 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. 4.1.1 (Integrated Bluetooth down)



5. START THE TOOL:

5.1 Connect IDM Controller with Laptop

When the software installation is completed, it starts automatically. To connect a tool for the first time it has to be paired with the computer. To do so, follow this sequence:

- Switch on the IDM3 Controller (green LED).
- 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 one minute.
- Select the device, which has to be connected; (here IDM3) and click “OK”

Fig. 5.1.1 (Add Device)

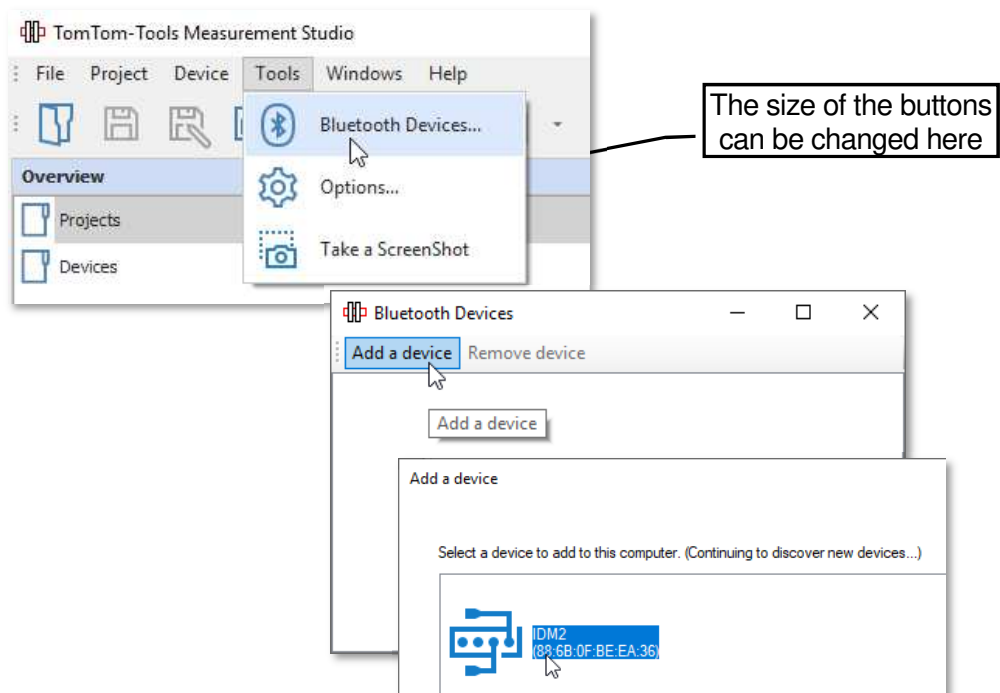


Fig. 5.1.2
(Connect Device)

- IDM3 gets added to the Device List
- To connect it, select it and click on the “Connect” Button



Fig. 5.1.3
(Device Window)

The screenshot shows the 'IDM2' device window in TomTom-Tools Measurement Studio. The window displays the following information:

- Device Information:**
 - Status: Connected
 - Autoconnect:
 - Identification: (88:6B:0F:BE:EA:36)
 - Bootloader: BL_IDM2 01.03
 - Firmware: FW_IDM2 01.06
 - Battery: 7.15 V (indicated by a green progress bar)
 - Board Temp. [°C]: 25 (indicated by a green progress bar)
 - Meas. Frequency [Hz]: set: 100
- Channel Configuration Table:**

Channel	1	2	3	4	5	6
Enabled	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Mode	Voltage	Voltage	Voltage	Voltage	Voltage	Voltage
Pin	2	2	2	2	2	2
Value [V]	0.15	0.15	0.15	0.15	0.15	0.15
- Scalings List:**
 - No Scaling
 - 30mm Turck
 - M30 IFM I15914
 - Sensor 30x14mm
 - Sensor 40x40mm
 - Sensor ø12mm
 - Sensor ø18mm
 - Sensor ø30mm

Annotations in the image include:

- "To connect click here" pointing to the Connect button in the Overview panel.
- "Device can be connected, when displayed here (in black letters)" pointing to the 'IDM3' label in the Overview panel.
- "Battery Status" pointing to the battery level indicator.
- "Click here to change the sampling rate" pointing to the 'Meas. Frequency [Hz]' field.
- "Add here the scaling of a new sensor" pointing to the 'New...' button in the Scalings list.
- "To change the pin of the input signal or from V to mA" pointing to the 'Edit...' button in the Channel configuration table.

6. RAW DATA ACQUISITION:

6.1 Purpose

The **Raw Data Acquisition** is a universal application to measure any kind of value. Either distances can be measured with the inductive sensors, included in the tool kit or other sensors can be connected with an output of 0...10V or 0...20mA.

This application is typically used, when measurements have to be taken, where no specific application is available in the Measurement Studio.

The values are directly displayed in the screen, where different zoom functions can be used. For further analysis, the data can also be exported to Excel or into other software.

6.2 Starting the Software Application

To start it, click “Projects / Add Raw Data Acquisition”

The computer screen will show the graph window with the empty sensor window below.

Click to add a channel and select the required sensor.

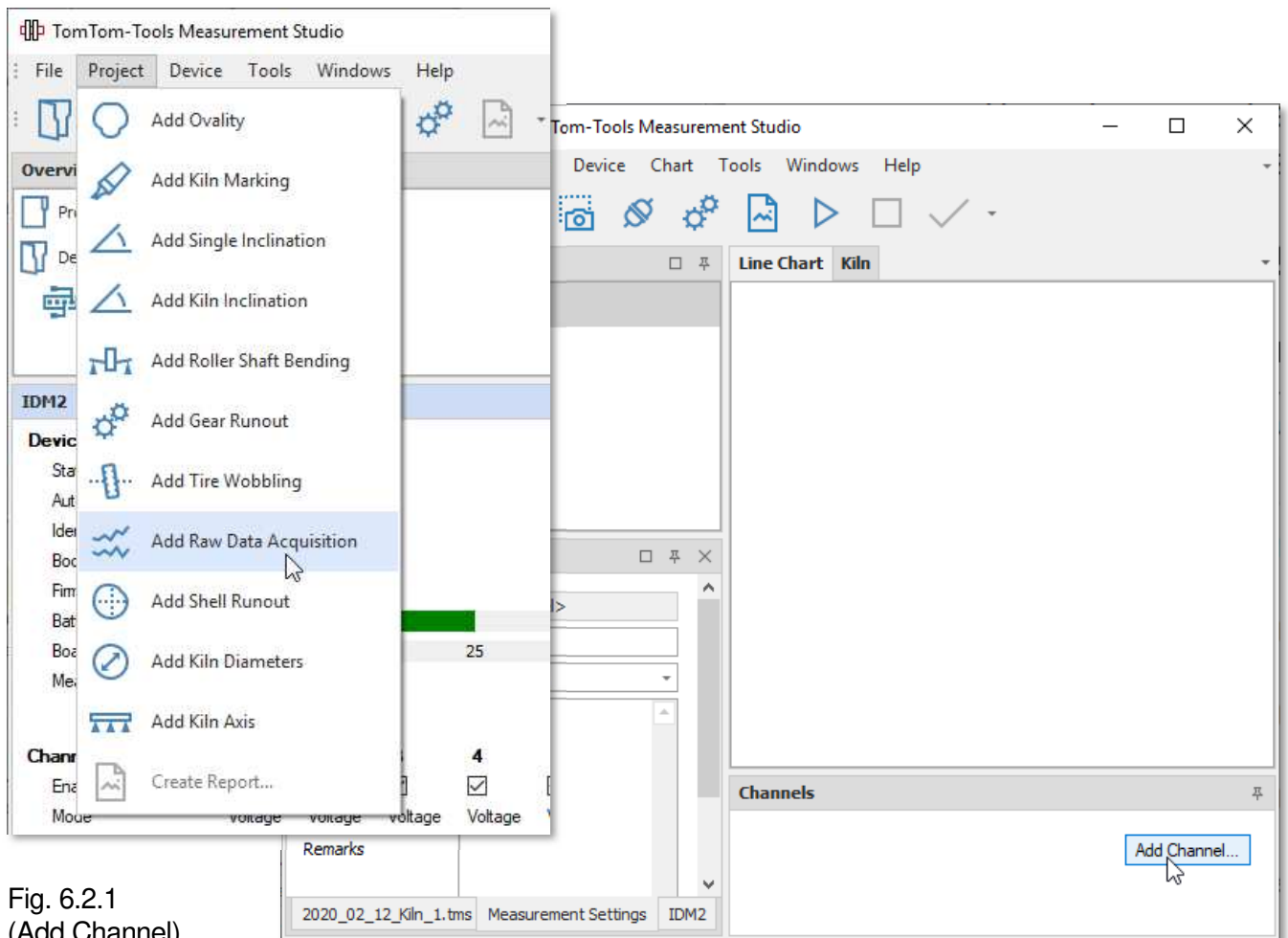
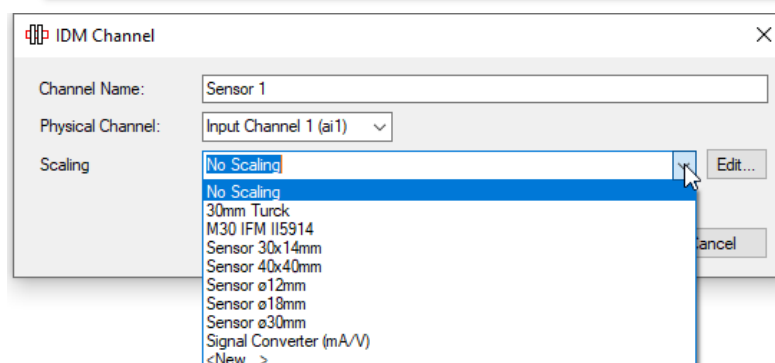


