

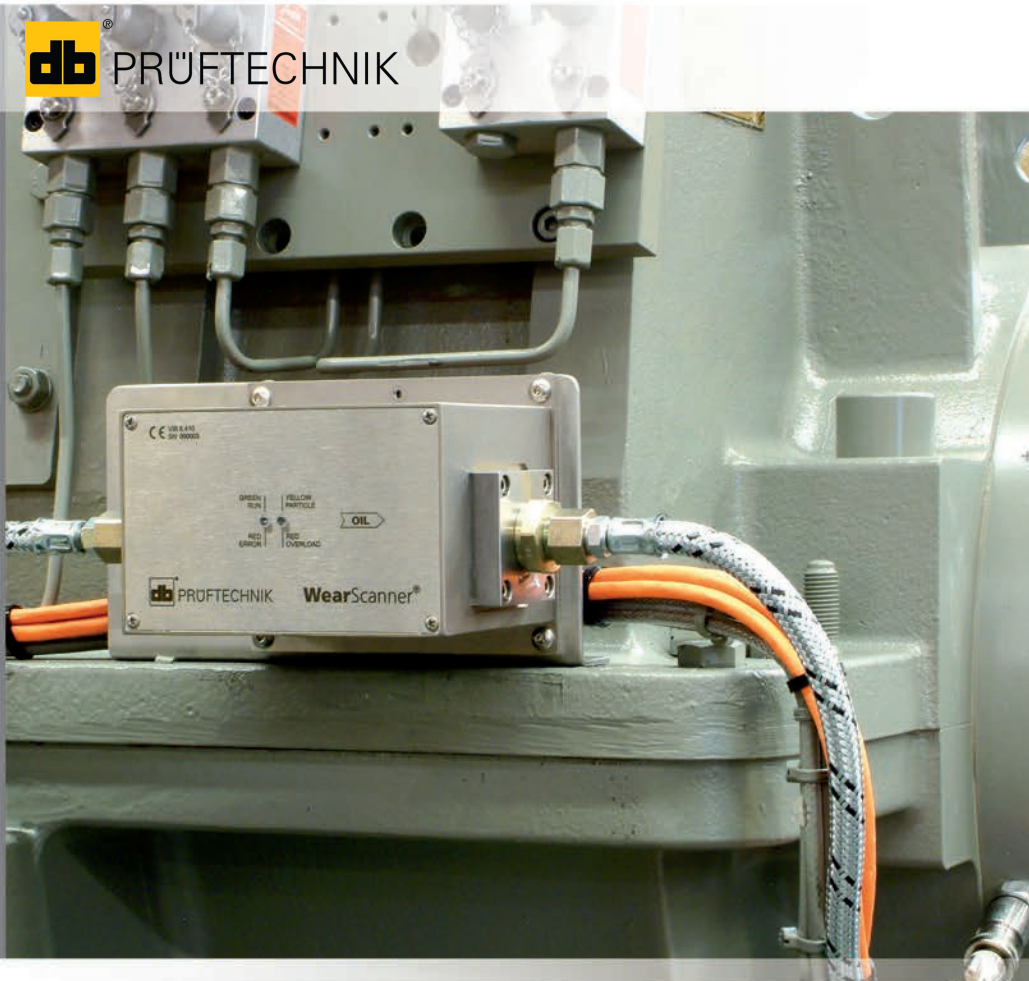
FLUKE®

Reliability

WEARSCANNER®

Installation and Operation

db PRÜFTECHNIK



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WEARSCANNER®

**Online particle size
distribution counter**

Installation and Operation



VIB 6.411 series

Firmware version 1.15 and higher



Edition: June 2014

Order no.: VIB 9.840.G

Translation of the german manual

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Chapter 1: Introduction

1.1 First steps

Checking delivery

Please check the delivered goods without delay for defects or missing parts. If your delivery is incomplete or you detect defective parts, mark the respective components on the freight dockets and contact the shipping company or local PRÜFTECHNIK sales partner.

Responsibilities

The **operator** of the machine must ensure that:

- All applicable statutory regulations, including safety, accident prevention and environmental protection regulations, and the recognized technical safety rules are strictly adhered to
- All tasks for the proper installation of the sensor are performed
- The system is installed by a qualified specialist technician
- All components and tools required for the installation are available on site (see also chapter "Installation")
- Electric power (24V) and a data network connection that conforms to the specifications are available on site
- An equipotential bonding connection is available on site.

1.2 Service addresses

If you have any queries, contact us:

Hotline: +49 89 99616-0

Fax: +49 89 99616-300

Fluke Deutschland GmbH
857373 Ismaning, Germany

Note

When calling our hotline, please have the serial number of the sensor at hand.

1.3 About this manual

This manual is an integral part of the product and, as such, should be kept for the duration of the product life and updated when necessary. Give this manual to all users and to any future owners of the product.

Disclaimer

The information and data in this manual are intended for information purposes only. Although due care was taken in the production of this manual, and the information it contains is correct and complete to the best of our knowledge, the possibility that it may contain errors cannot be excluded. PRÜFTECHNIK Condition Monitoring GmbH cannot be held liable for damage or consequential damage resulting from errors or inaccuracies that may be contained in this manual. PRÜFTECHNIK Condition Monitoring GmbH cannot be held liable for damage resulting from the failure to follow the instructions in this manual, either in part or in full.

Document structure

This manual contains important information for the proper installation, commissioning, troubleshooting, maintenance and disposal. It has been compiled in line with the requirements laid down in DIN EN 62079:2001.

Document layout

The text in this manual is formatted according to its purpose or function:

Explanatory text: No indent

Instructions, lists: List with • (bulleted)

General notes: Text delimited with lines at the top and bottom, preceded by signal word Note

Note

For safety symbols and signs, refer to chapter 2 "Safety".

Definitions

In this manual, the *WEARSCANNER online particle size distribution counter* is also referred to as 'WEARSCANNER' or 'sensor'. *Operating personnel* refers to the 'person or persons who are responsible for the installation, operation, taking into service, maintenance, cleaning, repair or transport of the machine'.

CERTIFICATE

Declaration of conformity

in accordance with EN ISO/IEC 17050-1



PRÜFTECHNIK Condition Monitoring GmbH,
Oskar-Messter Str. 19-21, 85737 Ismaning, Germany
declares in sole responsibility, that the product

Name: **WEARSCANNER**
Type: **VIB 6.410 / VIB 6.411**
Description: **Sensor for detection and monitoring
of electrically conductive particles in oil**

complies with the appropriate European Directives. The essential safety requirements set out in the European Directives are fulfilled.

Directive

EMC directive 2004/108/EC

Standards applied

DIN EN 61000-6-1: 2007

Immunity for residential, commercial and light-industrial environments

DIN EN 61000-6-2:2006

Immunity for industrial environments

DIN EN 61000-6-3: 2007

Emission standard for residential, commercial and light-industrial environments

DIN EN 60204-1:2006

Safety of machinery - Electrical equipment of machines: General requirements

CE marking was affixed in 2009.

Ismaning - February 03, 2010

Place and date of issue


Johann Lösl – Managing director

1.4 External interfaces

The sensor is installed in the lubricating oil circuit of the machine. The interfaces to the external areas are shown in the following figure:

- 1: Cable connection for supply, data network
- 2: Ground connection, PE connection
- 3: Pipe/hose connection for oil circuit
- 4: Switching output



Chapter 2: Safety

The WEARSCANNER was designed and built to comply with a carefully selected set of harmonized standards and technical specifications. Thus, the sensor offers the best technology available today and ensures a high degree of safety.

