FAG



FAG Detector III
F'IS Trendline 3

User manual

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1 General



Overview

The FAG Detector III 214 is a vibration measuring device, data collector and operational balancing device in one. Together with the FIS Trendline 3 22 software, the device allows improved planning of maintenance and increased machine availability.

Machine vibrations are a good indicator of a machine's condition. With the aid of Detector III, you can monitor machine vibrations according to ISO 10816 and roller bearing condition by means of the demodulation detection method. The base curve and demodulation signals stored in the system can then be used to analyze the signals in the time and frequency range. This permits detection of alignment errors and imbalance as reliably as roller bearing damage or gearing problems. Other process parameters that can be recorded are temperature and rotational speed.

Applications

Measuring and analyzing machine condition

The FAG Detector III records vibration signals at pre-defined measuring points by means of a sensor and then calculates the effective values for velocity, acceleration and demodulation. These characteristic values 269 describe the condition of the machine and component.

You can define and monitor frequency bands of any frequency width in the range from 0.1 Hz to 20 kHz. FAG Detector III can save up to 1600 measuring points and up to 270 time signals. Once a measuring round has been finished, all data recorded are transferred to the Trendline software, where they are evaluated, analyzed and displayed.

Balancing with the Detector III (available as accessory function)

There are many and diverse reasons for unscheduled machine standstills. However, a considerable number of these is due, directly or indirectly, to imbalance or alignment errors. During operation, imbalance may cause severe vibrations that can lead to consequential damage, for example premature bearing wear or fatigue-induced breaks. The result is machine failure and thus unscheduled production downtime.

The FAG Detector III is a tool with which you cannot only detect but also remedy such conditions easily and efficiently. The easy user interface provides good support during the balancing process. Step by step, the device software guides the user through the balancing process. The user can create a configuration for each balancing process with the Trendline software. Furthermore, he can define templates that can be adapted on site on the machine. The balancing results are sent to the Trendline software. You can display them there in table form or as a diagram.

Analyzing data with the Trendline bearing database

The integrated bearing database (approx. 20,000 bearings from various manufacturers) simplifies and speeds up analysis of measured data in combination with the FIS Viewer. It allows you to detect any irregularities at first glance and assign the appropriate components. You can save multiple bearings per measuring point. This allows you to check multiple bearing ball-pass frequencies at a measuring point. Every user can add new entries to the bearing database to suit individual needs.

1.1 Safety information

The Detector hardware is manufactured in accordance with the approved standards and guidelines (see Declaration of Conformity in the PDF appendix) and is safe for operation. Nevertheless, the device may pose certain unpreventable residual risks to users and third parties or objects. Therefore, it is essential that all safety information contained in this manual is complied with. Moreover, the universal safety and accident prevention regulations must be considered. Non-compliance can endanger the health and life of persons or cause material damage. The safety information in this manual are valid in the Federal Republic of Germany. In other countries are the relevant national rules valid.

Please note the **special security information**, which can be found at the beginning of the corresponding chapter or next to the individual steps.

Operating staff

Certain features of the Detector, e.g. balancing, may be performed only by accordingly trained staff.

1.2 Hazard symbols and signal words

Hazard symbols used

Safety and hazard information is characterized by standardized, specific hazard symbols. If no specific symbol applies, a general hazard symbol is used instead.

General hazard symbol

DANGER



Type and source of the danger are described here

Measures to prevent the danger are explained here.

Specific hazard symbols

DANGER



ELECTRICAL SHOCK HAZARD!

This symbol represents the electrical shock hazard which can lead to personal injury including death or material damage.

Signal words used

Signal words indicate the severity of danger given if the measures for reducing damage are not observed.

- **Caution**: Slight material damage can occur.
- **Warning**: Slight personal injury or severe material damage can occur.
- **Danger**: Personal injury can occur. In especially serious cases there is danger to life.

1.3 About this documentation

This documentation describes the functionality of the Detector III and the Trendline software. It explains:

- how to create configurations 53 or measuring routes 112 on a computer and transfer these to the Detector;
- how to use the device to perform measurements;
- how to transfer data from the Detector to the computer and
- how data can be analyzed and stored.

The PDF appendix also contains a brief description of the subject Temperature measurement with the Detector III. An introduction to the basic principles of vibration monitoring as PDF is on the delivered CD-Rom (see "General information on vibration monitoring").

Please read these instructions carefully prior to the start-up and keep them in a safe place. Ensure that

- these instructions are available to all the users,
- these instructions are included when the product is transferred to other users,
- any additions and changes provided by the manufacturer 277 are always included.

Symbols used



This symbol indicates

- *helpful additional information and*
- *device settings or application tips that help you perform tasks more efficiently.*

Cross reference symbol 12: This symbol refers to a manual page containing further information. When reading the manual in PDF-format on the computer screen you can jump to that page by simply clicking on the word to the left of the symbol.

2 Product description

Detector III is a hand-held measuring instrument with data recording function for offline monitoring of systems and machinery (condition monitoring). For this purpose, the instrument senses vibrations at pre-determined measuring points using a Detector and works out the RMS values of vibration velocity, acceleration in vibration and demodulation, the so-called characteristic values, for characterizing machine or component condition. In addition, Detector can measure temperatures using an infra-red sensor.

- Once a round of measurements is complete, the measured characteristic values and any recorded time signals are transferred to a computer where they are evaluated, analyzed and graphed using the Trendline software 22.
- The exact location of the measuring point within the system to be monitored is stored in the configuration 53. There, the sensor sensitivity for each measuring point and the threshold values for main or preliminary alarm are stored as well. The configuration is created using the Trendline software 22 and transferred to the Detector prior to measuring.
- For the measurement, the vibration sensor is attached to a pre-determined measuring point with the help of a magnet footing. If this is not possible due to the housing material (e.g. aluminum), attach an iron plate or a washer the size of the magnetic at the measuring point. This is easiest done with the help of a fast-curing superglue (e.g. cyan acrylate glue).
- The configuration of the measuring point is selected on the Detector and the measuring started. Detector records the sensor signals broadband and works out the characteristic values. These characteristic values are stored and transferred to the computer once the measuring round is finished.
- For each measuring point, the newly measured characteristic values are compared with the threshold values determined for this measuring point for a main alarm and pre-alarm. The Detector (main alarms) and the Trendline software (main and pre-alarms) display the threshold events. New characteristic values are stored. You can depict them graphically in the Trendline software depending on time of measuring.

In addition to the condition monitoring measurement (subsequently referred to as CM measurement 223) the Detector III also masters what is known as operation balancing. During this process the Detector helps you find the optimum position of balancing weights when performing the balancing measurement 234. These weights serve to compensate for imbalances in rotating parts and therefore extend their service life.

2.1 Intended use



The Detector as well as the associated components are not admitted for the use in residential areas!

Detector devices must only be operated within the limits specified in the Technical data 15 to the extent provided, the limits of use of the individual components must always be taken into consideration too.

Any other use exceeding the above is deemed unintended and the user will bear the full risk associated with it. The user is responsible for the intended use. This includes the compliance with these instructions.

Information to the user

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

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Industry Canada

This Class A digital apparatus complies with Canadian ICES-003.

2.2 Modifications by the user

The user may not carry out any modifications to the hardware of the Detector device. The user is merely allowed to make setting changes to the device by means of the Trendline software. For modifications in exceeds to this the user bears all responsibility! Should you encounter a defect in your Detector please contact your customer adviser 277.

2.3 Technical data

Device name	FAG DETECTOR III, DETECT3-KIT
Inputs	2 * BNC connectors (multiplexer) ICP (4,7 mA), arbitrary configurable sensitivity AC/DC ±5 V, impedance >100 kOhm 1 * AUX Tachometer input 5 up to 24 V, 30-9999 RPM (rising or falling edge selectable) IR-temperature sensor ±5 V, impedance >100 kOhm (freely configurable) Battery charger
Vibration measurements	
Outputs	Headset (envelope signal) RS 232 for data transfer (38,4 kbps; 57,6 kbps) AUX: supply trigger sensor (5 V max. 200 mA, 12 V max. 50 mA)
Measuring ranges	Acceleration / velocity 0,1 Hz to lowpass 0.1 Hz to 200 Hz; 0.1 Hz to 500 Hz; ... Demodulation 0 Hz until lowpass Lowpasses 200 Hz, 500 Hz, 1 kHz, 2 kHz, 5 kHz, 10 kHz, 20 kHz Highpass (demodulation branch) 750 Hz Temperature -20 °C to +550 °C (temperature range depends on the used sensor, freely configurable input)
Characteristic values	A_{eff} (2 kHz to lowpass), RMS value of the vibration acceleration A_{sel} RMS value of the vibration acceleration in a freely configurable frequency range ISO 10816 (10 Hz to 1000 Hz), RMS value of the vibration velocity V_{sel} RMS value of the vibration velocity in a freely configurable frequency range D_{eff} (frequency range depends on lowpass frequency), RMS value of the demodulation signal D_{sel} Effective demodulation signal in a freely configurable frequency range Crest factor, rotational speed, temperature, universal
Window type	Hanning
Averaging in frequency range	1–9 (FFT, characteristic value per channel)
Sampling rate	Linear max. 51,2 kHz, depending on the configured lowpass frequency (configured lowpass * 2,56)

A/D converter	16-bit (auto ranging) Dynamic range >90 db
Frequency resolution	1600, 3200 lines (0.0625 Hz up to 12.5 Hz depending on the configured lowpass frequency)
Balancing	
	1 or 2 plane balancing Weight positions: continuous (0 to 359°) or discrete (4 to 99 positions) Remove trial weights: yes/no
Balancing measurement type	Acceleration, velocity, displacement
Measurement	Peak, Peak – Peak, RMS
Balancing units	g, mm/s, inch/s, µm, mil
Weights units	g, oz (up to 99 999,99 g / oz)
Automatic measuring point detection (RFID)	
Radio frequency	13.65 MHz
RFID standard	ISO 15693
Product must only be operated in	European Union (EU), Switzerland, USA, Canada, Australia
General	
Separate measurements	Temperature, rotational speed, headset (envelope signal)
Keyboard	Membrane keyboard with 21 keys
Display	Backlit graphic display (LCD) 128x 64 pixels, dimension 55 x 33 mm
Memory	1600 measuring points plus 270 time signals (maximal 300 time signals)
Power supply	NiMh 2 000 mAh Voltage 6V Operation time approx. 6 to 8 hours (charging time for empty battery approx. 4 h)
Size and weight	230 x 70 (53) x 45 (53) mm (L x W x H), approx. 500 g (including battery)
Temperature range	0 to 50 °C (operating temperature) 0 to 40°C (to load the charger) -20 to +70 °C (storage and transport temperature)
Operation time	approx. 6 to 8 hours continuous operation

Housing	ABS, IP 40
Protective bag	Two compartments, black nylon material 2 windows with foil cover, openings with Velcro strip fastener Velcro strip ties for cables and sensor, carrying strap
EMC standards	EN60950-1, EN61000-4-2, EN61000-4-3, EN61000-4-6
Firmware	Free firmware updates on the Internet Available languages: German, English, Finnish, French, Italian, Dutch, Polish, Portuguese, Swedish, Slovenian, Spanish and Turkish
Software	FIS Trendline (updates on the Internet) Available in: German, English, French, Portuguese and Spanish – Configuration of the FAG Detector III via RS 232-interface – Bearing database with ca. 20 000 bearings – Graphical display of the measured values and trends – Trend analysis – View of time signals and FFTs – Tabular and graphic view of the balancing data – Configurable report tool



Subject to technical modifications!

2.4 Scope of delivery

DETECT3-KIT



- Base unit with accumulator
- Accelerometer with magnetic foot
- Infrared temperature sensor
- Battery charger with travel adapter
- PC data cable (serial/USB)
- Manual
- Protective bag with temperature sensor holder
- Trendline PC software
- Case

DETECT3.BALANCE-KIT



- Acceleration sensor with magnetic foot and sensor cable
- Trigger sensor (optical and inductive)
- Scales
- Magnetic holder for trigger sensor
- Extension stick for magnetic holder
- Cable for trigger sensor (length 10 m)
- Reflex mark for optical trigger sensor
- Dongle for activating the balancing function
- Case

RFID KIT

- Base unit with accumulator and RFID reader
- 5 RFID tags:
  - 2 units FIS.DETECTORIII.RFID.TAG.KEY
  - 3 units FIS.DETECTORIII.RFID.TAG.DOME (specially for metallic foundations)
- Accelerometer with magnetic foot
- Infrared temperature sensor
- Battery charger with travel adapter
- PC data cable (serial/USB)
- Manual
- Protective bag with temperature sensor holder
- Trendline PC software
- Case

Accessories

Sensor extension cable (5 m and 15 m length), sensor bases and rail magnets are available on request.

Optional accessories

In connection with the Detector device, FAG Industrial Services offers a wide range of optional accessories. Please *contact your customer adviser* 277.

3 Before you start

The RFID kit or RFID Detector up to version F3 is delivered with three snap ferrites. These must be attached to the three sensor cables (cables for the acceleration sensors as well as trigger sensors) of the Detector.



Snap-on ferrite



- *Ferrites prevent electromagnetic disturbances from the Detector from affecting other electronic devices nearby.*
- *From RFID Detector version F4 snap ferrites are no longer needed.*

Attach ferrites

- Lay the sensor cable in the groove of the snap-on ferrite.
- Arrange the cable as shown in the picture below. Please note that the ferrites must be attached as closely to the Detector as possible.
- Close the snap-on ferrite so that it is tightly around the cable and snaps.



Ferrites attached to sensor cables

4 Trendline 3

The Trendline software is the server-based program for the Detector III. The Detector itself is designed only for the recording of measured values. All data organization and evaluation tasks are carried out by the Trendline software.

The software is configured to monitor a system as well as evaluates, analyses, and stores the measured data collected by the Detector.

Further, Trendline 3 manages the exchange of data between the server on which the software is running and the Detector.



- *The Trendline software version 3.6 operates only with the Detector firmware 3.6.*
- *If your Detector has a lower firmware version, please update the Detector's firmware* 26.

4.1 Program installation

This chapter describes the installation of the Trendline software.

The Trendline software requires the MS SQL database server. It must be installed either on the local computer or on a network server. If you are already using an MS SQL database server (see "System requirements" 22), you can register the CM databases with this.

4.1.1 System requirements

In order to use the Trendline software in an optimum way, the following minimum requirements must be met:

General system requirements

- Pentium III PC with 500 MHz (recommended: 1 GHz)
- At least 512 MB RAM (recommended: 1 GB; Windows 7: 64 Bit version)
- Screen resolution: 1024x768 (pixels)

Operating systems

- Trendline software 3.6: Windows XP SP3, Windows 7: 64 Bit version
- Database program MS SQL Express 2005: at least Windows XP SP3 or Windows 7: 64 Bit version



MS Windows Server operating systems are not supported.

Hard disk memory for installing the Trendline software

- Trendline software 3.6 (without database and database server): 62 MB
- Detector Flash Updater: 4 MB
- Demo database and bearing database: 20 MB

Hard disk memory for installing the database server

- MS SQL Express 2005: 525 MB

Hard disk memory for the database

- MS SQL Express 2005: at least 4 GB (recommended: 10 GB)

Other requirements

- Microsoft Internet Explorer 6.0 SP1 or later

MS SQL database program

If you are already using a MS SQL database program, you can register the CM databases with this. You can use the following versions:

- MS SQL Server 2000 (requires a commercial license)
- MSDE (free version of MS SQL Server 2000 with limited functions)
- MS SQL Server 2005 (requires a commercial license)
- MS SQL Express 2005 (free version of MS SQL Server 2005 with limited functions).



A database that has been updated from MSDE or MS SQL Server 2000 to MS SQL Express 2005 cannot be re-opened with MSDE or MS SQL Server 2000.

Tips

- Install the database program and the CM databases on a central computer that is always available.
- If you are using MS SQL Express 2005, the database must be enabled for network access.

4.1.2 User rights and writing access

For installation and operation of the Trendline software you need special permissions. For problems with the safety requirements of your system, please contact your system administrator.

User rights

For the installation of the Trendline software you need administrator permission on your system.



Tip: Install the software with administrator permission and then switch back to a normal user.

Writing access

The Trendline software saves settings and log files during operation. You must have write access to the following default directories:

Using Windows XP SP3

- C:\Users\All Users\Application Data\Condition Monitoring\
- C:\Users\User\Local Settings\Application Data\Condition Monitoring\

Using Windows 7: 64 Bit version

- C:\Program Data\Condition Monitoring\
- C:\Users\User\AppData\Local\Condition Monitoring\

4.1.3 Installation Trendline software

Please insert the installation CD in your CD-ROM. If you do not have a CD, you can download the current version of Trendline software from our website (www.fis-services.com) in the "Downloads" section.

The installation directory on CD-ROM can be opened as follows in the Windows Explorer:

- Open **My computer**.
- Under **Equipment with removable media**, right-click the CD-ROM drive and
- then click **Open**.
- Open the directory "Trendline 3.6" and
- select one of the following installation types.

Installation type

The Trendline software can be installed in various ways. You can

- install the software completely on a local computer (recommended for default users)

or

- distribute it to different computers (e.g. in a network).



If you want to install components individually, e.g. to distribute them on different computers, make sure that these computers have a network connection so that the components can communicate with each other. In any case the CM databases must be registered on the computer where the database program is installed.

The following installation types are available:

Complete setup

All software components including databases will be set up on the system.

- Start the installation file "Trendline-Setup*.exe" with double-click.

The Trendline Setup Wizard 26 guides you through the installation.

Database setup

Only the database installations (Database program optional with databases) will be set up on the system.

- Start the installation file "TrendlineDatabases-Setup*.exe" with double-click.

The Database Setup Wizard 30 guides you through the installation.

Flash Updater setup

Only the Flash Updater, to update the Detector firmware, will be set up on the system.

- Start the installation file "DetectorFlashUpdater*-Setup.exe" with double-click.

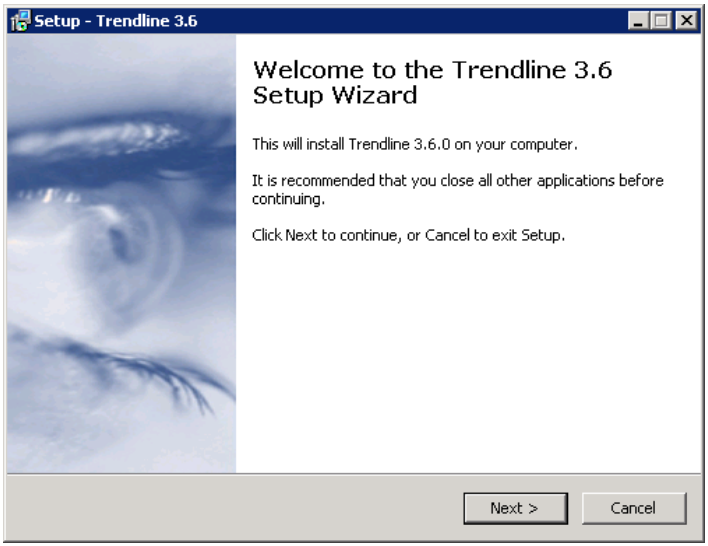
The Flash Updater Setup Wizard 28 guides you through the installation.

Parts of the Trendline software will need the Windows component MS .NET Framework 2.0. If this component is not installed on the system, it is automatically installed.

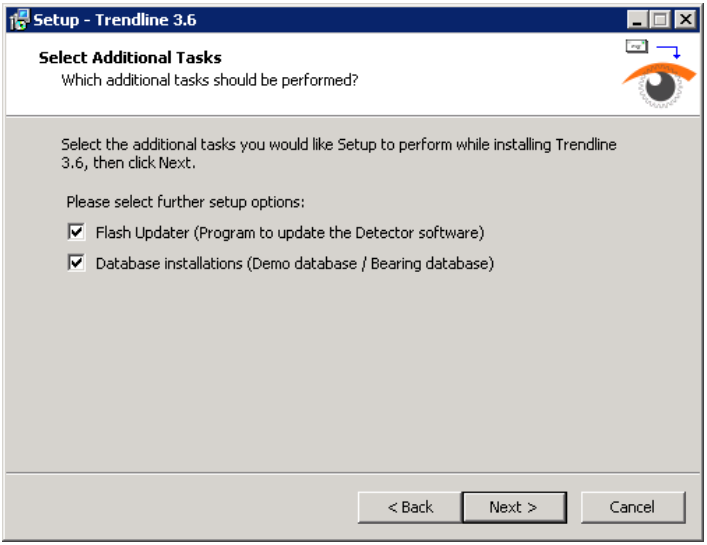
Below, the complete installation of the Trendline software will be described.

4.1.3.1 Trendline Setup Wizard

1. Please select the language to install the Trendline software. You can change the language settings 146 at any time after installing.