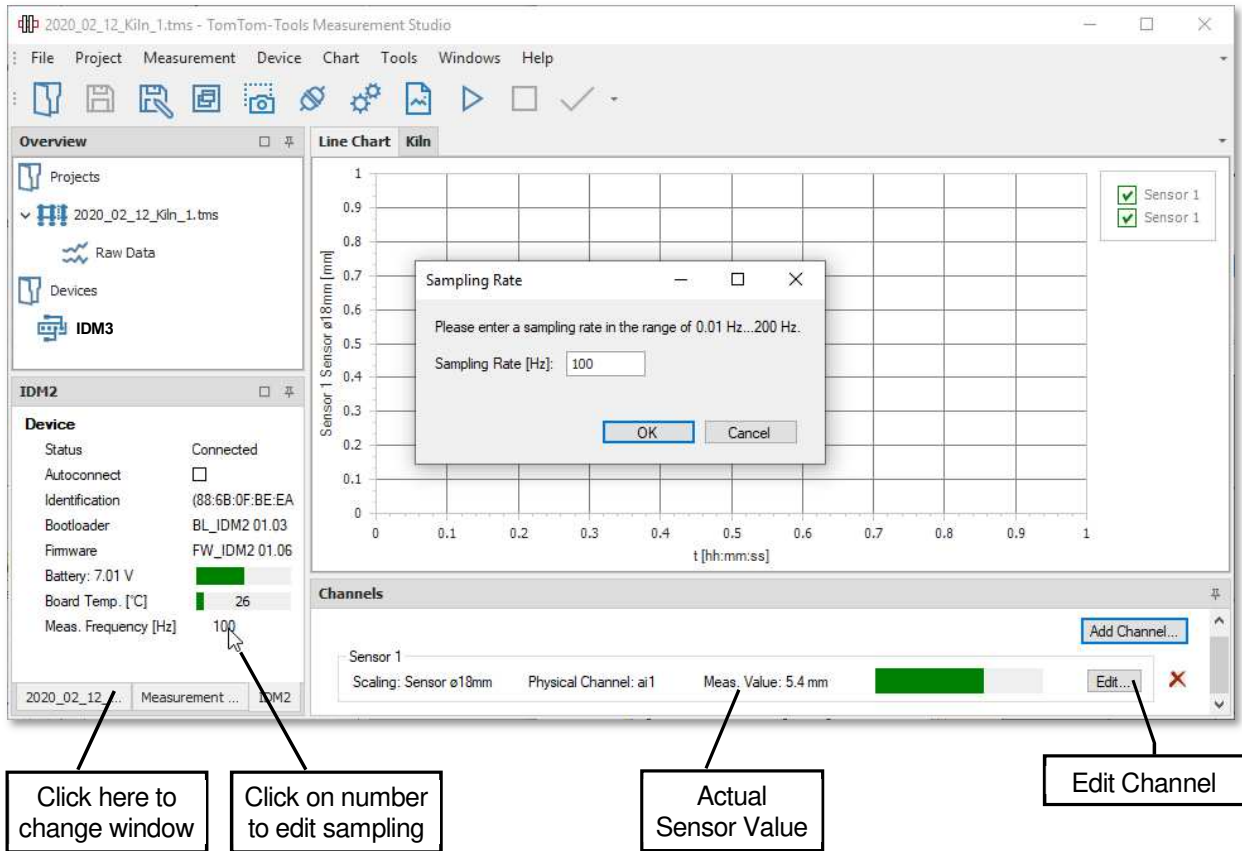
Fig. 6.2.1
(Add Channel)

Fig. 6.2.2
(Select Scaling)



Change the sampling rate by clicking on the number

Fig. 6.2.3 (Edit Sampling Rate)



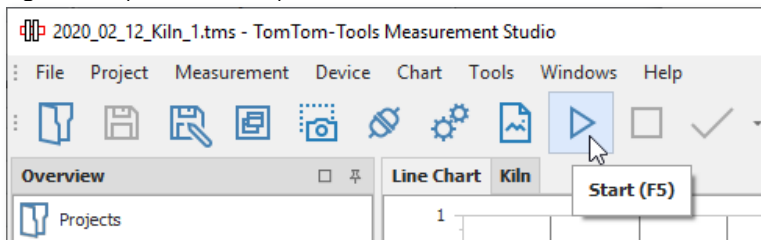
To add a sensor channel, click the button “**Add Channel**” (see picture above).
 Select an existing scaling or create a new one (as described above)

See the green bar; it indicates the **Sensor Value** (here; distance between roller surface and sensor).

6.3 Take Measurements

To **start** the measurements push the **Start** button or **[F5]**.

Fig. 6.3.1 (Start Button)

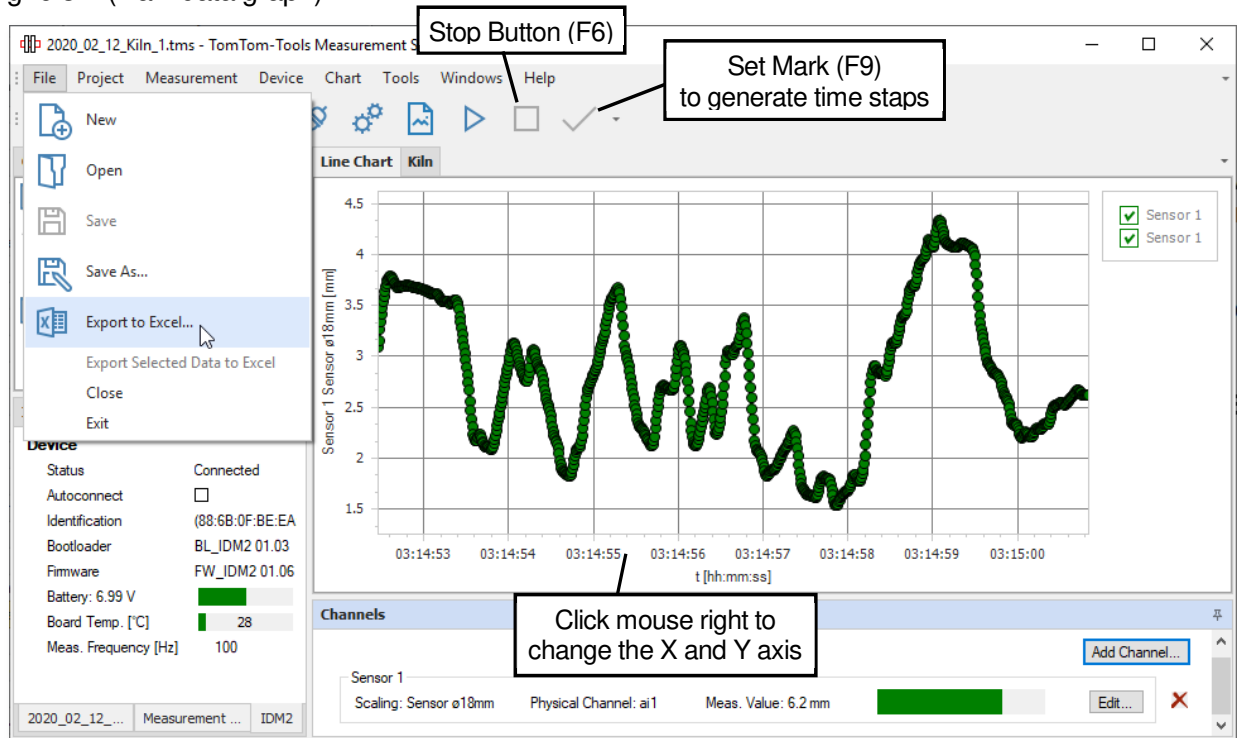


After starting the measurement, the values will appear on the computer screen. Each channel has its own curve with its own color. The lines can be hidden or displayed by clicking to the tick mark.

To **stop** the measurements push the **Stop** button or **[F6]**.

To **extract** the data in to Excel click: “**File / Export to Excel...**”

Fig. 6.3.2 (Raw data graph)



7. ROLLER SHAFT BENDING:

7.1 Measurement Principle

On a kiln support roller, the variation of the deflection of the roller shafts show possible cranks. Cranks are straightness errors in the kiln shell, which are affecting the loads on the roller stations with each kiln revolution.

There are two types of cranks:

- **Permanent / Mechanical Crank:**
Caused by plastic deformations in the kiln shell or errors during the kiln construction.
- **Thermal Crank:**
Caused by uneven temperature distribution / thermal expansion around the kiln shell circumference. (most severe close to the middle tire)

