

Installation and User Manual

4K-WISY Sensor System



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ODNF401EN01

Translation of the original installation and user manual.

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1 General

1.1 Information about the manual

The information available at the time of publishing is the base of this manual and is deemed as correct. The manual does not claim to provide all possible details and versions of hardware, software, installation and operation of the product. The manual is part of the product and has to be kept accessible at any times for use by the installation, operation, maintenance and cleaning staff.

For better representation of circumstances, the illustrations in this manual are not necessarily to scale and may slightly vary from the actual design of the product.

All contradictory statements cease to be valid as of the date of the publication. ARTIS GmbH reserves the right to implement changes in the interest of technical progress.

1.2 Manufacturer

The product was produced by:

ARTIS GmbH
Buchenring 40
21272 Egestorf
Germany

hereinafter called „manufacturer“ or “ARTIS”.

1.3 Contact details/customer service

ARTIS is a member of MARPOSS Group, which has 80 sales and marketing companies in 23 countries. Via this sales and service network MARPOSS provides direct and qualified customer service. Refer to the MARPOSS website for a full and up-to-date address list: www.marposs.com

Please have the following information at hand before contacting the technical customer service:

- Short description of the problem
- Information about machine type, machine control and operator panel of machine
- Information about the monitoring system (type, version, possibly serial number) and the visualization software
- Version of the sensor used.

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2 Safety

Notice

Read the complete chapter **Safety** before installing and commissioning the system. Thoroughly observe all safety instructions!

Compliance with all safety instructions and directives given herein is essential to operating safety. The local regulations for the prevention of accidents and the general safety regulations for the location, in which the machine is used, also apply.

⚠ Warning

Risk of injury!

Improper installation may cause damage of devices, injuries or death.

In order to protect human life and to ensure safe and reliable use of the product, let only qualified personnel install and operate the device.

2.1 Information about safety instructions

Safety instructions point out particular dangers for persons, property and the environment. Observe these instructions and act correspondingly. Also, pass these instructions on to other users.

⚠ Caution

Designates instructions, which – if not observed – may result in minor or moderate injuries of persons. Thoroughly observe the instructions in order to avoid damage to persons.

⚠ Warning

Designates dangers, which – if not observed – may cause impairments of health, injuries, permanent bodily damages or death. Thoroughly observe all work safety instructions and act with caution!

⚠ Danger

Designates electrical hazards. Non-observance of these safety instructions can result in severe injuries or death. The relevant operations may only be carried out by skilled electricians, who are familiar with the product.

2.2 Symbols and abbreviations

Notice

Designates instructions, which – if not observed – may result in damage, malfunction or failure of devices. Thoroughly observe the instructions in order to avoid partial or total loss of devices.

The following symbols shall be used in this document.

Information

This symbol emphasizes practical tips and information. Observation of these tips ensures efficient and trouble-free operation of the unit.

Function keys and parameters shall be emphasized using **CAPITAL BOLD LETTERS**.

Furthermore, the following abbreviations shall be used in our publications:

Abbreviation	Meaning
AC	Alternating current
AC Control	Adaptive Control
BA	Bridge amplifier
BN	Cutting number
DAC	Digital analog converter
DC	Direct current
DN	D number: cutting edge number
DTA	Digital torque adapter
F	Axial force
FFT	Fast Fourier Transformation
I/O	Input/output
in	Inch
lbf	Pound-force
lbs/in	Inch-pounds
MS	Microsoft
ms	Millisecond
N	Newton
Neg.	Negative
Nm	Newtonmeter

Abbreviation	Meaning
OP	Operate (Feed active)
PLC	Programmable Logic Controller
PN	Program number
Pos.	Positive
PWM	Pulse-width modulation (control via frequency converter)
RF	Rapid feed
SAS	Self Adjusting System
SW	Software
T	Torque
TC	Tool change
TN	Tool number
TP	Low pass filter
Ts	Delay time
Visu	Visualization, user interface

2.3 For member states of the European Union

2.3.1 WEEE and recycling



Information

The product you bought is subject to the Directive 2002/96/EC of the European Parliament on waste of electrical and electronic equipment (WEEE). This device may not be disposed of with domestic waste. Please dispose of this device in accordance with local regulations at the collecting point specified for electrical and electronic equipment by your community or use a waste disposal company specialized in separating waste electrical and electronic equipment.

The manufacturer is obligated to take back all the ARTIS waste equipment.

2.3.2 RoHS and chemicals



Information

The Directive 2002/95/EC of the European Parliament on the restriction of the use of certain hazardous substances in electrical and electronic equipment prohibits the introduction of new electrical and electronic equipment in the European market that contains more than the maximum permitted amount of lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE).

Control and monitoring equipment is exempted from this requirement: Therefore, it is not prohibited to use certain hazardous substances in monitoring devices, tool monitoring systems and measuring transducers of ARTIS GmbH.

2.4 Transport, packaging and storage

2.4.1 Transport inspection

On receipt of delivery, immediately check for completeness and any transport damage.

If transport damage can be detected externally, refuse the delivery or accept it only with reservations. Make a note of the scope of the damage on the transport documents/delivery note of the freight carrier and initiate a claim.

Make a claim against hidden defects as soon as they are identified because claims for damages can only be made binding when raised within the valid claim periods.

2.4.2 Packaging

If no appropriate agreement has been made on return of the packaging material, then it remains with the customer.

2.4.3 Storage

The following regulations apply when storing:

- Store dry.
- Do not leave packages outdoor.
- Make sure that the floor of the stockroom is dry during storage.
- Protect from direct sunlight.
- Store dust-free.
- Avoid mechanical vibrations and damages.

If storing for longer than approx. 3 months, then check the conservation measures. In aggressive weather conditions, preservation may have to be renewed.

2.4.4 Ambient conditions during transport and storage

Name	Technical data
Ambient temperature	-20 °C – +65 °C
Temperature change	max. 5 °C/min
Relative humidity	max. 85%
Air pressure/elevation	max. 12.000 m above sea level
Condensation	none
Recovery time	2 h

2.5 Liability and warranty

Notice

This manual must be read carefully prior to any use of the system, notably prior to commissioning.

The manufacturer does not accept any liability for damages or disturbances, which originate from non-observance of the manual.

The manufacturer reserves the right of technical changes which improve the usability or contribute to further technical development of the product.

All information and references in this user manual were compiled in consideration of applicable regulations, the current technical engineering stage of technology as well as our many years of findings and experiences.

Material defects are covered by the warranty with the following limitations:

- Guarantee period: The warranty covers the product and all repairs carried out within the standard warranty terms.
- Subject of the guarantee: The warranty applies to the product and its parts marked with the serial number or other identification number used by Marposs.

The above warranty applies unless other agreements are reached between Marposs and the customer.

No warranty is accepted after interference with or modifications of the product, which were not carried out by the manufacturer!

The manufacturer accepts no liability for damages to persons or objects, which originate from unauthorized interference with the product!

Furthermore, the obligations agreed upon in the delivery contract apply as well as the manufacturer's general terms and conditions and terms of delivery and the valid legal regulations at the time of contract completion.

2.6 Intended use

4K-WISY is a stand-alone sensor system for collecting measurement data of rotating tools. It includes the following components:

- 4K-WISY-Rotor-Accu: Sensor based on strain gauge technology, individually adapted to the customer's tool holder, integrated rechargeable battery
- 4K-WISY-Antenna Module: Antenna module with USB interface for measurement data transfer to a PC, radio frequency 2.4 GHz
- 4K-WISY-Visu: Visualization software
- Charging unit.

The sensor system has the following functions:

- Measurement of torque, feed force and bending moment at production machinery
- Measurement data transfer via antenna module
- Visualization of measurement data via personal computer.

2.7 Warning against foreseeable misuse

The intended use and the specified ambient conditions have to be observed during operation to ensure trouble-free functioning.

Any other use is explicitly excluded.

2.8 Disturbances

Only specially qualified personnel from the relevant department is authorized to remedy disturbances of electrical installations and mechanical components.

In case of disturbances, which cannot be resolved with the measures described in this chapter the manufacturer or an authorized service partner of the manufacturer has to be informed.

2.8.1 Safety instruction

Warning

Improper remedy of disturbances can result in damages to persons and/or material. Only specially qualified and authorized personnel may remedy disturbances!

2.8.2 Behaviour in case of disturbances

In general, the following applies:

1. Take the device out of service immediately in case of danger for persons, material and/or plant safety.
2. In case of disturbances, which do not imply any of these dangers, switch off the device via the system control. Also, interrupt the power supply of the device and secure against being switched on again.
3. Immediately inform the responsible person on site about the disturbance.
4. Let authorized qualified personnel determine the nature, extent and origin of disturbance and have it eliminated.

2.9 Repair

All repairs of this device must be carried out by the manufacturer. The manufacturer ensures a consistent high service quality, the required safety of the repaired devices by comprehensive function and safety checks as well as the use of highly skilled staff and suitable measuring and test equipment.

Danger

Danger caused by electricity!

Electrical energy can cause extremely severe injuries. Damage to the insulation or to single parts may result in danger to life. Disconnect the device from the power supply before opening the housing.

Warning

Risk of injury from burns!

High temperatures of components in the device can persist up to approx. 10 minutes after switching it off!

Let the device cool down to ambient temperature before performing any work on it. Use only specified types when replacing defective fuses. Bypassing fuseholders is forbidden!

Opening the device is only permitted to appropriately qualified staff.

2.9.1 Warranty exemption

Any liability and warranty is exempted after unauthorized tampering with and/or modifying the device unless by the manufacturer has taken place!

The manufacturer does not take any liability for damages to persons or material, caused by unauthorized external interference to the device by third parties!

2.10 Requirements placed on user groups

Warning

Danger due to improper installation!

Installation and operation require qualified personnel. Improper installation and handling can result in damage to the devices, injuries to persons and fatal accidents. Let only qualified, instructed and trained personnel install and operate the device.

The requirements are subdivided into the user groups:

Group/Task	Requirements
Operator/operation	Instruction by the owner operator required
Service/installation/dismantling	Qualified electrician required

2.11 Conditions on site

Name	Technical data
Ambient temperature	0 °C – +50 °C
Temperature change	max. 0.5 °C/min
Relative humidity	max. 10% to 85%
Absolute humidity	up to max. 30 g/m ³
Air pressure/elevation	max. 3.000 m above sea level
Condensation	none
Vibration	1.0 g (20 to 50 Hz)
Shock	10.0 g (10 ms)

2.12 Electrical safety

Name	Technical data
Classification	DIN EN 61326-1
Protection class	3

ARTIS GmbH's and Marposs SpA's quality control system is certified according to DIN EN ISO 9001:2008.

3 Description

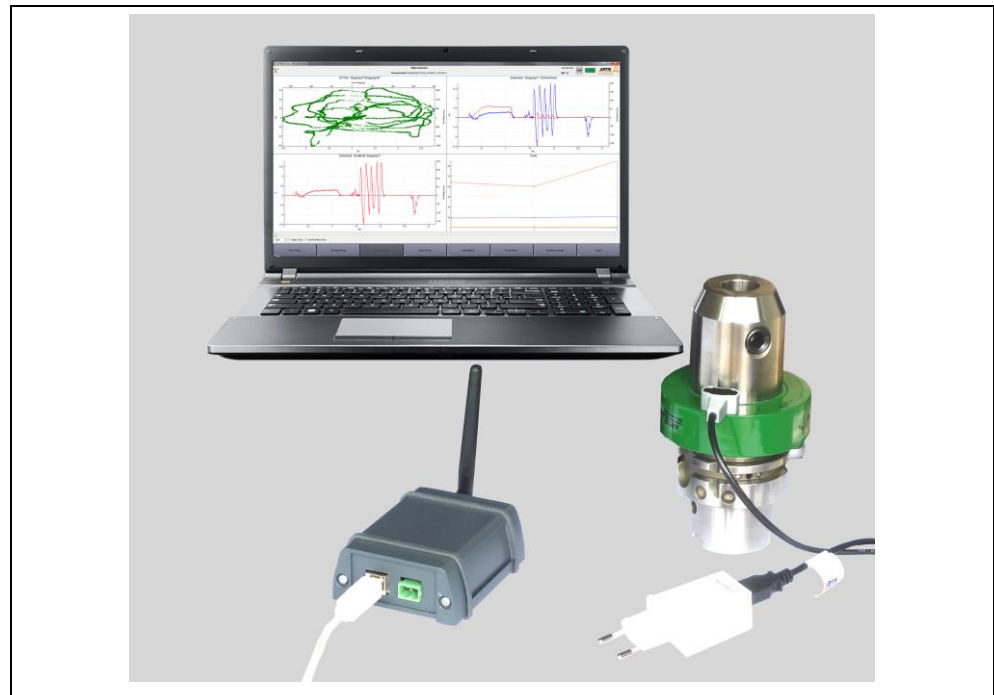


Fig. 1: 4K-WISY sensor system

Properties

- Stand-alone sensor system for measurement data logging of rotating tools
- Contact-free operating principle
- Data transmission via radio
- No installation work.