2. **Accept** the license agreement and click **Next** to proceed with the installation.
3. Select the directory where you want to install the software and click **Next**.
4. Select the start menu directory and click **Next**.



5. Optionally you can select additional components for installation. Select from the list:
   - **Flash Updater** to install a program for Detector firmware updates
   - **Database installations** to install the demo database and/or bearing database
6. and click **Next**.
7. In the next window check your settings and click **Install** or click **Back** to correct your settings.

The Trendline software will be installed.

8. Click **Finish** to exit Trendline installation.

If you selected additional components for installation, please change to the chapter "Flash Updater installation" 28 respectively "CM database installation" 28.

Please restart your system after all installations have been completed!

4.1.3.2 Detector Flash Updater Setup Wizard

If you selected "Flash Updater" when you installed the Trendline software, the Setup Wizard automatically starts the installation.



1. Select the directory where you want to install the software and click **Next**.
2. Select the start menu directory and click **Next**.
3. Optionally, you can add program icons on the desktop or to the quick launch bar. To do so, check the checkbox next to the option
   - **Create a desktop icon** to add a shortcut on your desktop
   - **Create a Quick Launch icon** to add a symbol to the Quick Launch bar next to the Start button
4. and click on **Next**.
5. In the next window check your settings and click **Install** to install the Detector Flash Updater or **Back** to correct your settings.

The Detector Flash Updater will be installed.

6. Click **Finish** to exit the Flash Updater installation.

4.1.3.3 Database Setup Wizard

If you selected "Database installations" when you installed the Trendline software, the Setup Wizard automatically starts CM database installation. The Setup Wizard helps you to install the database program and to register the databases that are necessary for the operation of the Trendline software.

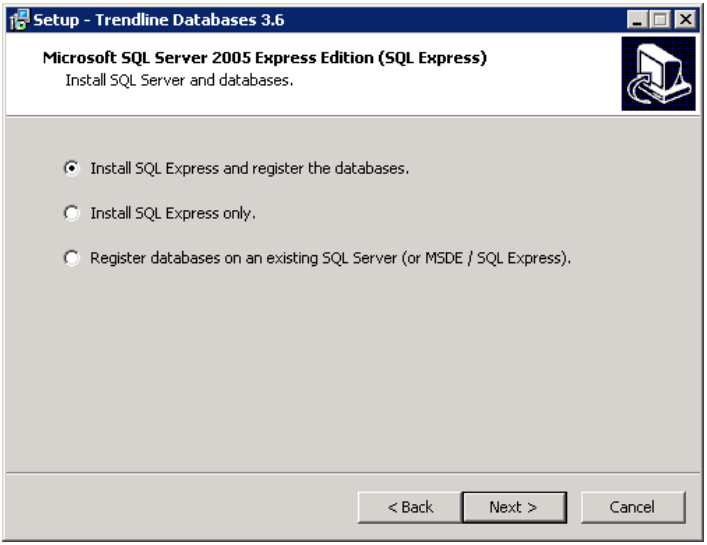


- *If no database program or CM database is installed on your computer yet, the following databases are automatically installed:*
  - demo_online: CM database with demo data
  - cm_bearings: Bearing database
- *Each new added database will be marked by a sequential number.*



- Click **Next** to proceed with the installation.

The following installation depends on whether you already have a MS SQL database program or not.



- Select **Install SQL Express and register the databases**, if no MS SQL database program is installed on your system and if you want to install the database program with databases on your system.
  Please read the section "Database program does not exist" 30.

Or:

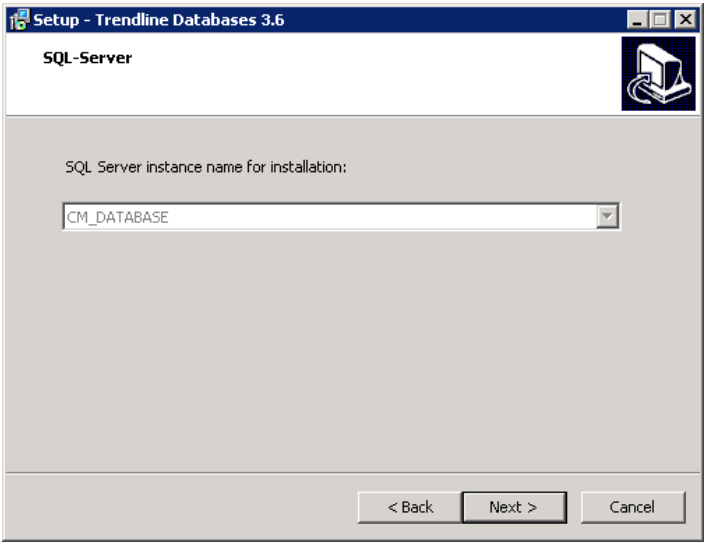
- Select **Install SQL Express only**, if you want to set up only the MS SQL database program on your system.
  Please read the section "Database program does not exist" 30.

Or:

- Select **Register databases on an existing SQL Server (or MSDE/SQL Express)**, if a MS SQL database program (see "System requirements" 22) is already set up on your system and you want to register only the databases on it.
  Please read the section "Database program exists" 33.

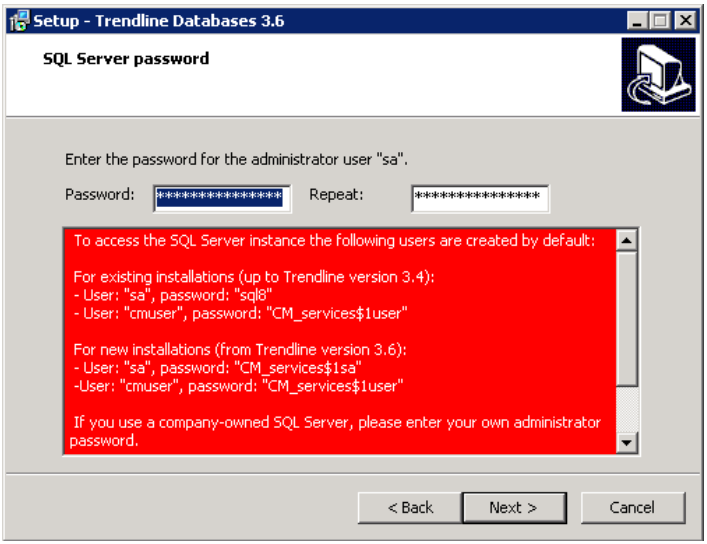
Database program does not exist

If no MS SQL database program is installed on your computer, the database program and optionally the databases will be automatically installed and registered.



The Setup Wizard shows the name of the server instance that is created.

1. Click **Next**.



For the installation and administration of the server instance the administrator's password for the user "sa" is required (for more information see "Users and passwords" 91).

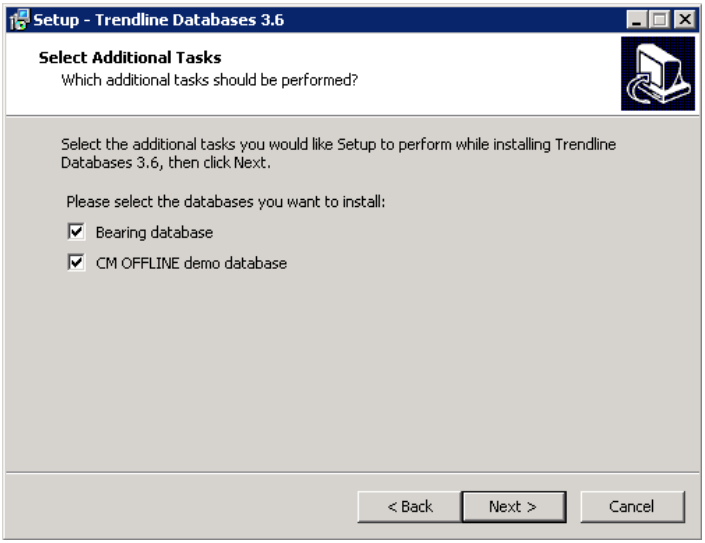
2. Accept the default password "CM_services$1sa" or enter your own password for the server instance.



- *If you want to assign your own password for the administrator user "sa", please use a password that meets the security policies of your computer. This can be, for example, a strong password with at least 10 characters, upper and lower case and alphanumeric and special characters.*
- *We recommend to note the user-defined password in your records.*

3. Click **Next**.

If you selected the installation with databases, you can select which database(s) should be registered in the next step.



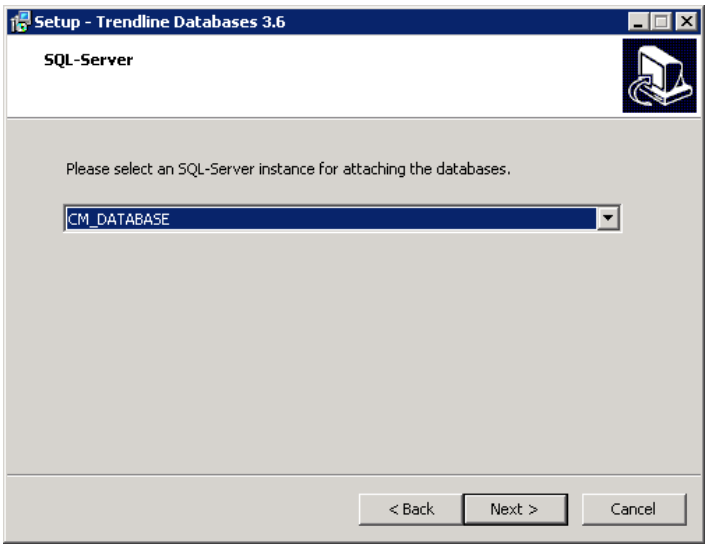
4. Select the database(s) which should be installed and registered at the database server and
5. click **Next**.

The database program will be installed and the selected databases will be registered (attached) automatically.

6. Click **Finish**, to exit installation.

Database program exists

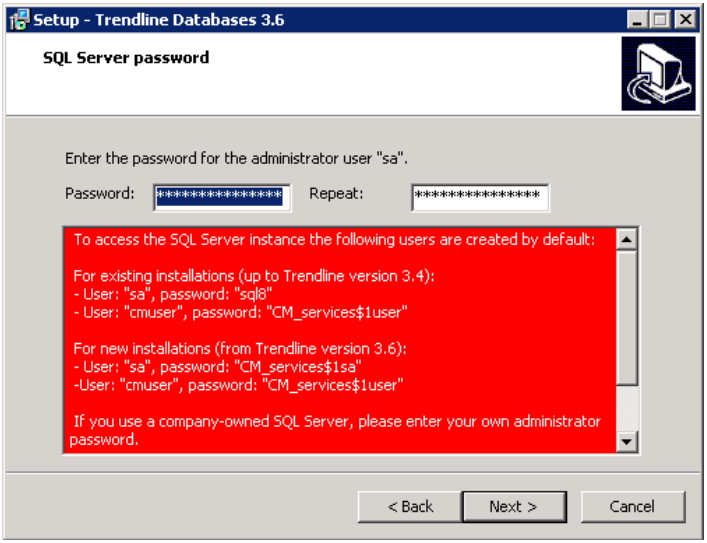
If you already have a MS SQL database program (see "System requirements" 22), only the databases must be installed and registered on the server. To access your own database server you need the administrator password.



The Setup Wizard shows, which server instances are already set-up on the computer.

With a new installation from FIS Trendline version 3.4 the name of the server instance is "CM_DATABASE". In previous installations, it is called "FIS_DATABASE".

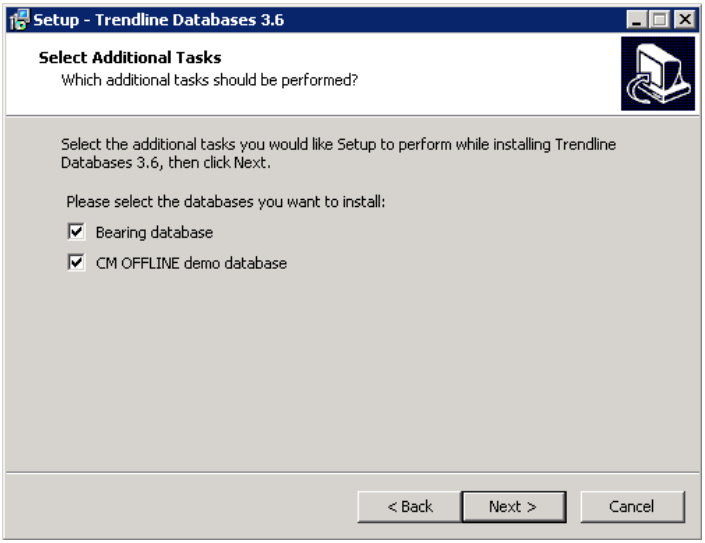
1. Select the server instance.
2. Click **Next**.



For installation and registration of databases at the server instance the administrator's password for the user "sa" is required (for more information see "Users and passwords"[91]).

3. Enter the administrator password for the server instance.

4. Click **Next**.



5. Select the database(s) which should be installed and registered on the database server.
6. Click **Next**.

The selected databases will be installed and registered (attached) on the server automatically.

7. Click **Finish**, to exit installation.

4.1.4 Update



The Trendline software can check in user-defined intervals whether an update for the Trendline of Detector firmware is available for download from our Internet server (see "Automatic notification of updates" 36*).*

You can update the Trendline software and its components:

Update Trendline software

To update an existing Trendline software, proceed as follows:

- Make a backup copy 102 of your database(s),
- uninstall 36 the Trendline software and
- run the Trendline setup 22.

The Setup Wizard guides you through the installation.

Update database in the Trendline software

If you want to use an existing database with the current Trendline version, it must possibly be updated. When connecting to a database, the Trendline software automatically checks the version number of the database and provides update information if necessary. See chapter "Update database" 98.

Update Flash Updater software

If you want to update the Detector Flash Updater, proceed as follows:

- Uninstall 36 the Flash Updater software and
- run the Flash Updater setup 22.

The Setup Wizard guides you through the installation.

Update Detector firmware

If you want to update the firmware of the Detector, you need the Flash Updater. See chapter "Update firmware" 267.

4.1.5 Uninstalling



Please note that configuration and export files are left on your computer. For your safety, the database program and database(s) will not be deleted either. To completely uninstall, you must delete these files manually.

Uninstall Trendline software

To uninstall the Trendline software please click in **Programs** > **FIS** > **Trendline 3.6** on **Uninstall Trendline**.

Uninstall Flash Updater

To uninstall the Detector Flash Updater please click in **Programs** > **FIS** > **Detector Flash Updater** on **Uninstall Detector Flash Updater**.

4.2 Start program

- Click **Start** > **Programs** > **FIS** > **Trendline 3.6** > **Trendline**.

The Trendline software is starting.

When the Trendline software starts the first time, you can configure automatic notifications for software updates.

If you have set up the Trendline software without database program and databases, please select the CM database on the server 93.

4.2.1 Automatic notification of updates

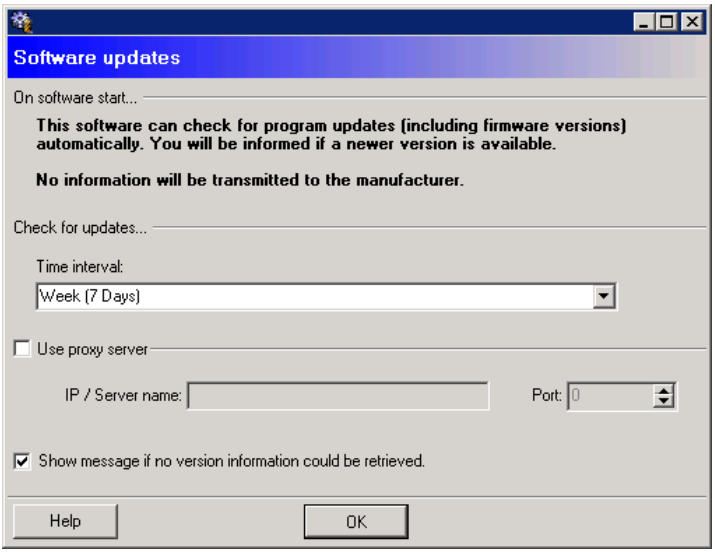
The Trendline software can check in user-defined intervals whether an update for the Trendline of Detector firmware is available for download from our Internet server. The following results are possible:

- No update information could be obtained, for example, due to a problem with the Internet connection.
- The Trendline version installed is up-to-date.
- A newer version of the Trendline software is available.
- The firmware on all Detector devices registered in the database is up-to-date.
- There is a newer firmware version for at least one of the Detector devices registered in the database.

No data is transmitted to FAG Industrial Services GmbH during the update check. The Trendline software only compares the version of your installation with the version currently available on our server.

Configure automatic notifications of updates

You can configure the automatic notification the first time you start the program. If you want to adjust the settings at a later time, click in the Trendline tools menu at **Options** and select **Update** > **Update settings** from the list.

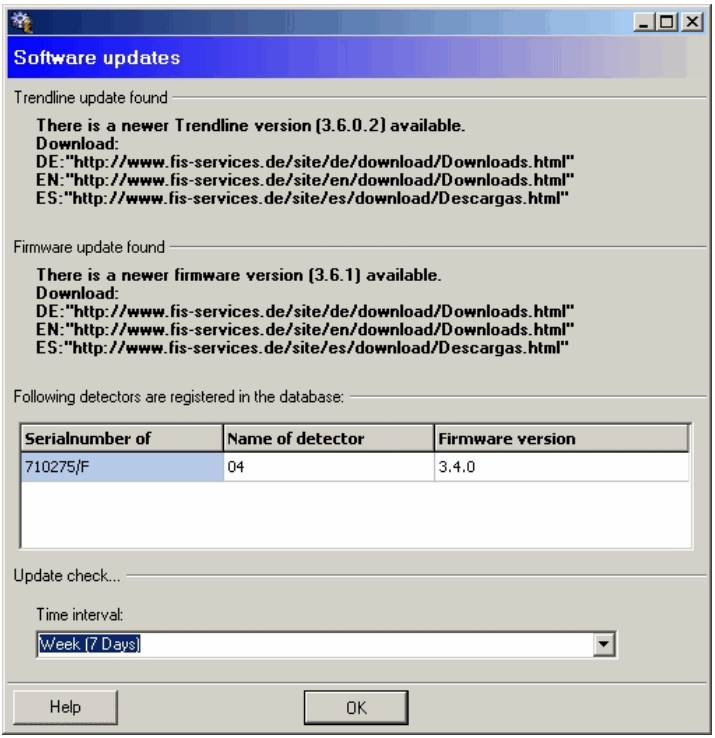


- Under **Time interval** you can enter how often the Trendline software should check for updates. The default setting is **weekly**.
- If your computer is connected to the Internet via a proxy server, activate the **Use proxy server** setting and enter the IP address or the server name as well as the port number you are using. If you have any questions about the configuration, please contact your system administrator.
- If you activate the **Show message, if no version information could be retrieved** option, the Trendline software will also display a message even if no update information was found.

You can change the setting for the automatic notification in the program settings (see Updates 150) at any time.

Updates were found

If updates were found for the Trendline software or Detector firmware, the download address will be displayed. If a firmware update is available, the Trendline software also displays the registered Detector devices and the firmware version installed on each device. This allows you to quickly recognize which devices require a firmware update.



Connection could not be established.

If no update information was found, for example, due to a problem with the Internet connection, you can deactivate this message for future queries. To do

this, check the box **Don't show this message again**.

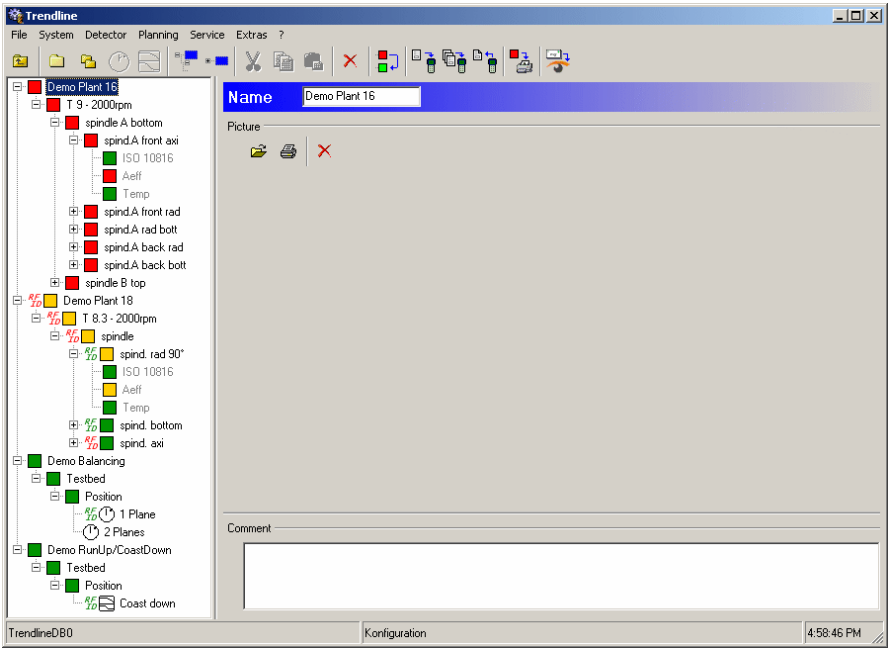
Manual query

To manually start the update of the Trendline software or Detector firmware, click on

- **Extras** > **Check for Trendline updates** (Trendline) or
- **Detector** > **Check for firmware updates** (Detector).