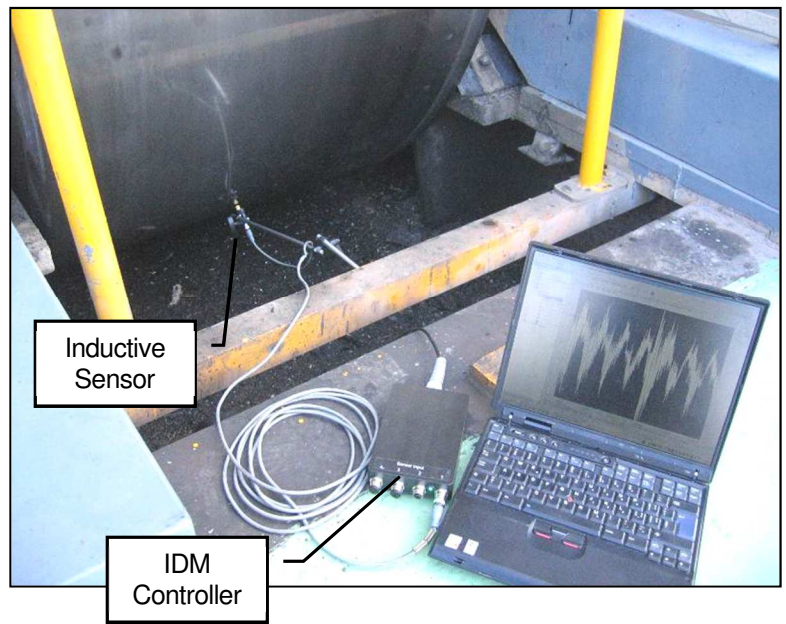
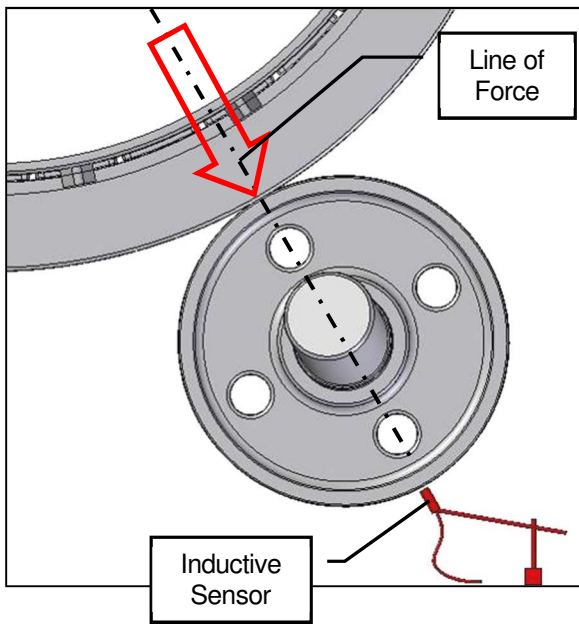
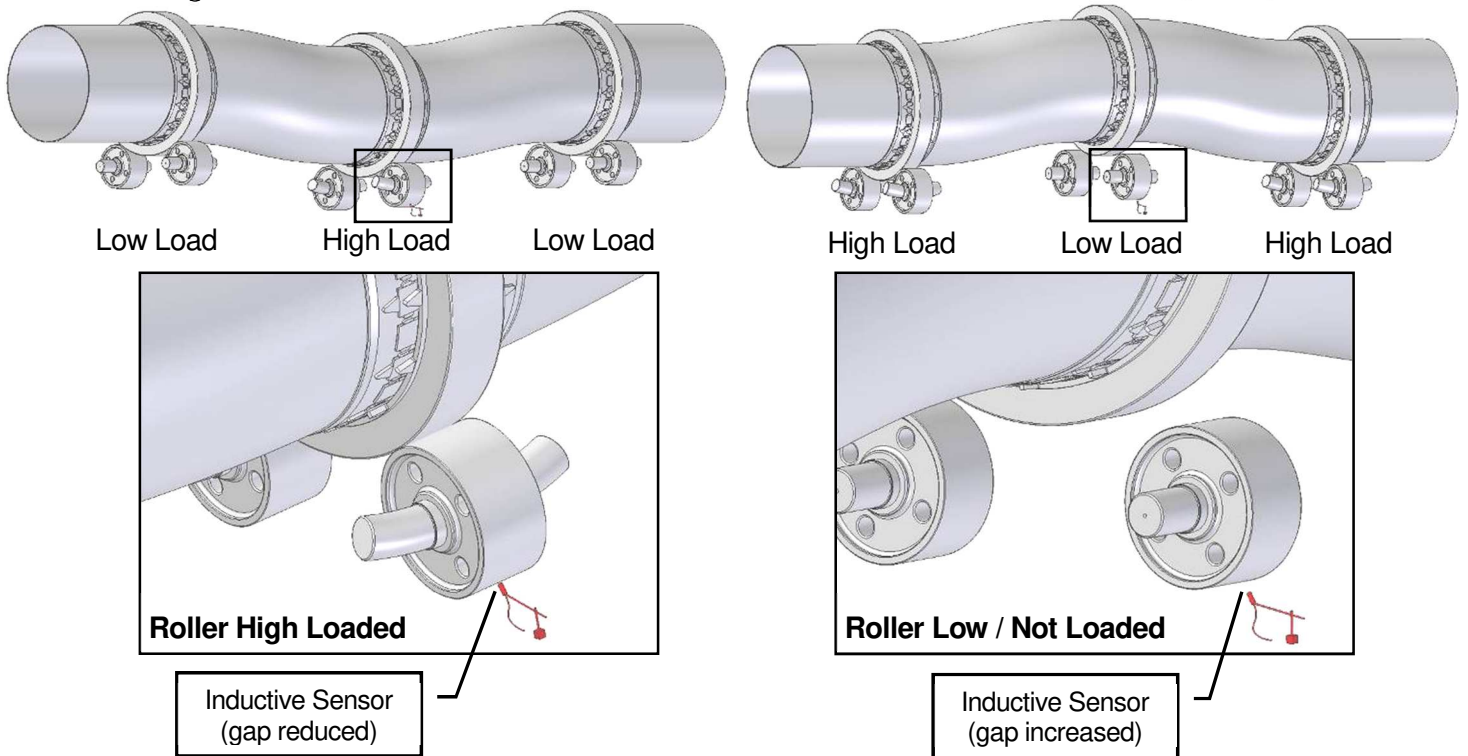
The load changes caused by cranks can be very strong and overload the tires and rollers, which results in cracks in tires, rollers and roller shafts.

The crank pushes the roller down; hence the distance between the sensor and the roller surface is reduced. Half a kiln revolution later, the crank turns up and the load gets reduced on this station; hence the distance to the sensor is getting bigger.

7.2 Place the Sensor

To measure the effect of a crank, an inductive sensor, typically $\varnothing 12\text{mm}$ is placed under the support roller in the line of force. That means on the opposite side of the contact to the kiln tire. (See pictures below)

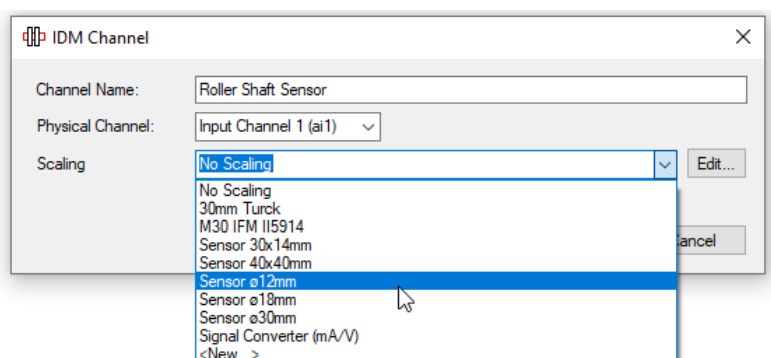
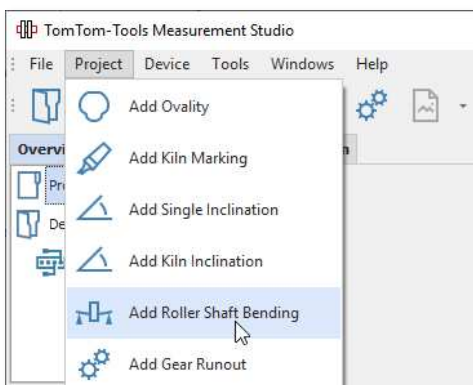
Due to the high stiffness of the roller shafts, these movements are very small (within tenths of millimeter), therefore it is recommended to use the smallest sensor of the IDM Tool Kit ($\varnothing 12\text{mm}$) to have the highest accuracy



7.3 Start The Software Application

The Measurement Studio includes a specific application to measure and calculate the variation of the roller shaft bending.

To start it, click “**Measurements / New / IDM / Roller Shaft Bending**”

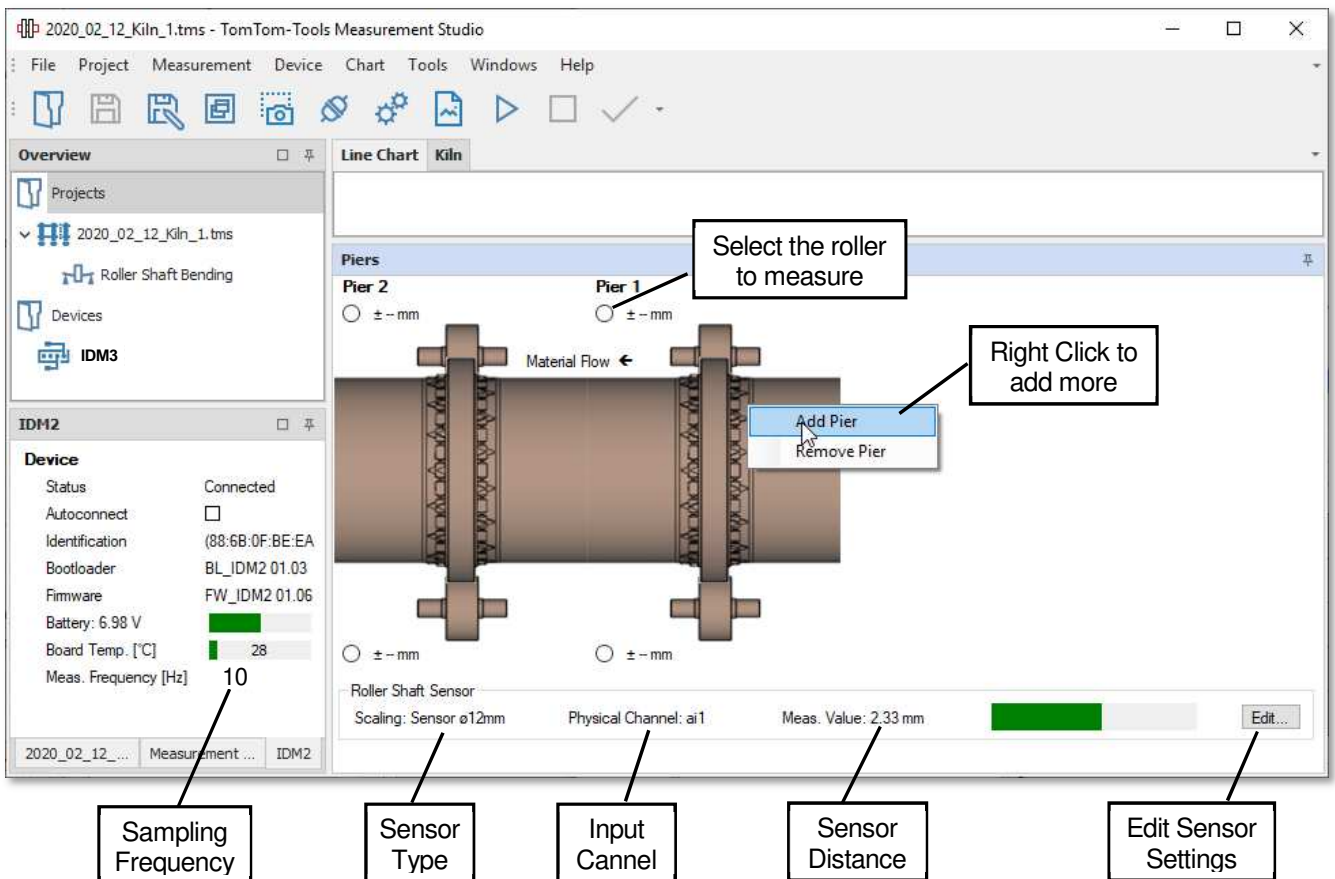


The computer screen will show a kiln tire with two rollers (top view).