The 4K-WISY sensor system includes the following components:

Component	Property
4K-WISY-Rotor-Accu	Sensor based on strain gauge technology, attached to the customer's tool holder, integrated rechargeable battery
4K-WISY Antenna Module	Antenna module, USB interface for transmission of measurement data to a PC, radio frequency 2.4 GHz
4K-WISY-Visu	Visualization software
Charging unit	

The sensor system has the following functionalities:

- Measuring of torque, feed force and bending moment in production machines
- Data transmission via antenna module
- Visualization of measurement data via PC.

4 Technical data

4.1 4K-WISY-Rotor-Accu

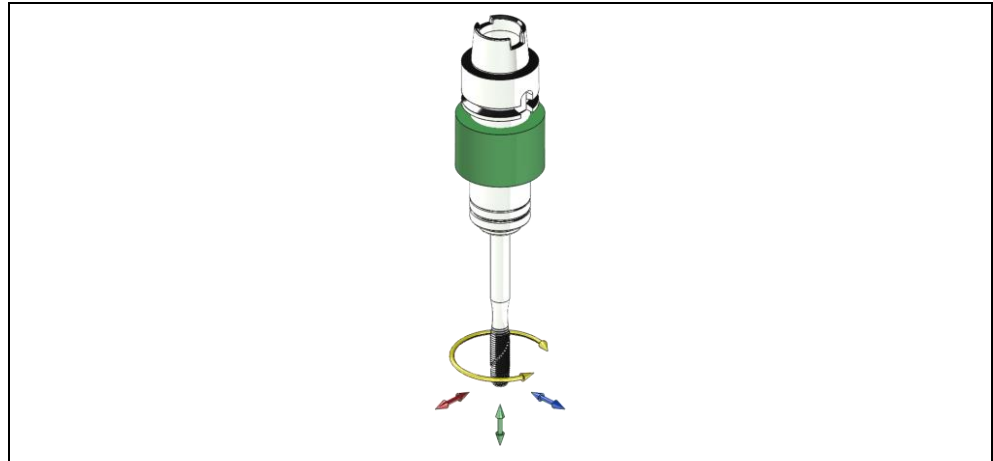


Fig. 2: 4K-WISY-Rotor-Accu

4K-WISY-Rotor-Accu	
Marposs Code	O3PZ1021101
Dimensions	Depending on tool-holder
Degree of protection	IP67, resistant to cooling lubricants
Surface	High tenacy, protected against abrasion by chips
Temperature range	15 °C – 50 °C
Measuring range	Depending on the application, separate measuring ranges for torque, feed force and bending force, technical consultation required!
Measuring principle	Strain gauge technology in full-bridge circuit
Resolution	16 bit
Accuracy	± 5% of measuring end value
Repetitive accuracy	± 5% of measuring end value
Data transmission rate	0.5 ms (2 kHz)
Sampling rate	0.5 ms (2 kHz)
Maximum rotational speed	n max = 1×10^6 /rotor diameter (mm) [rpm] max. rotational speed = 55 m/s
Maximum transmission power	+4dBm = 2.5 mW
Maximum transmission distance	5 m , sight connection recommended
Total number of channels	70

4K-WISY-Rotor-Accu	
Frequency range	2402 MHz – 2472 MHz
Charging principle	via magnetic charging plug 5 V, min. 0.5 A
Energy accumulator	Lithium polymer battery 300 mAh
Operating time	approx. 8 h
Charging time	approx. 3 h
Conformity	CE

Notice

The individual rotor properties depend on the employed tool-holder.

Note

Risk of malfunction!

In order to avoid malfunction of the rotor after keeping it in the stock, thoroughly follow the instructions concerning the integrated rechargeable battery as stated below:

- Only store the rotor with fully charged battery.
- Recharge battery at least every 3 months.
- Fully charge battery prior to starting a measurement.



Information about the radio application

Maximum transmission power	+4 dBm = 2.5 mW
Maximum transmission distance	5 m non-line-of-sight
Total number of channels	70
Frequency range	2402 MHz – 2472 MHz

A channel spacing of at least two channels is required for applications with more than one antenna module.

4.2 4K-WISY Antenna Module

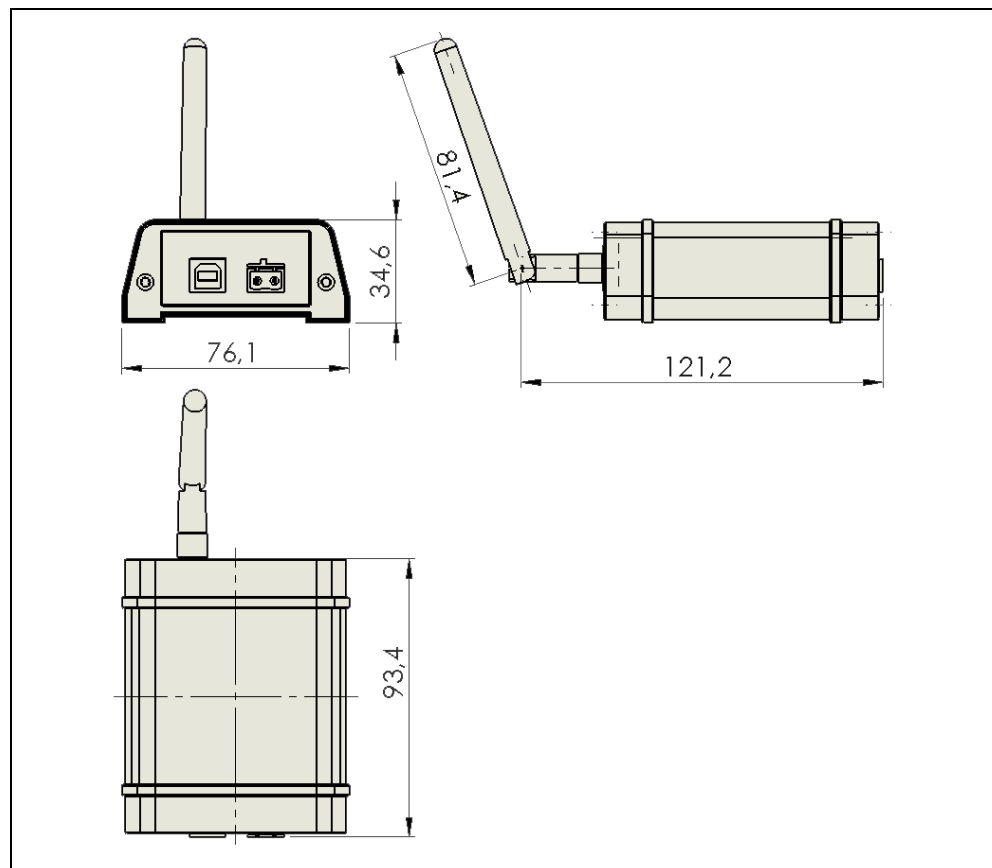


Fig. 3: 4K-WISY Antenna Module

4K-WISY Antenna Module	
Marposs Code	O830Z711001
Weight	300 g
Operating temperature	0 °C – +60 °C
Housing	Metal
Dimensions	see drawing
Degree of protection	IP30
Supply voltage	via USB, max. 200 mA
Interfaces	USB 2.0 (table top device), digital input 0...24 V
Connecting cable	Length 2 m
Radio frequency	2.4 GHz
Conformity	CE

4.3 4K-WISY-Visu

System requirements

- Windows 7 or higher
- 1 available USB 2.0 port
- for the installation: at least 60 MB free disk space

5 Installation

5.1 Visualization software

Copy the directory **4K-Visu** into the file system on the PC.

Information

Administrator rights are required for the following steps 1 – 4.

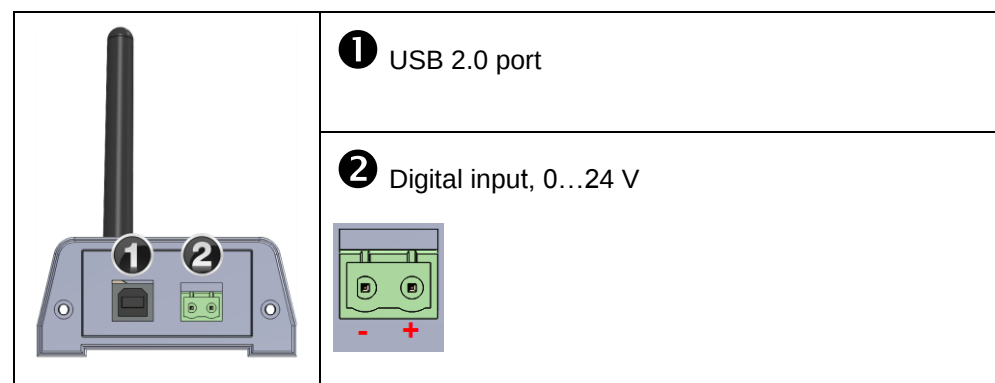
Driver installation (not required with Windows 10):

1. Do not attach the 4K-WISYAntenna Module yet
2. Open directory **Driver**
3. Open file **Setup.bat**
4. A dialog is displayed. Select second option (**Install this driver software anyway**).



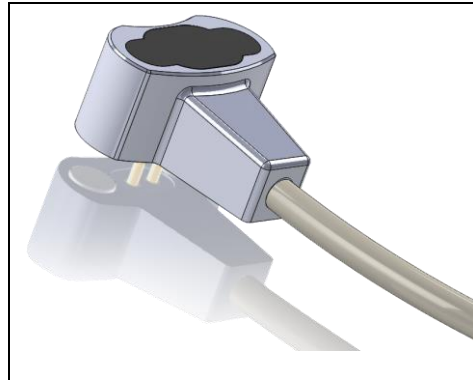
5.2 Antenna module

Place the 4K-WISY Antenna Module at a suitable position and connect it to the PC, which is intended for displaying the measurement data.



5.3 Sensor

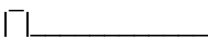
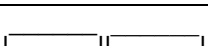
The sensor, which is designed as a cylindrical rotor, is attached to the customer's tool holder and firmly connected to it.



Connect the rotor (sensor) to the charging unit using the magnetic charging plug (figure on the left side). Connect charging unit to a power source.

Rotor status

The LED, which indicates the rotor status is located at the tool side of the rotor. Meaning of the different flash cycles:

Flash-cycle (4 s)	Description
	Idle state: no communication, no charging
	Communication
	Charging
	Communication and charging

Rotor off

The rotor switches off automatically after 30 minutes without communication. Push key **[sF5] Power off rotor** to switch off the rotor manually.

5.4 Installation guidelines

Notice

Risk caused by moisture!

The antenna module complies with degree of protection IP30. Penetrating moisture causes the destruction of the device. For this reason, do not install the antenna module in the machine working area and protect it against moisture at all times.



Information

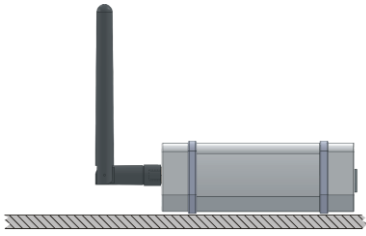
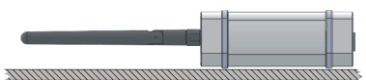
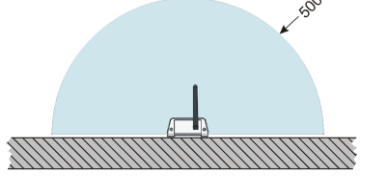
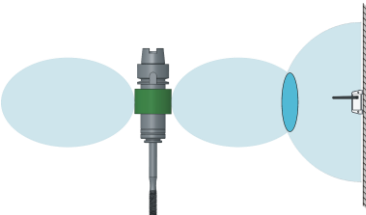
For any queries regarding the installation of the system, do not hesitate to contact the Marposs customer service at any time.

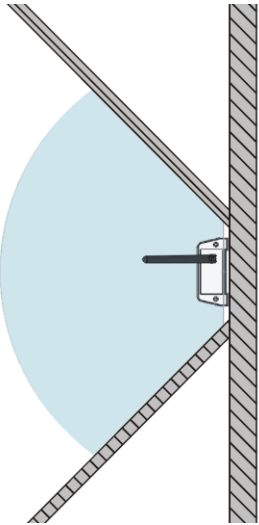
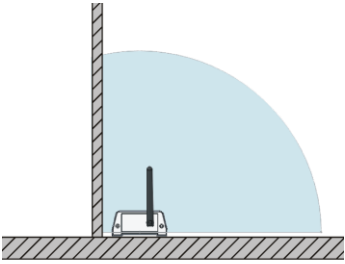
The advantage of a radio-frequency system is the fact that communication is also possible without being in direct line-of-sight. However, when installing a radio-frequency system, a direct communication line between transmitter and receiver needs to be established. Only determine the final installation of the different components after thorough tests (ranging from a few hours to several days). Also consider the information stated below.

- All electrically conductive objects which come into contact with the system may affect the power level.
- All metal containers reflect emitted radio waves. The machine working area acts as Faraday Cage when its door is closed. The wavelength at 2.4 GHz is approximately 120 mm.
- Any conductive object positioned in contact with or very close to the antenna module or the 4K-WISY-Rotor may cause the antenna detuning.
- If the antenna module is not positioned directly in line with the 4K-WISY-Rotor, the majority of the signal it receives has been reflected off the conductive objects in the immediate environment (floors, ceilings, machines installed nearby etc.)
- The immediate environment of the antenna module must be kept free from all electrically conductive objects. This applies in particular if no line-of-sight can be established between the 4K-WISY Rotor and the antenna module.
- The antenna module must not be fitted with any unauthorized accessories, especially conductive material. If it is absolutely indispensable to install such devices, please contact the customer service first.
- Evaluate the installation by performing or simulating a real working cycle.