4.2.2 User interface

4.2.2.1 Main window



At the top edge of the main window you will find the menu bar 40. Here you can access the various program functions with the different menu bar items. Frequently used functions can also be activated using the buttons in the toolbar 43.

On the left-hand side of the window the structure of the configuration for the system you are monitoring is displayed in the form of a directory tree. The highest structural element are the "Configurations", which are split in descending order into the levels "Section", "Machine" and "Measuring Point". This ensures that a measuring point within a configuration is clearly defined by its name and name of

the machine where the measuring location is located and the section where the machine is located.

Next to the name of each element of the configuration and system structure you will find a box that is highlighted in color. This indicates the alarm status for this part of the system as shown in the following table.

Color	Meaning
	For this level of the system structure no alarm is recorded.
	For this level of the system structure a preliminary alarm was signaled.
	For this level of the system structure a main alarm is recorded.
	This level has just been created or the alarm is not ready configured or has been canceled.
RF ID	An RFID tag has been assigned to this measuring point.
RF ID	An RFID tag in this part of the system has been marked as defective.

On the right-hand side next to the configuration and system structure you can insert an image. At the highest level you will find the tab sheets, where you can adjust the settings of the individual measuring points.

The dividing line between the image of the configuration and system structure can be shifted towards the right or left by dragging with the mouse.



In the configuration structure, always one element is marked. The properties of this element are depicted in the right-hand part of the window.

4.2.2.2 Menu and toolbar

Menu bar

The menu bar allows access to the following functions of the Trendline software:

Menu	Menu items and function	
File	New	Creates a new database.
	Open	Opens an existing database.
	Import	Loads records exported with Trendline.
	Export	Exports part of a current measuring point structure using the Export Wizard 137 or export a single measuring point 138.
	Recently used	Trendline displays recently used databases at this point in the menu.

Menu	Menu items and function	
	databases	You can specify the number in the program settings 148.
	Close	Quits the Trendline software.
System	To root level	Takes you from your current position in the tree right back to the beginning, all the time.
	Rename	Rename currently selected element.
	New item	Inserts an element of the configuration structure in the same level as currently displayed.
	New sub-item	Inserts an element of the configuration structure in the level below the current.
	Add balancing configuration 69	Inserts a balancing configuration.
	Add amplitude/ phase configuration 76	Creates an amplitude/phase configuration.
	Add run up / coast down configuration 82	Creates a run up/coast down configuration.
	Expand selection	Flaps up all elements under the current element.
	Collapse selection	Closes the complete tree structure.
	Cut	Cuts out the current element of the tree.
	Copy	Copies the current element of the tree.
	Paste	Pastes the element on the clipboard into the current position in the tree. This is only possible in the tree level above that of the copied element. For example, when copying a machine, this can only be pasted into the plant level of the tree.
	Delete entry	Deletes the current entry in the tree with all sub-entries.
	Delete measured data 124	Deletes measured data from the current position.
	Reset alarm status 124	Reset all alarms for the element of the configuration and system structure selected.
	Adjust alarm limits 87	Automatic adjustment of the alarm limits.
	Save configuration as template 111	Saves a configuration as template so that it can be used for free measurements.
	Create new configuration from template 111	Creates a new configuration from a template.
Detector	Send configuration	Send all measuring points from currently selected element downwards to Detector.

Menu	Menu items and function	
	Send route/template	Sends one of the pre-selected routes/templates to the Detector.
	Load data from Detector	Opens a connection to the Detector and downloads all data stored in the Detector.
	Configure Detector	Allows to set all options to the Detectors registered.
	Balancing activation 50	Enables the balancing function on the Detector.
	Load Detector logfile 125	Retrieves the log file from the Detector and saves it.
	Check for firmware updates 36	Checks whether a newer Detector firmware version is available for download.
	Sensor	Adds 45, edits and deletes sensors.
	Comment selection list 68	Create and edit a list of comments.
Planning	Route	Creates and edits routes.
	Template	Defines and edits configuration templates that can be used for free measurements.
Service	E-Service	Sends selected data for further analysis.
	Measurement report 127	Creates a measurement report.
	Balancing report 133	Creates a balancing report.
	Amplitude / phase report 134	Creates an amplitude/phase report.
	Run up / coast down report 135	Creates a run up/coast down report.
	Alarm report 132	Creates an alarm report.
	Route report 133	Creates a route report.
Tools	Options	Program settings
	Bearing DB	Opens the bearing database 102.
	Deleting current database 101	Deletes the Trendline database currently opened.
	Start database administration 95	Opens a program to administrate Trendline databases.
	Save Trendline log file 125	Saves the log file of the Trendline software.
	Check for Trendline updates 36	Checks whether a newer version of the Trendline software is available for download.
?	Contents	Contents of the online help.
	Index	Search index for the online help.

Menu	Menu items and function	
	First steps	Start using the Trendline Software.
	Menu bar	Explains all menus of the Trendline Software.
	Toolbar	Explains all icons in the toolbar.
	Info	Information about the Trendline Software.

Toolbar

Frequently used functions of Trendline software can be used via the toolbar.


Go to root level


Create new item


Create new sub-item


Add balancing configuration


Add amplitude/phase configuration


Add run up/coast down configuration


Expand selected element


Collapse selected element


Move selection up


Move selection down


Cut (Ctrl+X)


Copy (Ctrl+C)


Insert (Ctrl+V)


Delete


Reset alarm status


Send configuration to Detector


Send route/template to Detector


Download data from Detector


Alarm report


E-Service

4.2.2.3 Tree elements

In the system tree of the Trendline software you can cut, copy or delete configuration elements.

Moving or copying configuration elements

You can only move configuration elements if the target is on a higher level, i.e. you can

- move or copy a measuring point (level 4) to another machine (level 3), and
- move or copy a machine (level 3) to a different section (level 2).



If the target already contains sub-elements, the moved/copied element is always appended to the end of the list.

In order to shift or copy elements the following possibilities are available:

Moving an element

- Left-click on the element, keep the mouse button pressed, and drag the element onto the target element.
- Release the mouse button to insert the element.

Or:

- Right-click on the element and select **Cut**.
- Right-click on the target element and select **Insert**.

Or:

- Left-click on the element and
- press the key combination **CTRL+X** or click on .
- Left-click on the target element and
- press **CTRL+V** or click on .

If you want to change the element order within a level,

- select the element by left-click and
- click on  or .

Copying an element

- Left-click on the element while pressing the CTRL key, keep the mouse button and CTRL pressed, and drag the element onto the target element.
- Release the mouse button and CTRL to copy the element.

Or:

- Right-click on the element and select **Copy**.
- Right-click on the target element and select **Paste**.

Or:

- Right-click on the element, keep the mouse button pressed, and drag the element onto the target element. A pop-up menu displays.
- Select **Move**.

Or:

- Left-click on the element and

- press the key combination **CTRL+C** or click on .
- Left-click on the target element and
- press **CTRL+V** or click on .

Deleting elements



When you delete a configuration element, the element is deleted along with all its sub-elements including data forever!

- Right-click on the element and select **Delete entry**.

Or:

- Left-click on the element and press **Del**.

Or:

- Left-click on the element and
- click on .

4.3 First steps

4.3.1 Adding a sensor

Before you can set up configurations, you must define the sensors you want to use. Detector III is delivered with all necessary sensors. They are pre-defined in the Trendline software.

WARNING ***Damage to sensors when continuous operation is activated***

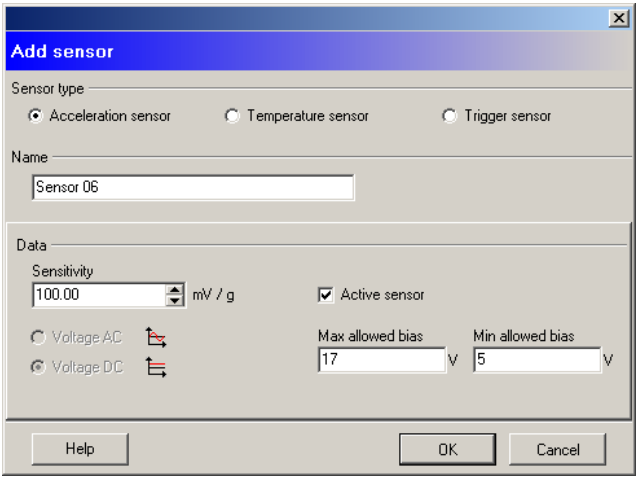


If you would like to connect passive sensors to the Detector, the continuous operation of the sensor must be deactivated to avoid damaging the sensor.

Proceed as follows to add new sensors:

- In the **Detector** menu click **Sensor** > **Add**.
- In **Sensor type** choose from Acceleration, Temperature or Trigger sensor.
- In the **Name** field, enter a name for the sensor, e.g. "IMI 627".

Acceleration sensor



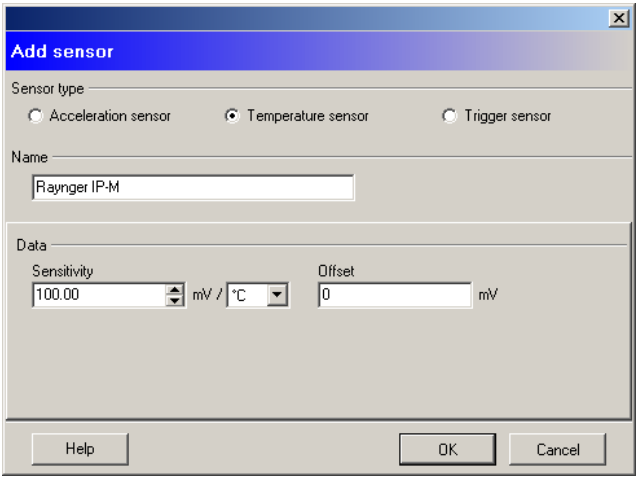
- Enter sensor sensitivity in mV/g in the **Sensitivity** field. Sensitivity is printed on the sensor or indicated in the enclosed specifications.
- When you add an active sensor, select **Active sensor** and enter minimum and maximum bias voltage in the appropriate input boxes. On the one hand, this activates sensor supply voltage in the Detector before the measurement is performed and activates a high pass to filter the supply voltage out of the measuring signal. On the other hand, the Detector checks whether sensor bias voltage is within the set thresholds. Minimum bias voltage must be at least 3, maximum bias voltage must not be greater than 17. The difference between the two values must not be less than 10.



*If you want to measure on a power supply unit, **Active sensor** must not be enabled. In this case select AC or DC voltage.*

- Click **OK** to save the new sensor.

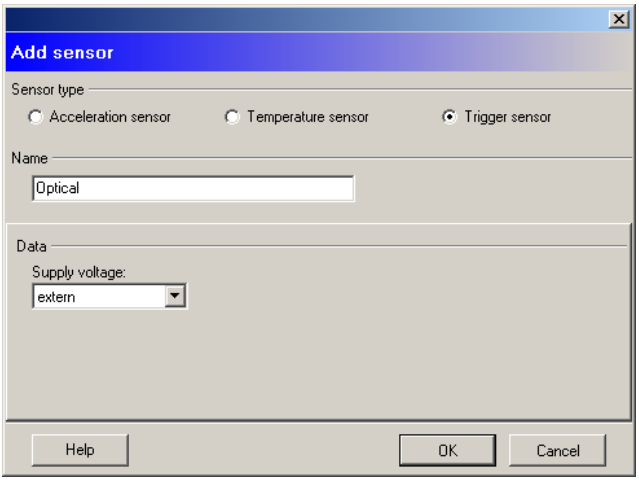
Temperature sensor



- Enter sensor sensitivity in mV/°C, mV/°F or mV/K and the offset in mV.
- Click **OK** to save the new sensor.

Trigger sensor

The trigger sensor serves to measure rotational speed and is used in operational balancing to start the measurement[234].



- Select the **Supply voltage**: **extern**, **5 V**, **12 V**.

- Click **OK** to save the new sensor.

4.3.2 Installing USB-serial converter

A USB serial adapter is supplied with the Detector in order to connect the Detector to computer via USB.

When installing the adapter software make sure you have the adapter and the installation CD provided to hand.



Do not plug in the adapter!

Installation of the adapter software

To install the adapter software proceed as follows:

- Insert the CD provided. The installation program should start automatically.

If the installation program does not start automatically you can start it manually using Windows Explorer:

1. Open **My computer**.
2. Under **Equipment with removable media**, right-click the CD-ROM drive, then click **Open**.
3. Double click to launch **autorun.exe**.
4. Depending on the color of the adapter provided, select **USB TO RS232 Converter** or **USB 2.0 TO RS232 Converter**.



4. Click on the folder symbol next to **Product Driver**.
5. Select the **win_98se_me_2000_xp** folder.
6. Click on **Setup.exe**.

This launches the installation wizard, which guides you through the installation.

Plug the adapter into a free USB port.

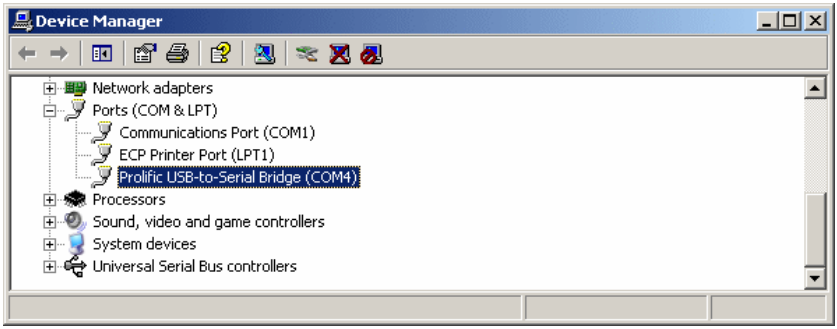


If you are already using other devices that use a Prolific USB to Serial chip, please uninstall the drivers for the old devices first as this may result in conflicts.

Checking serial interface settings

To make sure that communication between the Trendline software and the Detector works smoothly, you can check the USB serial adapter settings for the serial interface:

1. Click the right mouse button on **My computer** then click on **Properties**.
2. Click **Hardware** then **Device manager**. The adapter should be displayed as "Prolific USB-to-Serial Bridge" under **Connections (COM and LPT)**.



3. Close the Device manager.

Removing the adapter software

The adapter software can be removed as follows:

1. Go to **Start**, **Control panel** and then click on **Software**.
2. Click on **Modify or remove program** then click on **PL-2303-USB-to-Serial**.
3. Click on **Uninstall/Change** to uninstall the software.

4.3.3 Balancing activation

The Detector III is supplied ex works with the balancing function deactivated. You can enable this function if you have purchased a Detector III balancing kit.

The balancing kit contains a USB dongle that can be used to enable one unit only.



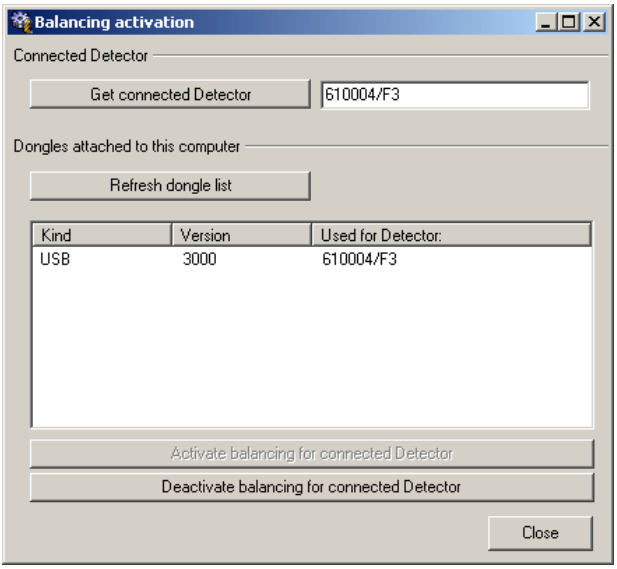
Dongle

This activation is basically carried out as follows:

- A dongle that has not previously been used is supplied with the balancing kit.
- You can use this dongle to enable the balancing functionality for only one (any) Detector.
- Once enabled, the serial number of the Detector is saved on the dongle. From this point onwards the dongle may only be used with this specific Detector.
- You can also deactivate the balancing functionality in the Detector, again using the corresponding dongle. The serial number on the dongle is then deleted and you can now use it to enable any other Detector of your choice. This is useful, for example, if you are sending a Detector to the manufacturer for

calibration and want to use the balancing function on a different Detector in the meantime.

To activate the balancing function on the Detector, start the Trendline software. Connect the Detector to the PC using the serial cable. Plug the dongle into a free USB port. Switch on the Detector and **select** the Trendline menu item **Detector** > **balancing activation**. The following window is now displayed:



The serial number of the connected Detector is displayed at the top. The dongle that has been identified is displayed at the bottom. The identified version should start with "3" in the case of Detector III. The serial number of the Detector for which this dongle has already been used or, if the dongle has not yet been used, **Empty** is displayed in the **Used for Detector:** column. Now select the required dongle from the **Type** column (should be displayed as "Empty" in the "Used for Detector" column). You can now enable the balancing functionality via **Activate balancing for connected Detector**. A new line **Balancing** should now be visible and the serial number of the Detector is displayed in the dongle line.

Please note the following:



- *The first time the dongle is used Windows detects the driver that was previously installed with the Trendline software. If Windows asks for a driver, select the automatic search option.*
- *If the dongle is not displayed or a previously used dongle appears in the list, please click* ***Refresh dongle list****.*
- *If the dongle is correctly identified by Windows but this is not displayed in the Trendline dongle list you may have an old driver installed on your system. You can check this in the device manager under USB controller -> CBUSB Ver 2.0. If Version 1.x is displayed, uninstall this driver and install the current driver on the Trendline CD to the CbSetup directory. In this case select the CRYPTO-BOX USB.*

4.3.4 Register and configure new Detector

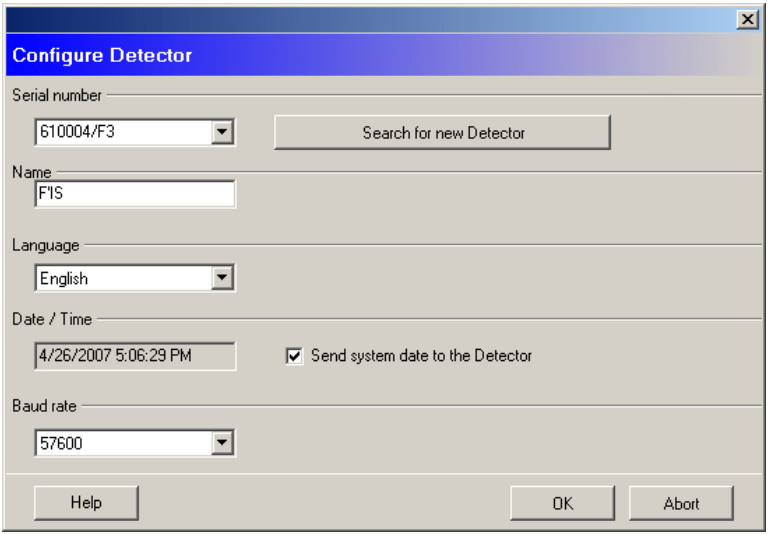
The Trendline software uses a database to manage all Detectors being used. Prior to sending data to the Detector for the first time, it has to be registered to Trendline software. To do that, you connect the Detector to a serial interface of your computer using the data cable supplied and switch on the Detector.



The Detector that has just been connected to the computer is normally detected automatically by the system and does not need to be registered.

How to register a new Detector:

- Click on **Detector** > **Configure Detector**.



- Connect the Detector to your PC and switch it on. Click on **Search for new Detector** to register the new Detector on to the program.
- You may give the Detector a **name**, which will be displayed in the default display when switching on the instrument.
- You can select the **language** for the Detector. Nevertheless it still can be changed at the Detector.
- You can set the time of the Detector either by entering the correct time and date (to do this, click on the figure you want to change) or by clicking **Send system date to the Detector** (that way the Detector is set to the same time and date as your PC).
- Here, you can select the **baud rate** of the Detector. Normally, you should select the highest possible (57.6 kbps). In case of problems with communication (e. g. the connection breaks down at times) you may select the lower baud rate of 38,4 kbps.
- After completing all settings, click on **OK** to send the changes to the Detector. Make sure that the Detector is switched on when clicking **OK**, because otherwise no communication is possible.

4.4 Setting up configuration

4.4.1 Set up system tree

Each configuration is subdivided into three levels, e.g. section - machine - measuring point.