To add more tires, click right mouse button and select “**Add Pier**” (see picture below)

See the green bar, which indicates the **Sensor Distance** (gap between roller surface and sensor). It should be approximately in the middle of the sensor range, at least never go to one of the extreme positions.

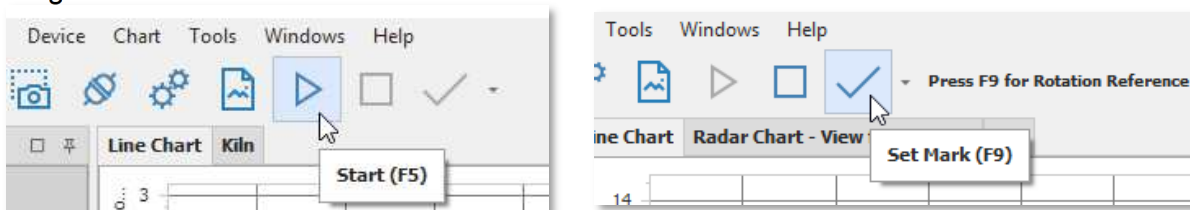
Software for Roller Shaft Bending Measurement:



7.4 Take Measurements

To start the measurement, select the roller on the computer screen and push the **Start** button or [**F5**].

Fig. 7.4.1/2



After starting the measurement, the values will appear on the computer screen (green curve)

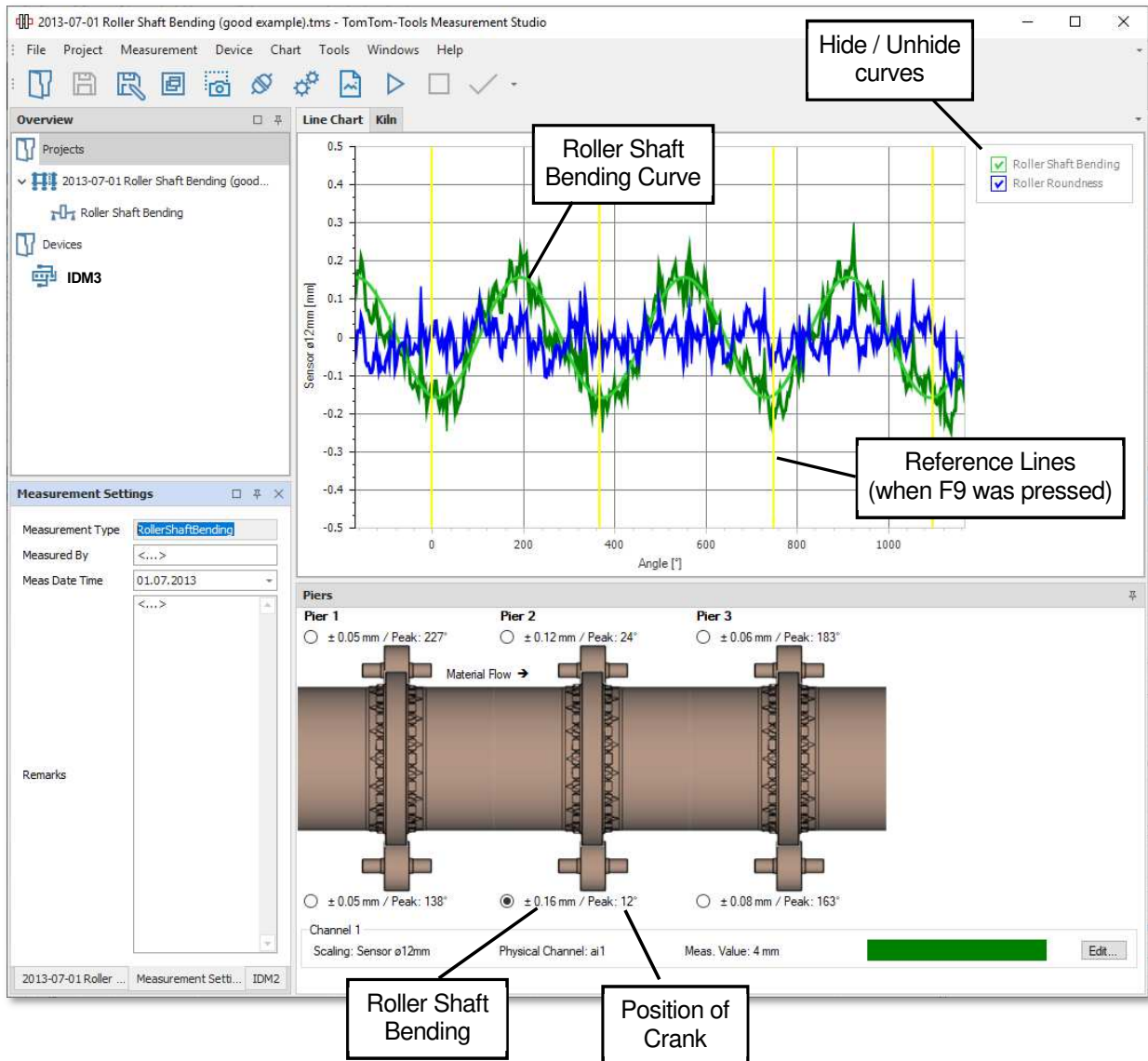
Note:

To be able to calculate the roller shaft bending value and its position around the kiln, the software needs a reference signal, when the reference point is passing the roller, which is measured.

Typically, the manhole in the kiln shell is used as reference point.

Each time when this reference point is passing the direction of the measured roller, push the **button [F9]** to indicate the kiln rotation. A yellow line in the graph will show the position of the reference point.

Fig. 7.4.3



The **green** curve shows the **measured values**



The **blue** curve is sinusoidal and shows the variation of **roller shaft bending** coming from a crank in the kiln shell



The **red** curve indicates the **roundness of the support roller** and is the difference between the measured curve (green) and the shaft bending curve (blue).

After about 3 kiln revolutions, sufficient data are collected and the measurement can be stopped. **To stop** the measurements push the **Stop** button or **[F6]**.

7.5 Interpretation of Results

To detect a crank on a 3 Pier Kiln, measuring the roller shaft bending on the middle pier is normally sufficient. Both rollers of a pier deflect typically the same way.

In case of high values, it is recommended to measure both rollers on the middle pier, to double check if really a strong crank is present or if some looseness in a bearing or foundation is causing the high values.

Note:

TomTom-Tools GmbH does not provide guide lines about roller shaft limits.

It has to be according to the equipment manual or discussed with the suppliers, how much roller shaft bending can be allowed.

Nevertheless, based on the experience of different kiln supplier the following guide values were established.

It has also been seen, that the values are valid for small and for big kilns, because the ratio between the load on the rollers and the dimensions is for all kilns similar.

Roller Shaft Bending Value:

> ±0.2mm	HH	Alarm
> ±0.15mm...±0.2mm	H	Warning
0...±0.15mm		Normal

The **position of the crank peak** is indicated by the angle in ° (deg) relatively to the reference point on the kiln shell (e.g. manhole).

For example, the value 167° means that the peak of the crank is located 167° after the manhole (consider the sense of kiln rotation).

Note:

The angle value of the crank peak is not important to judge the severity of a crank, but it helps to find out, if it is a permanent or a thermal crank.

Thermal cranks occur randomly; hence the peak angle will change.

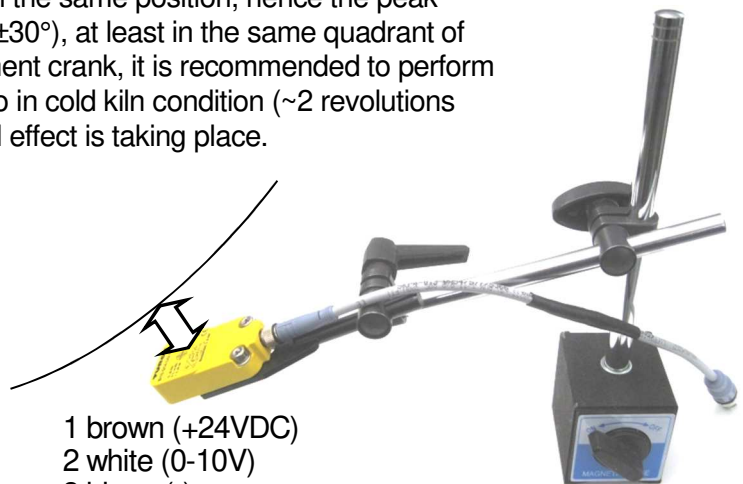
Permanent / mechanical cranks stay on the same position, hence the peak angle will stay more or less same (within ±30°), at least in the same quadrant of the kiln. In case of indication for a permanent crank, it is recommended to perform the roller shaft bending measurement also in cold kiln condition (~2 revolutions with auxiliary drive) to be sure; no thermal effect is taking place.

Optional:

For narrow space, flat sensor to measure roller shaft bending



- 1 brown (+24VDC)
- 2 white (0-10V)
- 3 blue (-)
- 4 black (=2)



8. GEAR RUN OUT:

8.1 Measurement Principle

Most rotary kilns and many ball mills are driven by open gear drives (pinion and girth gear). Due to difficulties during the installation or later during the operation, the girth gears might do not run concentrically nor straight.

The so-called axial and radial run-out can be measured, both in the same time, with the IDM Tool Kit during normal operation.