5.4.1 Aligning the antenna module

Follow the instructions stated below when aligning the antenna module:

Correct alignment  Wrong alignment 	Install the antenna module on an even surface on a wall and not inside a cavity or any enclosure. Do not use any other antenna or cable extension with the antenna module.
	A hemispherical space around the antenna module must be kept free from all electrically conductive objects (radius of the hemisphere 500 mm).
	Guarantee a direct path between the antenna module and the 4K-WISY-Rotor, even while parts are being machined. Keep the immediate environment of the antenna module free from all electrically conductive objects.

Correct alignment 	An imaginary cone (having a hypotenuse equivalent to 500 mm) projected in front of the antenna module must be kept free from all electrically conductive objects. The cone shall be defined by a vertex positioned at the center of the receiver contact plane and a minimum angle of aperture of 90°.
Wrong alignment 	

The dimensions indicated above represent the minimum requirements. The quality of communication improves if the free space beyond these limits increases.

5.4.2 Positioning of the antenna module (examples)

Use below schematic drawing of the typical work environment of a machine tool for understanding how to position the antenna module(s) optimally.

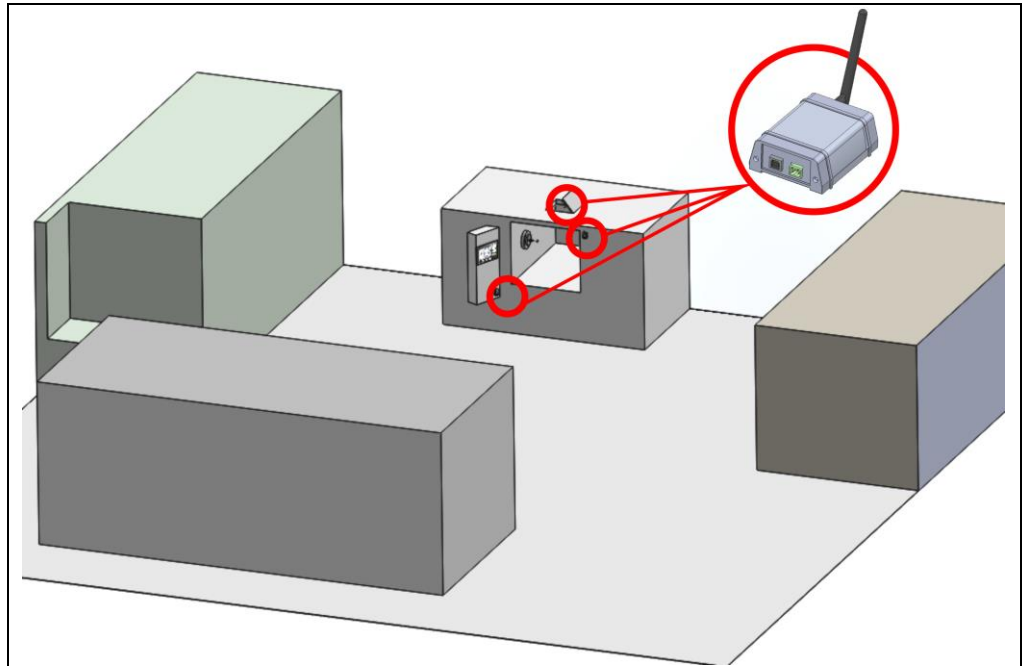


Fig. 4: Typical work environment of a machine tool

❶ and ❷ in the figure below show typical ways of positioning the antenna module(s).

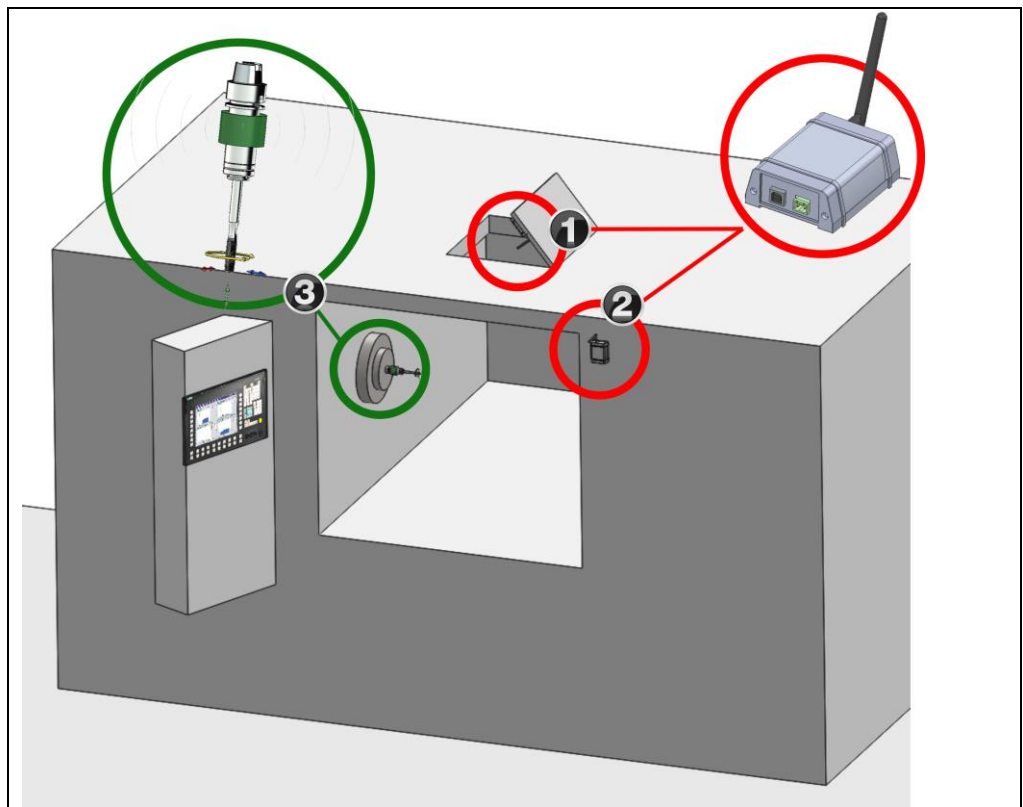
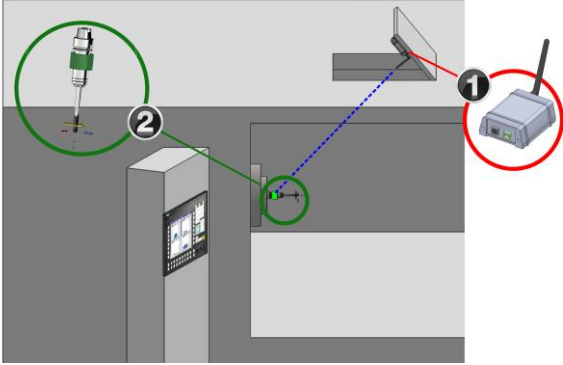
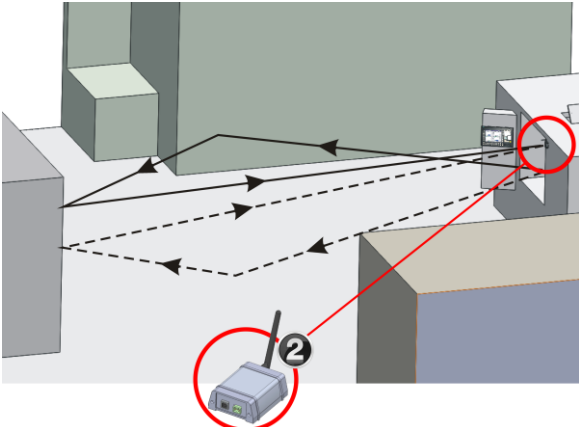


Fig. 5: Typical ways of positioning the antenna module

- ❶ With emission direction to the 4K-WISY-Rotor ❸
 - ❷ With emission direction parallel to the input direction of the machine window
- These are just *guidelines*.

NEVER install antenna modules at the following positions:

- Inside metal structures
- Inside deep niches
- Directly in front of metal walls preventing the emission of radio waves to the front of the receiver.

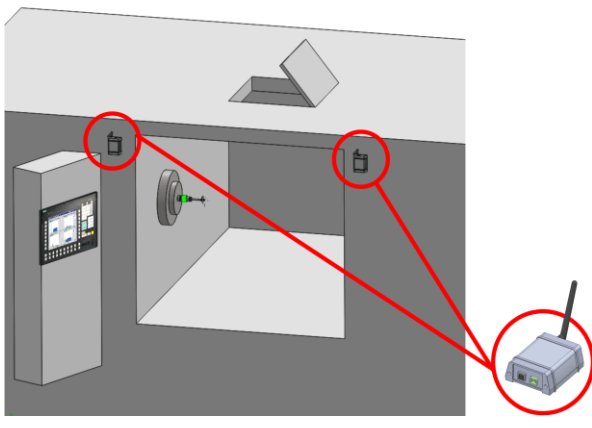
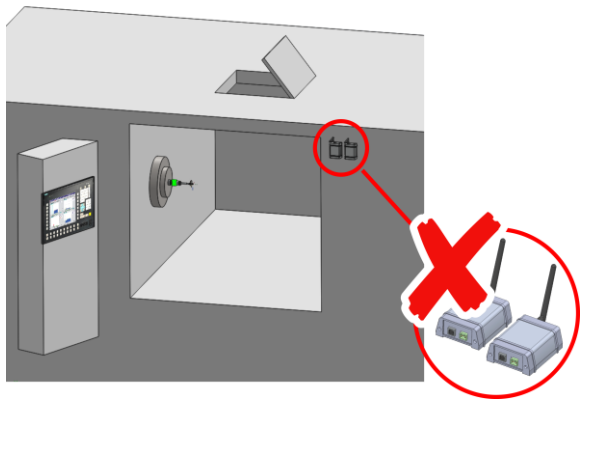
	Correct positioning Antenna module ❶ has direct visibility toward the 4K-WISY-Rotor. Communication takes place correctly.
	Correct positioning Typical configuration if antenna module ❷ and 4K-WISY-Rotor have no line-of-sight. Transmission takes place through reflections of the radio waves off floor, ceiling, walls and other objects in the area. There must always be a window (without metal grille) for access to the radio waves on the machine walls because the metal walls screen them. The emission direction of the 4K-WISY-Rotors is parallel to that of the window on the machine so (after a few reflections) the radio signal can reach the antenna module.

For the following reasons, the conditions proposed in the second example (antenna module (❷)) are more critical than the ones proposed above (antenna module (❶)):

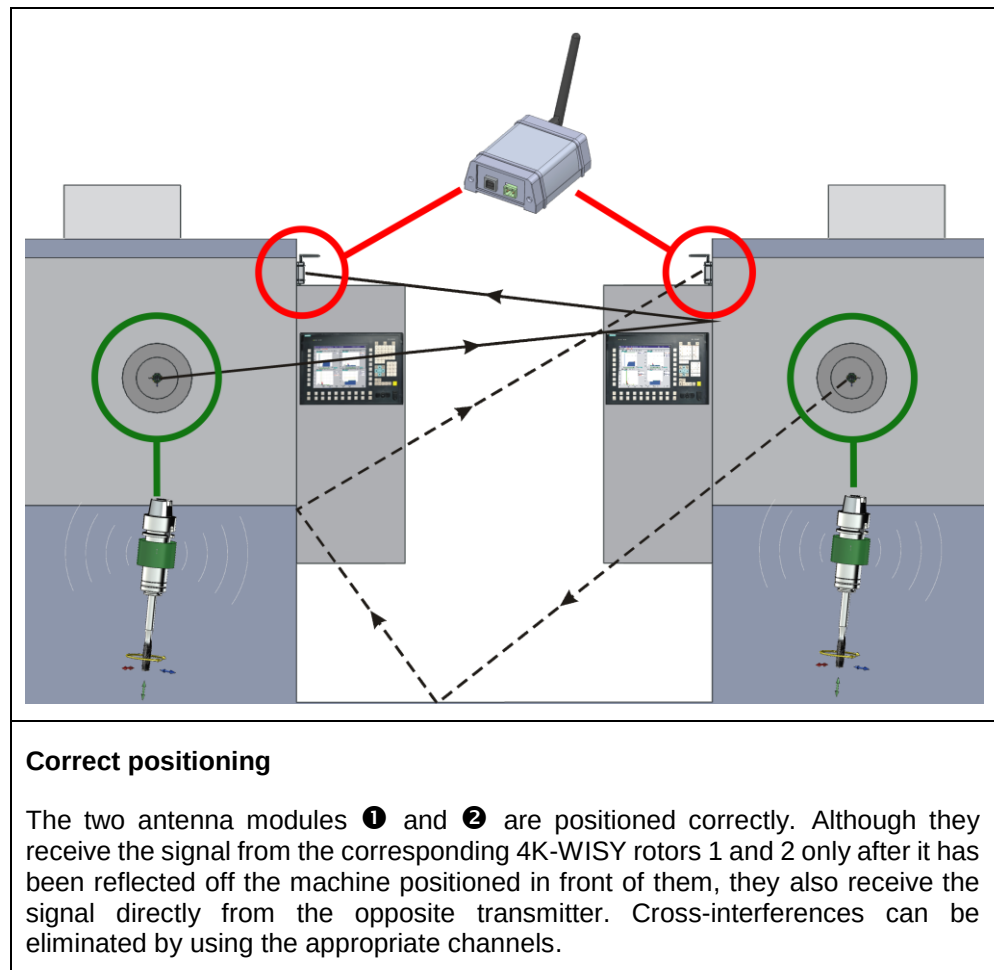
1. The radio transmission path is longer.
2. The antenna module is exposed to external interferences (e.g. Wi-Fi®, Bluetooth®).
3. The machine structure acts as an obstruction to transmission, rather than shielding it from interferences.
4. Staff, who passes close to the machine or approaches it with other radio transmission systems may interfere with the connection.
5. It is very important to ensure that the maximum transmission distance does not exceed 5 m.
6. The antenna module should not be installed as in the drawing below if the door is fitted with a metal grille.