You can change the defaults for the level names in the settings 146.

Setting up configuration elements

In order to create a new configuration, carry out the following steps:

- Click on **System** > **New item** or click on .
- Name the entry, e.g. "Location Aachen".
- Add the new sub-entry by clicking on **System** > **New sub-item** or click on . This way, you add a new section to the configuration. Name this "Section 1", for example.
- Exactly as with the section, add another machine (“Machine 1”) and a new measuring point (“Measuring point 1”) by following the sequence via **New sub-item**.



- *The name of the configuration element must not exceed 49 characters.*
- *If you have set up templates, you can use them for your configurations (see "Planning with templates and routes* 109*").*

Manage configuration elements

In the system tree of the Trendline software you can cut, copy or delete configuration elements. You can find further information in the chapter "Tree elements 43".

4.4.2 Automatic assignment of RFID tags to measuring points

In order to simplify allocation of measuring points in the Trendline configuration to measuring point in your system, you can add RFID tags to them. The Detector can read existing RFID tags at the measuring points and automatically assign the measured values to the correct measuring point in the Trendline software.

- *If you are using RFID tags, the sensor cable of the Detector must be provided with the delivered snap-on ferrite (see "Before you start"* 21*).*
- *If you transfer a configuration with RFID settings to a Detector without an RFID reader, it displays an error after data transfer and ignores the RFID settings.*

Affixing an RFID tag to a measuring point

You must first affix the RFID tag to the measuring point. There are two different types of RFID tags:



FIS.DETECTORIII.RFID.TAG.KEY (left) and FIS.DETECTORIII.RFID.TAG.DOME (right)

The RFID tag "Key" can be affixed to the measuring point using a tape or wire tie. The RFID tag "Dome" is designed especially for metallic foundations and can be glued onto the measuring point. When using at temperatures above 85°C, you should fix it into place using a screw, for example.

The RFID tag "Key" should not be affixed to a metallic foundation! The electromagnetic field can be affected by the metal and disrupt the measurements taken at the measuring point.
Always use the RFID tag "Dome" for metallic foundations.

Assigning an RFID tag to a measuring point

Before using, you must assign the RFID tags placed on the measuring points. You can do this immediately before a CM or balancing measurement. Select the measuring points wither in the Trendline software or in the on-site Detector:

Selection in the Trendline software

1. Select a measuring point in the Trendline configuration.
2. Click on the **General settings** tab.
3. In the **RFID Status** box select **Assign RFID**.
4. Repeat this procedure for all measuring points to which you wish to assign RFID tags.
5. Send 90 the configuration to the Detector.
6. During the round, select the appropriate measuring point in the Detector (see Selection of measuring point 224).
   a) Select **Start measurement**. The Detector reads the RFID tag on site and assigns it to the measuring point.
   b) If you do not want to perform a measurement but just want to assign the RFID tag, select **Assign RFID** at the appropriate measuring point on the Detector.
7. Load the data from the Detector in Trendline. The RFID status of the measuring points is now set to "RFID assigned" and the green RFID icon is displayed in front of the measuring point in the configuration tree.



- *Hold the underside of the Detector at the height of the display at a distance of approximately 20 mm as long as "quiet" above the RFID tag, until the measuring point has been measured and you hear a signal.*
- *You can set the status of all measuring points of an element (e.g. a machine) to "RFID assigned". To do so, right-click the element and select **Assign RFIDs globally**. On the next round with the Detector you can assign the RFID tags placed here to all the appropriate measuring points.*

Selection in Detector

1. If you have not assigned an RFID tag to a measuring point yet, you can also assign one on the Detector. You can assign it immediately before a CM/ balancing measurement or before a run up/coast down test. Select the measuring point on the Detector and then the **Assign RFID** command. You can then perform a measurement.
2. Load the data from the Detector in Trendline. The RFID status of the measuring points is now set to "RFID assigned".

Removing the assignment of an RFID tag

1. Select a measuring point with an RFID tag assigned in the Trendline.

2. Click on the **General settings** tab.
3. In the **RFID Status** box select **Delete RFID**.
4. Send 90 the configuration to the Detector.
5. During the round, select the appropriate measuring point in the Detector (see Selection of measuring point 224).
6. Select **Start measurement**. The Detector prompts you to delete the tag.

   Delete the tag and select **Tag deleted**.

   If you do not delete the tag, select **Tag stays**.
7. Continue measuring.
8. Load the data from the Detector in Trendline. The RFID status of the measuring point is set to "No RFID" if the tag was deleted.



*You can globally delete all RFID tag assignments to measuring points of an element (e.g. a machine) in the configuration. To do so, right-click the element and select **Delete RFIDs globally**. On the next round, confirm deletion of the RFID tag assignment for each measuring point before the measurement.*

Changing the assignment of an RFID tag

To change the assignment of an RFID tag to a measuring point: First change the RFID status in the Trendline configuration and transfer the modified configuration to the Detector. On the next round with the Detector, you can then import the new RFID tag.

1. Select the measuring point in the Trendline configuration.
2. Click on the **General settings** tab.
3. In the RFID Status box select **Edit RFID**.
4. Send 90 the configuration to the Detector.
5. During the round, select the appropriate measuring point in the Detector (see Selection of measuring point 224).
6. Select **Start measurement**. The Detector prompts you to delete the tag.
   a) Delete the tag and select **Tag deleted**. You can now assign the new RFID tag.
   b) If you do not delete the tag, select **Tag stays**.
7. Continue measuring.
8. Load the data from the Detector in Trendline. The new RFID tag is assigned in the measuring point in the system configuration.

Exchanging a defective RFID tag

If communication with the RFID tag at a measuring point does not work, the user can mark it as "defective" in the Detector and then continue measuring. After the next data synchronization with the Trendline software, the RFID status "RFID defective" is displayed at the measuring point and recursively up to the top level in the configuration tree. You can then assign a different RFID tag to the measuring point.

1. The Detector cannot read the RFID tag at the measuring point. Select **RFID tag defective** in the Detector.
2. The program displays "Is the tag defective?". Select **Yes**.
3. Delete the RFID tag from the measuring point.
4. Load the data from the Detector in Trendline. The RFID status of the measuring points is now set to "RFID defective".
5. You can now assign a different RFID tag to the measuring point.

Additional information

- You can abort Detector RFID tag assignment handling functions by pressing **Esc**. This preserves the previous state of the assignment.
- If the Detector recognizes an RFID tag that is not in the configuration, it displays the error message: "At least one configuration does not exist".
- Hold the underside of the Detector at the height of the display at a distance of approximately 20 mm as long as "quiet" above the RFID tag, until the measuring point has been measured and you hear a signal.
- If an error occurs while reading the RFID tag, the serial number in the Detector will be marked by three dashes.

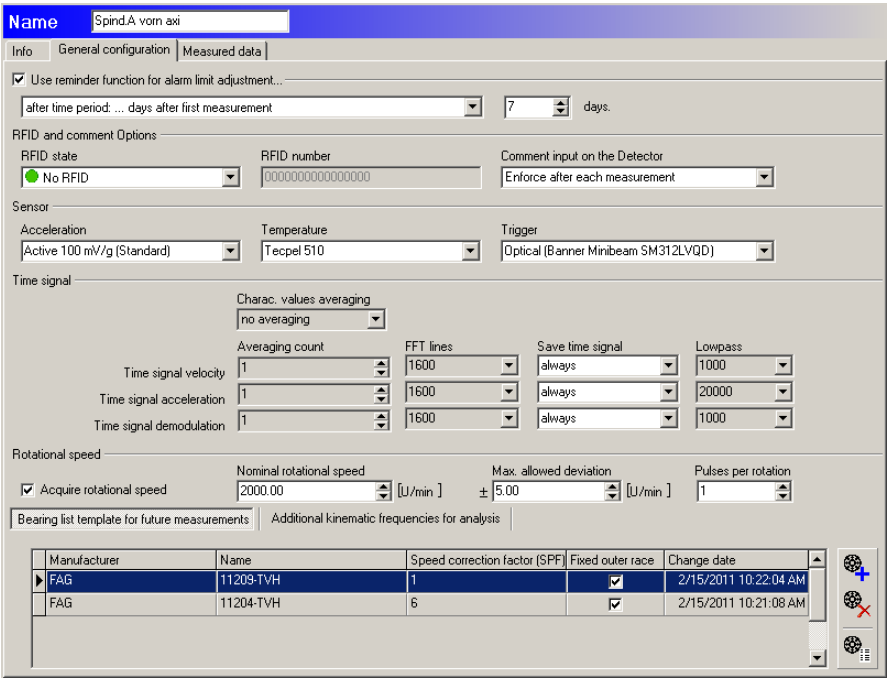
4.4.3 Set up a measuring point

Now you can configure the settings for the measuring point. Three tabs are assigned to each measuring point in the right-hand window: Information 58, Configuration 59 and Measured values 117.

Info

Comments on this measuring point may be entered in the field provided on the **Information** tab. It is also possible to insert an picture. To do this, click  and select the desired picture in the file dialogue. You can print out the picture by pressing  and remove it by pressing .

General settings



Reminder function for alarm limit adjustment

The Trendline software can remind you about the alarm limit adjustment 87.

- Activate the checkbox **Use reminder function for alarm limit adjustment** and
- choose when you want to be reminded.

RFID and comment options

In this section you can display and edit the status of an RFID tag assigned to the measuring point and also set up the comment options on the Detector:

RFID status

- **No RFID**: No RFID tag is assigned to the measuring point.
- **Assign RFID**: This option instructs the Detector to assign an RFID tag placed on the machine to this measuring point during the next round.
- **RFID assigned**: An RFID tag is assigned to the measuring point. The unique ID is displayed in the **RFID number** field.

- **Remove RFID**: This option instructs the Detector to cancel the RFID tag assignment to the measuring point during the next round.
- **RFID defective**: The Detector has marked the assigned RFID tag as defective.
- **Change RFID**: This option tells the Detector to replace the assigned RFID tag. During the next round, you must delete the tag and assign a new one before you can perform the measurement at this measuring point.



You can only select the statuses that are accessible as a follow-up status of the current status.

Further information in the chapter "Automatic assignment of RFID tags to measuring points 54".

Comment input on the Detector

Here you can specify whether you want to enter a comment for each measurement on the Detector. Select

- "Only manual selection" if you want to select a comment manually,
- "Display after each measurement" if you want to be asked after each measurement or
- "Enforce after each measurement" if you definitely want to enter a comment to each measurement.

Sensor

You can adjust the vibration measurement sensors and the temperature at **Sensor**. Only the sensors that were previously entered in the sensor database will be available for selection (see "Add sensor 45"). You can select a sensor for **Acceleration**, **Temperature** and **Trigger** from the sensor database.

Time signal

In this area you can specify how the Detector should handle time signals 271, FFTs and characteristic values.

- **Characteristic value averaging**: the FFTs or characteristic values calculated from the time signals are averaged. If four values should be averaged, for example, four values are recorded in succession, the FFT is calculated and the (frequency selective) characteristic values are produced. The time signals stored for the purposes of an averaged measurement are always the last time signals measured. Select **FFT** to determine the mean values of the FFTs calculated from the time signals. Then select **Char. values** to apply the average determined for the characteristic values calculated from the FFTs.
- **Averaging count**: The Detector averages measured values during the

measurement. Specify how many values are to be used for averaging.

- You can set the resolution of the spectrum under **FFT lines**. Select 1600 (corresponds to 4096 samples) or 3200 FFT lines (corresponds to 8192 samples).
- You can use **Save time signal** to specify when a time signal should be saved: **never**, **always, on pre-alarm** or **on main alarm**.
- Under **Lowpass** you can select a lowpass frequency from a list. This will be used for the frequency band being measured. The sample rate in this case is always 2.56 times the selected lowpass frequency.



Note that the filter calculation in the software is performed at the 200 Hz and 500 Hz settings and is therefore slower than at the other frequencies. Therefore, you should only select this high frequency if you really need it. Otherwise, select a greater number of FFT lines: For example, it is faster to measure at 1 kHz / 3200 FFT lines than at 500 Hz / 1600 FFT lines, although both measurements are performed at the same resolution.



*Apart from **Save time signal** the time signal settings can no longer be changed after the first measurement as otherwise it would no longer be possible to compare characteristic values.*

Rotational speed

If the rotational speed also needs to be determined by the Detector during the measurement select the **Acquire turning speed** option. The nominal rotational speed as well as the maximum permissible deviation in rpms and pulses per rotation should also be entered in the appropriate fields. If the rotational speed deviates from the rotational speed band defined here during measurement, the Detector issues an error message but still performs the measurement.

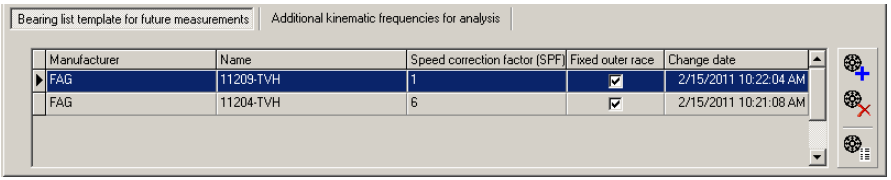
Bearing list template

In this section you can assign bearings from the bearing database102 to the measuring point or delete an assignment. The associated kinematic frequencies of the selected bearing are then also displayed in the evaluation diagram in the FIS Viewer. Both when making assignments and deleting assignments you can choose whether

- to only apply bearing data in future
- for all measurements already performed, or

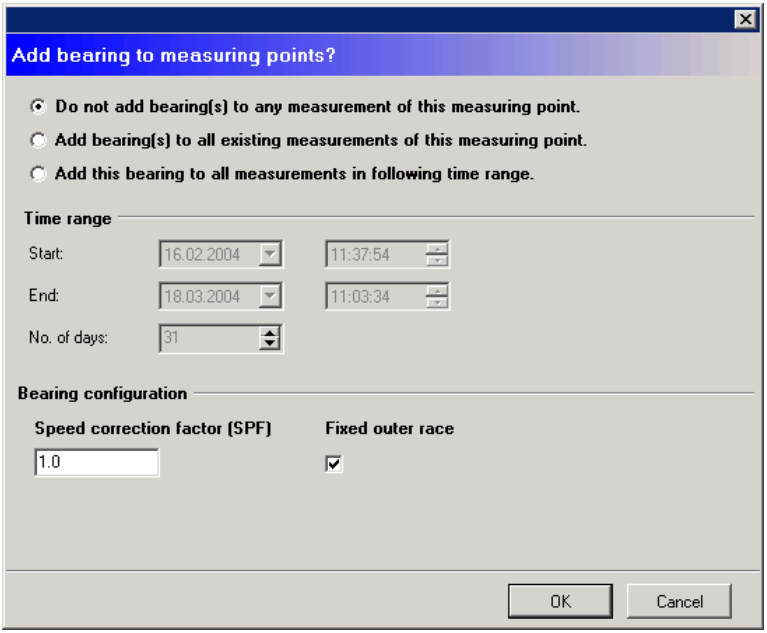
- only for measurements from a certain period

Specify the bearing assignment at measuring point level in the configuration. You can also assign bearing data directly to individual measured values. For more information refer to Measured values 117.



Add bearing to measuring point

- Click and
- select a bearing from the bearing database 102.



- Select to which measurements the bearing should be added:
  - If you only want to apply the bearing information for future measurements,

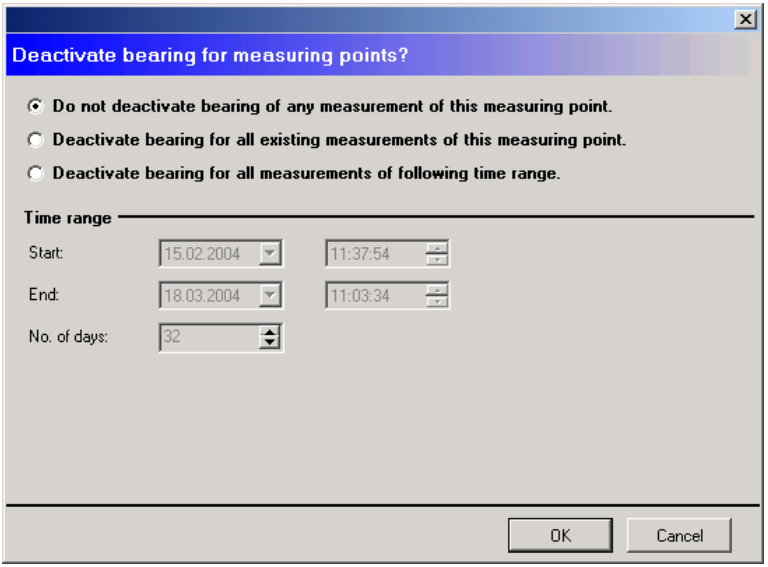
click **Do not add bearing(s) to any measurement of this measuring point**.

- If you want to apply the bearing information to all saved measurements, click **Add bearing(s) to all existing measurements of this measuring point**.
- To apply the bearing information to measurements in a certain time range, click **Add this bearing to all measurements of following time range** and select the time range.

- In the **Bearing configuration** section enter the speed correction factor (SPF) and select whether the bearing has a fixed outer race.
- Click on **OK**.

Delete selected bearing

- Click on the bearing to delete and
- then click .



- Select from which measurements the bearing should be removed:
  - To keep the bearing information for the existing measurements of this measuring point, click **Do not deactivate bearing for any measurement of this measuring point**.
  - To delete the bearing information from all saved measurements of this measuring point, click **Deactivate bearing for all existing measurements of this measuring point**.
  - To delete the bearing information from measurements in a certain time

range, click **Deactivate bearing for all measurements of following time range** and select the time range.

- Click on **OK**.

Show and edit bearing information

- Click on the desired bearing and
- then click .

This displays the bearing information in the bearing database.

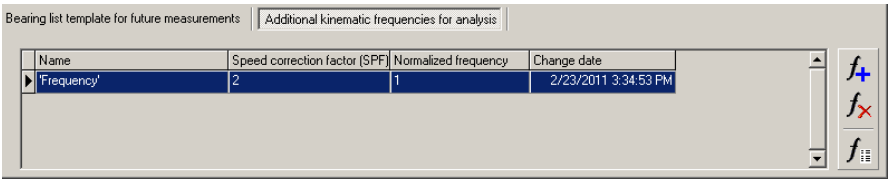
- Edit the **Speed correction factor (SPF)** and select **Fixed outer race** optionally.

The kinematic frequencies can only be changed in the bearing database.

- Click on **OK**.

Additional kinematic frequencies for analysis

In this section you can define additional kinematic frequencies for analysis. These are also displayed in the evaluation diagram in the FIS Viewer.



Add kinematic frequency

- Click on .
- Enter the **Name**, the **Speed correction factor (SPF)** and the **Normalized frequency**.
- Click on **OK**.

The additional kinematic frequency will be added.

Delete kinematic frequency

- Select the kinematic frequency to delete.
- Click on  and
- click on **Yes**.

Edit kinematic frequency

- Select the kinematic frequency from list.

- Click on f and
- edit the settings.
- Click on **OK**.

Measured values

In the Measured data section you can display the acquired data numerically and graphically. For more information refer to Measured values 117.

4.4.4 Setting characteristic values

You can create the following characteristic values per measuring point:

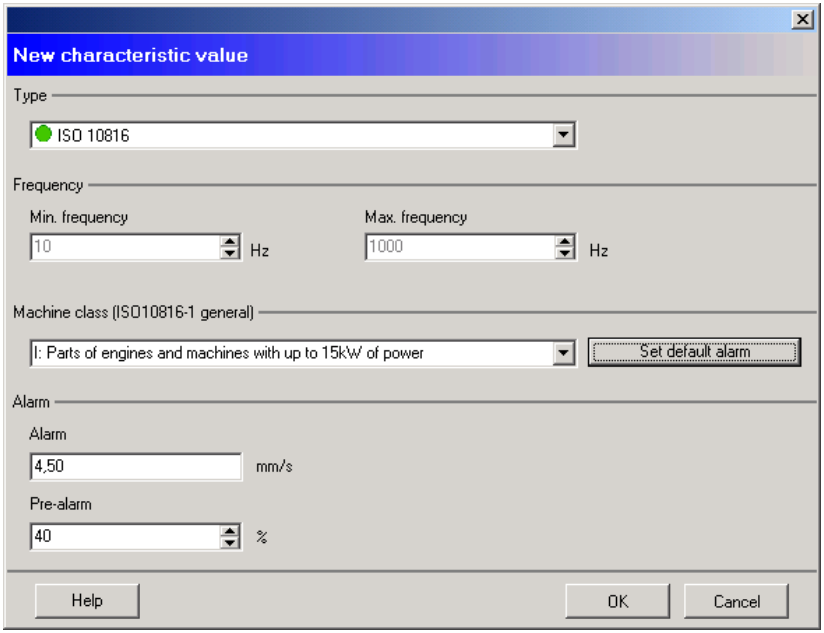
- ISO 10816,
- A_{sel} and A_{eff},
- D_{sel} and D_{eff},
- Temperature,
- V_{sel},
- Crest factor and
- Universal.