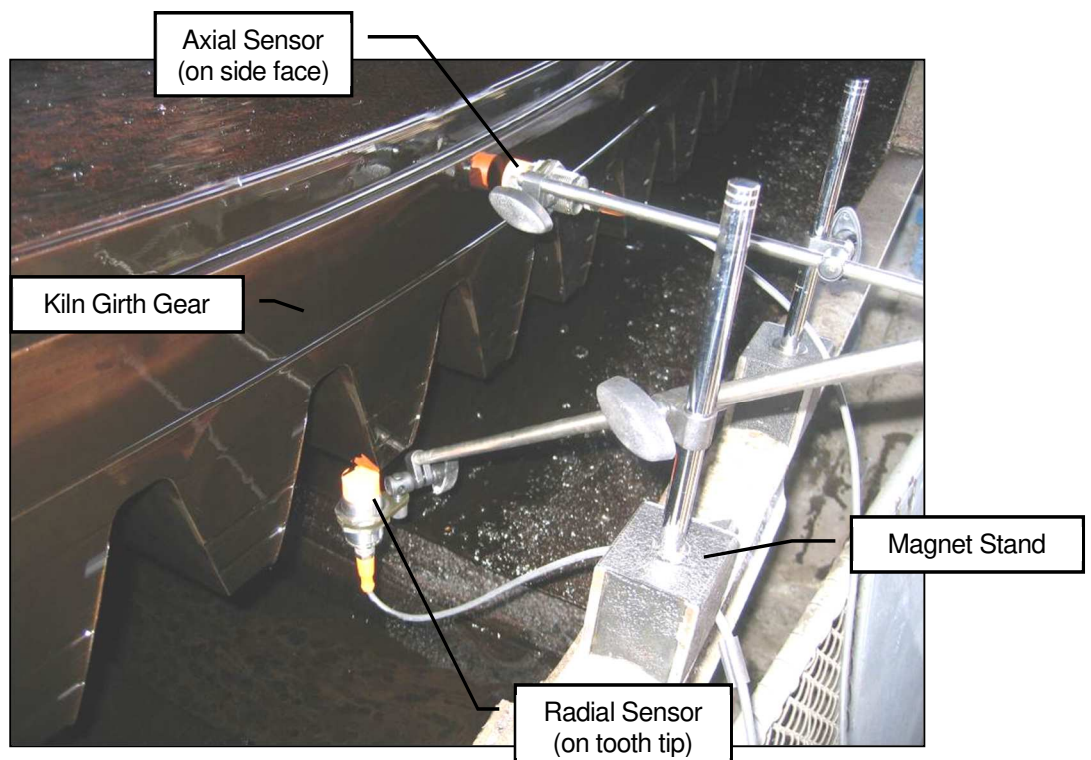
- **Radial Run-Out:**
Results in a change of center distance and affects the tooth engagement it is measured on the tip of the teeth.
- **Axial Run-Out:**
Affects the load distribution over the tooth width and is measured on a machined side face of the girth gear or on the side face of the teeth.

8.2 Place the Sensor

To measure the axial and radial run-out, two inductive sensors, typically Ø18mm are placed somewhere on an inspection window in the girth gear cover where is access to the tooth tip and to a machined side face of the girth gear.
(See pictures below)

Safety (first see page 3):

Never place sensors where the teeth are engaging; place them always on the out running side or far away from the pinion, to avoid items get caught between.

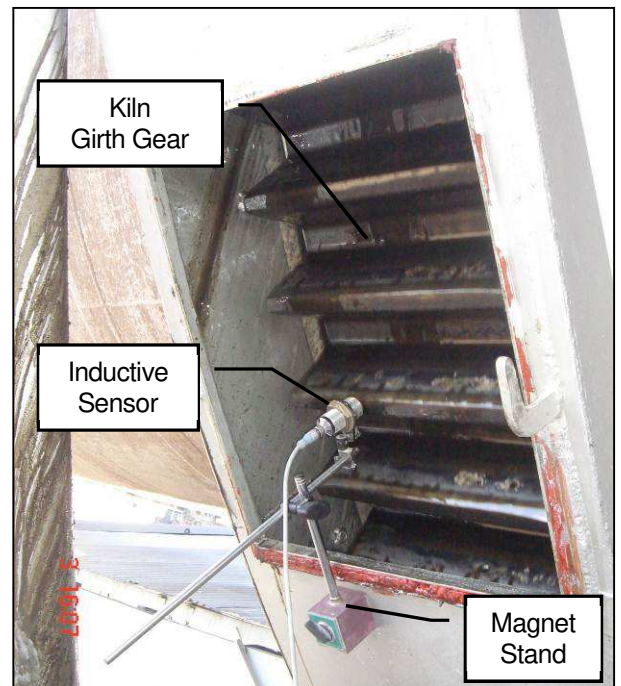
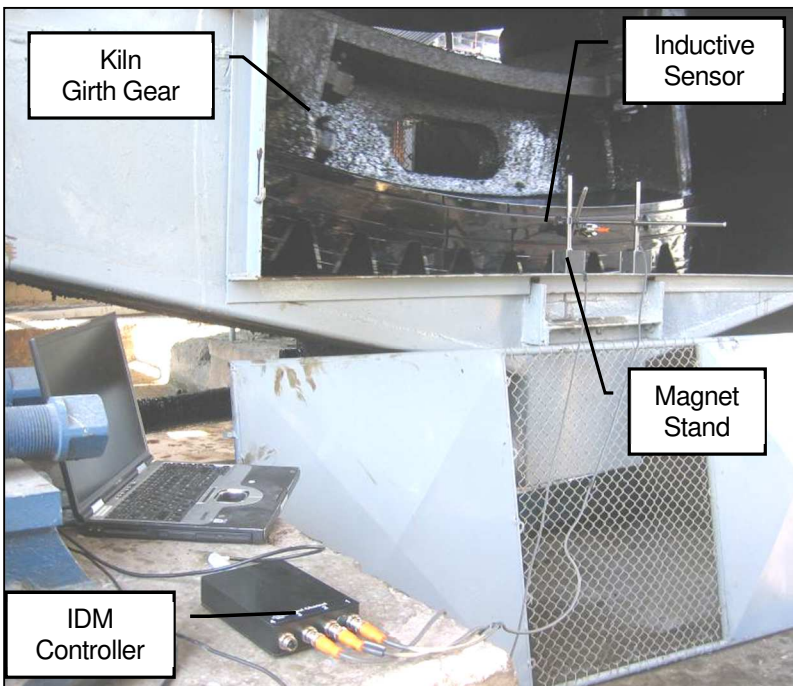
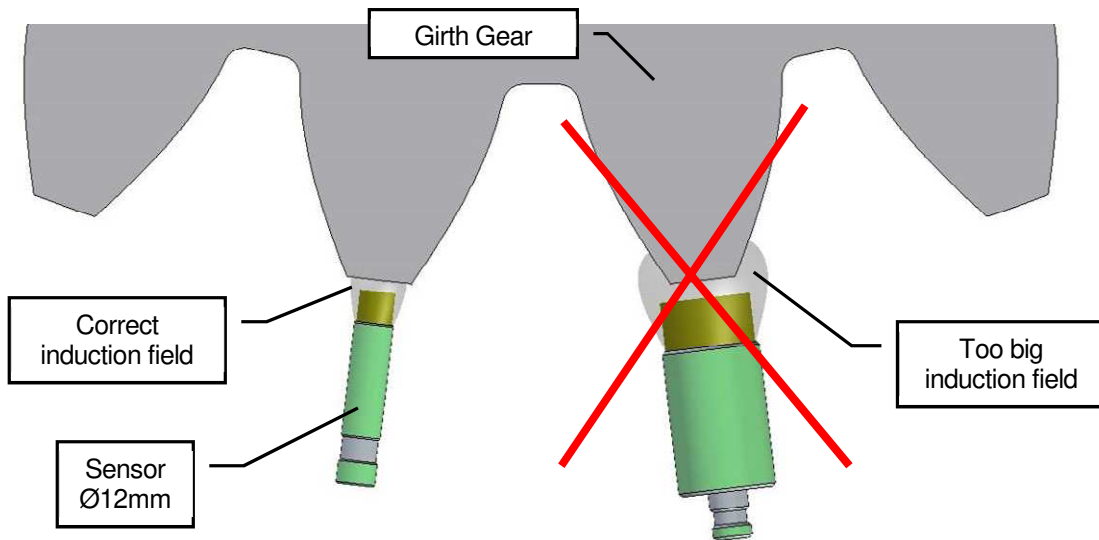


Sensor Size:

In this application it is also recommended to use the smallest possible sensor to have the highest accuracy. Unfortunately, often is the sensor range not sufficient, hence a bigger sensor with more range has be used, especially on kilns.

Note:

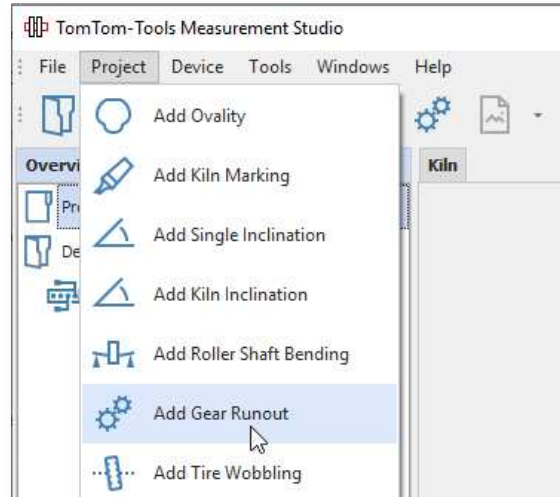
The surface which gets measured has to be bigger than the sensor diameter, in order to get the correct distance value (see picture below). On small surface use small sensor, otherwise the error has to be evaluated case by case and corrected in the sensor scaling.



8.3 Start The Software Application

The Measurement Studio includes a specific application to measure and calculate the run-out of gears. It can also be used for measuring the axial run-out of kiln tires.

To start it, click “**Project / Add Gear Runout**”



The computer screen will show the graph window with the value window below.

Both types of measurements (radial and axial) are equipped with two buttons to **select the surface type**. In case of measuring the run-out on tooth tips, click on the left button; this activates the measurement filter, which will hide automatically the not useful measurement points between the teeth. For evaluation this filter function can also after measuring be activated and deactivated.

See the green bar, which indicates the **Sensor Distance** (gap between measured surface and sensor). It should be approximately in the middle of the sensor range, at least never go to one of the extreme positions unless between teeth, where the distance is out of range.