5.4.3 Positioning of more than one antenna module

More than one antenna modules close to each other must be positioned in such a way that the antennas do not interfere mutually.

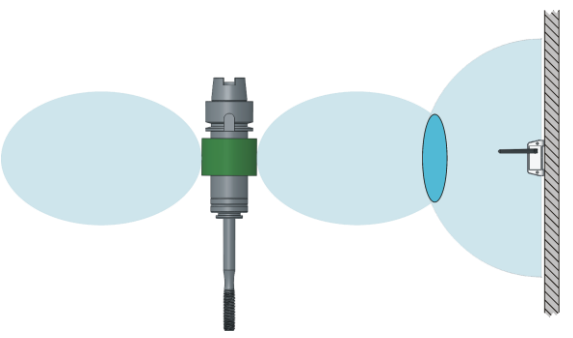
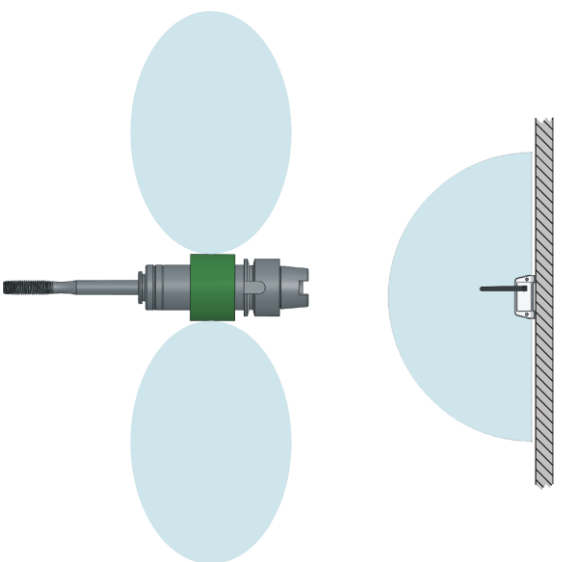
	Correct positioning The two antenna modules are installed at a sufficient distance to each other; mutual interferences do not occur. Ensure minimum distance of 0.5 m between two antenna modules!
	Wrong positioning The two antenna modules are installed too close to each other; mutual interferences occur. The radiation diagrams change and sufficient transmission quality in the direction necessary for entering the machine is not ensured. Ensure minimum distance of 0.5 m between two antenna modules!

5.4.4 Machines positioned side by side



5.4.5 Alignment of the 4K-WISY-Rotor

The 4K-WISY-Rotor radiation diagram is practically circular in a plane lying perpendicular to the transmitter axis. The intensity of radiation is at its maximum level in this plane. Although the system will function correctly when using reflected transmission paths, it is preferable to use the transmission direction recommended below. Optimal alignment is attained when using the 90°-extension for the rotor.

	Recommended solution Milling machine. The predominant radiation directions of 4K-WISY-Rotor and antenna module coincide.
	Non recommended solution Milling machine. The predominant radiation directions of 4K-WISY-Rotor and antenna module do not coincide.

Notice

Risk of significant attenuation of the radio signal!

Metal objects and other electrically conductive materials may affect the performance of the antenna and result in attenuation of the radio signal.

Avoid these negative influences by reducing the number of metal objects near the 4K-WISY-Rotor to a minimum and keep the rotor and the antenna module free from chips and coolants during operation.

5.4.6 Using the radio frequency channels

2.4 GHz ISM band

The 4K-WISY system uses the internationally reserved 2.4 GHz ISM-Band (Industrial-Scientific-Medical) band which occupies the following frequency range:

- 2402 MHz – 2472 MHz (worldwide)

The 4K-WISY system emitted power is approximately +4 dBm (~2.5mW) which means that it is classified as a class 2 transmission device. There are currently numerous wireless systems which use this frequency range (2.4 GHz). So it is very important to ensure that there is sufficient space available in the frequency spectrum for the system to function reliably.

1. 4K-WISY channels

The 4K-WISY system features 70 frequency channels each occupying a bandwidth of 2 MHz. To convert the channel number into the effective frequency range, use the following formula:

$$\text{Effective frequency} = 2400 \text{ MHz} + \text{channel number} \times 1\text{MHz}$$

Selecting the most suitable working channel for each radio system is very important for guaranteeing constant and reliable communication. When compared to other systems such as FHSS (Frequency Hopping Spread Spectrum), 4K-WISY has the advantage that it enables users to plan and allocate the way the frequency spectrum is used by selecting and defining the channels.

If there are multiple systems in the same area (factory) it is possible to re-use channels provided the correct distance is maintained.

	Distance	Example
a) Minimum distance between antenna module and 4K-WISY-Rotor (using different channels)	0.5 m	27A ← 0.5 m → 43A
b) Minimum distance before re-allocating any given frequency channel	100 m	27A ← 100 m → 27A

A. Machine with single antenna module installed

The most frequently used application consists of a machine equipped with a spindle and one 4K-WISY antenna module. In this configuration, it is possible to use a different frequency channel for each system installed.

B. Multiple antenna modules installed on a single machine

In the case of machines equipped with dual spindles, in order to measure two parts simultaneously it is necessary to install an antenna module for each spindle. In this configuration it is important to ensure that:

- The minimum distance between the devices is respected
- The antenna modules are positioned as far apart as possible
- Identical or adjacent frequency channels are avoided.

C. Installation with two or more machines positioned close together

Given the unpredictable way in which electromagnetic waves are propagated, the machines must never be treated as though they are isolated systems; in other words, whenever a radio frequency system is installed, it will influence and be influenced by all the other machines that are installed around it.

The 4K-WISY system has a wide communication range. Therefore, two machines installed with a few meters of each other should be treated as a single, large machine equipped with multiple spindles when planning the system layout. Therefore, the suggestions listed in chapter B above need to be taken into consideration. This especially applies if the antenna modules are installed outside the working zone, since the 4K-WISY-Rotor signal may be more attenuated than those emitted by the surrounding 4K-WISY systems.

2. Manual planning

When installing a system on equipment where other radio systems are already in place, it is important to take the following factors into consideration:

A. Wi-Fi®

The PC wireless network is the most commonly used system and, as a class 1 device, it is capable of transmitting more power than other systems (+20 dBm, ~100 mW). Its typical frequency usage is shown below:

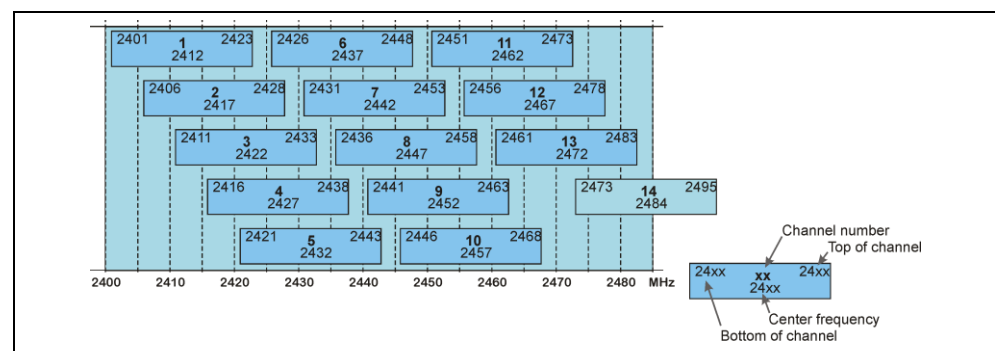


Fig. 6: Wi-Fi® channels

Each block marked in dark color corresponds to a different set of superimposed channels, naturally a single set must be used for each area. 1, 6 and 11 are the most commonly used frequency ranges. The generic Wi-Fi® name covers a range of different standards; the new, faster communication networks can interfere significantly with the 4K-WISY system, hence it is advisable to select channels at the limits of the occupied band in each zone.



Information

Example of the rule that should be followed in these types of installation:

Set one 4K-WISY to channel „n“ and set the other to channel „n+20“ when a Wi-Fi® system is present; assuming an initial bandwidth of 20 MHz, in this way one 4K-WISY will be positioned “to the left” of the Wi-Fi®-channel and the other “to the right”.

B. Bluetooth® Wireless

This system has frequency and modulation characteristics that are very similar to 4K-WISY (channel bandwidth 1 – 2 MHz and typical output power level of +4 dBm (~2.5mW)). It uses the FHSS (Frequency Hopping Spread Spectrum) in order to minimize the effect of interference from other systems. In this standard, all channels are used in turn, “hopping” from one channel to another at random. Devices that use Bluetooth® wireless technology do not represent significant sources of interference.

The Bluetooth® mark and logo are registered trademarks of the Fa. Bluetooth SIG, Inc.

C. Andon™

This system is used for wireless monitoring of OMRON® manufactured machines and features the following specifications:

- 67 channels in frequency range 2401 MHz – 2480.2 MHz;
- Modulation in DSSS format;
- Equivalent output power 10 mW/MHz

Communications are practically continuous in the channels used by the Andon™ system, therefore they may represent a source of interference for the 4K-WISY system. In order to co-exist correctly with this system it is necessary to observe the following precautions when selecting the 4K-WISY frequency:

- $F_c (4K-WISY) \geq F_c (Andon^{\text{TM}}) + 2,5 \text{ [MHz]}$ or:
- $F_c (4K-WISY) \leq F_c (Andon^{\text{TM}}) - 2,5 \text{ [MHz]}$

Where:

- $F_c (4K-WISY)$ = main frequency of the 4K-WISY system;
- $F_c (Andon^{\text{TM}})$ = main frequency of the Andon™ system.

D. IEEE 802.15.4 systems

These transceivers are sometimes used in customized protocols for industrial environment and give rise to moderate levels of interference.

6 Commissioning

6.1 Starting the visualization software

1. Open directory **4K_Visu** in your file system.
2. Execute file **4K_WiSy_Visu.exe** by double-clicking.

The page **Visualization** is displayed.

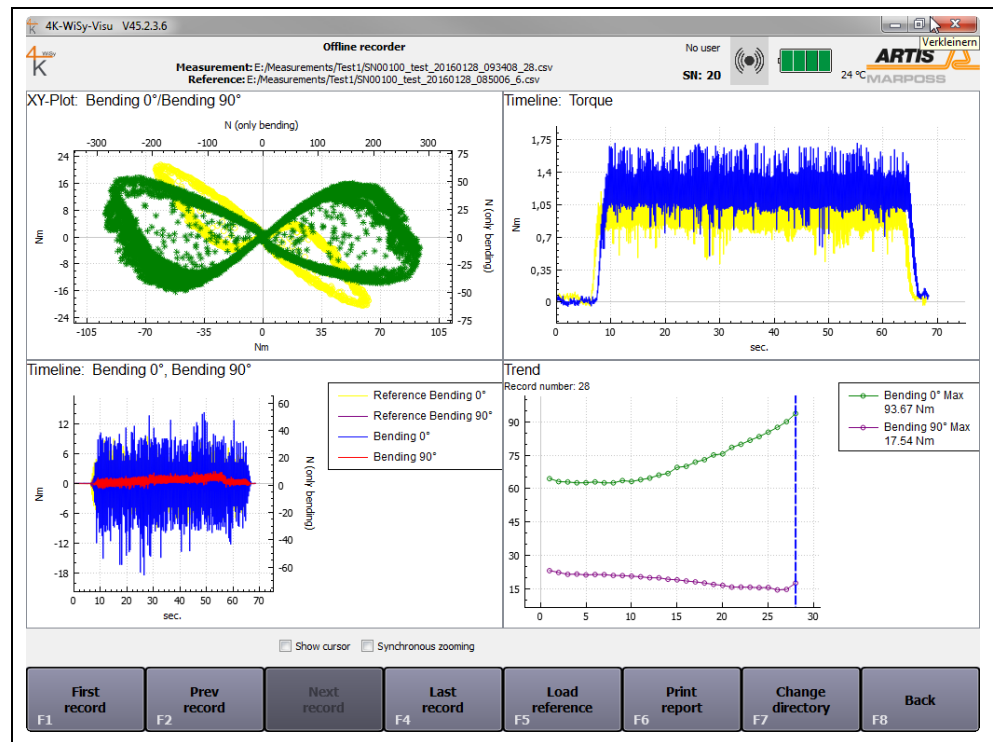


Fig. 7: Visualization

6.2 Logging in the rotor

1. Push key **[F6] Configuration**.

The page **Visualization settings** is displayed.