Nevertheless, there are certain risks that may arise during installation and operation against which precautions should be taken.

It is important that you follow all of the general safety instructions in this section and the embedded safety instructions throughout the manual. Safety instructions explain how to avoid injury to yourself and others and how to prevent property damage.

The operator of the system is responsible for injuries and damage that result from the failure to comply with the information provided in this manual.

2.1 Safety notices

In this manual

CAUTION

Information on avoiding injury.

Failure to follow these instructions can result in light, medium or severe injury.

Notice

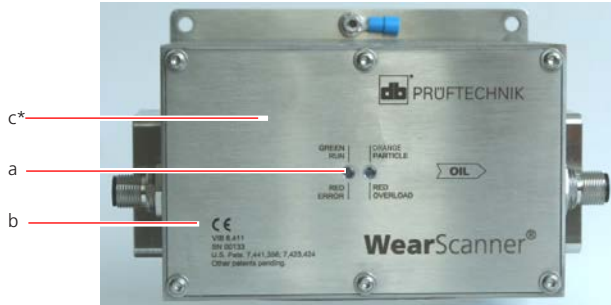
General instructions

To avoid property damage.

On the sensor

The safety labels on the sensor are shown in the following figure. The safety labels must be followed and must not be covered or removed.

* This safety label needs to be applied by the operator if needed.



a. System LED 1

This indicator lights up red in the event of a fault.

b. CE label

c. CAUTION! - Danger of burns

The housing can become very hot (> 40°C)*

2.2 Information for the system operator

Duties of the system operator

During operation, maximum safety can only be achieved, if all necessary measures are taken. It is the duty of the operator to ensure that these measures are properly planned and implemented.

In particular, you must ensure that

- the sensor is only be used for its intended purpose
- the sensor is only operated when it is in proper working condition
- the sensor is installed and operated only by suitably qualified and authorized personnel
- All operating personnel have been instructed in the relevant occupational safety and environmental protection issues in relation to the system, and in the use of this manual, with particular reference to the safety instructions
- The responsibilities for installation, commissioning and operation have been assigned.
- the safety and warning labels on the sensor are not removed and remain legible

Compliance with operating manual

You must ensure that

- This manual has been read and fully understood by all operating personnel, and that all instructions are strictly adhered to
- A copy of the manual is filed near the sensor and accessible at all times to the operating personnel
- The manual is handed over to any future owner of the sensor

Training

You must instruct the operating personnel on a regular basis on the application of all safety instructions. It is your duty to ensure that all safety instructions are strictly adhered to.

You must also instruct your personnel to comply with all statutory and other binding safety and accident prevention regulations and ensure that all warnings are observed.

As the system operator, you must ensure that all personnel work with due regard to safety.

2.3 Information for operating personnel

Qualification

The sensor may only be taken into service and operated by personnel that has been appropriately trained and is authorized to do so. Installation and deinstallation may only be performed by technicians qualified in electrical and hydraulic installations. The operating personnel must be familiar with the operating manual and act accordingly.

Personal protective equipment

When installing, taking into service and deinstalling the sensor

- work gloves,
- safety shoes,
- hard hat,
- goggles

are required.

Personal protective equipment is not needed during normal operation.

Rules for normal operation

The operating state is indicated by system LED 1 (see '5.5 Functional test', page 33). It lights up green during normal operation and red in the event of a fault.

- Check the following points regularly:
 - Is there visible damage to the sensor?
 - Are all oil lines leaktight and connected correctly?
 - Are any of the cables pinched or damaged?
- Eliminate any defects immediately and notify the operating company. The sensor may only be operated when it is in perfect condition!
- In the event of a fault, disconnect the sensor from the power supply.

The lubricating oil circuit is not impaired when the sensor is taken out of service. The machine can continue to be operated.

2.4 Intended use

The WEARSCANNER is only intended for the continuous measurement of the size and number of electrically conductive particles in lubricating oil circuits in force-lubricated machines.

The WEARSCANNER is installed in the return flow line **upstream** from the filter.

The WEARSCANNER may only be operated within the specifications contained in this operating manual.

Ambient conditions

Temperature range:	-20°C to + 80°C -20°C to +60°C, no flow
Humidity:	90%, condensation permissible
Outdoor use:	Yes, suitable for tropics, seawater resistant

Operating conditions

Operating pressure:	16 bar max.
Burst limit:	30 bar
Oil types:	Mineral, synthetic, biologically degradable
Temperature range:	-20°C to + 80°C

Foreseeable misuse

It is not permissible to operate the sensor with media that have not been specified here.

- Corrosive, acidic media may not be passed through the sensor. These media can destroy the housing or seals, cause chemical burns in persons installing or deinstalling the sensor, and permanently damage the sensor.
- Other, non-aggressive media do not impair the function of the sensor and do not present a risk, provided that the medium is not hotter than 80° C and does not exceed the burst limit of 30 bar.

At high ambient temperatures ($T_a > 65^\circ\text{C}$), oil must flow steadily to ensure that the heat in the sensor is dissipated continuously.

PRÜFTECHNIK Condition Monitoring GmbH cannot be held liable for damage resulting from incorrect use of the sensor.

2.5 Residual risk and protective measures

The WEARSCANNER has been proven to be safe when operated as intended. In the event of incorrect operation or improper use, the following injury and damage to persons and property may occur:

- Personal injury
- Damage to the sensor or the connected machine
- Reduction in sensor performance
- Environmental damage

CAUTION

Risk of scalding from leaking hot fluids!

The media that flow through the sensor may have temperatures up to 80°C. Hot fluid may exit during installation, causing scalding injuries.

- If the sensor is being used in the high temperature range (40°C and higher), label it accordingly prior to installation.
 - Wear suitable protective clothing.
 - Capture exiting fluids in a suitable container.
-

CAUTION

Risk of burns from touching the equipment!

The sensor takes on the temperature of the medium flowing through it and can reach 80°C. Touching the sensor without protective equipment can cause burns.

- If the sensor is being used in the high temperature range (40°C and higher), label it accordingly prior to installation.
 - Wear suitable protective clothing.
 - Before deinstalling the sensor, switch off the machine and let the sensor cool first.
-

⚠ CAUTION**Risk of bursting oil lines!**

If the oil line is leaky, oil can exit under high pressure and cause eye and skin injuries.

- Do not remove spray guards from the oil lines when the oil circuit is under pressure.
- Work on the oil circuit may only be performed by qualified personnel.
- Wear goggles and work gloves.

⚠ CAUTION**Risk of injury from heavy, compact design!**

The WEARSCANNER sensor is small but unexpectedly heavy (weight: 3.5 kg). When lifting it with one hand only, it may slip, fall down and cause injuries.

- Always lift the sensor with both hands.
- Wear work gloves and safety shoes when unpacking, transporting and mounting the sensor.

⚠ CAUTION**Risk of injury from sharp edges!**

The mounting plate on the housing has overhanging sharp edges and corners.

- Wear work gloves and always lift the sensor with both hands.

Notice**Do not open the housing!**

The WEARSCANNER housing may not be opened during its service life – except by authorized PRÜFTECHNIK employees. In particular, the components of the oil line connection may not be disassembled.

- In case of faults that cannot be corrected on location, send the sensor to PRÜFTECHNIK Condition Monitoring GmbH.

If the housing is opened anyway, any liability claims against PRÜFTECHNIK Condition Monitoring GmbH become void.