Attention:

For measuring tooth wheels on the tooth tip, **adjust the sampling rate to min. 5 times the gear mesh frequency**. (See also chapter 4.4)

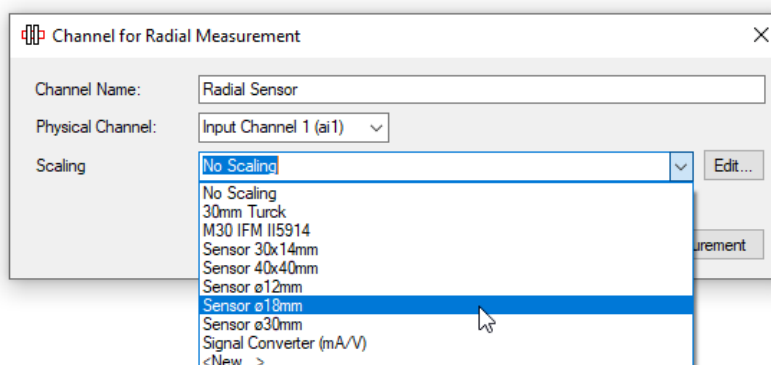
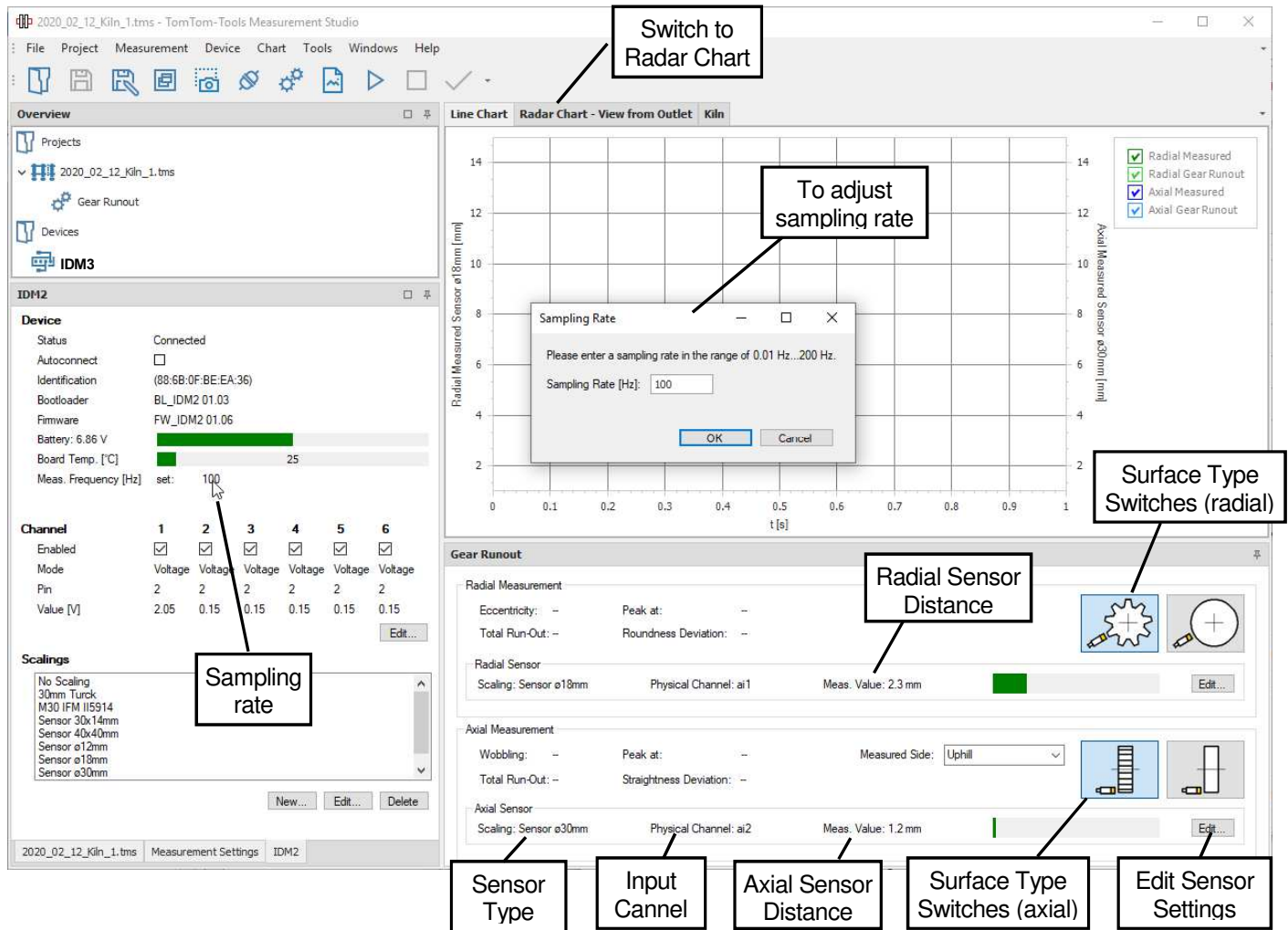


Fig. 8.4.1 (Gear Runout Measurement)



8.4 Sampling Rate (Frequency) Adjustment

The sampling rate is the numbers of measurements, which are taken within one second; hence the unit is Hz (Hertz). It is important to adjust the sampling rate to the measurement application.

In case of fast changing signals (e.g. run-out measurement of a kiln girth gear under full speed), the frequency has to be high to catch each tooth tip (e.g. 100Hz)

In case of slow changing signals (e.g. kiln support roller shaft bending), the frequency can be low (e.g. 10Hz) because the interesting value, varies only once over one complete kiln revolution.

Of course, slow applications could also be measured with a high sampling rate, but then, unnecessary big data files would be created.

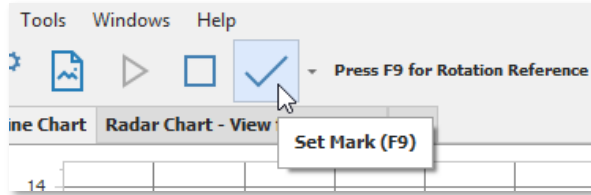
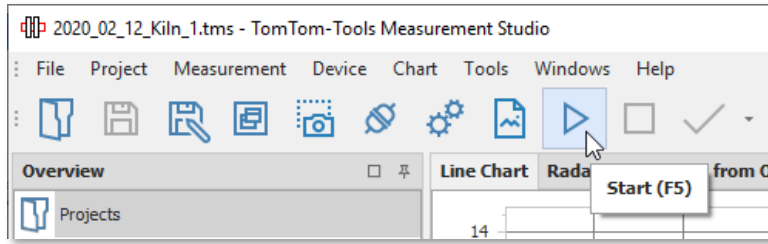
Some guidelines about the adequate sampling rates are also given later in the chapters of the different measurement applications.

Attention:

In case, the sampling rate is tool low while measuring tooth wheels on the tooth tip, the results will not be useful. **Adjust the sampling rate to min. 5 times the gear mesh frequency.**

8.5 Take Measurements

To start the measurements, push the **Start** button or **[F5]**.



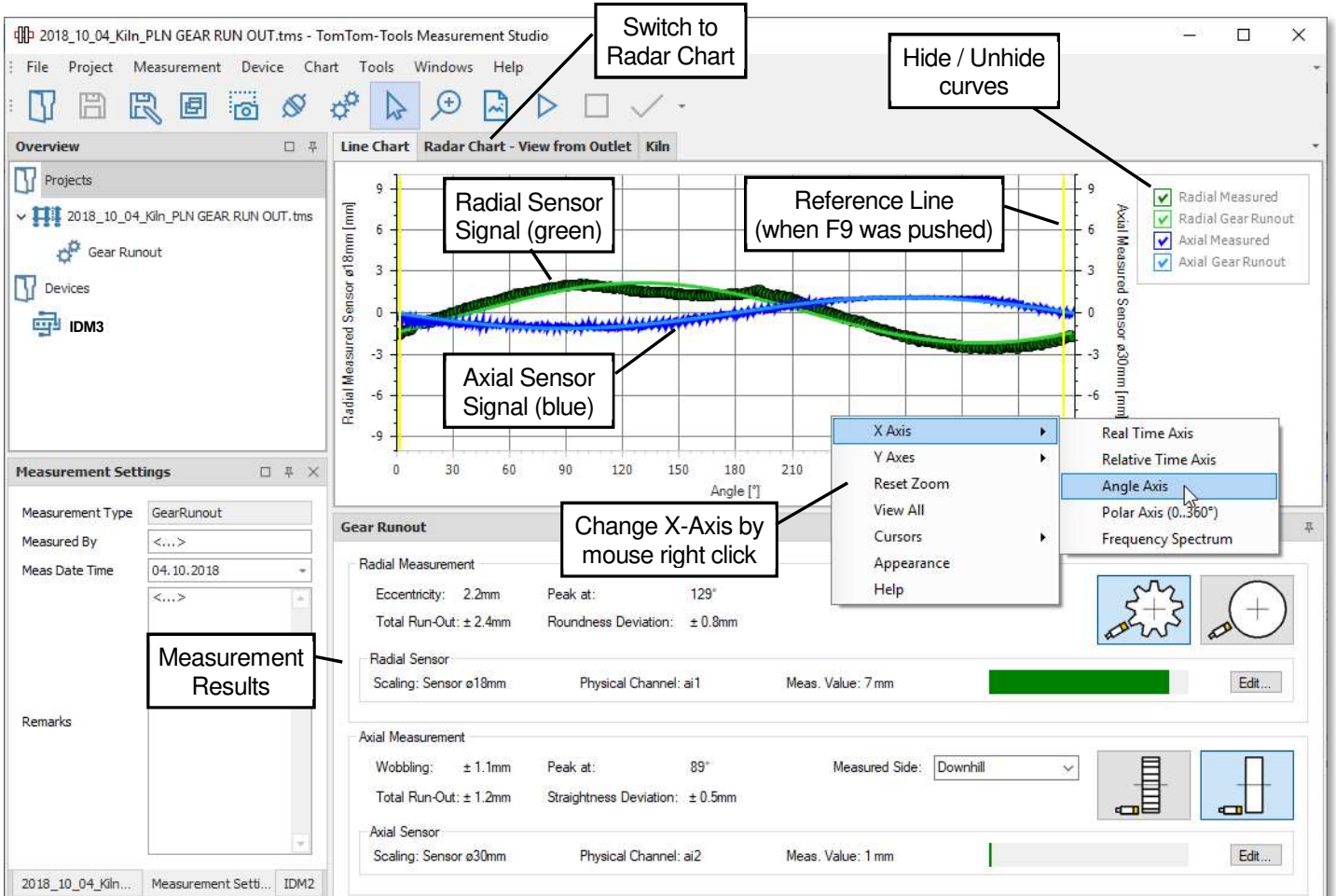
After starting the measurement, the values will appear on the computer screen (green curve)





Note:

To be able to calculate the run-out value and its position, the software needs a reference signal, when the reference point is passing the sensors position.