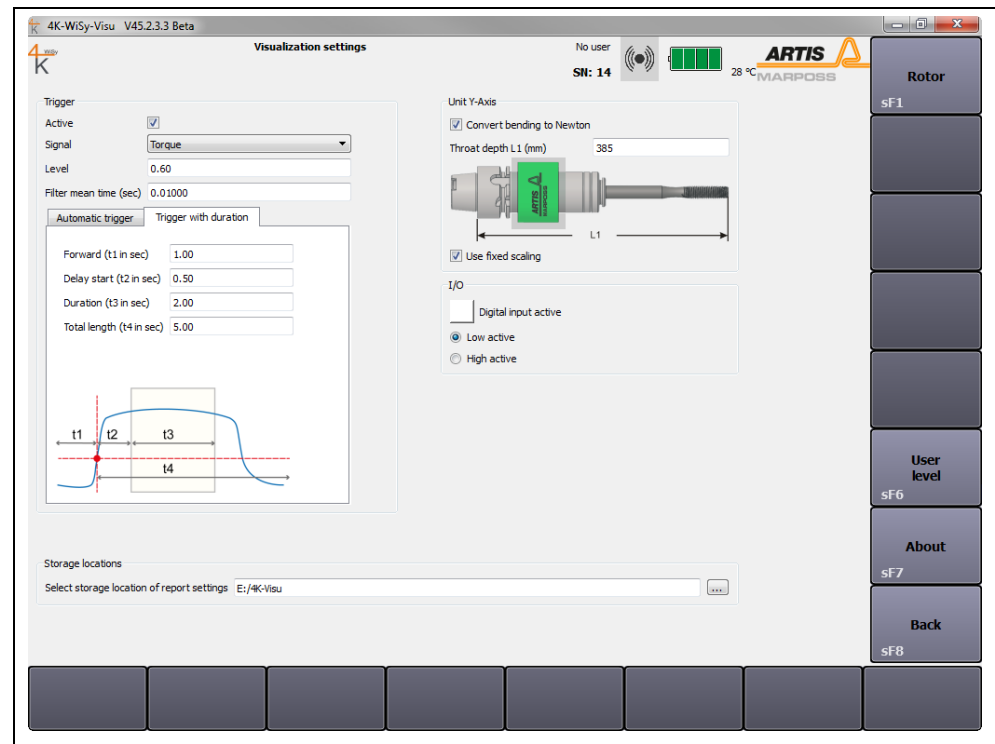


Fig. 8: Visualization settings

2. Push key **[sF4] Rotor** in the vertical menu bar.

The page **Rotor settings** is displayed.

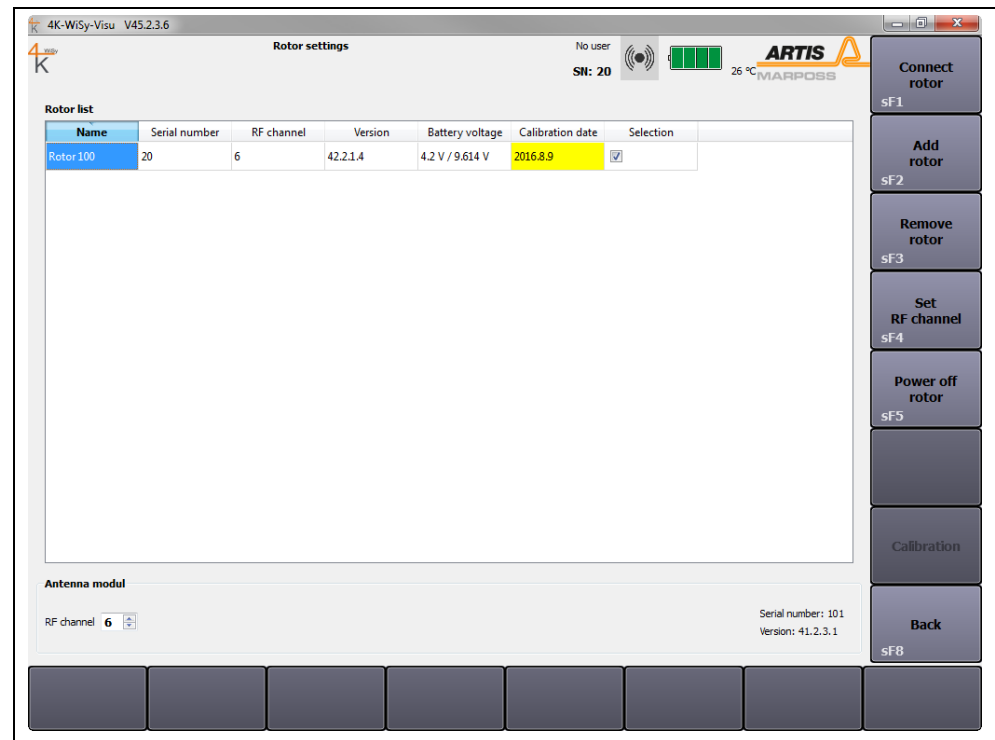


Fig. 9: Rotor settings

3. Push key **[sF2] Add rotor** in the vertical menu bar. Any number of rotors may be added.
4. Adjust rotor parameters:

Name:	Rotor name
Serial number:	Enter serial number (printed on the rotor)
RFChannel:	Enter radio channel. The channel number, which is entered here, must correspond to the channel of the antenna module (see lower left corner of the display).
Version:	Software version recognized by the rotor
Battery voltage:	Battery voltage/charging voltage
Calibration date:	Last calibration date. If the field is highlighted in yellow, the recommended calibration period has elapsed and re-calibration of the sensor is recommended.

Setting of the calibration period in file:
 4K_WiSy_Visu: 24 = 24 months

[Service]
 CalibrationPeriode=24
- Selection: Tick the rotors in use
5. Push key **[sF4] Set RF channel** in the vertical menu bar.
6. If necessary, push key **[sF4] Connect rotor** in order to select the rotor for communication.

The serial number is displayed left to the symbol .

The color of the control display in the header changes from red  to gray . This indicates that the system has recognized the rotor and that the radio connection has been established successfully.

7. Push key **[sF3] Remove rotor** in order to disconnect unused rotors.
8. Push key **[sF8] Back** in the vertical menu bar after completing all entries.

The page **Visualization settings** is displayed again.

9. Push key **[sF8] Back** again.

The page **Visualization** is displayed again.

Rotor off

Push key **[sF5] Power off rotor** to switch off the rotor manually. The rotor switches off automatically after 30 minutes without communication (visualization stopped).

7 Basic settings

There are three screen areas in the 4K-WISY visualization:

- Header: general status information about the system
- Main screen: 4 freely configurable windows for displaying the measurement data
- Menu bar(s).

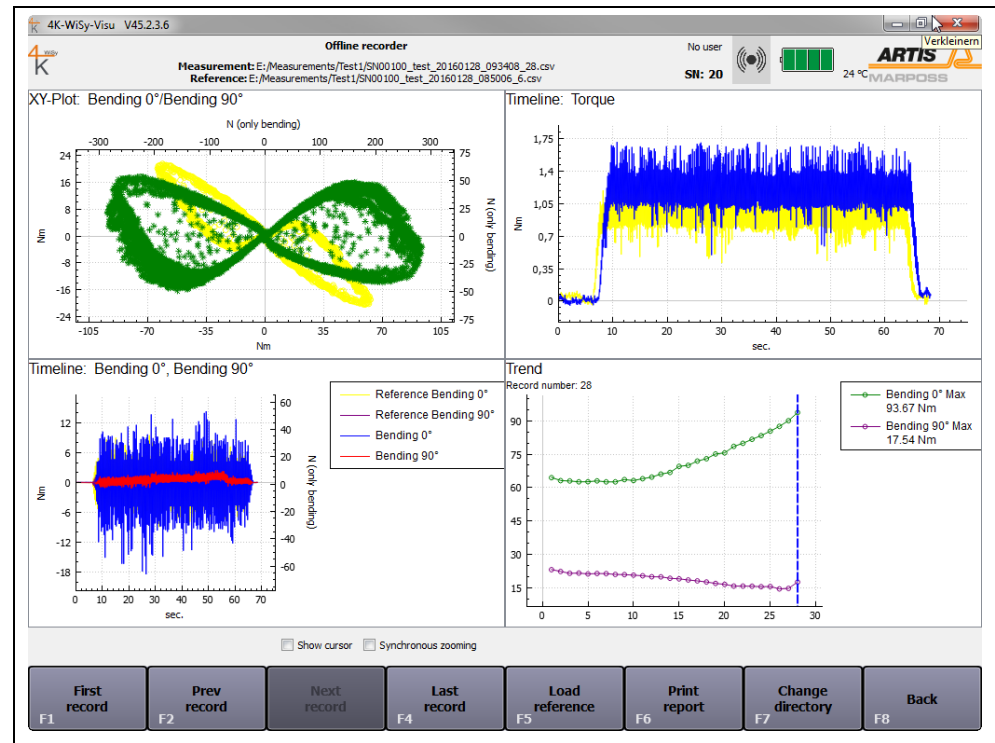
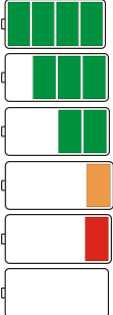


Fig. 10: 4K-WISY main screen

Header

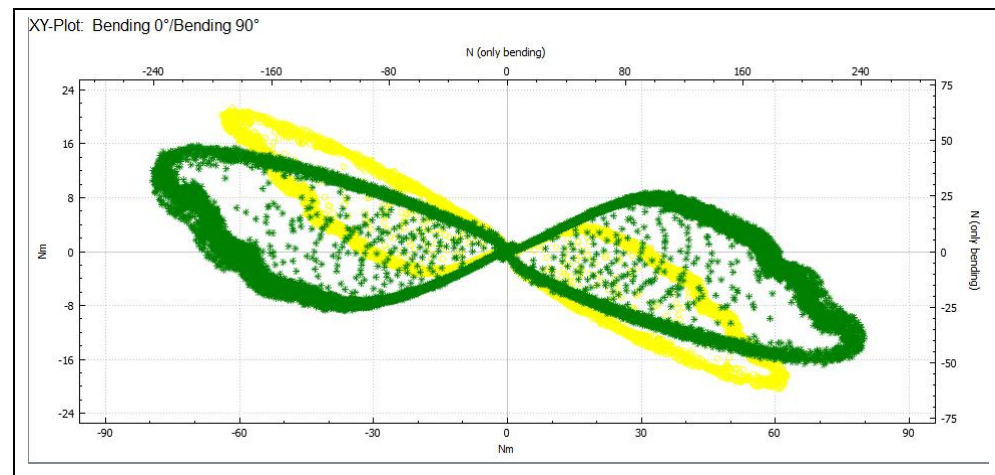
General status information about the system is given on the right side of the header:

<User name> SN: 20   	
<User name>	Name of currently logged in user
SN	Rotor serial number
	Rotor control display Gray: Rotor detected Red: No rotor detected
	Control display: charging level of battery, the yellow flash on the battery symbol indicates that the battery is currently being charged. 4 green bars: Battery fully charged = 100 % 3 green bars: Charging level = 75 % 2 green bars: Charging level = 50 % 1 amber bar: Charging level 25 % 1 red bar: Charging level 10 % No bar: Flat battery

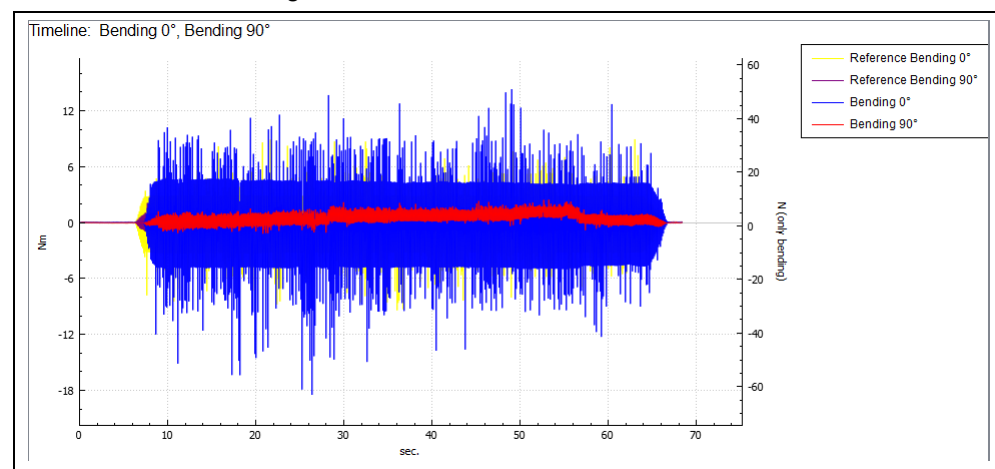
Main screen

The 4 windows of the 4K-WISY visualization are freely configurable. These are the available display options:

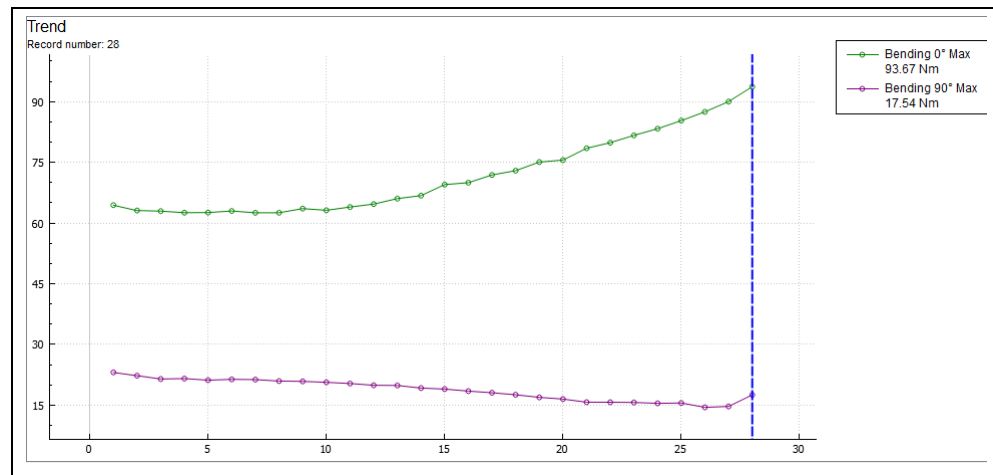
- XY-plot (scatter-plot)
Note that the display option XY-plot is only sensible for illustrating the signals **Bending 0°** and **Bending 90°**. The example diagram below shows:
Yellow: Reference values
Green: Bending forces during one turn of the tool.