Please also observe the information in the "Frequency selective characteristic values 270" section.



Characteristic values can be changed until they have been sent to the Detector for the first time. After that the characteristic values turn grey in the tree and cannot be altered anymore. Otherwise, the measuring results could not be compared.

To add a new characteristic value, right-click the measuring point the characteristic value is meant for and, after that, on **New sub-item**. Alternatively, you can do it via **System** > **New sub-item** or via . The following window now opens:



Under **Type** you can select the various characteristic values that can be measured with the Detector. With selective characteristic values (e.g. a_{sel}) the upper and lower cut-off frequency can be set in **Min frequency** and **Max frequency**, between which the characteristic value will be calculated. For more information on this topic, see Frequency-selective characteristic values 270. For the other characteristic values (ISO 10816, a_{eff} and d_{eff}) the cut-off frequencies are pre-set.

In the **Alarm** section you can set a threshold value for each characteristic value. If a measurement exceeds this value, the both Detector and Trendline software show an Alarm. You can also set a pre-alarm threshold in Trendline software. If the measured value exceeds this threshold, the Trendline software will display a pre-alarm for this measuring point. The Detector shows main alarms only. Pre-alarms are only displayed in Trendline. Further information under "Reset alarm status 124".

ISO 10816 type

If you have selected the characteristic value type **ISO 10816** you can specify in the **Machine class** section, whether characteristic values will be measured in accordance to ISO 10816 (Class 1-4). You can adjust the alarm settings within the class limits. If you want to set the defaults of a class click on **Set default alarm**. If you select "User defined alarm limit configuration", you can define free

alarm values. For more information about the classes of ISO 10816 see "ISO 10816 220".

Universal type

To enter a characteristic value at a selected measuring point that is not measured by the vibration or temperature sensor, you can set up a **universal characteristic value** in the Trendline software. For each configuration you can create several universal characteristic values. On the Detector you can enter for example the machine temperature and the ambient temperature for the analysis in the Trendline software. With the characteristic value type Universal you can define custom alarm values.



Universal characteristic values are displayed in the Detector without unit. To assign later what has been measured with this parameter, you should entitle the characteristic value accordingly (e.g. "Machine temp. [C]"). In the Trendline software you can edit the name in the "General settings" tab. On the Detector you can only change the name in the settings of free measurements.

4.4.5 Editing / deleting sensors

If you have added custom sensors 45 in addition to the pre-defined sensors, you can edit or delete them.

Editing a sensor

- In the **Detector** menu click **Sensor** > **Edit**.
- Select the sensor in the **Edit sensor** window.
- Edit the settings (see also Add sensor 45).
- To edit the sensor name, click on .
- Click **OK**.

Deleting a sensor

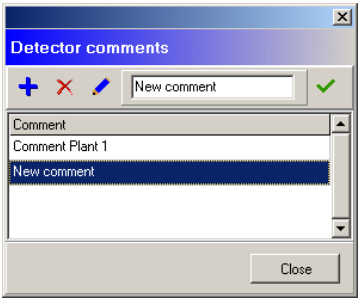
- In the **Detector** menu click **Sensor** > **Delete**.
- Select the sensor to delete in the **Delete sensor** window and click **OK**.



As long as a sensor is still in use, thus it is assigned to a measurement point, you cannot delete this sensor.

4.4.6 Managing measurement comments

In the Trendline software you can create short texts as measurement comments. The comments list of the Trendline software will be transferred while sending data to the Detector. During the measuring round, you can assign a comment from the list to every measurement on the Detector. The comment is saved with the measurement and displayed in the measuring results in the Trendline software. If you edit or create new comments on the Detector, this will be added to the measured data in the Trendline software (see "Measured data 117"). The comment list will not be changed.



Create comment

- Click **Comment selection list** in the **Detector** menu.
- In the **Comments window** click .
- Enter the desired text and click .
- Click **Close**.

Delete comment

- Click **Comment selection list** in the **Detector** menu.
- In the **Comments window** click .
- Click **Close**.

Edit comment

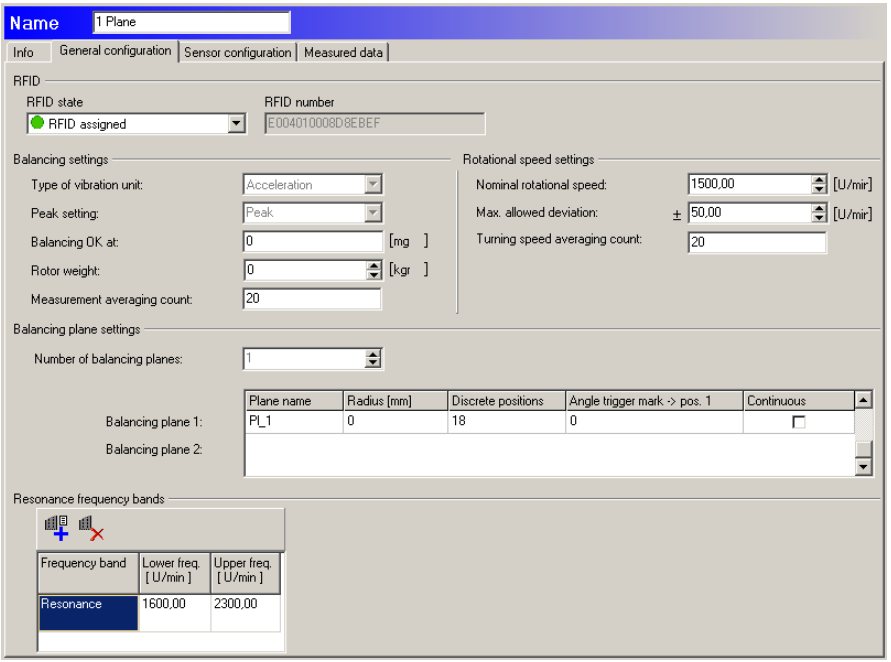
- Click **Comment selection list** in the **Detector** menu.
- In the **Comments window** click .
- Enter the new text and click .
- Click **Close**.

4.4.7 Add balancing configuration

To create a balancing configuration

- click on a level 3 configuration element (machine or motor, for example).
- Then click **System** > **Add balancing configuration** or click on .

General settings



RFID status

- **No RFID**: No RFID tag is assigned to the measuring point.
- **Assign RFID**: This option instructs the Detector to assign an RFID tag placed on the machine to this measuring point during the next round.
- **RFID assigned**: An RFID tag is assigned to the measuring point. The unique ID is displayed in the **RFID number** field.
- **Remove RFID**: This option instructs the Detector to cancel the RFID tag assignment to the measuring point during the next round.
- **RFID defective**: The Detector has marked the assigned RFID tag as defective.
- **Change RFID**: This option tells the Detector to replace the assigned RFID tag. During the next round, you must delete the tag and assign a new one before

you can perform the measurement at this measuring point.



You can only select the statuses that are accessible as a follow-up status of the current status.

Further information in the chapter "Automatic assignment of RFID tags to measuring points 54".

Balancing settings

- **Type of vibration unit**: Select **Acceleration**, **Velocity** or **Displacement**.
- **Peak setting**: Specify here whether the **peak-to-peak** value, the **peak** value or the root mean square (**RMS**) should be evaluated.
- **Balancing OK at**: define the limit value for the balancing measurement here. If all measured values are below the value specified during the trim run 245 the balancing procedure has been successfully completed and the Detector ends the balancing measurement.
- **Rotor weight**: Here you enter the weight of the rotor (kg) for which the balancing measurement is performed. The Detector uses this value to calculate a suggested test weight (see notes in section "Balancing measurement" 234). If you enter 0 here, the Detector cannot calculate a suggested test weight.
- **Measurement averaging count**: The Detector averages measured values during the measurement. Specify how many values are to be used for averaging.

Rotational speed settings

- Enter the **Nominal rotational speed** (in the predefined unit, see "Program settings / General 146") and the **Max. allowed deviation** in the appropriate input boxes. Note that a deviation of more than 10% is not possible. If the acquired speed by the Detector is outside the rotational speed range defined here, the Detector displays an error message 263.
- The Detector averages the rotational speed values during the measuring process. Specify how many rotational speed values are to be used for averaging at **Turning speed averaging count**. If you enter 20, for example, the Detector averages the values obtained for rotational speed across 20 revolutions.

Balancing plane settings

- **Number of balancing planes**: Select "1" for single-plane balancing or "2" for two-plane balancing.
- Enter a **plane name** for the selected planes or use the names suggested by the Trendline software (see also "Program settings / General 146"). Due to the

Detector display this name can only contain 5 characters.

- Enter the radius in mm for which balancing weights can be applied to the rotor. The Detector uses this value to calculate a suggested test weight (see notes in section "Balancing measurement"234). If you enter 0 here, the Detector cannot calculate a suggested test weight.
- Deactivate **Continuous** if you can attach the balancing weights anywhere on the shaft. If this is not possible (e.g. with a fan with 10 blades), **Continuous** must not be selected.
- If you activated **Continuous**, use **Discrete positions** to select the number of possible positions for the balancing weights, e.g. for a fan. In addition, please enter the angle of the next possible position against the direction of rotation to the reflex mark edge in **Angle trigger mark -> Pos. 1.** This position is called P1.

Resonance frequency bands

In this section you can manually enter the resonant frequency bands determined for this measuring point.

- Click on .
- Enter the name of the frequency band.
- Select the **Start frequency** and **End frequency** and
- then click **OK**.

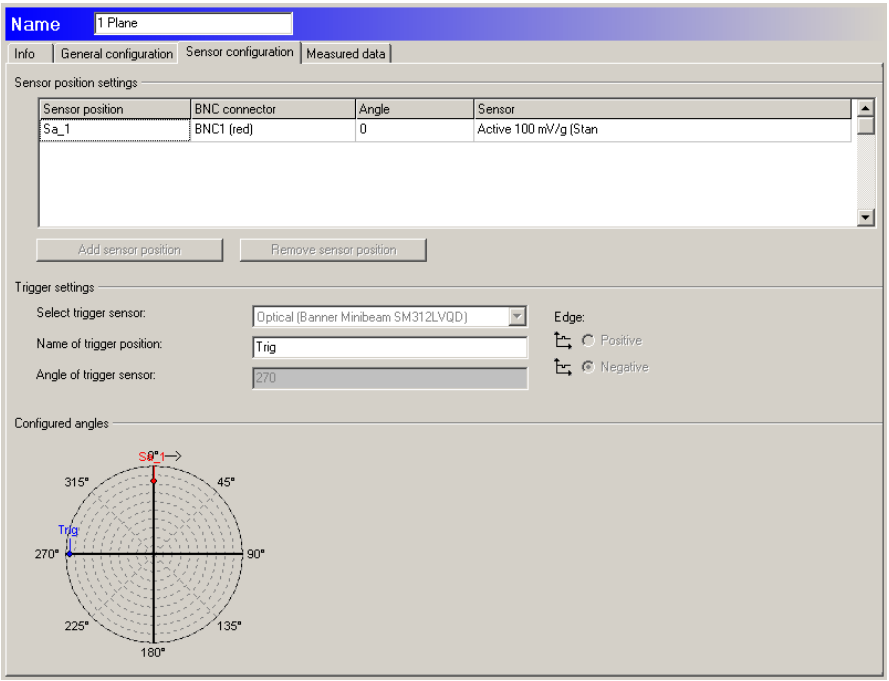


You can copy resonant frequency bands determined from a run up/ coast down test and subsequent creation of an amplitude/phase diagram to the balancing configuration (see Setup run up/coast down 82*).*

To delete frequency bands

- select a frequency band .
- Click on  and
- confirm with **Yes**.

Sensor configuration



Sensor position settings

In this section you can insert up to four sensor positions. Each balancing plane must have at least one sensor position. If you add a new balancing configuration to the system configuration, a sensor position is automatically added per balancing plane.

- **Sensor position**: Enter a name for the sensor here (maximum of 5 characters). Due to the size of the Detector display this can only be 5 characters long.
- **BNC connector**: Select the BNC port 216 used to connect the sensor during the measurement. If you are measuring with two sensors, you should use both BNC connectors on the Detector as this accelerates the speed of measurement.
- **Angle**: Enter the angle of displacement of the sensor from the zero position in the direction of shaft rotation. The stator is always used as the reference for the zero position which points vertically upwards.
- **Sensor**: Select the sensor used from the sensor database 45 here.

Trigger settings

- **Select trigger sensor**: Select the trigger sensor used from the sensor database 45 here.
- **Name of trigger position**: Enter a designation for the trigger position. This is required by the Detector to identify the trigger sensor. Due to the size of the Detector display, this name can only be five characters long.
- **Angle of trigger sensor**: Enter the angle of displacement of the trigger sensor from the zero position in the direction of rotation. The stator is always used as the reference for the zero position which points vertically upwards.
- Select **Positive** or **Negative** to indicate whether the measurement should start on a positive or negative edge on the trigger sensor. This edge determines the 0° position of the shaft.

Configured angles

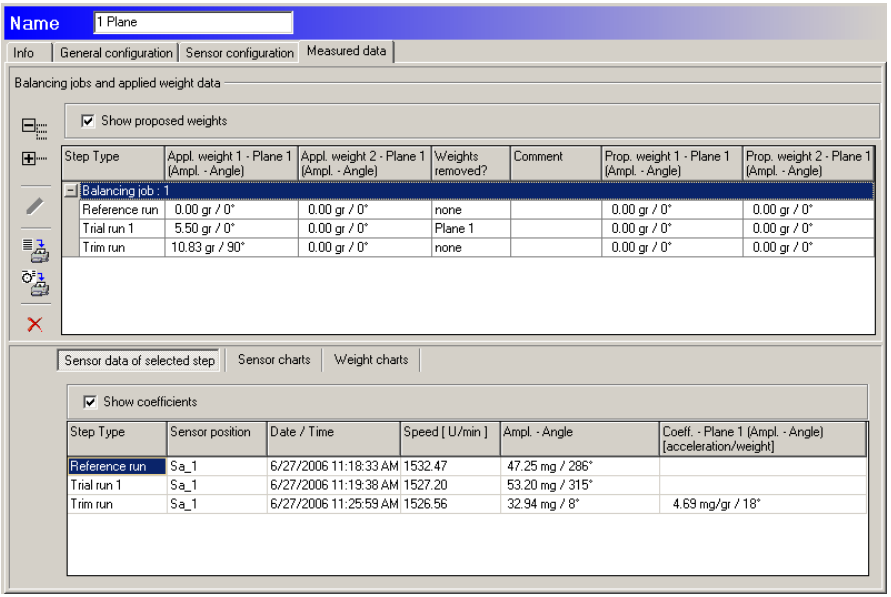
In this area the Trendline software provides a graphic representation of the position of the sensors.



The sensor positions are always counted in the direction of shaft rotation.

Measuring data

You can view the measured data in this area once a balancing measurement is complete and the data have been transferred to the Trendline software from the Detector.



Edit comment

- In order to edit a measurement comment, click on the measurement and then on .

Show details

- To display the details of a measurement click on the appropriate entry in the list then click on .

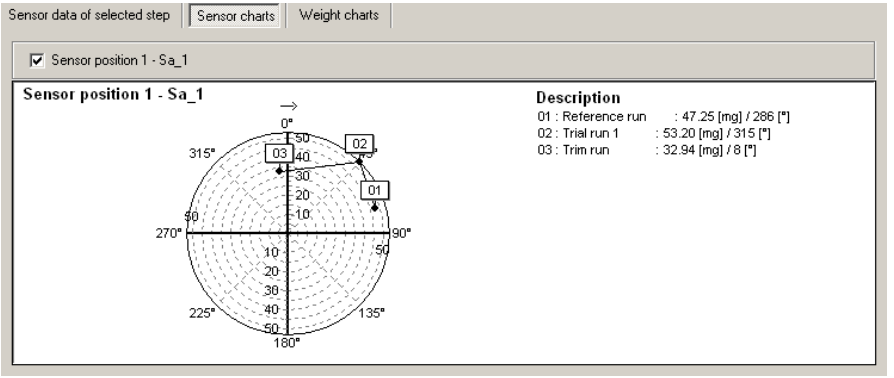
The Trendline software displays the sensor position, time of measurement, rotational speed, amplitude and phase of the vibration at the sensor at each stage of the balancing measurement. If you also wish to see the suggested weights and their amplitude and angel or coefficients used and their corresponding amplitude and phase, click **Show proposed weights** or **Show coefficients**.

If you wish to hide the details again click on .

Display sensor charts

- Click **Sensor charts** to display the position of the sensors as a chart.

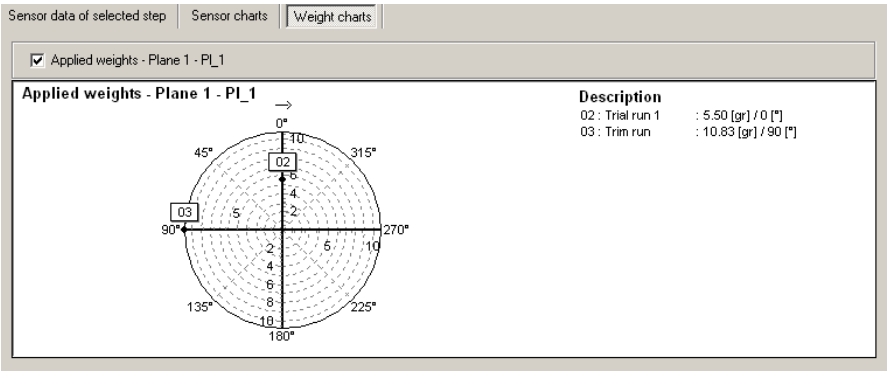
Trendline enters the sensor position on a circular chart for each individual step of the measurement. You can activate/deactivate the display of each sensor at **Sensor position n**.



Display weight charts

- Click **Weight charts** to display the weights as a chart.

The Trendline software enters the position of the weights during the trial run and trim run in a circular chart. You can switch the display of weights for each plane on or off by clicking on **Applied/proposed weights - Plane n**.



The positions of the weights are indicated against the direction of shaft rotation.

Print view of graphics

- Click on to call up a print preview of the graphics.

Balancing report

- Click on  to generate a balancing report[133].

Delete balancing data

To delete the data obtained during a balancing measurement

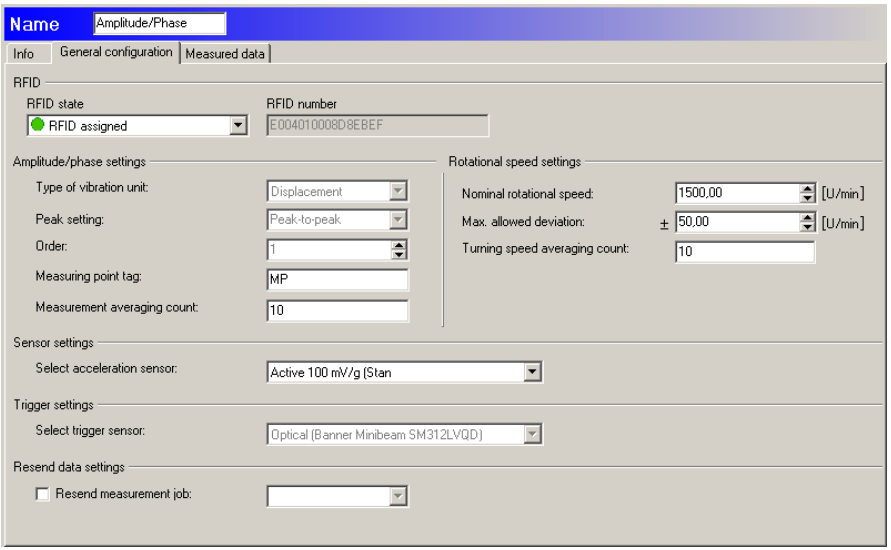
- click the corresponding entry in the list then click  and
- confirm deleting with **Yes**.

4.4.8 Set up amplitude/phase configuration

To create an amplitude/phase configuration,

- click on a Level 3 configuration element (e.g. a machine or motor).
- Then click **System** > **Add amplitude/phase configuration**.

General settings



RFID status

- **No RFID**: No RFID tag is assigned to the measuring point.
- **Assign RFID**: This option instructs the Detector to assign an RFID tag placed on the machine to this measuring point during the next round.
- **RFID assigned**: An RFID tag is assigned to the measuring point. The unique ID

is displayed in the **RFID number** field.

- **Remove RFID**: This option instructs the Detector to cancel the RFID tag assignment to the measuring point during the next round.
- **RFID defective**: The Detector has marked the assigned RFID tag as defective.
- **Change RFID**: This option tells the Detector to replace the assigned RFID tag. During the next round, you must delete the tag and assign a new one before you can perform the measurement at this measuring point.