Typically the manhole in the kiln or mill shell is used as reference point.

Each time when this reference point is passing the position of the sensors, push the **button [F9]** to indicate the rotation. A yellow line in the graph will show the position of the reference point.



-  The **green** graph shows the **measured values** from the **radial** sensor
-  The **green** curve is the calculated sinus from the radial readings
-  The **blue** graph shows the **measured values** from the **axial** sensor
-  The **blue** curve is the calculated sinus from the axial readings

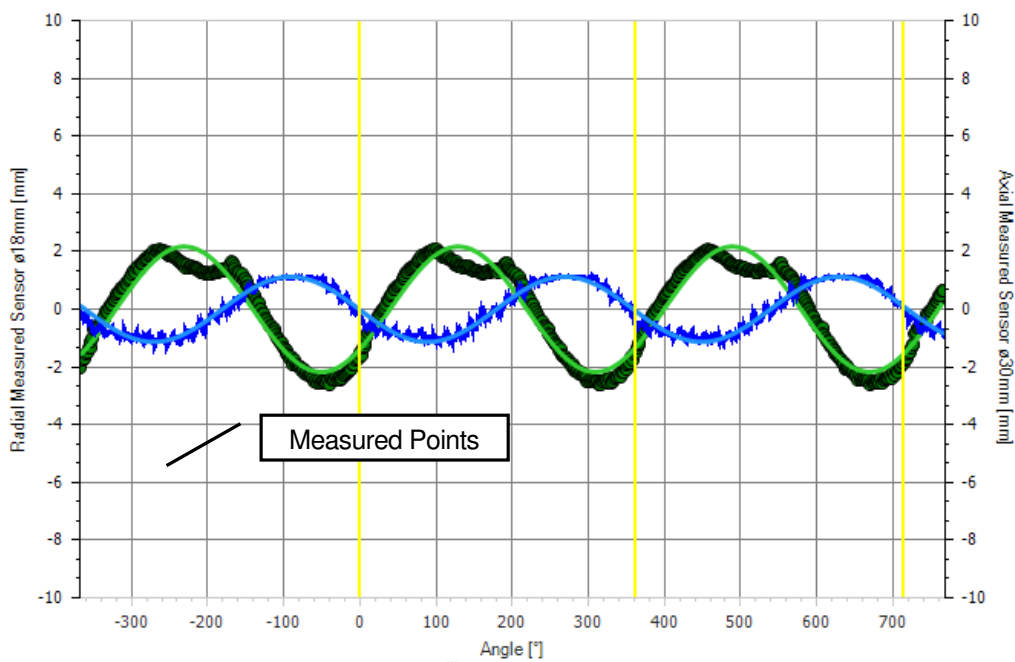
After 2 to 3 kiln revolutions, sufficient data are collected and the measurement can be stopped. **To stop** the measurements push the **Stop** button or **[F6]**.

8.6 Results

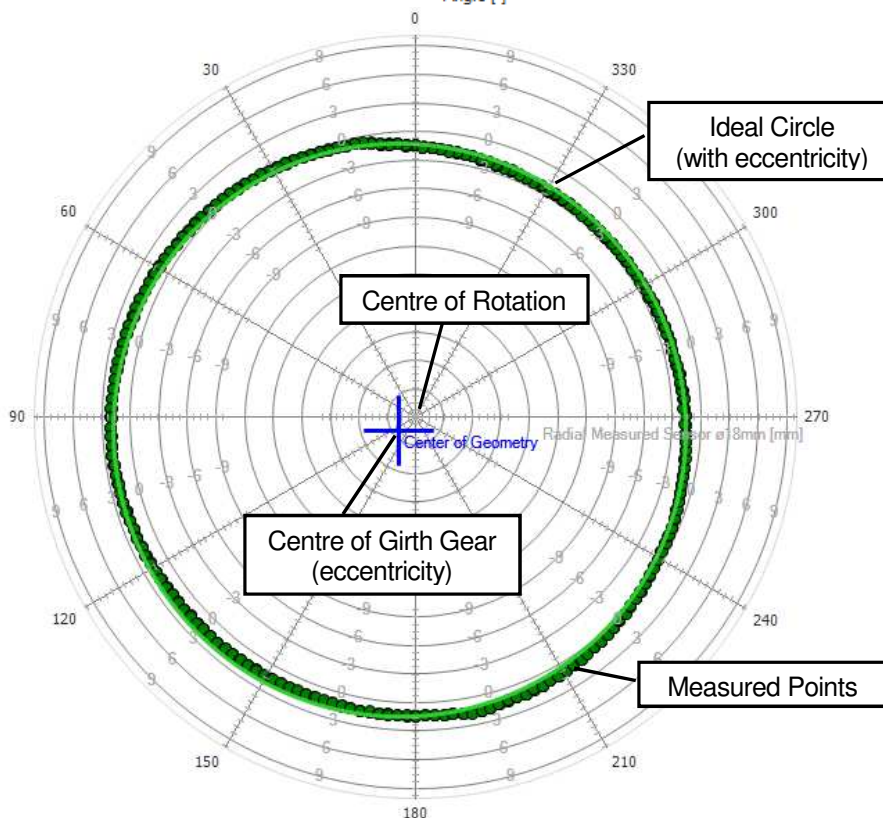
The Results are shown as graphs in the graph window and as numbers below.

The radial run-out can also be seen in the radar chart

Line Chart: Radial & Axial Values



Radar Chart: Radial Values



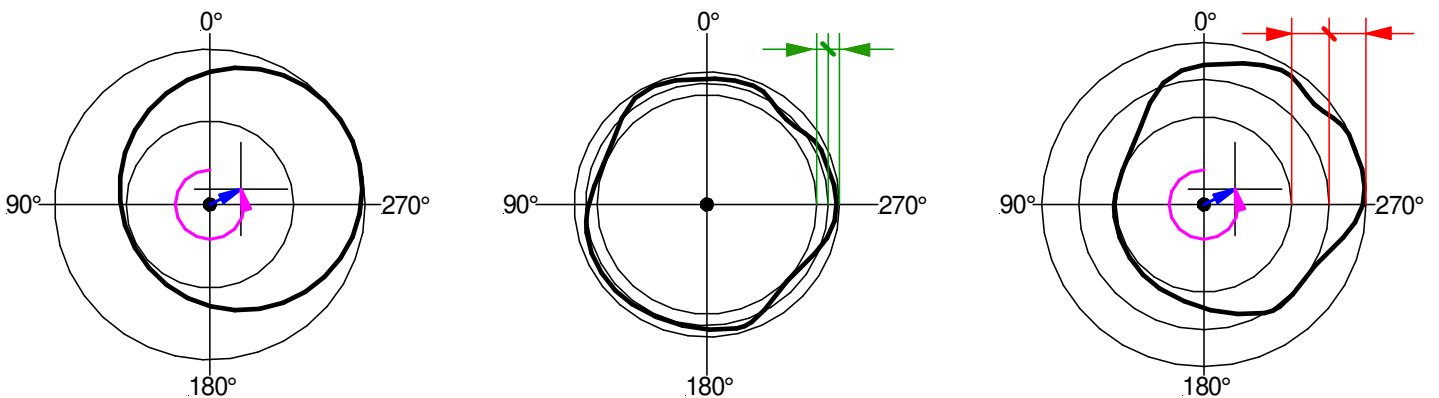
The following values are calculated and shown as numbers:

Radial:

Radial Measurement			
Eccentricity:	2.2mm	Peak at:	129°
Total Run-Out:	± 2.4mm	Roundness Deviation:	± 0.8mm

- **Eccentricity:** shows how much the girth gear is out of the center of rotation, it is the distance between the center of rotation and the center of the girth gear (blue arrow)
- **“Peak at”:** indicates the angle (purple arrow) where the peak of the eccentricity is located. It is counted in degrees after F9 was pressed. The position of F9 appears in the radar chart on top at 0°.
- **Roundness Deviation:** shows the maximal deviation from the ideal circle. It is a +/- value (green arrows)
- **Total Run-Out:** is the combination of eccentricity with roundness deviation. It corresponds directly to the measured values. The Total Run-Out is a +/- value (red arrows)

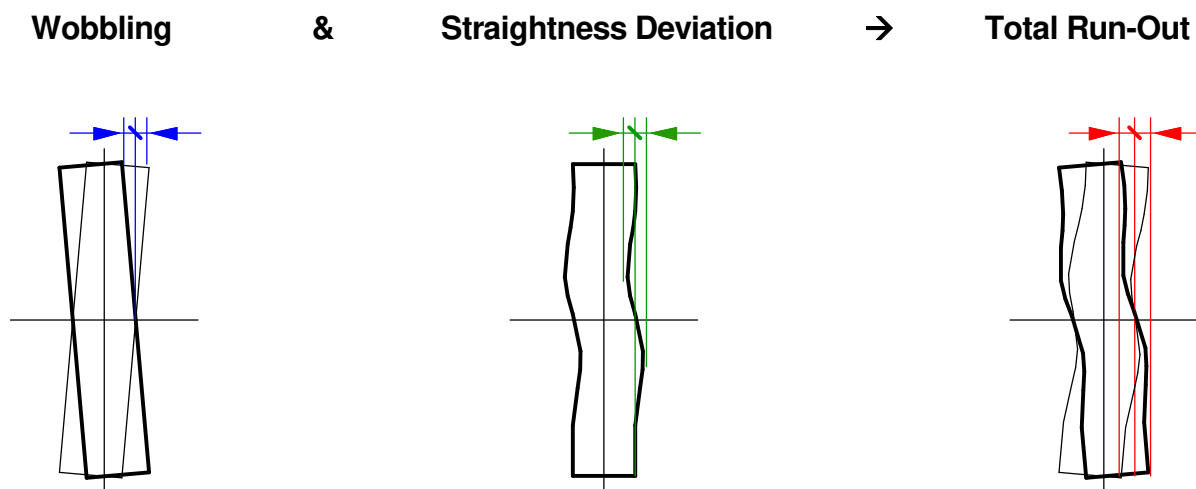
Eccentricity & Roundness Deviation → Total Run-Out



Axial:

Axial Measurement			
Wobbling:	± 1.1mm	Peak at:	89°
Total Run-Out:	± 1.2mm	Straightness Deviation:	± 0.5mm

- **Wobbling:** shows how much the girth gear is not perpendicular to the axis of rotation. It is a +/- value (blue arrow)
- **“Peak at”:** indicates the angle where the peak of the wobble is located. It is counted in degrees after F9 was pressed. It is analogue to the value in radial direction (see above)
- **Straightness Deviation:** shows the maximal deviation from the ideal plane surface. It is a +/- value (green arrows)
- **Total Run-Out:** is the combination of wobbling with straightness deviation. It corresponds directly to the measured values. The Total Run-Out is a +/- value (red arrows)



8.7 Limits

TomTom-Tools GmbH does not provide guide lines about acceptable run-out limits.