Notice**EMC**

- High frequency radiation in the environment of the sensor can result in faulty measurements.
 - Electrostatic discharge (ESD) in the environment of the sensor can lead to faulty measurements.
 - The sensor supply line may not be laid in high voltage cable conduits.
-

Notice**Indicators must be visible at all times**

System LED 1 lights up red in the event of a fault (see '5.5 Functional test', page 33).

- Install the sensor in such a way that the LED is visible to the operating personnel and cannot become dirty.
 - In dirty environments, clean the LED regularly.
-

Procedure in an emergency

If the oil line is connected improperly, it may disconnect during operation and oil may exit under high pressure.

- In this case, switch off the machine immediately. Information on how to perform an emergency stop of the machine can be found in the associated operating manual.
- Then switch off the sensor power supply, and eliminate the cause of the fault.

Safety precautions during installation and deinstallation

- Wear personal protective equipment (see '2.3 Information for operating personnel', page 12).
- Have suitable aids for stopping and cleaning away the oil ready (container, cleaning rags, etc.).

Before opening the oil line:

- Switch off the machine, depressurize the oil line and place a suitable container underneath.

After working on the oil line:

- Perform a leakage test for all installed components.
- Remove excess oil (fire and slip hazard).
- Check the safety equipment before taking the machine back into service.

Chapter 3: Technical data

Measuring method

Eddy current, differential coil principle

Particles

Ferritic or non-ferritic

Particle size class

Three size classes are set by default; up to 8 size classes can be set

Signal processing

Particle distribution counter with integral average determination and classification

Mean flow velocity / Mean flow rate

0.01 m/s ... 5 m/s and 0.08 l/min. ... 39 l/min. respectively

Oil types

Mineral, synthetic, biodegradable

Oil pressure

Max. 16 bar operating pressure / 30 bar burst pressure

Temperature range

Ambient temperature: -20°C ... +80°C, flow
 -20°C ... +60°C, no flow
 Oil temperature: -20°C ... +80°C

Interfaces | protocols

Ethernet, 100 Mbit /s / Modbus TCP

Power supply

- Voltage 24V_{DC} (21 V ...30 V)
 - Current consumption approx. 400 mA at 24 V
 - Power consumption approx. 9.6 W

Switching capacity

- Digital switching output:
 Potential-free Power-MOSFET switch
 24 V_{DC} (max. 30 V) / 0.2 A (continuous load)
 - Alive switching output:
 Potential-free Power-MOSFET switch
 24 V_{DC} (max. 30 V) / 0.2 A (continuous load)

Internal memory

64 MB; sufficient for data storage period of 150 days to 10 years, depending on the data logger time interval

Display

System signal LED 1: Green = ready, Red = fault

Operat. signal LED 2: Orange = particles passing through,
Red = overload (particles too big/many,
offset voltage too high)

Self-monitoring

Integrated

Overload protection

Integrated

Electrical connection

- Power supply / LAN:
Male socket M12, 8 pins
- Digital output / Alive output:
Male socket M12, 5 pins

Permissible common mode voltage

max. 50 V (housing / ground)

Connections oil circuit

2x G 1/2" (Witworth pipe thread DIN ISO 228)

Sensor tube inner diameter

approx. 13 mm

Housing material

Stainless steel 1.4308 (seawater resistant)

Weight

approx. 3.5 kg

Dimensions

- Sensor approx. 170 x 86 x 102 mm³ (L x W x H)
 - Mounting plate approx. 137 x 110 x 3 mm³ (L x W x H)
- The mounting plate is mounted on the sensor.

IP rating

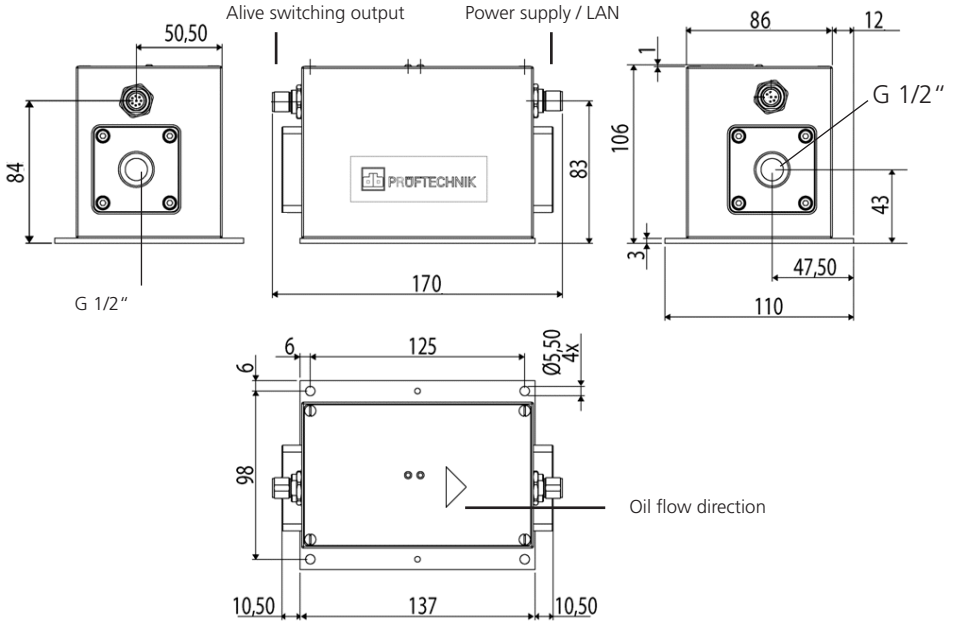
IP 65

Maintenance

No moving parts, maintenance-free

Dimensions

in mm



Chapter 4: Description

4.1 Properties

The WEARSCANNER is a sensor that detects electrically conductive particles in the medium that passes through it. The WEARSCANNER has the following features:

- Size-based counting and classification of particles
- Size classes are adjustable as specified in ISO 16232
- Continuous operation with integrated signal processing
- Suitable for lubricating oils
- Records oil temperature
- Temperature range: -20°C to +80 °C (+60°C, no flow)
- Large permissible flow rate range
- Many measurement functions customizable to machine and application, such as:
 - Threshold
 - Measurement time window
 - Electronic filter
 - Averaging
 - Gain etc.
- Internal ring memory for measurement data recording
- Persistent log file for the documentation of setting changes
- Modbus TCP communication
- Additional switching output as an option
- Network capability through its own IP address
- Switching output for signaling particle quantity exceeding
- Alive switching output for signaling system faults
- Self-monitoring
- Overload protection
- Maintenance-free

Particle size classes

(ISO 16232)

Classe	B	C	D	E*	F*	G*	H	I	J	K
Size	5µm- 15µm	15µm- 25µm	25µm- 50µm	50µm- 100µm	100µm- 150µm	150µm- 200µm	200µm- 400µm	400µm- 600µm	600µm- 1000µm	1000µm or larger

Size classes covered by the WEARSCANNER

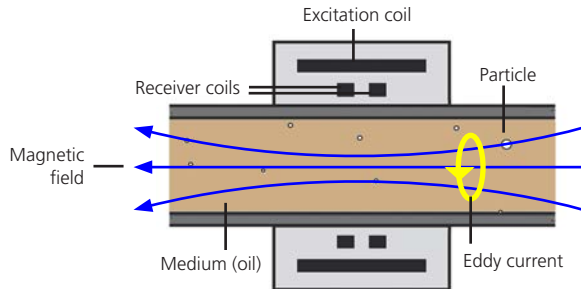
* Classes E - G only with appropriate configuration

4.2 Mode of operation

A patented process based on the eddy current measuring method is used for detection of the particles. WEARSCANNER is therefore virtually independent of temperature, flow quantity, viscosity, air and water content or coloration (darkening) of the medium being monitored.