You can only select the statuses that are accessible as a follow-up status of the current status.

Further information in the chapter "Automatic assignment of RFID tags to measuring points 54".

Amplitude-Phase settings

- **Type of vibration unit**: Select **Acceleration**, **Velocity** or **Displacement**.
- **Peak setting**: Specify here whether the **peak-to-peak** value, the **peak** value or the root mean square (**RMS**) should be evaluated.
- **Order**: Select what signal order the Detector should determine (1 = rotational speed signal, 2 = 1st harmonic, 3 = 2nd harmonic, 4 = 3rd harmonic).
- **Measuring point tag**: Enter a name for the measuring points. You can change the standard designation "MP" in the Program settings 146. During the measurement, the Detector adds a consecutively increasing number to this name to uniquely identify a measuring point. Due to the size of the Detector display, this name can be a maximum of 15 characters long.
- **Measurement averaging count**: The Detector averages measured values during the measurement. Specify how many values are to be used for averaging.

Rotational speed settings

- Enter the **Nominal rotational speed** (in the predefined unit, see "Program settings / General 146") and the **Max. allowed deviation** in the appropriate input boxes. Note that a deviation of more than 10% is not possible. If the acquired speed by the Detector is outside the rotational speed range defined here, the Detector displays an error message 263.
- The Detector averages the rotational speed values during the measuring process. Specify how many rotational speed values are to be used for averaging at Turning **speed averaging count**. If you enter 20, for example, the Detector averages the values obtained for rotational speed across 20 revolutions.

Sensor settings

- **Select acceleration sensor**: Select the sensor used from the sensor database 45 here.

Trigger settings

- **Select trigger sensor**: Select the trigger sensor used from the sensor database 45 here.

Resend data settings

If you would like to repeat an amplitude/phase measurement, you can resend the configurations to the Detector, including the measured data and any comments that have been entered. During the measurement, the Detector replaced the existing measured values with the current measured values. This is only done for the measurement points that have actually been measured again. New measuring points are attached to the measurement job. After the measurement, you can select a new comment from the Comment list 68 on the Detector. During the transfer to Trendline, the repeated measurement is added to the configuration as a new measuring job. The data from the previous measurement are therefore fully retained.

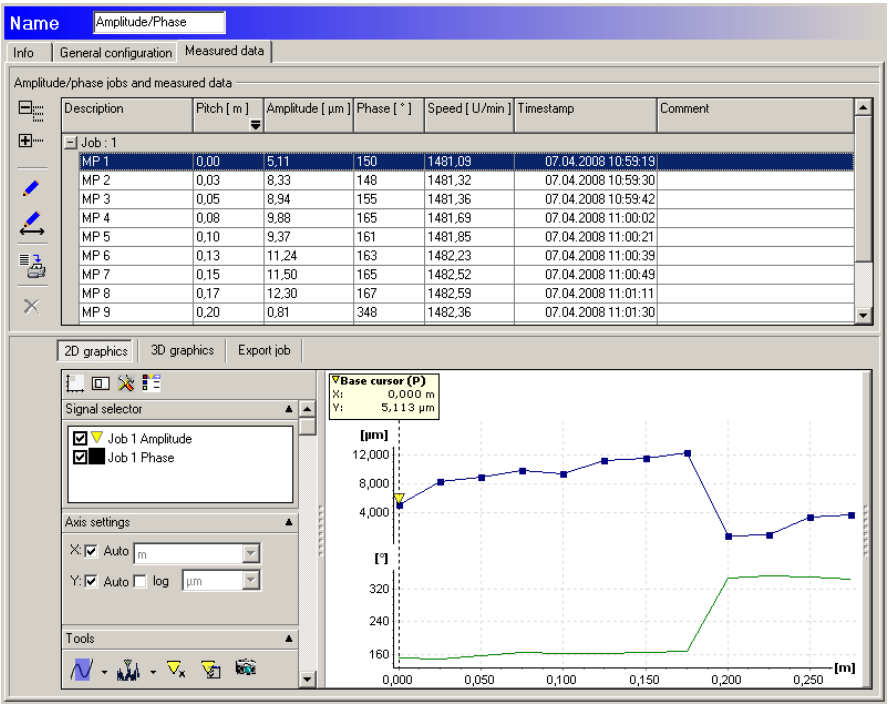
> **Example**: You resend a measuring job to the Detector with the measuring points MP1-MP5. If you now use the Detector to remeasure MP1 and MP2, the measured values at MP1 and MP2 are replaced. If you remeasure at a new MP6 measuring point, the measured value is attached to the job. After transferring the data to the Trendline, you will find the complete measurement as a new measurement job in the corresponding configuration in the Trendline software.

- To repeat a measurement, activate the **Resend measurement job** checkbox and select the consecutive number of the desired measurement job.

For further information under Send configuration 90.

Measured data

You can view the measured data in this area once a Amplitude / phase measurement is complete and the data have been transferred to the Trendline software from the Detector.



Show details

The measured values are combined in measurement jobs. A measurement job contains all related measured values. To display the details of a measurement job click on the appropriate entry in the list then click on .

For each step of the Amplitude / phase measurement, the Trendline software shows sensor position, distance of the measuring point from the referencing point of the measurement, amplitude and phase of the vibration on the sensor, speed as well as data and time. The list is sorted in ascending order according to the distance from the referencing point. The values are displayed in the selected units (see "Program settings"146). To select the unit for the "Pitch" column, click on and select the desired unit.

If you wish to hide the details again click on .

Pitch of a measuring point at the start of the measurement.

- Click on the measuring point in the table of measurements.
- Click on and enter the desired value in the **Change pitch** field (max. 5 places before and max. 2 places after the period).

- The list is resorted in ascending order by pitch.

Edit comment

- In order to edit a comment of a measurement, click on the measurement and then .

Amplitude/phase report

- Click on to create an Amplitude/Phase Report for the selected measurement job.

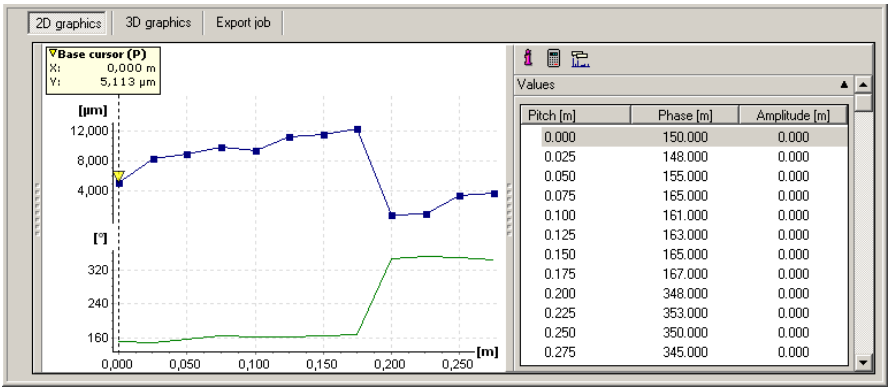
Delete amplitude/phase measurement

- Click on the measurement job in the table of measurements, then on .

Display two-dimensional amplitude/phase graph

- Click **2D graphics** to display measurements in a graphic format.

The Trendline software plots the amplitude and phase of the vibration signals at the measuring points separately over a shared axis that shows the positions of the measuring points to scale.

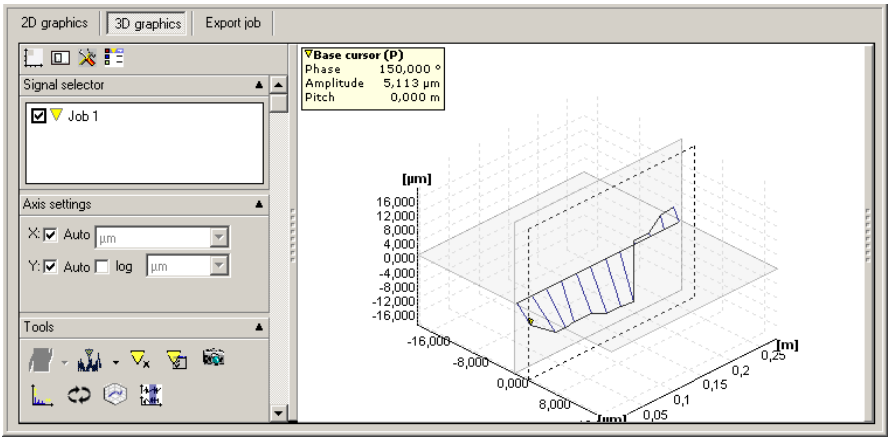


- **Cursor tools**: In 2D display mode the the base and difference cursor as well as the zoom tools of the FIS Viewer are available. For each measuring point selected using the cursor, the diagram shows the values for phase/amplitude of the signal as well as the pitch at the reference point. If the difference cursor is activated, the corresponding difference values between the selected measuring points are also shown.

Display three-dimensional amplitude/phase graph

- Click **3D graphics** to display measurements in a graphic format.

In the three-dimensional view, the pitch at the measuring points is displayed on an asymptote. At each measuring point, the vibration signal is shown in the pitch of the amplitude and with the phase angle of the signal around the asymptote. This makes phase leaps immediately recognizable.

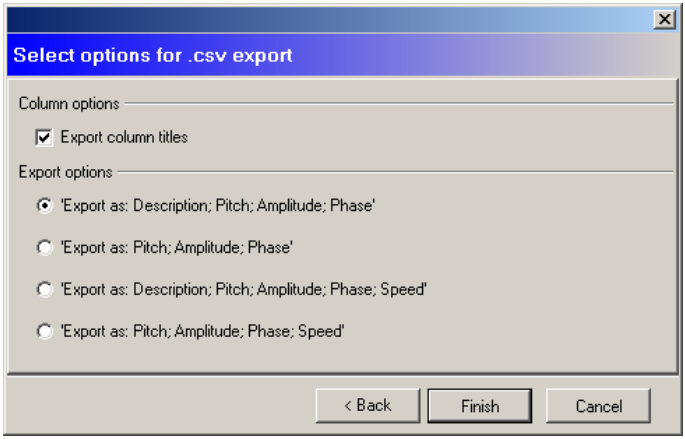


- **Cursor tools**: In 3D display mode, the base and difference cursor of the FIS Viewer are available. For each measuring point selected using the cursor, the diagram shows the values for phase/amplitude of the signal as well as the pitch at the reference point. If the difference cursor is activated, the corresponding difference values between the selected measuring points are also shown.
- **Rotation**: The display can be rotated around the x and y-axis using the middle mouse button. If you also hold down the "Shift" key, the graph will only be rotated around the x-axis; holding down the "Ctrl" key will rotate the graph only around the y-axis.
- **Zoom**: You can zoom in on or out from the graph using the mouse wheel.
- **Reset picture**: Click on  to reset the picture to the standard values (60% size, 45° rotation around the x-axis, 30° rotation around the y-axis).

Export job

You can export a measuring job as a table in CSV format (each column is separated by a semicolon):

- Select the desired measuring job and click on **Export selected job in .csv format**.
- Click **File name** and select the path and file name.
- Click on **Continue**.



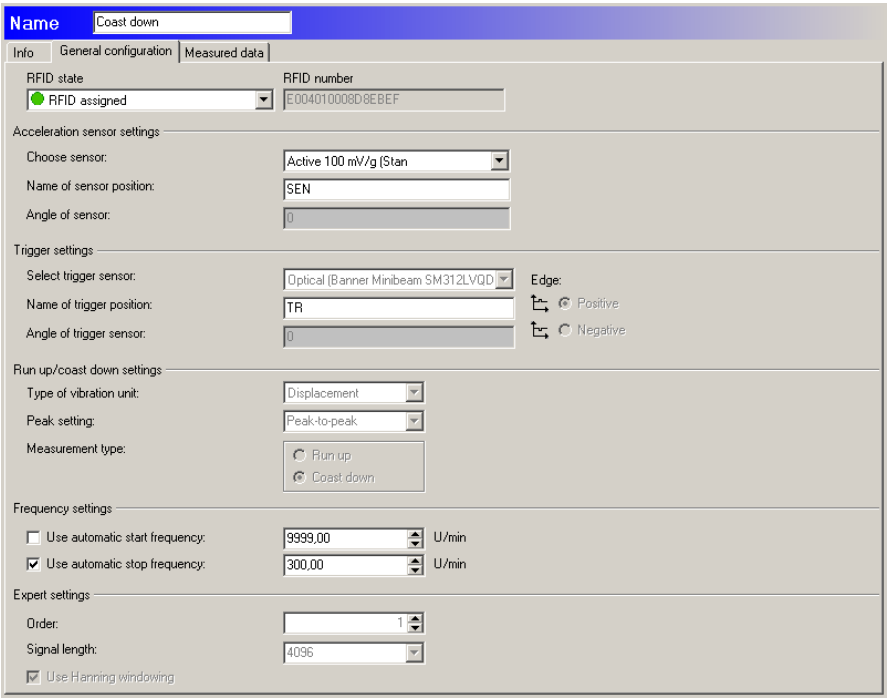
- Specify whether the export file should contain column headings.
- Under **Export options**, choose whether the columns will be exported to include the column descriptions and/or rotational speed (pitch, amplitude and phase are always exported).
- Click on **Finish** to create the file.

4.4.9 Set up run up/coast down

To create an run up/coast down configuration,

- click on a Level 3 configuration element (e.g. a machine or motor).
- Then click **System** > **Add run up/coast down configuration**.

Configuration



RFID status

- **No RFID**: No RFID tag is assigned to the measuring point.
- **Assign RFID**: This option instructs the Detector to assign an RFID tag placed on the machine to this measuring point during the next round.
- **RFID assigned**: An RFID tag is assigned to the measuring point. The unique ID is displayed in the **RFID number** field.
- **Remove RFID**: This option instructs the Detector to cancel the RFID tag assignment to the measuring point during the next round.
- **RFID defective**: The Detector has marked the assigned RFID tag as defective.
- **Change RFID**: This option tells the Detector to replace the assigned RFID tag. During the next round, you must delete the tag and assign a new one before you can perform the measurement at this measuring point.



You can only select the statuses that are accessible as a follow-up status of the current status.

Further information in the chapter "Automatic assignment of RFID tags to measuring points 54".

Acceleration sensor settings

- **Choose sensor**: Select the sensor used from the sensor database 45 here.
- **Name of sensor position**: Enter a designation for the sensor position. This is required for identification of the sensor by the Detector. Due to the size of the Detector display, this name can only be five characters long.
- **Angle of sensor**: Enter the angle of displacement of the trigger sensor from the zero position in the direction of rotation.. The stator is always used as the reference for the zero position which points vertically upwards.

Trigger settings

- **Select trigger sensor**: Select the trigger sensor used from the sensor database 45 here.
- **Name of trigger position**: Enter a name for the trigger position. This is required by the Detector to identify the trigger sensor. Due to the size of the Detector display, this name can only be five characters long.
- **Angle of trigger sensor**: Enter the angle of displacement of the trigger sensor from the zero position in the direction of rotation.. The stator is always used as the reference for the zero position which points vertically upwards.
- Select **Positive** or **Negative** edge to indicate whether the measurement should start on a positive or negative edge on the trigger sensor. This edge determines the 0° position of the shaft.

Run up/coast down settings

In this section you can make settings required for Determining the resonance range of a machine 247 with the run up/coast down test.

- **Type of vibration unit**: Enter which vibration unit to use at run up/coast down. The following are available: Displacement, Velocity and Acceleration.
- **Peak setting**: Specify here whether the **peak-to-peak** value, the **peak** value or the root mean square (**RMS**) should be evaluated.
- **Measurement type**: Enter whether the Detector measures during **run up** or **coast down** of the machine

Frequency settings

In this section you can set the start and end velocity for Determining the resonance range of a machine [247] with the run up/coast down test.

- **Use automatic start frequency**: Enter the frequency at which the Detector starts measuring.
- **Use automatic end frequency**: Enter the frequency at which the Detector stops measuring.

Expert settings

The settings in this section concern conditioning of the measuring signal determined while Determining the resonance range of a machine [247] with the run up/coast down test.

- **Order**: Select what signal order the Detector should determine (1 = rotational speed signal, 2 = 1st harmonic, 3 = 2nd harmonic, 4 = 3rd harmonic).
- **Signal length**: Enter how many samples (1024, 2048 or 4096) the Detector should measure per measuring signal.
- **Use Hanning windowing**: Select whether the Detector should use Hanning windowing when conditioning the measuring signal. Hanning windowing leads to better quality of the digitized measuring signal, particularly at low rotational speeds. However, this additional step requires computing time in the Detector and leads to increased noise in the digitized signal.



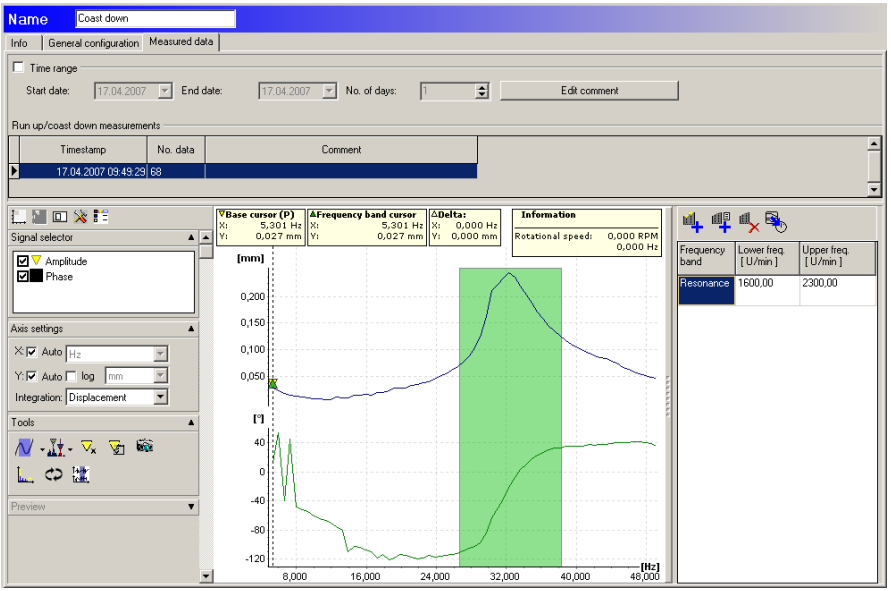
The effects of this setting depend very much on the type of machine and on the individual demands on the ratio of accuracy to the number of signal support points. As a general rule, you should

- *measure as many amplitude and phase values as possible for machines that run up/coast down quickly - i.e. reduce signal length and thus signal quality and do without Hanning windowing,*
- *increase accuracy for machines that run up/coast down slowly, i. e. increase signal length and thus signal quality and activate Hanning windowing.*

Measuring data

In the Measured data window you can

- create an amplitude/phase diagram for a set of measured data,
- save frequency bands selected in the diagram and copy them to a balancing configuration [69].



The Run up/coast down measurements section displays the run up/coast down measurements saved for the measuring point.

Limit time range

- In order to limit the time range of the measured values displayed, select the **Time range** option.
- Set the desired start and end date.

Edit comment

- In order to edit a measurement comment, click on the measurement and then **Edit comment**.

Below the measurements the window is split into three sections. The amplitude/phase diagram is displayed in the middle, with the diagram editing tools to the left. To the right of the diagram there is a list of the user-defined frequency bands.

Displaying the amplitude/phase diagram and setting the frequency band

- Click on a measurement to display the amplitude/phase diagram in the diagram window.

You can use the FIS Viewer zoom tools described in the "FIS Viewer" section to edit the diagram. Cursor tools for the diagram include the base cursor (see "

Cursor tools") and a difference cursor, with which you can specify a frequency band.

How to specify a frequency band in the amplitude/phase diagram:

- Move the base cursor (yellow) to the measuring point to specify the lower cutoff frequency.
- Move the difference cursor (green) to the desired measuring point to specify the upper cutoff frequency.

In the diagram information, you can read the position of the base and difference cursor and the width of the frequency band and amplitude difference.

Saving the frequency band

- Select the frequency band in the amplitude/phase diagram and click .
- Enter a name for the frequency band and click **OK**.

Or:

- Click on .
- Enter the name of the frequency band.
- Select the start and end velocity and click **OK**.

Deleting a frequency band

- Click on the frequency band to delete.
- Click on .

Copying frequency bands to a balancing configuration

- Click on .

The **Add frequencies to balancing configuration** window displays the balancing configurations available in the system configuration.

- Select the desired balancing configuration and
- click **OK**.

4.4.10 Adjust alarm limits automatically

The Trendline software can automatically adjust the alarm settings for the individual characteristic values. During this process the software determines the average of all measured values for the relevant characteristic value and automatically adjusts the corresponding alarm value according to your specifications. Alternatively, you can use the values suggested by the software.