It has to be according to the equipment manual or discussed with the suppliers, how much run-out and roundness error can be allowed.

Out of experience the following table can be taken as an example for **kiln girth gears** but **might need to be adjusted to the specific case:**

Run-Out [mm]	As Installed	Need Re-Alignment
Radial	$\pm 0.035 M$	$\pm 0.0875 M$
Axial	$\pm 0.00015 D - 0.25$	$\pm 0.000375 D - 0.25$

M: Module [mm]
D: Gear Diameter [mm]

9. OPTIONAL SENSOR TO MEASURE SHAFT MOVEMENT IN GEARBOXES

TomTom has developed a sensor, which can be connected to the IDM Controller and measures the axial movement of floating shafts. It can be installed during normal mill operation.

Flender DMG2 (Combiflex), FLS Maag LGD, CMD Millrex and Wikov Side Drive are designed to drive ball mills. These gearboxes are equipped with a floating shaft, which is dividing the torque evenly to the two output pinions, by its axial movement. Disturbances as radial runout on the girth gear or pitch errors at the splits of the girth gear can cause excessive axial movement which is harmful for the gears. Therefore, it is recommended to measure as a condition monitoring routine the movement of the floating shaft.

Not only the value of the movement is important; but the acceleration too. Smooth sinusoidal movement by each turn of the mill is indicating eccentricity of the girth gear. Abrupt changes in axial position are indicating dangerous roundness or pitch problems in the girth gear.

- To measure, use the menu “Raw Data Acquisition” (see chapter 6)
- Choose the scaling for the sensor **Ø18mm** (see chapter 5.3)
- Remove the 3/4” tap on the cover of the floating shaft and mount the adapter
- Put the sensor carefully into the adapter and push it in until it touches the floating shaft
- Pull it back by about 4mm and tighten the two screws with the ball heads
- Now the measurement can start

Fig. 9.1. Lateral Gearbox with torque Split

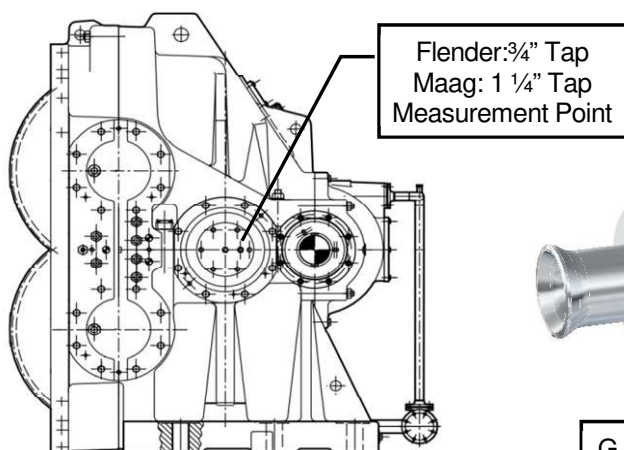
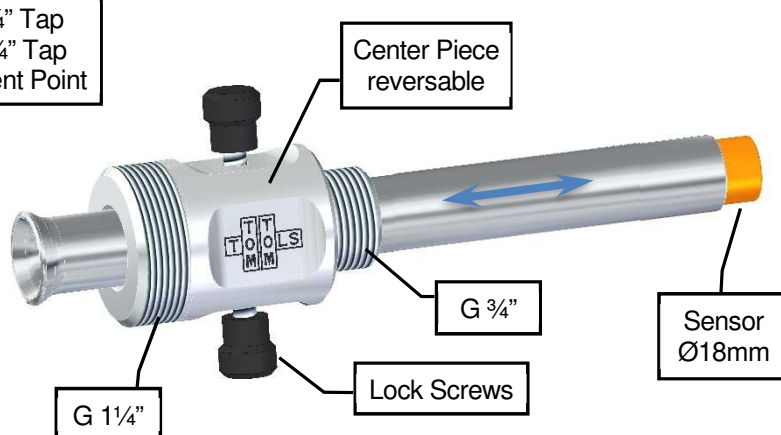


Fig. 9.2. Sensor for Floating Shaft

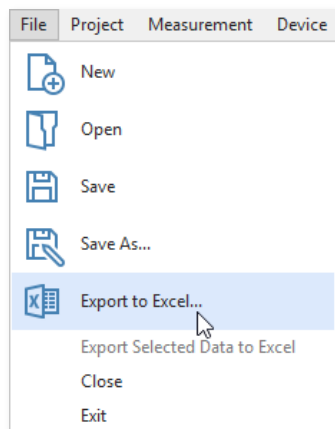


10. REPORT

10.1 Export to Excel

All data can easily be exported to excel.

Fig.10.1.1



10.2 Create a report

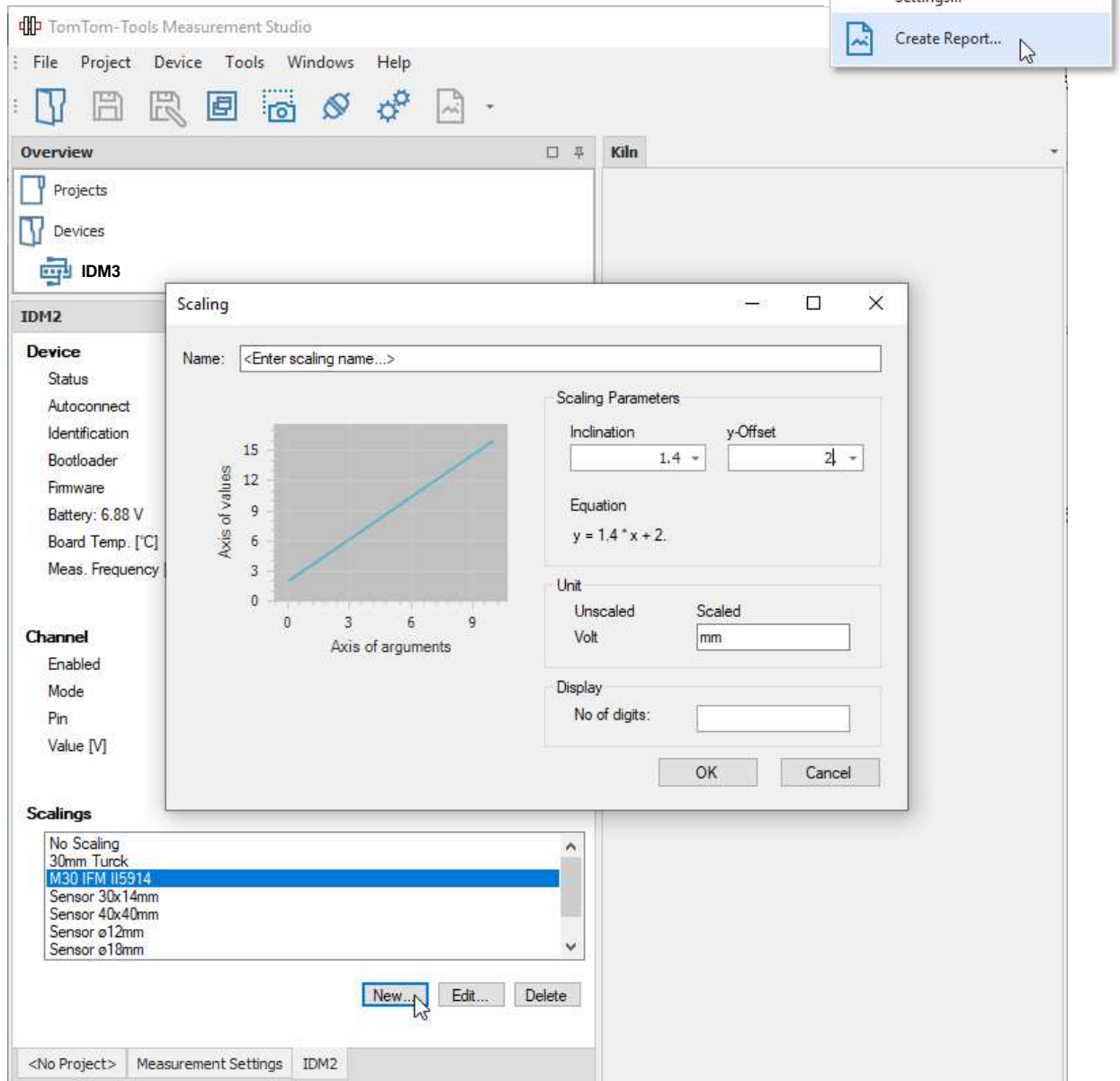
The measurements can be extracted into a report. All additional information from “Setting Window” is included in the report as well.

Fig. 10.2.1

10.3 Adding a New Sensor Scaling

The four inputs of the IDM Controller measure 0...10V which correspond to the measurement range of the sensors. Hence each type of sensor needs its scaling, which describes the relation between sensor distance and voltage output.

The scaling of the sensors, which are included in the IDM Tool Kit, are already defined in the software and can be selected as shown in the picture below.



If a pressure sensor, flow meter or temperature probe is connected, just replace the unit [mm] to [bar] or [°C] or any kind of unit.