Eddy current measuring method

WEARSCANNER contains an excitation coil and two counter-wound receiver coils. The exciter coil produces a magnetic alternating field that induces eddy currents in the oil flowing through the sensor. These eddy currents are detected by the two receiver coils. Electrically conductive particles change the amplitude and phase length of the induced voltage when they pass the coil combination. Due to the differential coil system, the process features very fast response behavior and can detect very small particles even at high flow rates.



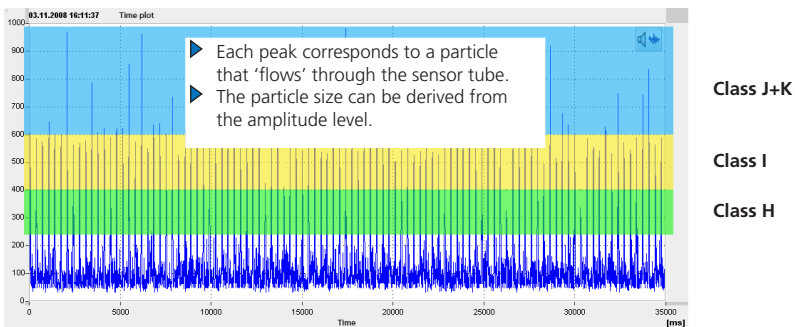
Signal processing

The amplitude of the voltage generated by the receiver coils is a measure for the particle size. The particle size classes according to ISO 16232 (see 'Particle size classes', page 23) can therefore be assigned to the corresponding voltage thresholds.

In the configured measuring time window* the sensor detects the particles and classifies them according to the active size classes. The configured time interval (sliding count)* can therefore be used to determine which averaged number of particles per class and time unit was detected periodically. Counters with thresholds set to 0% are disabled. Changes in the number and size of the detected particles indicate a trend with developing surface damage to toothing or bearings early on.

In addition to the sliding count, the particles detected according to size classes are also added up in cumulative counters*. If the configured thresholds* are exceeded, messages are sent via the digital switch output and the counter(s)* are reset to zero.

The use of modern electronic circuitry with fast DSP enables flexible adaptation of the WEARSCANNER to the respective monitoring task and the general conditions. Coil transmitting power, amplifications, measuring time windows, time intervals, filters and other parameters* can be preconfigured via software.



Example: WEARSCANNER configured for 3 size classes

Saving and transfer of data

WEARSCANNER features a ring buffer where the most important measuring and configuration data are saved periodically. The capacity of this memory is sufficient for about 150 days of operation, if the 'Data logger time interval' is set to the lowest setting of 1 minute. In case of longer configured data logger intervals* the recording time range is accordingly larger. If the storage volume is exceeded, the FiFo principle is used to overwrite the data.

If connected to a data network, WEARSCANNER transfers the measurement data via Modbus TCP to the system controller or online via a condition monitoring system directly to the site operator or service center.

*see also delivery certificate, section 'Factory settings'.

Monitoring of oil temperature

The sensor (tube) of the WEARSCANNER takes on the temperature of the flowing media. The sensor temperature and system temperature are measured and recorded together with the other measurement data.

Digital switch output for notification

A potential-free power MOSFET switch outputs signals with a particular pulse duration whenever a defined number of particles is reached within a class. The thresholds of these cumulative counters can be configured independently of each other for the respective classes. After a threshold is exceeded – depending on the configuration – all cumulative counters or only the triggering counter is reset to '0'.

Note

The pre-configured values at the time of delivery can be found in the tables 'Cumulative count' and 'Digital switch output' in the delivery certificate.

Alive switch output for system monitoring

The basic function of the WEARSCANNER can be remotely monitored by means of a potential-free power MOSFET switch. As long as the system detects correct functioning of the eddy current measuring circuit during a continuous self-test the Alive switch output is low-impedance (closed circuit principle; NC 'normally closed').

Chapter 5: Installation

5.1 Local requirements

The operating company must meet the following requirements and make the following preparations onsite to ensure that the equipment can be installed properly.

Qualifications of personnel

The equipment may only be installed by personnel qualified in hydraulic and electrical systems.

Installation location

The sensor is installed in the return flow line of the machine **upstream** of the filter. The machine must be switched off while the sensor is being installed and the oil circuit must be interrupted.

The sensor must be installed with a sufficient amount of surrounding space to avoid interference with components of the machine. The minimum installation dimensions can be found in the dimensional drawing in 'Technical Data' (see 'Dimensions', page 21). Also take into account the size of the fitting and the wiring.

Permissible ambient conditions

Temperature:	-20°C to +80°C (flow) -20°C to +60°C (no flow)
Relative humidity:	max. 90%
Vibrations:	max. 5g (12 Hz to 75 Hz)

There may be no strong electromagnetic fields in the close vicinity of the sensor, e.g. from generators, electric drives, high voltage cables, etc.

Required connections

Oil circuit:	one G1/2" fitting (Withworth DIN ISO 228 thread) each at the inlet and outlet of the sensor
Supply:	21 - 30 V DC, 400 mA \pm 10% @ 24 V DC
Network:	Ethernet with TCP/IP, 100 Mbit/s
Switching output: (Dig. / Alive)	Connection to PCS / PLC

Tools and supplies

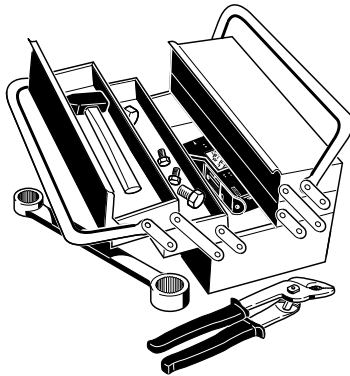
- Fittings, size G1/2", 2 pieces
- Wrench for G1/2" fitting
- Supplies for stopping oil and cleaning (bucket, cleaning rags, adhesive tape, plastic bags)
- Bolts (Ø: 5 mm) and washers for attaching the mounting plate, 4 pieces each
- Open-end wrench in the size required for the fixing bolts
- Ground line, sufficiently sized
- Standard tools for electrical connections (wire cutters, cable stripper, screwdriver, ...)
- Suitable strain relief for cable lock
- Industrial ethernet cable* (CAT 5) of sufficient length for connection to the power supply and data network and for connection of the switching outputs to the PCS / PLC.
- Wire end ferrules
0.25 mm² x 5 mm and 1 mm² x 6 mm for shield.

* e.g. VIB 90030, available as an accessory

** VIB 6.420-L and VIB 6.426-L, available as an accessory

Note

If you use the pre-assembled cables**, you only need ferrules for connection to the control system.



5.2 Installation method

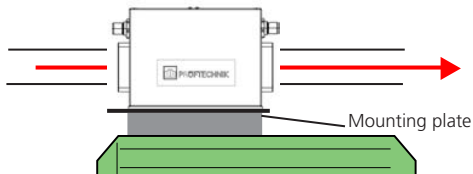
Position and direction of flow

The sensor may be installed in any position. Install the sensor in the oil circuit such that the direction of flow matches that shown on the sensor.



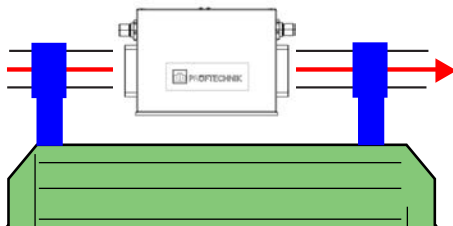
Rigid attachment

The sensor is rigidly installed on the machine using the preinstalled mounting plate or a suitable anchoring on the machine.