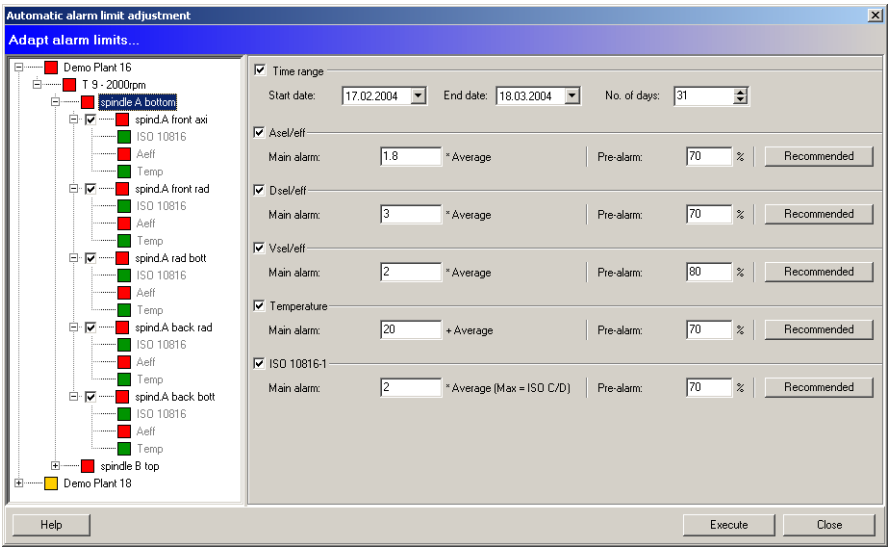
CAUTION *Modification of alarm thresholds may have severe effects on the service life of the monitored components if used improperly. You should therefore always carefully check whether the intended settings are suitable for your specific system.*

To adjust the alarm values automatically proceed as follows:

- In the **System** menu, click on **Adjust alarm limits**.
- Select the required element from the configuration tree, a specific machine, for example.

The alarm values for this element and all sub-elements it contains are adjusted. Please select or unselect sub-elements if necessary.

You can define the default values for the alarm limit adjustment in the program settings 146.



Specify time range

You can use the **Time range** option to limit the measured values used for averaging. To do this, enter the start and end time. Alternatively, you can enter the end time and specify the duration in whole days in the **No. of days** input field. In

this case the start time will be determined automatically.

Configuring automatic adjustment

Automatic adjustment of alarm values can be defined for each characteristic value 269 (acceleration, demodulation, velocity, temperature and ISO 10816-1) of the element selected in the configuration tree.

To activate the automatic adjustment for one characteristic value proceed as follows:

- Select the characteristic value.
- Enter the **main alarm** adjustment as a factor of the average value.
- Enter the **pre-alarm** adjustment as a percentage (less than 100).

or:

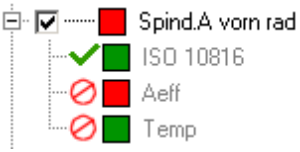
- Click **Recommended** to set the values recommended by Trendline.



- *For the ISO 10816 value, the alarm limits can only be created within the class boundaries of pre-alarm (C) and main alarm (D). More information about ISO 10816 classes can be found in the "ISO 10816 220" chapter.*
- *The values suggested by Trendline for the automatic adjustment of alarm values are based on empirical values used by FAG Industrial Services GmbH. Because entirely different settings may be required, depending on the properties of the components being monitored, these must be regarded purely as suggested values, which are completely non-binding. The user is always responsible for selecting appropriate alarm values.*

- Click **Execute** to apply the settings.

The Trendline software adapts the alarm limits of the selected elements. A green check mark displays a successful adjustment at the measurement point. A red struck out circle indicates that the adjustment failed. In this case check the settings and repeat the configuration.



- Click **Close** to exit the alarm limit adjustment.

4.4.11 Send configuration

In the Trendline software You can send a configuration or a part of a configuration to the Detector. For that, follow the sequence below:

- Select a machine in the tree.
- Connect the connector to the serial interface using the data cable.
- Switch on the Detector.
- Click on **Detector** > **Send configuration** or click on .

The configuration for the machine for the selected machine, including all measuring points, is sent to the Detector. If you want to send a complete configuration, you would have to select the configuration in the tree (in the example in paragraph "Setting up system tree"53 this would be “Cement Plant 1”) prior to sending the data. It is even possible to send one measuring point. This facility is mostly used for test purposes.



If the "Always save" option is selected for more time signals in the configuration that you wish to send to the Detector than are permitted in the Detector memory an error message will be output and the data will not be transferred. For more on this, see also chapter "Frequency analysis" (see PDF "General information on vibration monitoring" on the delivered CD-Rom).

4.5 Trendline database

About the Trendline databases

The data required for configuration and evaluation of data is stored centrally in the Trendline database. The Trendline software is delivered with the MS SQL Express 2005 database program, but the size of the database is limited to 4 GB for licensing reasons. If you require more space in the database please consult FAG Industrial Services GmbH.

The database program can be used to manage multiple database files. Each database contains a MDF and a LDF file. For the sake of simplicity, individual database files are referred to in this manual as "database".

Please note:

- If you would like to attach, detach or update a database, use the database administration that is provided and described in the following chapter.
- If you would like to create or delete a database, you can do this directly from the Trendline software. For more on this see "Create database"99 / "Delete database"101).

If there is less than 512 MB of unused space in the Trendline database, a warning is displayed.

CAUTION

Measured data may be lost if database is full!

If the maximum storage capacity of the Trendline database has been used up, a warning is displayed. If additional measured data is downloaded from a Detector device when the database is full, this data cannot be saved and will be lost!

Free up storage space in the database by

- *deleting unneeded data,*
- *storing existing data to a different location using the export function and then deleting the Trendline database.*

4.5.1 Users and passwords

During the installation of the Trendline software the following users and passwords will be set up for the database program (SQL server) access:

User name	User password	User rights
sa	CM_services$1sa (for new installations from version 3.6)	Install and register databases at the SQL server
	sql8 (for existing installations up to including version 3.4)	
cmuser	CM_services$1user	Select, attach, detach, update and delete databases in the Trendline software

The user passwords can differ depending on your specifications!



The following possibilities can be considered for the user password:

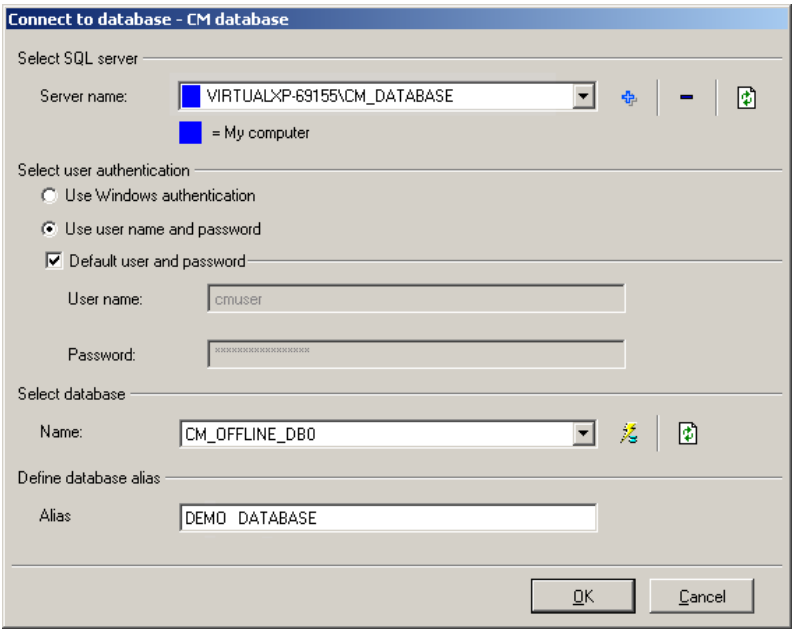
- *If the SQL server has been set up with the FIS Trendline software up to version 3.4 the password is "sql8".*
- *If the SQL server has been set up with the FIS Trendline software from version 3.6, the password is "CM_services$1sa".*
- *If you use your own SQL server, you need the password for this one.*
- *If you have defined your own password according to your security rules, you need this one.*

With user-defined passwords maybe you have to use a password that meets the security policies of your computer. This can be a strong password with at least 10 characters, upper and lower case and alphanumeric and special characters, for example.

For problems with the safety requirements of your system, please contact your system administrator.

4.5.2 Select database on server

You can select a CM database on a database server as follows:



1. Select SQL server

First select the SQL database server where the database is located. You have the following options:

- By default, the **Server name** list displays the server instances running on your computer. Select an instance.

Or:

- Click and enter the full server name.

Or:

- Click to search the SQL database servers that are available in the network and display them in the server list. Then select the server from the list.



- *The server list will be empty, if you are working with a restricted Windows user account. In this case you have to enter "PC name\CM_DATABASE" manually (if you use an older version of Trendline software it is "PC name\FIS_DATABASE"). You can find your PCs name above the disk drives in the Windows Explorer. When your PCs name is "peters_laptop", then enter "peters_laptop\CM_DATABASE" as server name.*
  If you are unsure about the computer name ask your administrator.
- *Database servers that have been added with , will be saved in the list **Server name** and were automatically available next time you open the program. You can delete items from this list by clicking .*

2. Select user authentication

You have several options for the user authentication on the database server:

- Check **Use Windows authentication** to use your Windows user name and password.

Or:

- Check **Use user name and password** and
- activate **Default user and password** to use the default logon (see tip).

Or:

- Check **Use user name and password**,
- disable **Default user and password** and
- enter your own user name and password for the selected database.



- *To access the database server a user account is created during Trendline installation with the default name "cmuser" and password "CM_services$1user". For database server that have been installed with Trendline software version 3.4 or earlier, the user name is "sa" and the password "sql8".*
- *If you use your own (custom) password, please enter this one.*
- *Further information in chapter "Users and passwords"* 91.

3. Select database

After selecting a database server in step 1, the available databases will be displayed on the select list **Database**.

- The **Name** list displays the available databases. Select a database or click  to refresh the list of available databases.
- Click  to test the connection. If the connection fails, check your user data. If necessary, contact your system administrator.

4. Enter database alias

Optionally, you can give the selected database an alias name to make it easier to distinguish it from other databases. If you have already given the database an alias name, it is displayed, otherwise the name of the database is including the name of the server.

- Click **OK** to use the selected CM database.

4.5.3 Database administration

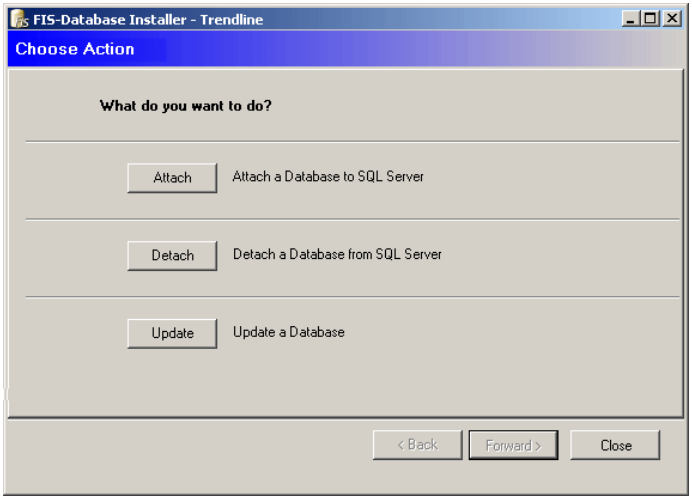
With the database administration of the Trendline software you can perform several administration tasks, so as attaching, detaching or updating a Trendline database.

You can start the database administration as follows:

- Click on **Extras** > **Start Database Administration** in the Trendline-Software**.**

Or:

- Close the Trendline-Software.
- Open the start menu and click on **Programs** > **FIS** > **Trendline 3.6** > **FIS Database Administration**.



Attach a database

To use a database on a SQL database server, the server needs to know where the database files (*.mdf and *.ldf) of a specific database are. With **Attach Database** you let the server know where the database files are located.

Detach a database

If you detach a database from SQL database server, you remove the database file from the list of known databases for a specific server. The database files are still present on your computer, but they are not accessible by the database server or the Trendline-Software anymore.

If you want to make a detached database accessible for the Trendline Software, you have to attach the database again.

Update a database

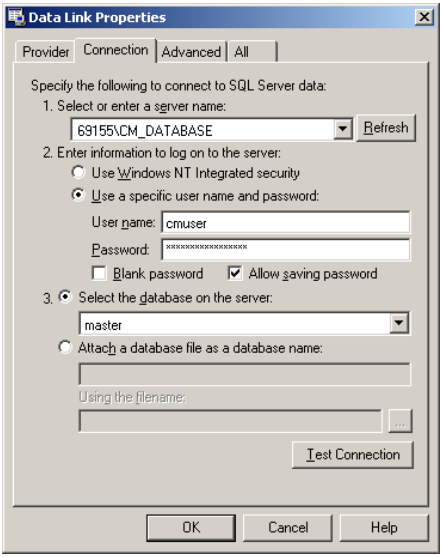
When new features are added to the Trendline database, it might be possible that the database format has to be changed. With this option, you can update the database to the new format.

4.5.3.1 Attach database

You can attach a database to the SQL database server as follows:

- Start the **Database administration**.
- Click **Attach**.

- Click on **Connect** to connect to the master database:



- From the server list, select the database server that contains the database or enter it manually there. You can click **Refresh** first in order to update the list of available servers.
- Click **Use a specific user name and password** and enter your user name and password to log in to the master database.
- Select the **Allow saving the password** option.
- Select the "master" database from the database list and click **OK**.
- Click **Continue** in the database administration.
- Select the required database file to be imported (MDF file) and click **OK**. Now select the corresponding LDF file and click **OK**.
- Click **Continue** and enter a name for the database.
- Click on **Execute**. The database is attached.

4.5.3.2 Detach database



- *You can only detach a database if it is not being used by the Trendline Software.*
- *If you have disconnected the database from the database server, you can only access the database again with the Trendline software by reattaching* 96 *the database again.*

You can detach a database from the SQL database server as follows:

- Start the **Database administration**.
- Click **Detach**.
- Click on **Connect** to connect to the master database.
- From the server list, select the database server that contains the database or enter it manually there. You can click **Refresh** first in order to update the list of available servers.
- Click **Use a specific user name and password** and enter your user name and password to log in to the master database.
- Select the **Allow saving the password** option.
- Select the "master" database from the database list and click **OK**.
- Click **Continue** in the database administration.
- Select the database to be detached in the database administration and click **OK**.
- Click on **Execute**. The database is detached.

4.5.3.3 Update database

ATTENTION



Back up 102 *your Trendline database before updating it!*

You can update a database as follows:

- Start the Database administration.
- Click **Update**.
- Click on **Connect** to connect to the master database.
- From the server list, select the database server that contains the database or

enter it manually there. You can click **Refresh** first in order to update the list of available servers.

- Click **Use a specific user name and password** and enter your user name and password to log in to the master database.
- Select the **Allow saving the password** option.
- Select the "master" database from the database list and click **OK**.
- Click **Continue** in the database administration.
- Select the database to be updated in the database administration, click **Continue** and then **Execute**.

The database is updated.

- Click **Execute**.

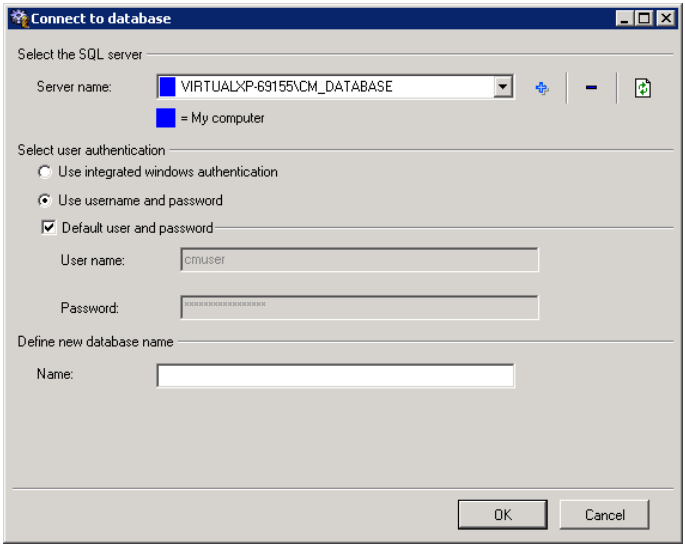


- *If you try to open a Trendline database that needs to be updated, Trendline software offers to start the database administration with all preliminary steps for an update. If the database administration is opened, click* **Execute** *to update the database.*
- *A database that has been updated from MSDE or MS SQL Server 2000 to MS SQL Express 2005 cannot be re-opened with MSDE or MS SQL Server 2000.*

4.5.4 Create database

You can create a new CM database as follows:

- Click **File** > **New** in the Trendline software.



- Select from the **Server name** list the database server or enter it manually.
- Define the **User authentication** for the database server access and enter user name and password if necessary.
- Select a name for the new CM database.
- Click **OK**.

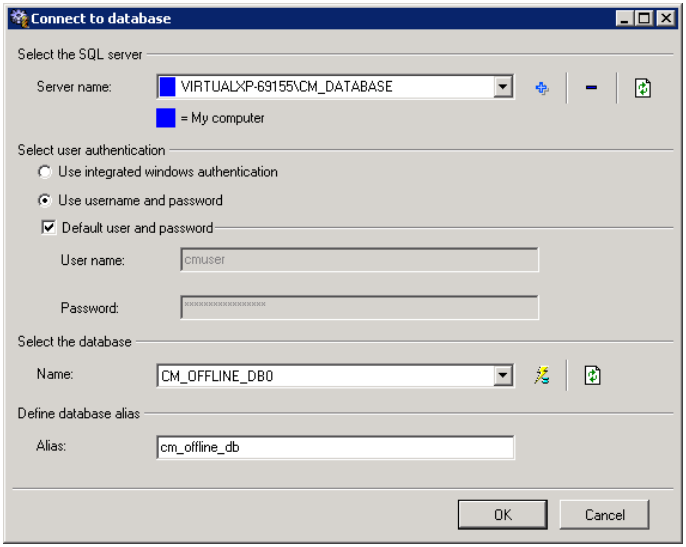
The CM database will be created.

You can find further information to the settings of the database connection dialog in the chapter "Select CM database on server" 93

4.5.5 Open database

You can open a CM database as follows:

- Click **File** > **Open** in the Trendline software.



- Select from the **Server name** list the database server or enter it manually.
- Define the **User authentication** for the database server access and enter user name and password if necessary.
- Select the CM database from the **Name** list (e.g. "CM_OFFLINE_DB0").
- Enter an **Alias** name for the database optionally.
- Click **OK**.

The selected CM database can be used.

You can find further information to the settings of the database connection dialog in the chapter "Select CM database on server" 93

4.5.6 Delete database

To delete a CM database proceed as follows:

- Open the Trendline database.
- Click in the menu on **Extras** > **Delete current database**.

A safety information is displayed.

- Click **Delete**.

The database will be deleted irreversibly.



- *If you delete a CM database, all configuration and measured data will be removed irreversibly!*
- *You cannot interrupt the delete process!*

4.5.7 Back up database

You can back up database(s) as follows:

- To make a backup of a database, you have to detach the database from the database server (see "Detach database" 98).
- Start **Windows Explorer** and choose the directory where the database files are located.
- Copy both the MDF and the LDF file of the database, which you want to back up, to da different location.



For backup, it is essential that you copy both database files! Therefore always copy the MDF and the LDF file.

4.6 Bearing database

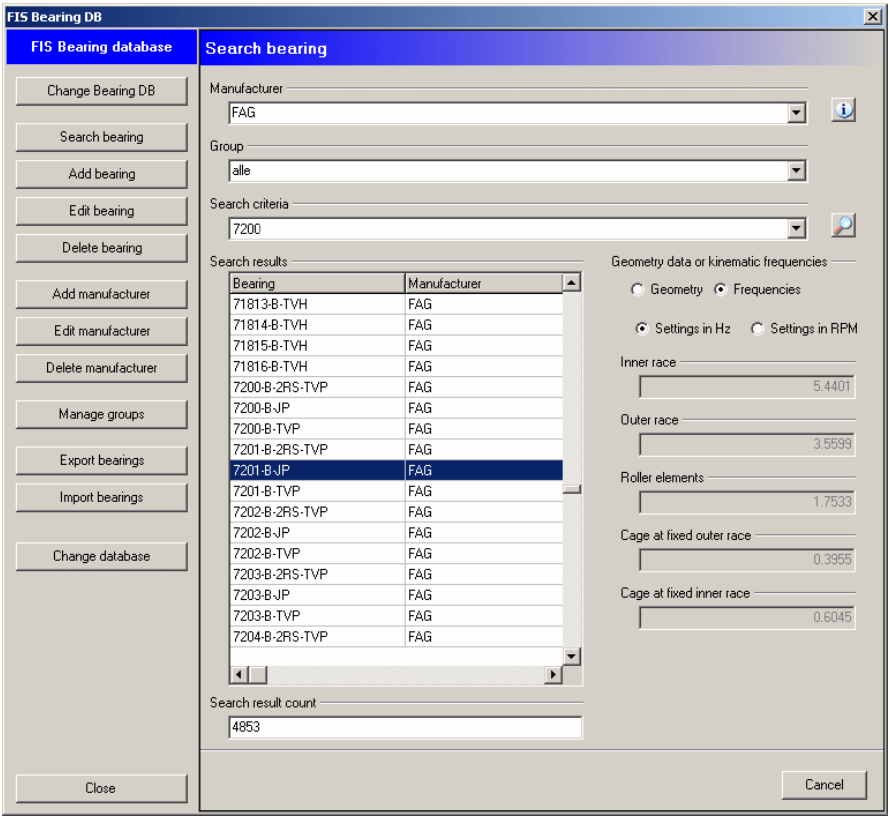
The Trendline database provides you with data on the most widely used bearings for use in your individual configuration (see Setting up measuring point 58).