- Force level during time



- Trend curve



Right-click the different windows in order to open the context menu **Visualization Settings**. The different setting options are explained in detail in the chapter **Setting the visualization** of this manual.

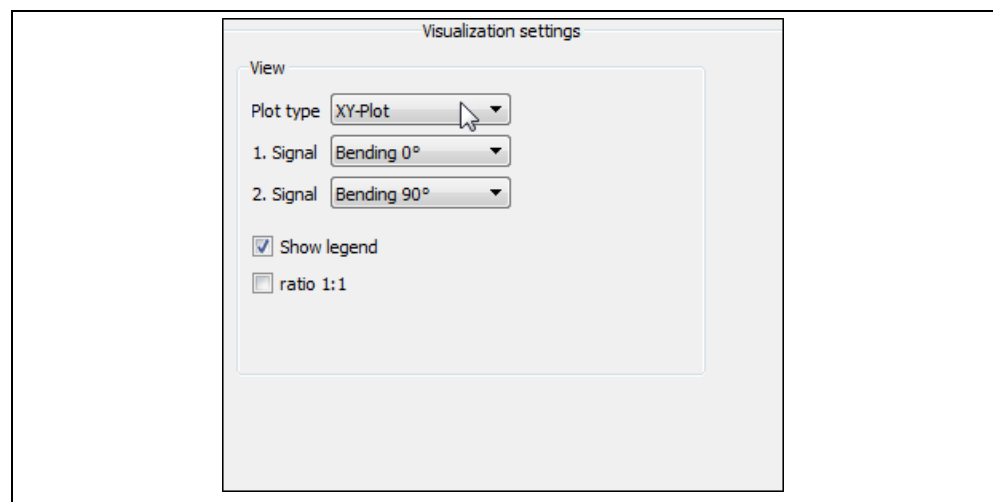


Fig. 11: Context menu Visualization settings

For more information refer to chapter Setting the visualization.

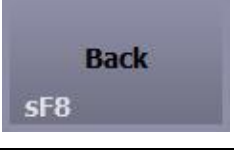
Menu bar

The menu bar is located in the lower part of the screen. Depending on the current user level, the display of active **[F]**-keys may vary.

Other pages of the visualization have an additional vertical menu bar on the right side of the screen.

	[F1] Process ON
	[F2] Operate ON or
	[F2] Operate ON Trigger active In this case, recording of measurement data only starts after the trigger level has been exceeded
	[F5] Rotor
	[F6] Configuration
	[F7] Offline

Push key **[F6] Configuration** on page **Visualization**. Page **Visualization settings** with a vertical menu bar on the right side is displayed.

 A dark grey rectangular button with the word "Rotor" in white bold text and "sF1" in smaller white text below it.	[sF1] Rotor Push Shift + [F1] and navigate to page Rotor settings, see chapter Commissioning
 A dark grey rectangular button with the words "User level" in white bold text and "sF6" in smaller white text below it.	[sF6] User level Push Shift + [F6]. The authentication dialog is displayed (for service purposes only)
 A dark grey rectangular button with the word "About" in white bold text and "sF7" in smaller white text below it.	[sF7] About Push Shift + [F7]. Information about the Qt-class library
 A dark grey rectangular button with the word "Back" in white bold text and "sF8" in smaller white text below it.	[sF8] Back Push Shift + [F8] to step back

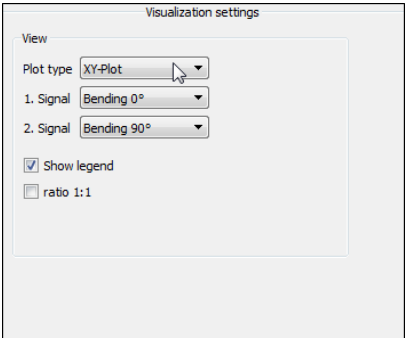
7.1 Setting the visualization

The settings for the 4 freely configurable windows which display the measurement data are carried out on page **Visualization settings**.

1. Right-click the desired window.

The page **Visualization settings** is displayed.

2. Use drop-down list to select the desired display parameters in field **View**.

		
Plot type	Off XY-plot Timeline Trend	No data displayed 2 signals in XY-plot 1 - 2 signals in timeline Trend of measurement data
1st – 4th signal	No signal Torque Force Bending 0° Bending 90° Bending value Bending angle	Signal not assigned Select torque signal Select axial force signal Select bending 0° signal Select bending 90° signal
Show legend	Set checkmark	Color assignment of the different signals is displayed in the plot
Ratio 1:1	Set checkmark	Activate square display option (only available with XY-Plot)
Filter active	Set checkmark	Activate filter (only available with Plot type = Timeline)
Filter	Mean Max Min Peak to Peak	Moving average value based on x points Maximum value Minimum value Peak to Peak
Time	Enter value (max. 99)	Time in seconds for mean filter value

3. Push key **[sF8] Back**.

7.2 Setting the tool length

Move back to the page **Visualization settings** in order to enter the tool length.

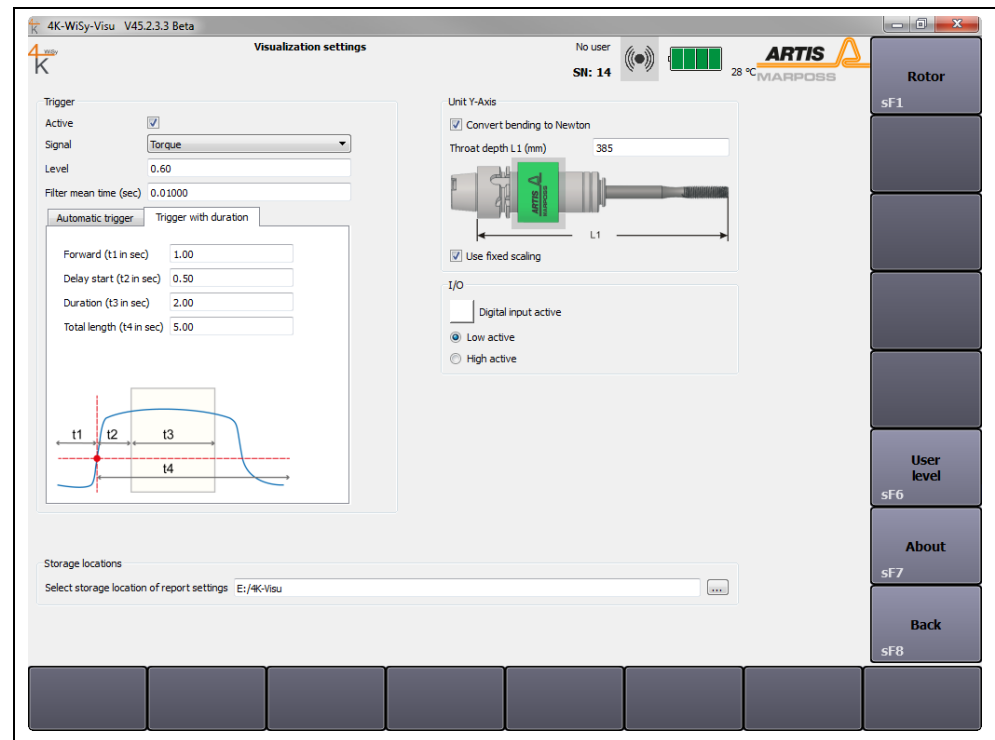
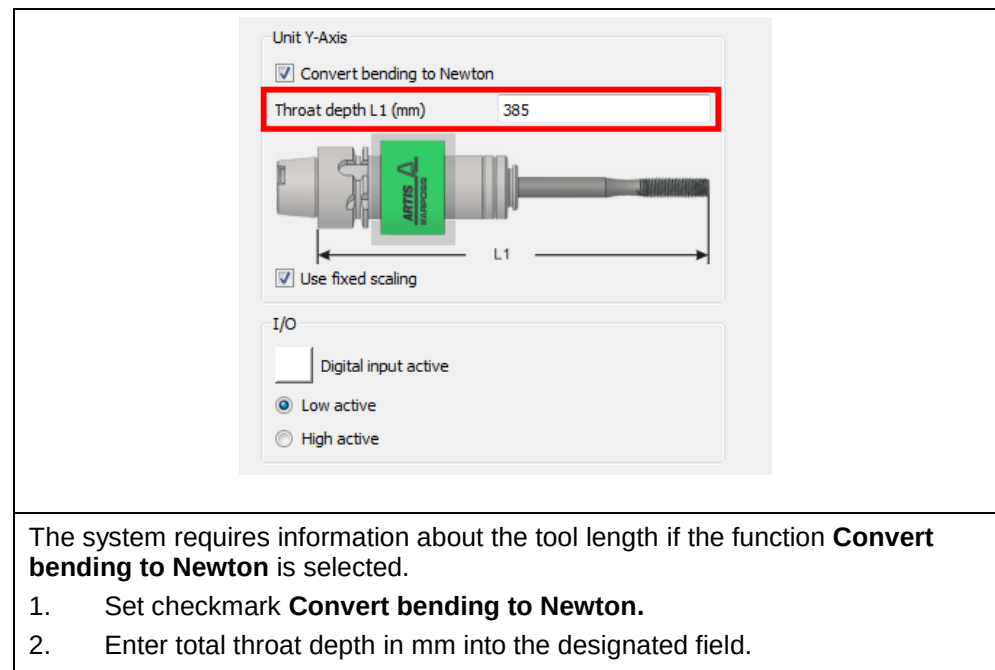


Abb. 12: Visualization setting

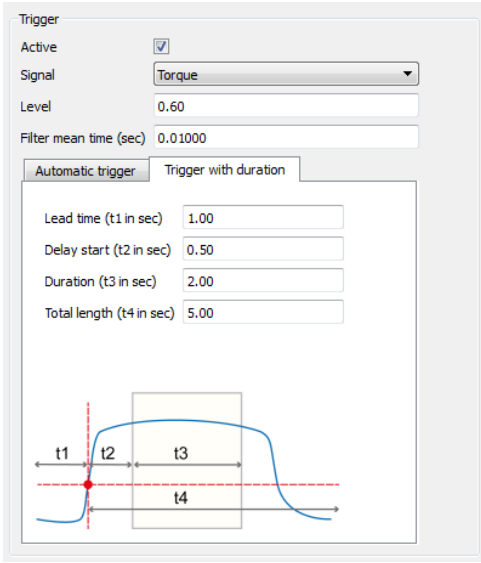


7.3 Setting the scaling of the visualization

Set checkmark **Use fixed scaling**, in order to deactivate the automatic auto scaling function of the measurement data in the visualization.

7.4 Setting the trigger

With activated Trigger function, measuring starts once the trigger level is exceeded.



Active	Set checkmark	Activate trigger
Signal	No signal Torque Axial force Bending 0° Bending 90° Bending value Bending angle	Signal not assigned Select torque signal Select axial force signal Select bending 0° signal Select bending 90° signal Select bending value signal Select bending angle signal
Level	Enter value	Define height of trigger level
Filter mean time (sec)	Enter value	
Automatic Trigger	Enter value	Define lead/lag and delay time
Trigger with duration	Enter value	Define lead time, delay, duration and total length of time

7.5 Selecting the storage location of the report and process settings

All measurements are stored automatically to the directory, which was selected after pushing **Process ON** (page **Visualization**). The path to the process settings leads into the file system of the computer, which is used for running the 4K-WISY-Visu.

Storage locations

Select storage location of report settings E:/4K-Visu

Open the file system and select a directory

7.6 Setting the interface

The desired I/O parameters are defined on the page **I/O settings**.