Suspended attachment

The sensor can be freely suspended on the oil lines, provided that these are fixed close to the sensor so that no bending forces act on the sensor.



5.3 Unpacking the sensor

- Take the sensor out of the packaging.

 **CAUTION**

Risk of injury from heavy, compact construction!

The WEARSCANNER sensor is small but unexpectedly heavy (weight: 3.5 kg). When lifting it with one hand only, it may slip, fall down and cause injuries.

- Always lift the sensor with both hands.
 - Wear work gloves and safety shoes.
-
- Dispose of the packaging material properly (see 'Chapter 9: After use', page 51).

5.4 Electrical connection

Notes

- Mark the cable ends for clear identification of the connections.
- Install the grounding or the equipotential bonding on the WEARSCANNER mounting plate with low resistance (wire cross section and length), to prevent electromagnetic interference in the sensor area.
- Avoid the formation of 'ground loops', so that no compensating current interferes with the sensor. It may be possible to remedy such problems by installing the oil connection with electrically non-conductive pipe fittings.
- Place the cable screen on one side only to prevent the formation of ground loops at these locations as well.
- Do not exceed the maximum permissible cable lengths. If the industrial Ethernet cable VIB 90030 is used, the maximum cable length is 20 meters.

Network and power supply connection

- Connect the industrial Ethernet cable* (CAT 5) to the included 8-pin M12 socket (VIB 6.421).

* e.g. VIB 90030,
available as accessory



Cable connection side

1	Tx+	or/wh	Network TCP/IP
2	Tx-	or	
3	Rx+	gn/wh	
4	24V+	bn	
5	24VGND	bn/wh	
6	Rx-	gn	
7	not connected		Power supply
8	not connected		

or = orange
wh = white
gn = green
bn = brown

Note

The pin configuration / color sequence corresponds to the cable set VIB 6.420-L.

Ground/equipotential bonding connection

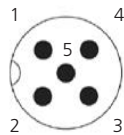
- Connect the grounding/equipotential bonding connection on the WEARSCANNER and the machine frame with a grounding cable, if the installed screw connections do not ensure a sufficiently low-resistance and safe electrical connection.



* e.g. VIB 90030, available as accessory

Connecting the switch output (5-pin)

- Connect the industrial Ethernet cable* (CAT 5) to the included 5-pin M12 socket (VIB 6.425).



Cable connection side

1	KAO+	gn/wh	Higher potential
2	KAO-	gn	Lower potential
3	PCO-	bn	Lower potential
4	PCO+	bn/wh	Higher potential
5	Shield		

gn = green
wh = white
bn = brown

KAO: Alive switch output
PCO: Digital switch output

Note

The pin configuration/color sequence corresponds to the cable set VIB 6.426-L.

Notes

Pin 5 is connected to the sensor housing internally and can be used for connecting a cable screen.

For switching power refer to the WEARSCANNER technical data and also the specification of the cable used.

5.5 Functional test

Prior to delivery, the size classes are preset and the sensor undergoes a quality check.

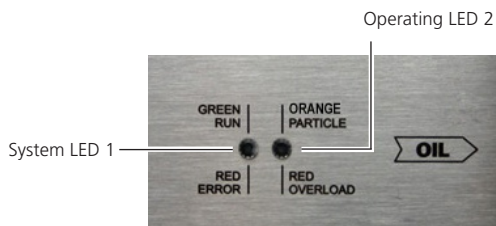
e.g.: size classes H, I, J-K (see delivery certificate).

If necessary, check that the sensor is functioning properly and counting particles before you install it in the oil line.

- Connect the sensor to the power supply. The system LED 1 lights up green when the sensor is operational (approx. 15 seconds).
- Apply an electrically conductive particle (e.g. iron shavings) to a plastic rod.
- Rapidly insert the plastic rod into the sensor opening. The operating LED 2 lights up orange when the sensor counts a particle.

Note

If the operating LED 2 lights up red, the particle is too large. However, this does demonstrate that the sensor is working.



System and operating displays on the WEARSCANNER

LED status codes

Color	LED 1	LED 2	LED 1 & 2
●, lights up	in operation	---	---
●, lights up	synchronizing	particle count	---
●, lights up	system fault	overload	---
●, blinks	---	---	Meas. data transfer Software update

5.6 Adaptation of the IP address

All WEARSCANNERS are delivered with a pre-configured, standardized IP address (see delivery certificate).

In many cases it may be desirable to configure the IP address of the WEARSCANNER to the locally assigned address before connecting to the network. To do this, use the 'WEARSCANNER utility' (see 'Chapter 8: WEARSCANNER utility', page 41).

Note

Before changing the IP address, document the old and the new IP address.

5.7 Installation

After the functional test is successful, install the sensor into the oil line.

- Note the local requirements and the information on the method of installation (see '5.1 Local requirements', page 27), (see '5.2 Installation method', page 29).
- After installation, perform a leakage test for all installed components (sensor, hoses, connections, ...)

⚠ CAUTION

Risk of burns!

The sensor takes on the temperature of the medium that flows through it and can reach up to 80°C. Touching the sensor without protective clothing can cause burns.

- When using the sensor at high temperatures (above 40°C), label accordingly before installing.
 - Wear suitable protective clothing.
-

⚠ CAUTION

Risk of bursting oil line!

If the oil line is leaky, oil can exit under high pressure and cause eye and skin injuries.

- Do not remove spray guards from the oil lines when the oil circuit is under pressure.
 - Wear goggles and work gloves.
-

Chapter 6: Startup

After installing start up the machine and connect the WEARSCANNER to the power supply. WEARSCANNER is in operation as soon as the system LED 1 (see 'LED status codes', page 33) lights up green continuously.

Note

Operation and data recording with the WEARSCANNER are not dependent on the existence of a data connection (network or LAN).

6.1 Establishing the network connection

Note

The network connection must be established by trained and authorized IT personnel.

The data are transferred to the system controller or a computer via Modbus TCP in the standard application. For communication, port 502 must be enabled in these devices.

The program WEARSCANNER utility enables simplified data queries (see 'Chapter 8: WEARSCANNER utility', page 41).

6.2 Factory settings and definitions

Note

Changes to the pre-configured parameters should be made with caution and thoroughly documented! An incorrect value can result in malfunctions or incorrect measurements.

The factory settings for each WEARSCANNER are listed in the delivery certificate included with the unit. Check the type designation and serial number to ensure that the certificate matches the WEARSCANNER unit.

The thresholds provided in the table area “sliding count” correspond to the following particle classes (see ‘Particle size classes’, page 23):

5 %: Class H; 40 %: Class I; 80 %: Classes J–K

Terms used in the delivery certificate

- **Configuration designation:**

This name is used to define the corresponding parameter set for the factory settings.

- **Coil transmitting power:**

A percentage figure for the strength of the exciter field in the sensor (excitation voltage).

- **Additional amplification (HW):**

Share of the configurable (= variable) amplification compared to the total amplification.

(Total amplification = primary amplification (fixed 40 dB) + variable amplification. Example: if 31 dB is specified as the amplification, the total amplification is 71 dB).

- **Additional amplification (SW):**

No function! For internal purposes only. Leave value set to 0dB!

- **Band-pass filter setting, recommended for flow rates ... :**

The filters (low-pass and high-pass) are supposed to suppress disruptions. On the other hand, the useful signal should not be excessively affected by band-pass filter widths that are too narrow. The filter thresholds are therefore selected for a wide range and depend on the expected particle velocity, which is influenced to a large degree by the oil flow rate.

- **Measuring time window:**

This window indicates the time period in which new particles are detected. Only the largest particle is registered for each window. Particle velocity (flow rate), together with the filter setting and measuring time window affect the detection accuracy.

- **Time interval, sliding count:**

This values indicates the time period in which the quantity of particles of a particular size class are counted. These quantities per time unit are averaged on a sliding basis before further processing and saving.

- **Time interval, data logger:**

The particles are monitored continuously. The data logging, however, is carried out only periodically, so that the internal memory can be used for a longer recording period.

- **Trigger threshold:**

Particle sizes below this trigger threshold cannot be detected reliably and, like small interfering signals, are excluded from the count.

- **Sliding count:**

This table lists the numbered counters that are classified by size classes (threshold values in %). A particle is counted only in the highest class that applies to it; lower thresholds and therefore also exceeded thresholds are not taken into account in these cases.

Counters with threshold set to 0 % are inactive!

- **Cumulative count:**

The size-dependent particle quantities detected by the sliding count are also added up in these separate counters. If the values in the tables are exceeded, a warning signal is sent by the switch output.

- **Reset mode:**

This field indicates whether only the affected counter whose threshold was exceeded is reset to "0" or whether all counters are reset if only one threshold is exceeded.

- **Digital switch output; switching behavior:**

This field describes whether the digital switch output operates according to the closed-circuit principle ("normally closed") or the open-circuit principle ("normally open").

- **Digital switch output; pulse duration:**

Indicates the pulse length of the warning signal in seconds. After this time has expired the signal returns to the initial state.

Chapter 7: Maintenance & troubleshooting

7.1 Care and maintenance

As with any electronic measuring device, the WEARSCANNER must be handled with care.

If necessary, clean the housing with a soft cloth to keep the two status indicators and the safety label visible. Immediately replace damaged cables and connectors.

WEARSCANNER is maintenance-free.

7.2 Troubleshooting

Symptom: The system LED 1 lights up red (see 'LED status codes', page 33).

Possible causes: System crash, power supply is not working properly.

Remedy:

- Switch the power supply off and on.
- Check the power source, cabling and electrical connections.

Symptom: The WEARSCANNER is not counting.

Possible causes: Is the sensor being supplied with power? Is oil flowing through the sensor? Is the sensor installed upstream from the filter units as required? Is the sensor still working?

Remedy:

- Check the power source, cabling and electrical connections.
- If the fault indicator lights up, switch the sensor off and on.
- Remove the sensor from the line and perform a function test with a particle (see '5.5 Functional test', page 33).

Symptom: The WEARSCANNER is counting even though there is no oil flow.

Possible causes: External fault sources, electrical installation.

Remedy:

- Check the cabling, the electrical connection and the grounding.
- Ensure that the sensor is not subjected to strong mechanical vibrations or electromagnetic sources.

Hotline

If the measures described here are not effective, please contact our technical support:

Telephone: +49 89 99616-0

Fax: +49 89 99616-300

Note

When calling the hotline have the serial number of the sensor ready as well as the information stored in the file ,start_log.txt'. This file can be downloaded from the sensor using the WEARSCANNER utility software.

Chapter 8: WEARSCANNER utility

WEARSCANNER utility is a utility for startup and system maintenance of the WEARSCANNER; it can be used for the following tasks:

- Change IP configuration
- Set system time
- Transfer and save readings (together with a network utility such as Netcat)
- Read current system settings
- Manually reboot

Most of these tasks are executed in normal mode from the connected control room via ModBus TCP. Therefore, this utility is used only in special cases and for IP configuration during initial startup.

WEARSCANNER utility is provided by PRÜFTECHNIK Condition Monitoring for download on the PRÜFTECHNIK website.

Notes

Changes to the WEARSCANNER settings should be made with caution and carefully documented! Incorrect values can result in malfunctions and incorrect measurements.

Before changing settings, save the configured parameters and existing measurement data (e.g. via the WEARSCANNER utility functions "Get Settings" and "Get Internal Memory")!

Comply with the data backup regulations for your area.

8.1 Installation and startup

Requirement: WEARSCANNER must be in operation and accessible via a network connection.

1. Installing WEARSCANNER utility

- Download the WEARSCANNER utility program package from the PRÜFTECHNIK website:
<http://www.pruftechnik.com/wearscanner-utility.zip>
- Create an installation directory on your PC and unzip the downloaded ZIP file (contains: wearscanner.exe, readme.txt).

Notes

Current information on changes in the software and system requirements can be found in the README file.

Files that you download with WEARSCANNER utility are automatically saved to the installation directory. The available storage space should be at least 200 MB. The actual space required depends on the number of WEARSCANNERS that are managed and the downloaded measurement data.

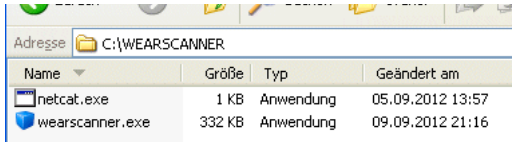
To download the content of the internal memory, you need a network utility such as Hyperterminal, PuTTY, etc. The connection uses the valid IP address and port no.: 2000.

To read measurement data with WEARSCANNER utility you need NETCAT – a free network utility, available for example from <http://netcat.sourceforge.net>.

When using such utilities, always comply with the conditions of use, national/regional regulations and any restrictions by your IT administration!

2. Installing NETCAT

- Download the NETCAT program file (netcat.exe) to the installation directory created in step 1.



Name	Größe	Typ	Geändert am
netcat.exe	1 KB	Anwendung	05.09.2012 13:57
wears scanner.exe	332 KB	Anwendung	09.09.2012 21:16

3. Starting WEARSCANNER utility

- Double click on the file “wears scanner.exe”. A start screen will appear:



The 'IP Address' field contains the IP address of the WEARSCANNER that was contacted last. The first time you start the program the field will be empty.

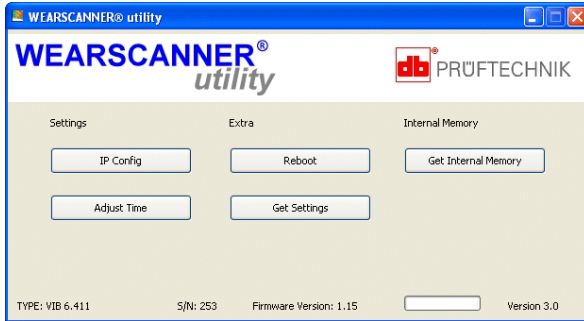
4. Contacting the WEARSCANNER

- Enter the IP address of the WEARSCANNER. For new units, it can be found in the enclosed delivery certificate.

Note

Only during initial startup: If the address range in your company network is different from the range of the WEARSCANNER address, you must connect WEARSCANNER directly to your PC and temporarily assign the PC a valid IP address (see delivery certificate) in order to establish the connection.

- Click “Connect”; if successful, the main menu will appear:



WEARSCANNER utility main menu

The data of the WEARSCANNER appears at the bottom of the screen.

Sample unit:

TYPE: VIB 6.411; serial number S/N: 253; Firmware version: 1.15
Version 3.0: WEARSCANNER utility version

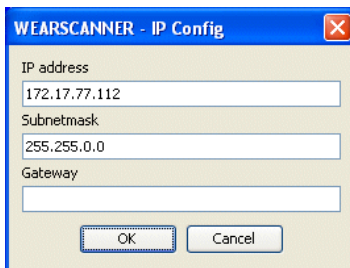
This information must match the information on the unit and the delivery documents.