I/O

Digital input active

Low active

High active

Digital input		☒ : External input active ☐ : External input inactive
Low active	Radio button	Level for external input (0 V)
High active	Radio button	Level for external input (24V)

7.7 Setting the rotor



Information

More information about adding and removing rotors can be found in chapter **Commissioning**.

8 Operation

8.1 Process ON

All measurement data are saved and stored automatically into the directory, which has been selected after pushing key **[F1] Process ON** (page **Visualization**).

1. Push key **[F1] Process ON**. The system automatically displays the measurement directory, which was used last. If this measurement is to be continued, confirm by pushing **OK**.
2. If another directory is to be used or if a new directory is to be created, proceed as follows:

1. Push the icon **Browse** .

The dialog **Choose or create directory** is displayed.

2. Select directory or enter a new directory name, push **Select folder** to confirm.
3. Push **OK** to confirm.

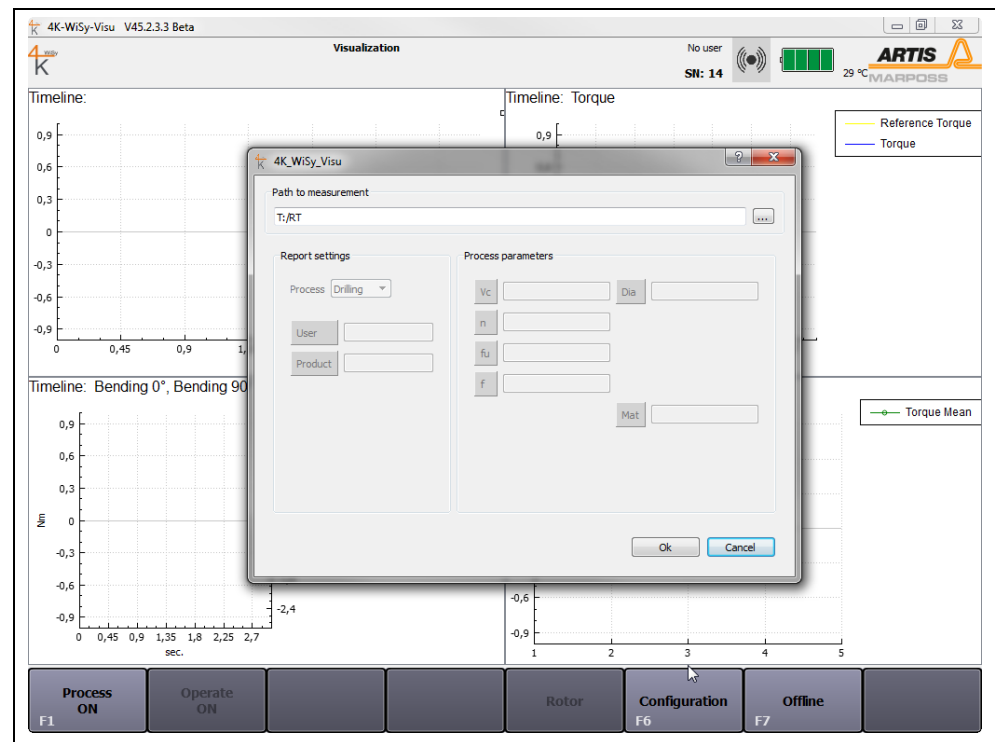


Fig. 13: Process ON

8.2 Report settings

The following screen is displayed if empty (newly created) measuring folders are selected. All entry fields may be edited.

Process	Pre-configured: Drilling Threading Reaming Milling	The list of processes can be adapted arbitrarily*. Process parameters depend on the selected process type.
User	Enter name	
Product	Enter name	
Process parameters	Enter value	Depending on process type
User sets	Select settings	Select pre-configured settings
Save	Save process parameters	Name is adopted from the list User sets .
Delete	Delete process parameters	Selected configuration is deleted from the list User sets .

* Adaptation of file 4K_WiSy_ProcessingSet.ini

8.3 Operate ON

Key **[F2]** or the **external output** are assigned alternatively with either **Operate ON** or **Operate OFF**. Measurement data are logged while the key **[F2]** is displayed in orange color.

1. Push key **[F2] Operate ON**. Measurement data are logged. The color and the labelling of the key **[F2]** switches to orange and **Operate OFF**.

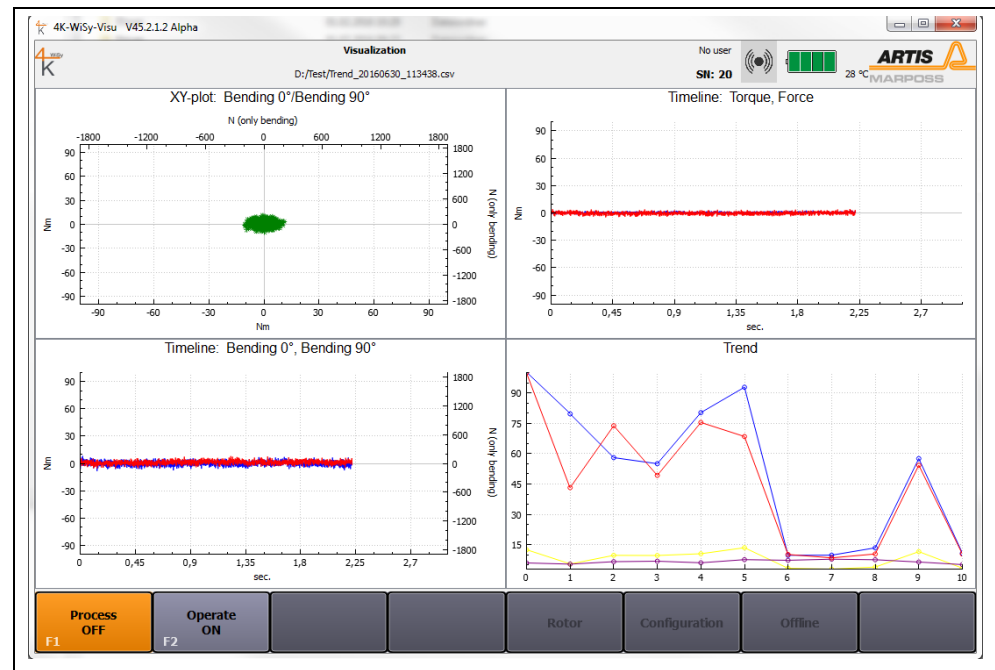


Fig. 14: Operate ON

2. The measurement data are displayed in the windows, which have been configured beforehand (see chapter **Commissioning**).
3. Shift key **[F2] Operate OFF**. Logging of measurement data is stopped. With each **ON/OFF**, another cycle is added to the directory, which has been selected after pushing **Process ON**.
4. A **Trend** curve is now displayed in the trend-window.

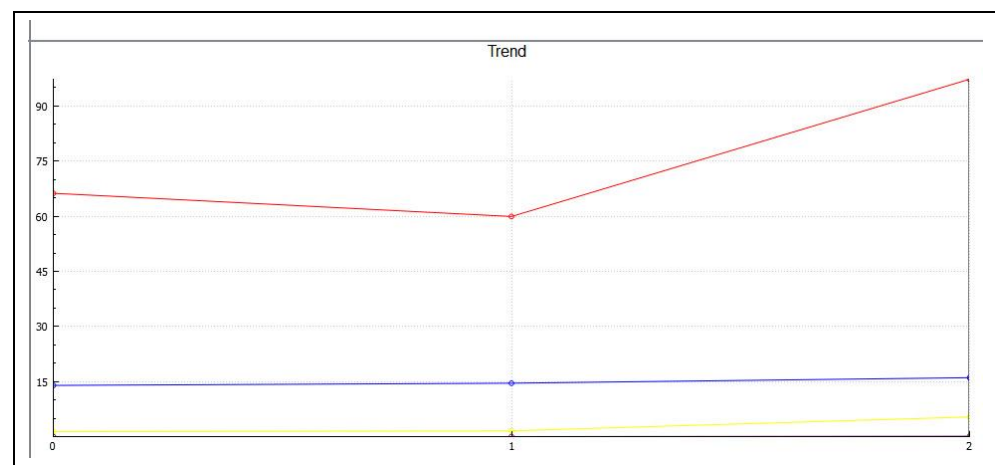
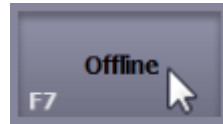


Fig. 15: Trend-window

9 Evaluating the measurement data

The collected measurement data can be retrieved from the Offline recorder. Push key **[F7] Offline** in the horizontal menu bar for switching to the Offline recorder.



The page **Offline recorder** is displayed.

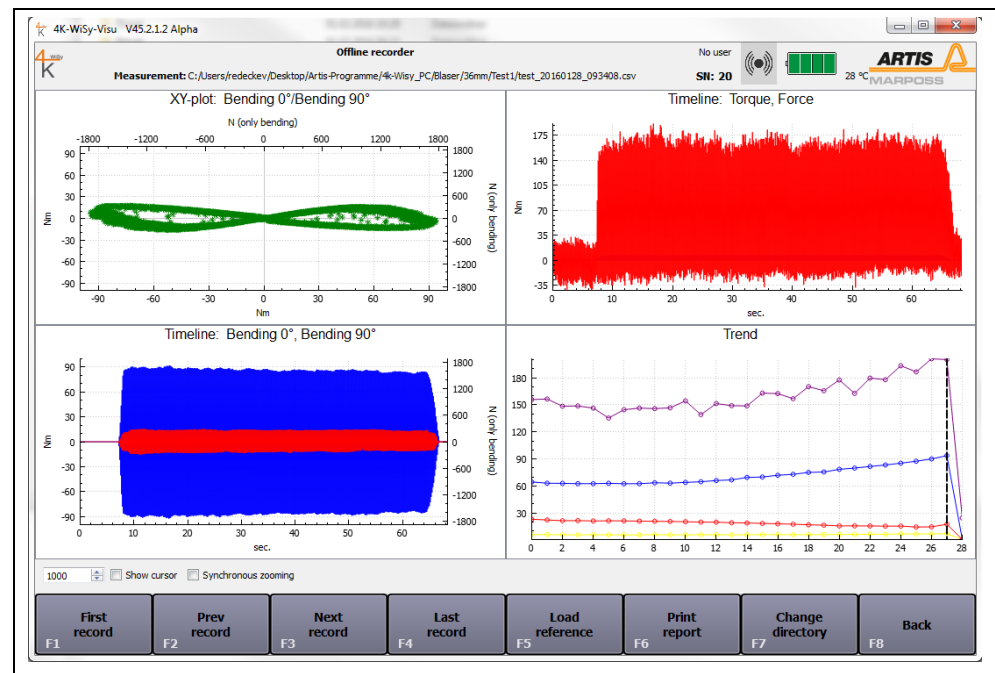


Fig. 16: Offline recorder

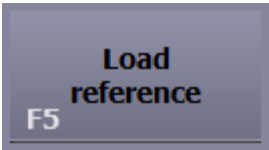
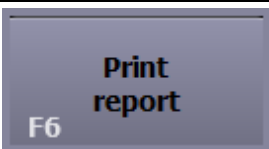
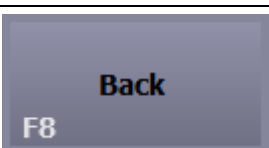


Information

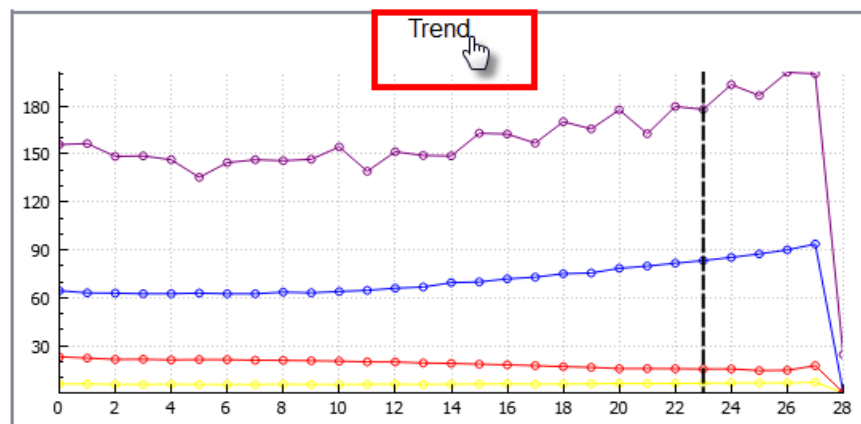
This function is only available if process recording is switched to Process OFF.

Menu bar

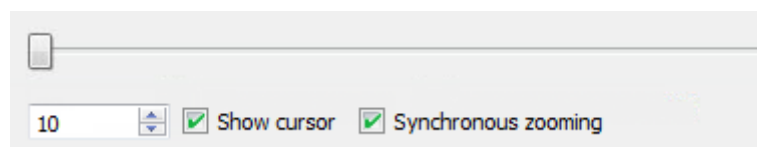
The menu bar is located in the lower part of the screen. Depending on the current user level, the display of active **[F]**-keys may vary.