5. Changing the IP configuration for WEARSCANNER

Note

Before making changes, document the new and old IP address and the serial number of the corresponding WEARSCANNER.

- In the main menu, click "IP Config".
- Enter the new IP address, the subnet mask and the gateway, if applicable.
- Click OK.



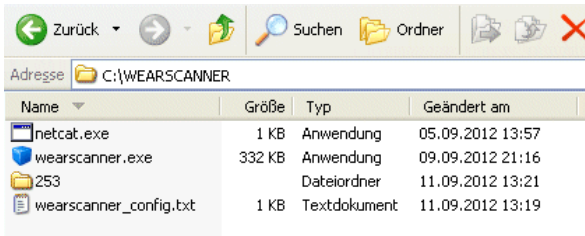
- A prompt will appear. Confirm with YES if the information is correct.
- Confirm the following message about waiting time with OK.

Note

WEARSCANNER automatically conducts a reboot following an IP configuration ('Reboot'). This process takes about 1 minute. A new connection can be established only after this waiting time has elapsed.

If you click 'Connect' before completion of the reboot process, the message 'IP address not available' will appear. Confirm this with OK.

- Wait until the reboot is complete.
- Confirm the message about completion of the IP configuration with OK. The installation directory now contains an additional device directory and a text file:



The device directory (directory name = serial number) was created automatically by WEARSCANNER. It is used to save the device configurations and the downloaded measurement data. The text file contains the IP configuration of the last WEARSCANNER that was started.

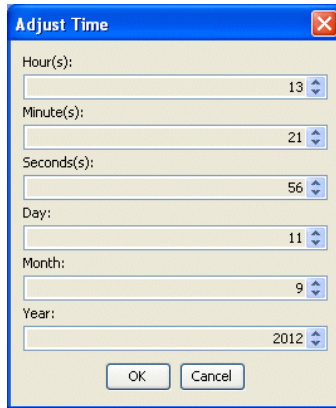
- In the startup screen click "Connect" to establish a new connection and to make any further settings.

8.2 Additional configuration options

1. Changing time and date

The units are set to the time at the production site where they were manufactured. It is recommended that new units be set to the current time at the site of use.

- In the main menu, click 'Adjust Time'.
- The dialog that follows displays the system time of your computer. Click OK if you wish to apply this setting for WEARSCANNER. Other values can be set by using the respective arrow buttons.
- Click OK.



First you will see the progress bar and then the confirmation window.

- Then click OK.

Notes

The time setting is automatically documented in the installation directory (file: "time.txt")

There is no automatic switching to and from daylight savings time!

2. Rebooting WEARSCANNER

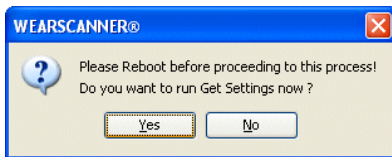
WEARSCANNER conducts a reboot every 24 hours, based on the last reboot. This can take up to one minute. Settings, parameters and measurement data are not changed by this. Therefore, the parameters are not reset to the factory settings! In case of a reboot, WEARSCANNER writes the current parameters/settings to a file (start_log.txt), which you can download with the WEARSCANNER utility ("Get Settings", see below). Before you download this file, therefore, you should always reboot WEARSCANNER.

- In the main menu, click 'Reboot' and confirm the prompt that follows with "Yes".
- Confirm the message about waiting time with OK.

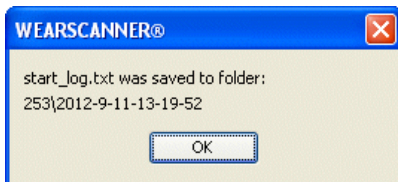
3. Downloading current settings

The current settings are stored in the WEARSCANNER in the file 'start_log.txt'. Before you download this file, you should conduct a reboot, because otherwise the file will not be updated (see previous section).

- In the main menu, click 'Get settings'.
- Confirm the following prompt with "Yes" if you have already conducted a reboot.
Otherwise, discontinue the data transfer with 'No' and start the reboot.



After the data transfer, the following window appears:



The directory name contains the serial number and the date.

Note

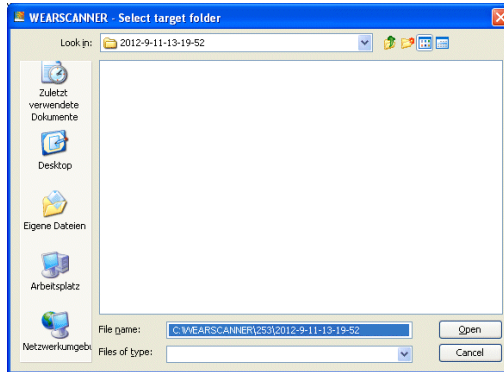
The file "start_log.txt" contains the settings and parameters that were valid at the time of the last reboot. A reboot is conducted automatically every 24 hours, after a power outage or manually by the user (see above). Changes to settings in the WEARSCANNER cannot be made by editing this file.

4. Downloading measurement data

Note

To transfer the measurement data, WEARSCANNER utility requires the network utility NETCAT. The program file (netcat.exe) must be saved to the installation directory.

- In the main menu, click 'Get Internal Memory'.
A selection dialog appears, with the default measurement data directory. By default it is created in the corresponding device directory.



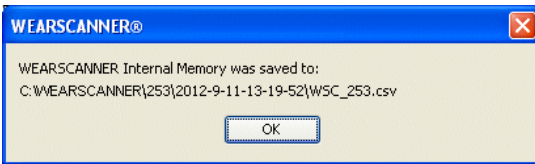
- Click 'Open' to confirm the input and start data transfer.
The data transfer can take a long time, depending on the file size!

During the data transfer a command line window appears:

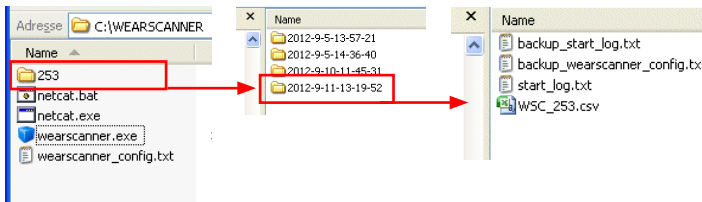
```

C:\WINDOWS\system32\cmd.exe - netcat.bat
C:\WEARSCANNER>netcat.exe 172.17.77.112 2000 1>WSC_253.csv
  
```

- After completion of the data transfer, confirm the corresponding message with OK:



After the data transfer, the installation directory contains the following sub-directories and files:



The device directory ("253" in this example) contains the measurement data directories. The measurement data directory contains the measurement data (*.csv) and the relevant settings and parameters (_start_log.txt) as well as IP configuration data (_config.txt).

Notes

The measurement data are stored in CSV format and can be converted to any other format (e.g. spreadsheet programs). Due to the potentially large file size, be aware of any limitations with respect to the number of lines. You may have to split the CSV file prior to conversion.

The measurement data remain in the WEARSCANNER after the data transfer. Nevertheless, you should back up data regularly in accordance with the guidelines for the respective project!

Chapter 9: After use

Taking out of service

- Disconnect the WEARSCANNER from the power supply and the signal lines.

Deinstallation



Risk of scalding from contact and emerging hot fluid

The sensor can reach 80°C. When deinstalling the sensor hot fluid may exit and cause scalding.

- Wear suitable protective clothing.
- Switch off the machine and let the sensor cool.
- Capture fluid that exits in a suitable container.

-
- Deinstall the sensor from the oil line.
 - Reconnect the oil line with a suitable fitting.
 - Perform a leakage test.

Disposal

Note

WEARSCANNER contains a lithium metal battery (lithium < 1g).

Dispose of the system components and the spent batteries according to the applicable waste disposal regulations.

In EU member states where the *EU Directive 2002/96/EC "Waste Electrical and Electronic Equipment" (WEEE)* has been implemented in national law, the following rules apply:

These devices can be returned to the manufacturer who is responsible for their proper disposal.

Consequences for end consumers:

- All electrical and electronic PRÜFTECHNIK products including electrical and electronic accessories (e.g. cables, sensors, etc.) must be disposed of through PRÜFTECHNIK or its waste disposal contractor. These products must not be disposed of as domestic waste.
- For information regarding the return of PRÜFTECHNIK products for disposal, please contact:
 - your local PRÜFTECHNIK sales office
 - your local PRÜFTECHNIK sales agent



Fluke Deutschland GmbH
WEEE Reg. no.: DE 30202500



Chapter 10: Appendix

Modbus read register

The settings (operating parameters) can be checked under “Get Settings” in the WEARSCANNER utility (see ‘Downloading current settings’, page 47).

The Modbus protocol (TCP) can be used to read the data (current measurement data) in a system controller that is equipped accordingly or with an online condition monitoring system.

The following tables list the most important Modbus registers that can be used for reading data.

Note

The Modbus code for reading register content is:
16-Bit access; Read Holding Registers; Function Code: 3

1. Date and time

Description	Info	Register address	Range
Year		0	2008 ... 2099
Month		1	1 ... 12
Date		2	1 ... 31
Hours		3	0 ... 23
Minutes		4	0 ... 59
Seconds		5	0 ... 59

2. Counter values from “sliding count”

A register pair (Low-Word W0 together with corresponding High-Word W1 = value * 65536), which – added together – results in the number of particles per time interval.

Example: Counter 1; W1 (High-Word) results in value of 3
Counter 1; W0 (Low-Word) results in value of 2300

results in: $3 * 65536 + 2300 = 198908$

which means:

Counter 1 registered 198908 particles in one time interval.

Description	Info	Register address	Range
Cnt1_W0	Low-Word	7	0 ... 65535
Cnt1_W1	High-Word	8	0 ... 65535
Cnt2_W0	Low-Word	9	0 ... 65535
Cnt2_W1	High-Word	10	0 ... 65535
Cnt3_W0	Low-Word	11	0 ... 65535
Cnt3_W1	High-Word	12	0 ... 65535
Cnt4_W0	Low-Word	13	0 ... 65535
Cnt4_W1	High-Word	14	0 ... 65535
Cnt5_W0	Low-Word	15	0 ... 65535
Cnt5_W1	High-Word	16	0 ... 65535
Cnt6_W0	Low-Word	17	0 ... 65535
Cnt6_W1	High-Word	18	0 ... 65535
Cnt7_W0	Low-Word	19	0 ... 65535
Cnt7_W1	High-Word	20	0 ... 65535
Cnt8_W0	Low-Word	21	0 ... 65535
Cnt8_W1	High-Word	22	0 ... 65535

3.Counter values from “cumulative count”

A register pair (Low-Word W0 together with corresponding High-Word W1 = value * 65536), which – added together – results in the cumulative number of particles since the last reset.

Detection of the number of particles corresponds to the procedure for “sliding count”; see above.

Description	Info	Register address	Range
SPS_CNT1_VALUE_W0	Low-Word	244	0 ... 65535
SPS_CNT1_VALUE_W1	High-Word	245	0 ... 65535
SPS_CNT2_VALUE_W0	Low-Word	246	0 ... 65535
SPS_CNT2_VALUE_W1	High-Word	247	0 ... 65535
SPS_CNT3_VALUE_W0	Low-Word	248	0 ... 65535
SPS_CNT3_VALUE_W1	High-Word	249	0 ... 65535
SPS_CNT4_VALUE_W0	Low-Word	250	0 ... 65535

Description	Info	Register address	Range
SPS_CNT4_VALUE_W1	High-Word	251	0 ... 65535
SPS_CNT5_VALUE_W0	Low-Word	252	0 ... 65535
SPS_CNT5_VALUE_W1	High-Word	253	0 ... 65535
SPS_CNT6_VALUE_W0	Low-Word	254	0 ... 65535
SPS_CNT6_VALUE_W1	High-Word	255	0 ... 65535
SPS_CNT7_VALUE_W0	Low-Word	256	0 ... 65535
SPS_CNT7_VALUE_W1	High-Word	257	0 ... 65535
SPS_CNT8_VALUE_W0	Low-Word	258	0 ... 65535
SPS_CNT8_VALUE_W1	High-Word	259	0 ... 65535

4. Temperatures

The system temperature indicates the temperature of the electronic circuitry inside the housing. The coil temperature is the temperature of the sensor and therefore corresponds approximately to the temperature of the flowing media.

Description	Info	Register address	Range
System temperature	°C	49	[-20]*... 85
Coil temperature	°C	50	[-20]*... 120

Note

* The display of negative temperature values is derived from the formation of the 16-bit two's complement!

Example: $-1\text{ °C} > 65535$

5. Signal values

The tab 'Noise-Abs.-Value' provides a sliding average of the measured signal, including the noise component. The tab 'Max.-Noise-Abs.-Value' saves the maximum signal amplitude value that occurred since the last query of the Modbus register.

Description	Info	Register address	Range
Noise-Abs.-Value	mV	69	0 ... 1000
Max-Noise-Abs.-V.	mV	70	0 ... 1000

6. System messages

The read value must be decoded and demasked to receive the corresponding condition information.

Example:

Read decimal value: $12_d >$ binary value: ... 00001100_b

This results in the following condition information:

System in operation; one particle detected (Bit 2 and Bit 3 = 1)

Description	Info	Register address	Range
Systemmeldung	0 oder 1 _b	25	0 ... 65535

Bit 0	System Error = 1	System error has occurred
Bit 1	Overload = 1	Overload in system
Bit 2	Particle = 1	A particle was detected
Bit 3	Running = 1	The system is running
Bit 4	Busy = 1	An automatic comparison is taking place

7. WEARSCANNER serial number

A register pair (Low-Word W0 together with corresponding High-Word W1 = value * 65536), which – added together – results in the serial number.

Example: W1 (High-Word) results in value of 0

W0 (Low-Word) results in value of 253

results in: $0 * 65536 + 253 = 253$

which means: WEARSCANNER has the serial number 00253

Description	Info	Register address	Range
Serial number Product W0	Low-Word	72	0 ... 65535
Serial number Product W1	High-Word	73	0 ... 65535

8. Software version (Firmware):

The read value must be decoded (dez > hex) to determine the corresponding version. The high-order bits (Bit 8 to Bit 15) stand for the number before the decimal point; the low-order bits (Bit 0 to Bit 7) represent the number after the decimal point.

Example:

The decimal value 271_d is read from register 46.

> results in hexadecimal representation: 010F_h

> the detected Firmware version is: 1.15

Description	Info	Register address	Range
SW-Release	X.XX	46	(0.0) ... (255.255)

Note

The serial number and the software version can also be read out with the WEARSCANNER utility (see 'Contacting the WEARSCANNER', page 43).

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Bearing condition

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VIBRONET® Signalmaster lets you monitor and analyze your machine condition from around the globe. It is the first telediagnosis system in the world to take advantage of Internet technology for communication and data transmission. When the situation at hand demands immediate attention, the Signalmaster instantly notifies the specialists by eMail or SMS.

VIBRONET® Signalmaster: Telediagnosis via Internet & mobile phone

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