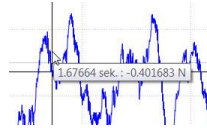
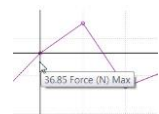
	[F1] First record Move to first recording
	[F2] Prev record Move to previous recording
	[F3] Next record Move to following record
	[F4] Last record Move to last recording
	[F5] Load reference Load reference recording. The loaded recording is displayed in yellow and shows deviations between the current and the reference recording
	[F6] Print report Print current cut
	[F7] Change directory Move to another recording directory
	[F8] Back Step back

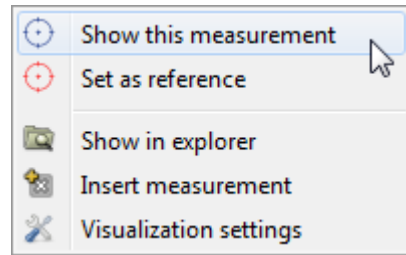
Double-clicking the headline of a window opens this particular window in full screen mode.



The tool bar for setting the display options is located beneath the recording windows.



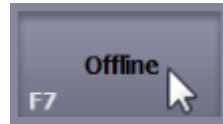
Slide control	The slide control is used for moving the cursor area within the display.
Show cursor	☒ : A certain part of the display is selected by a cursor. The number of points in the spin box determines the size of the cursor area. ☐ : No part selected.
Synchronous zooming	☒ : all timeline views scroll synchronously ☐ : only the selected timeline view scrolls Ctrl-key + mouse wheel: Y-axis is zoomed Alt-key + mouse wheel: X-axis is zoomed
Position cursor in timeline view	Select any point of the curve by mouse clicking and display time of measurement and measurement values for the selected point. 
Position cursor in trend view	Select any point of the curve by mouse clicking and display measurement values for the selected point. 

Context menu in the **Trend** view (right-click to display)

Show this measurement	Click measurement	The selected measurement is displayed in all windows
Set as reference	Click measurement	The selected measurement is set as reference measurement
Show in Explorer	Click measurement	Explorer is opened, the selected measurement is highlighted
Ignore measurement / Insert measurement	Click measurement	Measurement is either ignored or displayed in the Trend view
Visualization settings	Select entry	Context menu Visualization Settings is displayed

10 Creating a report

The collected measurement data can be retrieved from the Offline recorder. Push key **[F7] Offline** in the horizontal menu bar for switching to the Offline recorder.



The page **Offline recorder** is displayed.

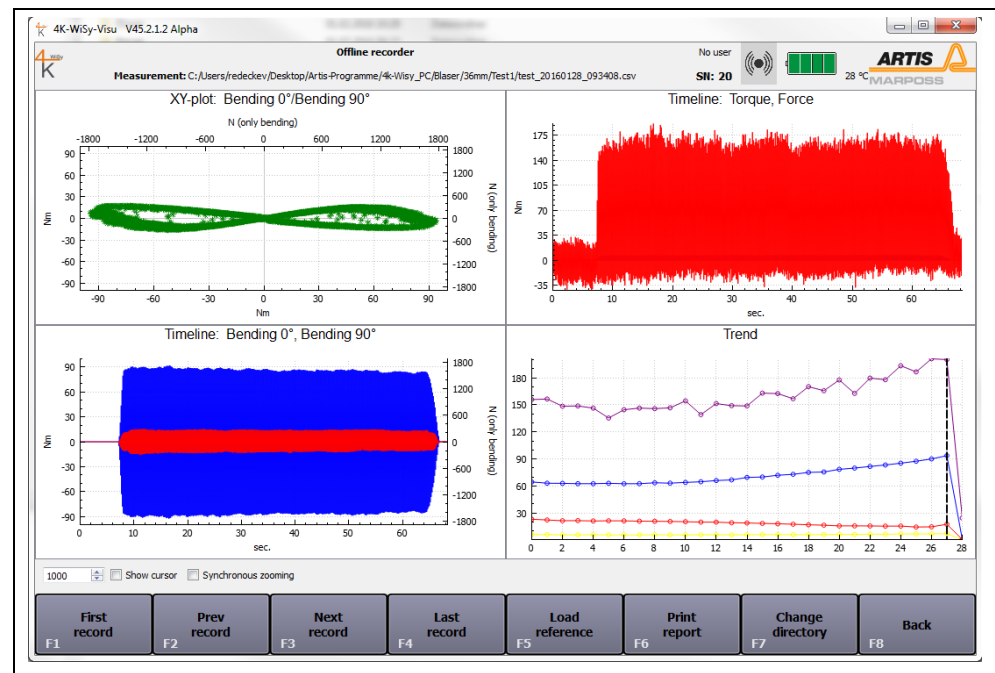


Fig. 17: Offline recorder



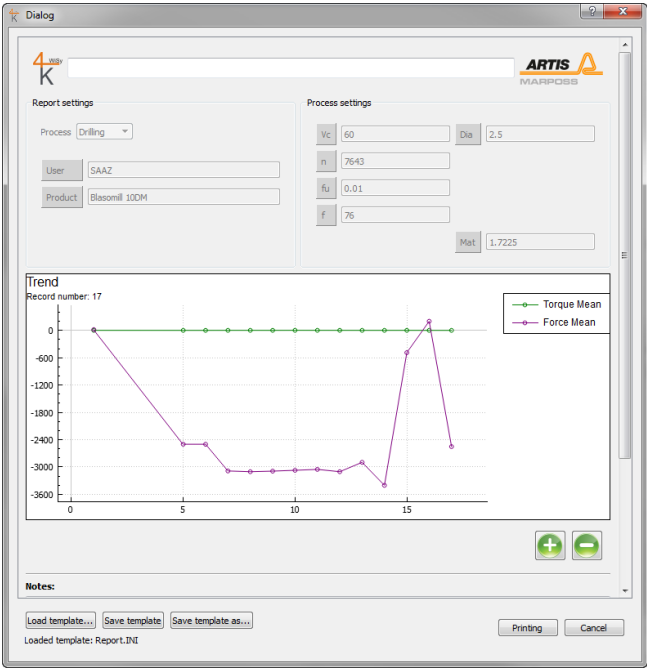
Information

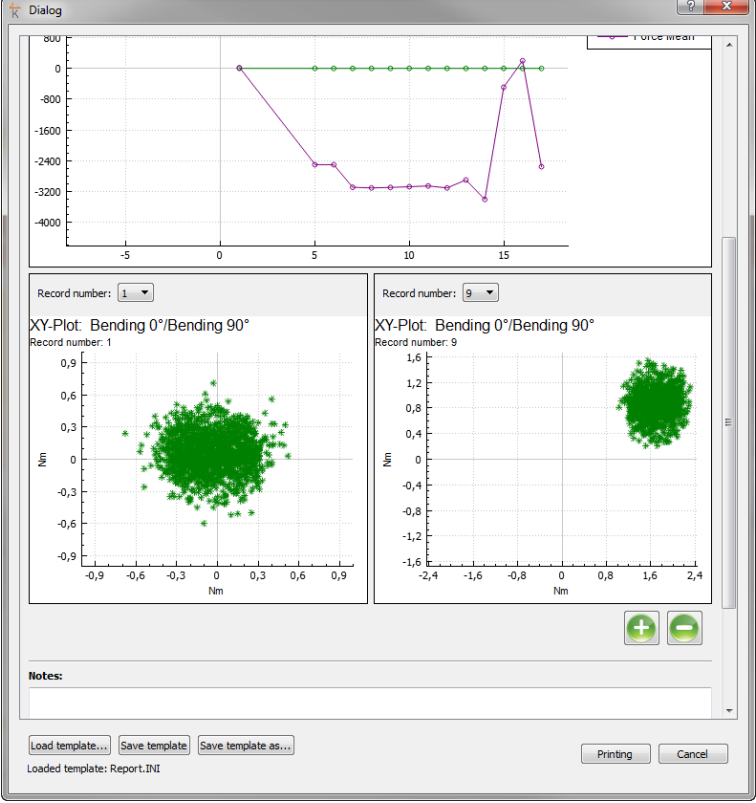
This function is only available if process recording is switched to Process OFF.

In order to navigate to the report tool, push key **[F6] Print report** in the horizontal menu bar.



The following screen with the report dialog is displayed.

	
Entry field (at the upper edge of the screen)	Enter report title
Report settings	These fields cannot be edited in this dialog. The data basis for the report is the measurement directory which was selected when recording the measurements → Process ON. In order to create a report using data from a different measurement directory, carry out the following steps: • Push Cancel and end report dialog • Push key [F7] Change directory • Push key Select folder. • Push key [F6] Print report and return to the report dialog.
Visualization (here: trend curve)	One visualization window is already opened. The context menu (right-click to display) is used for navigating in the visualization window. This context menu allows the following actions: • Show this measurement • Set as reference • Visualization settings (see chapter Evaluating the measurement data)

Keys Plus-/Minus 	Reports can be added to/removed from the report using the keys Plus and Minus.
	
Record number Record number: 1	Direct selection of certain measurements for the report.
Visualization settings	Right-click in any of the visualization windows in order to open the menu Visualization settings. This context menu allows the following actions: • Select plot type • Select signal type • Show legend • Ratio 1:1 • Filter active • Filter • Time (see chapter Setting the visualization).
Notes	Field for additional information.

Load template... Save template Save template as... Loaded template: Report.INI	
Load template Save template Save template as ...	In this example, the report bases on the template Report.INI. Administration of report templates is carried out with the keys Load template/Save template/Save template as.
Printing	Printing the report with all selected visualizations as PDF-file.
Cancel	End report dialog.



Information zur Anpassung des Report-Layouts

Im Verzeichnis **4K-Visu** befindet sich ein Unterverzeichnis **Report**. In diesem Unterverzeichnis sind zwei PNG-Dateien abgelegt:

- Logo-Left.png
- Logo-Right.png

Das Report-Layout lässt sich individualisieren, indem diese Datei(en) ausgetauscht werden.

11 Maintenance

The rotor applies to the specifications stated in this document and is calibrated ex works.

The recommended calibration interval is 24 months.

In order to adhere to the recommended calibration interval, the field **Calibration date** on the page **Rotor settings** is highlighted in yellow after the period of 24 months has elapsed.

The configuration of the calibration interval is carried out in the file 4K_WiSy_Visu: 24 = 24 months.

<code>[Service] CalibrationPeriode=24</code>
--

12 Appendix

12.1 Declaration of conformity

12.1.1 FCC Konformitätserklärung

Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

Conformité aux normes FCC Cet équipement a été testé et trouvé conforme aux limites pour un dispositif numérique de classe B, conformément à la Partie 15 des règlements de la FCC. Ces limites sont conçues pour fournir une protection raisonnable contre les interférences nuisibles dans une installation résidentielle.

Cet équipement génère, utilise et peut émettre des fréquences radio et, s'il n'est pas installé et utilisé conformément aux instructions du fabricant, peut causer des interférences nuisibles aux communications radio.

Rien ne garantit cependant que l'interférence ne se produira pas dans une installation particulière. Si cet équipement provoque des interférences nuisibles à la réception radio ou de télévision, qui peut être déterminé en comparant et en l'éteignant, l'utilisateur est encouragé à essayer de corriger les interférences par une ou plusieurs des mesures suivantes:

- Réorienter ou déplacer l'antenne de réception.
- Augmenter la distance entre l'équipement et le récepteur.
- Branchez l'appareil dans une prise sur un circuit différent de celui auquel le récepteur est connecté.
- Consultez votre revendeur ou un technicien radio/ TV pour assistance.

Les changements ou modifications à cet appareil sans expressément approuvée par la partie responsable de conformité pourraient annuler l'autorité de l'utilisateur de faire fonctionner cet équipement.

12.1.2 Konformitätserklärung für Kanada

Industry Canada Statements

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

This device complies with RSS-210 of the Industry Canada Rules. Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.

This device has been designed to operate with the antennas listed in the filing, and having a maximum gain of 3 dBi. Antennas not included in this list or having a gain greater than 3 dBi are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

Cet appareil est conforme avec Industrie Canada exempt de licence Rss standard(s). Son fonctionnement est soumis aux deux conditions suivantes: (1) cet appareil ne peut causer d'interférences, et (2) cet appareil doit accepter toute interférence, y compris des interférences qui peuvent provoquer un fonctionnement indésirable du périphérique.

Cet appareil est conforme à la norme CNR-210 d'Industrie Canada applicable aux appareils radio exempts de licence. Son fonctionnement est sujet aux deux conditions suivantes: (1) le dispositif ne doit pas produire de brouillage préjudiciable, et (2) ce dispositif doit accepter tout brouillage reçu, y compris un brouillage susceptible de provoquer un fonctionnement indésirable.

Pour réduire le risque d'interférence aux autres utilisateurs, le type d'antenne et son gain doivent être choisis de façon que la puissance isotrope rayonnée équivalente (e.i.r.p.) ne dépasse pas celle admise pour une communication réussie.

Cet appareil a été conçu pour fonctionner avec les antennes énumérées ci-dessous, et ayant un gain maximum de 3 dB. Antennes pas inclus dans cette liste ou ayant un gain supérieur à 3 dB sont strictement interdites pour une utilisation avec cet appareil. L'impédance d'antenne requise est de 50 ohms.

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