You can also add your own bearings 104 to the existing bearing data. Furthermore, the Trendline bearing database also includes a group administration feature 106 which you can use, for example, to group bearings of different makes that have similar characteristics.

- Click **Tools** > **Bearing database** to open the bearing database.

Select the database as described in "Select database" 93. The name of the included bearing database is "CM_BEARINGS". If you set it up during software installation, it is automatically opened when you call the bearing database for the first time. The program uses the default user name and the default password.

The bearing database opens.



4.6.1 Search bearing

To find a bearing click on **Search bearing** in the bearing database 102.

- Click on to display all bearings.
- To restrict the search you can specify the **manufacturer** and/or **group**.
- Additionally, you can further limit the name of the bearing in **Search criterion**. You can use the wildcards "?" and "*" in the usual way, e.g.

o "*1200*" to find all bearing names containing 1200 or

o "?200*" to find all bearings whose name includes the text "200" at position 2-4.

The list of hits is displayed in **Search result**.

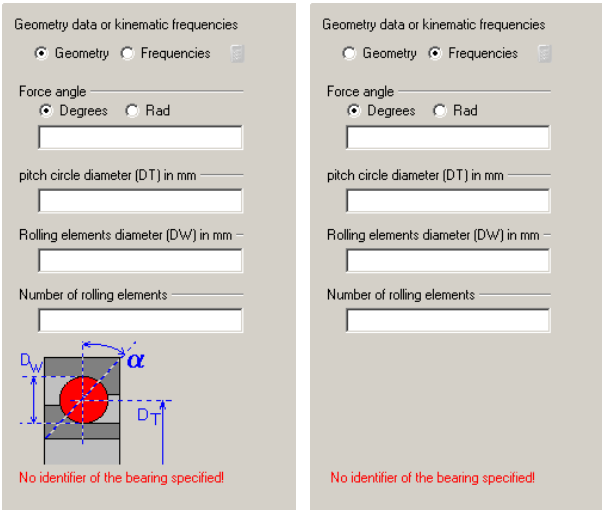
4.6.2 Add bearing

To add a bearing to the bearing database 102 click on **Add bearing**.

- Select a **manufacturer** from the list.
- Enter a name for the bearing in the **Label** field.
- Detailed comments may be entered in the **Comment** field (optional).

Geometry data or damage frequencies

- Use the **Geometry** and **Frequencies** options to switch between the input fields in the right-hand area of the window in order to enter corresponding data. When inputting the contact angle select either **degrees** or **radians** for units. When specifying the frequencies enter whether these should be in **Hz** or **rpm**.



Trendline indicates whether any information still needs to be input in the bottom right-hand area of the window. The bearing can be added to the database only if all inputs are completed.

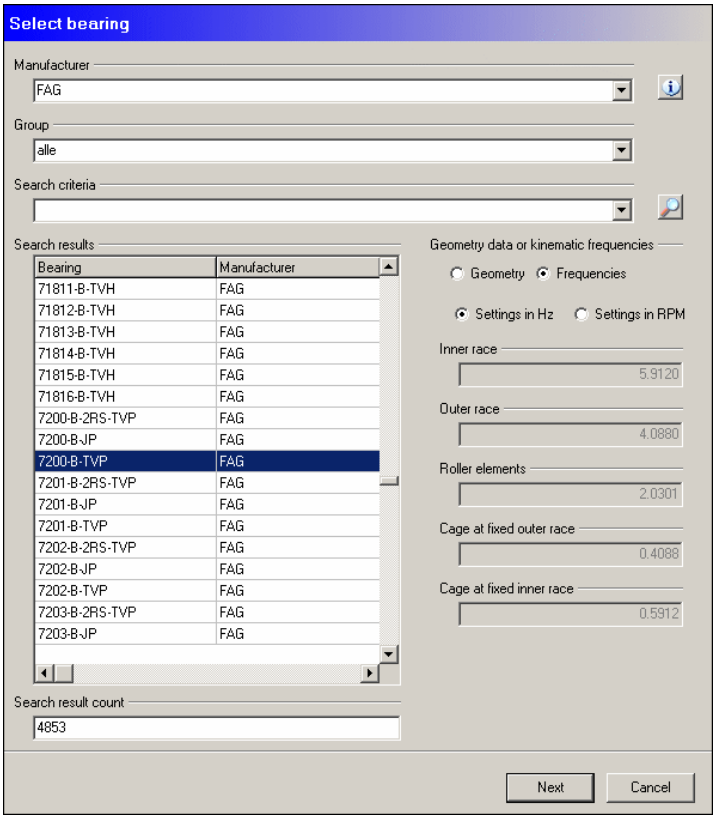
- Click on **Continue** to store the bearing in the bearing database.

If you add or edit a bearing, it is imperative that you check the plausibility of these data. Ensure that you have entered the correct values for the bearing data because these are factored into the calculation.

4.6.3 Edit / delete bearings

Editing bearings

Click on **Edit bearing** and start by searching for the corresponding bearing as described at Search bearing 103.



The list of bearings found is displayed in the **Search results** as well as the **number of hits**.

- Select the bearing to be modified and click on **Continue**.
- Enter the data for the required bearing as described under Add bearing 104.
- Click on **Continue**.



Click on  *to open the* ***Manufacturer details*** *window. You can find the contact details for the manufacturer here.*

Deleting a bearing

- Perform your search as described above[105]. Then select the desired bearing for deletion from the **Search results**.
- Click on **Delete bearing** to remove the bearing from the database.



You can only delete bearings that you have entered[104] yourself! Once all the bearings for a particular manufacturer have been deleted you can also delete the manufacturer[109].

4.6.4 Export / import bearings

Exporting bearings

Click on **Export bearing** and search for the bearing you would like to edit as described in Edit/delete bearings[105].

- You can **use** the Export **self-created bearings only** option to restrict the export to bearings you yourself have entered.
- Click  and select the path and file name. By default, Trendline uses a file name according to the convention `FISBearingDB_export_<year>_<month>_<day>.zip`. Alternatively, you can use your own file name.

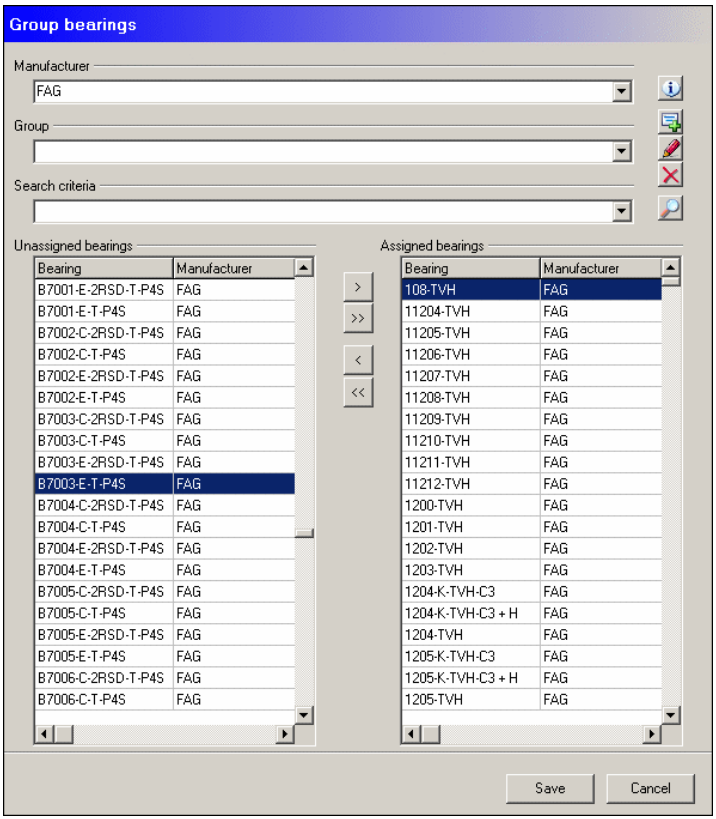
Importing bearings

- Click on **Import bearings**, then on .
- Select the import file.

4.6.5 Manage groups

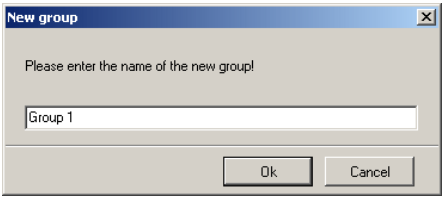
You can use the manage group feature to classify bearings with similar characteristics, regardless of their manufacturer.

- Click on **Manage groups** to call up the bearing database[102] group administration feature.



Create a new group

- To create a new group click on .



- Enter a name for the new group and click **OK**.

Assign bearings to a group

To assign one or more bearings to a group proceed as follows:

- Select the desired group from the **Group** list.
- Search for one or more bearings as described at "Edit/change bearing -> Search bearing[105]". The bearings found are displayed in the **Unassigned bearings** list.
- To assign a bearing to the group click on it then click on ›. The bearing should now be displayed in the **Assigned bearings** list.
- To assign all bearings found to the group, click on ››. All bearings should now be displayed in the **Assigned bearings** list.
- To delete a bearing from the group click on the bearing in the **Assigned bearings** list then click on ‹.
- To delete all bearings from the group, click on ‹‹.
- Click on **Save** assign the bearings to the group in the bearing database.

Rename a group

- To rename a group, select it from the **Group** list and click on .
- Enter a new name for the group and click on **OK**.

Delete a group

- To delete a group, select it from the **Group** list and click on .



Warning! the group is deleted immediately - you will not be prompted to confirm this! You should therefore only use these functions if you are sure that you want to delete a group.

4.6.6 Add manufacturer

- Click on **Add manufacturer** to create a new manufacturer.
- Enter the manufacturer's data in the appropriate input fields and click on **Next**.
- Check your input in the next window that appears. If the input is correct, click **Add** to save the manufacturer in the bearing database[102] or click **Back** to modify your input.

4.6.7 Edit / delete manufacturers

Edit manufacturer

- Click on **Edit manufacturer** to modify the data for a manufacturer.
- Modify the manufacturer data and click on **Next**.
- In the next window the Trendline shows your changes and the original data for an easy compare. Click on **Save** to store your changes in the bearing database 102 or click on **Back** to change your data.

Delete manufacturer

If you have deleted all bearings from a manufacturer from the bearing database (see Edit/delete bearings 105), you can also remove the manufacturer.

- Click **Delete manufacturer.**
- Then select the manufacture from the **Manufacturer** list and click **Continue.**

The manufacturer is then deleted from the bearing database.



You can only delete manufacturers which have been added 108 by yourself!

4.6.8 Select bearing database

- Click in the Bearing database 102 dialog on **Change database**.
- Select the database as described in "Select database" 93. The name of the included bearing database is "cm_bearings".

This opens the bearing database.

4.6.9 Close

To exit the bearing database

- click **Close**.

4.7 Template and route planning

Constantly recurring plant structures and measurement tasks can be performed efficiently with the help of templates and routes.

4.7.1 Template planning

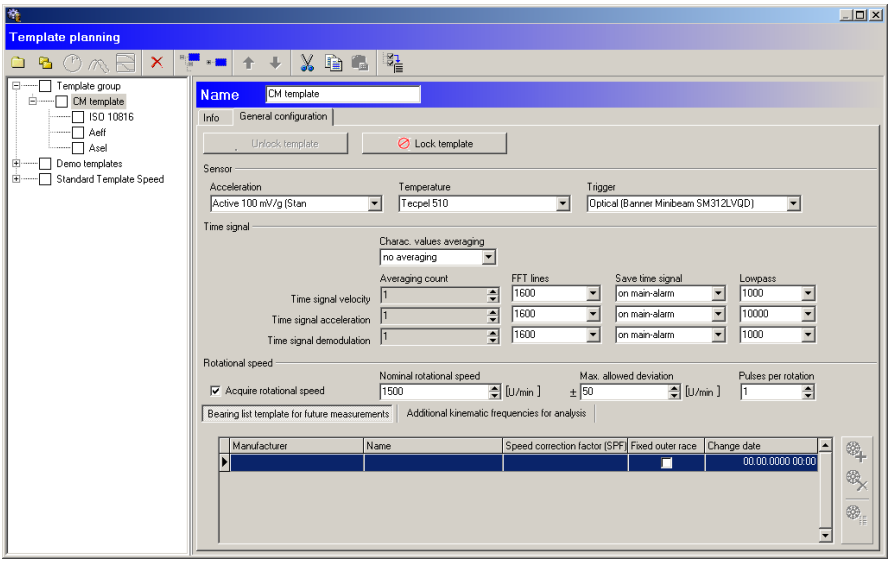
A template has the same layout as a measuring point. As with a measuring point, time signals can be recorded and different characteristic values set. If you want to

associate a free measurement with a certain measuring point, the template for this measurement must have the same layout as the respective measuring point. That means that the same characteristic values (with the same cut-off frequencies) must be set and the sensor must also be configured accordingly. Time signals and alarm thresholds may differ, as the characteristic values can be compared none-the-less.

Create new template

To create a new template, open the template planning.

- Click in the **Planning** menu on **Template**.



- Click on to add a new template group.
- Name the template group. On the "Info" page you can include a picture with or write a comment in the comment area.
  - With you create a new template. Here you can change the name (under "Info") and insert a picture or comments. On the "General settings" page you can configure different settings depending on the selected template (for more information see "Set up a measuring point 58").
  - Clicking lets you add new characteristic values to the template (for more information see "Setting characteristic values 65").
- With and with you can unfold the tree starting from the element selected or close again respectively.

- To add a new balancing configuration to the template group click on  (for more information see "Add balancing configuration 69").
- To add a new run up/coast down configuration to the template group, click on  (for more information see "Set up run up/coast down 82").
- To add a new amplitude/phase configuration to the template group, click on  (for more information see "Set up amplitude/phase configuration 76").
- With  you can delete the element selected from the list.



- *You can find more information about configuring measurement points and characteristic values in the chapter "Setting up configuration".*
- *You can create up to 255 templates per configuration type in a template group.*

Edit template

To edit a template

- click on the Planning menu on Template.
- Edit the settings as described in "Create new template".



- *The condition monitoring templates are protected against accidental editing. If you want to edit a template, click in the "General configuration" tab on **Unlock template**.*
- *Templates from FAG Industrial Services cannot be edited.*

You can move or delete single template elements:

- With  and  you can move a selected element within its level up or down.
- With ,  and  you can cut, copy and insert an element.
- With  you can delete a selected element.

Further information in "Tree elements 43"

Save configuration as template

If you want to save a configuration from a measurement point as template,

- select the measurement point in the Trendline configuration and
- click in the **System** menu on **Save configuration as template**.
- Enter a name to the configuration, e.g. "Fan" and

- select a template group.
- Click on **OK**.

The new template will be saved in the template planning.

Create configuration from template

If you want to create a new configuration from a template,

- select a machine from the Trendline configuration and
- click in the **System** menu on **Create new configuration from template**.
- Enter a name to the new configuration and
- select a template from a template group.
- Click on **OK**.

The new configuration will be set up.

Export/import templates

In the Trendline Software you can export and import templates. Further information in the chapter "Importing and exporting templates 144".

4.7.2 Route planning

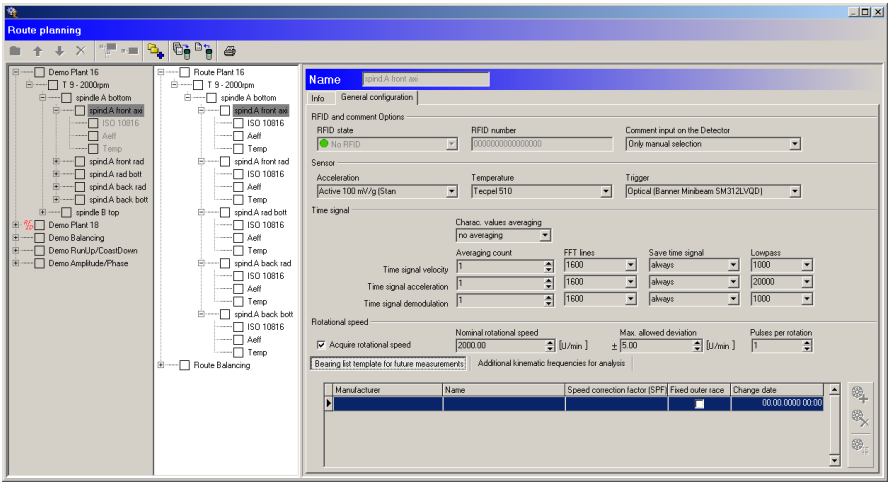
After the system structure has been entered into a configuration (or in several configurations as well), you have the option to group parts of those configurations into routes using the "Route" function. For example, you could create a route for each day of the week and measure certain machines only on Mondays. Another example would be a route for a certain mechanic who performs maintenance only on a few machines of a configuration.

Should you want to take measurements at a measuring point not contained in the current route, you can take a free measurement with the Detector. To define the settings for that, at least one template must have been created 109 before. In this template you can set exactly the same properties as in a normal measuring point, i.e. characteristic values, sensor type, time signals, etc.

Create new route

To create a new route, open the route planning.

- Click in the **Planning** menu on **Route**.



A new window that is divided into three parts will open. On the left you will find the configuration tree, in the middle the routes, and on the right-hand side the settings, respectively (same as in configuration view). To create a new route, follow the sequence below:

- Right-click the middle window and subsequently on Add Route. Alternatively you can click on  just as well.
- Name the route in the right window and add a picture, if desired (for that, click on ).
- Now you can add elements from the configuration to the route. You can do that in two different ways:
  - Left-click in the configuration tree on the element you want to add to the route . Next, left-click in the middle window on the route you want to modify. Finally, click  or select in the contextual menu **Add selection**.
  - Left-click on the part of the configuration tree you wish to add. Keep the left mouse button pressed and drag the element onto the name of the route. Release the mouse button.
- With  and with  you can unfold the tree starting from the element selected or close again respectively.
- Repeat this procedure for all routes you want to create, e.g. for Monday to Friday.
- Click on ✕ to close the route planning.

Edit route

To change route settings,

- click in **Planning** on **Route**.

You can move or delete single route elements:

- With ⬆ and ⬇ you can move a selected element within its level up or down.
- With ✕ you can delete a selected element.

Print route

In the Trendline software you can print a route report.

- Click on 🖶.
- Select a route.
- Click on **OK**.

Further information in the chapter "route report 133".

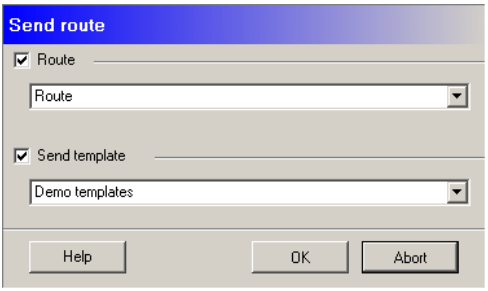
4.7.3 Send templates and routes

If you have created templates or routes (see "Template and route planning 109") you can transfer them to the Detector.



The transfer of a new route or configuration to Detector deletes all data stored on the instrument.

- Click on **Detector** > **Send route/template** or on .



Now you can select a template and/or a route:

- Activate **Route** and select the one you want to send to the Detector.
- Activate **Send template** and select a template group.
- Connect the Detector with the data cable to your PC and switch it on.
- Click **OK** to send the route to the Detector.

Another way of sending a route to the Detector is directly from route planning by

selecting **Planning** > **Route**. Click on . The **Send route** window opens. Then proceed exactly as described above.



If the "Always save" option is marked for a greater number of measurement points in the route you wish to send to the Detector than are permitted in the Detector memory an error message will be output. The data will not be transferred. Also refer to "System messages and their meaning 263".

4.8 Download data from Detector

After using the Detector to take a measurement, you must transfer the data to Trendline software.

- Connect the Detector with the data cable to your PC and switch it on.
- Click on **Detector** > **Load data from Detector** or on .

Another way of downloading data from the Detector is directly from route planning by selecting **Planning** > **Route**. Click on  in the route planning.

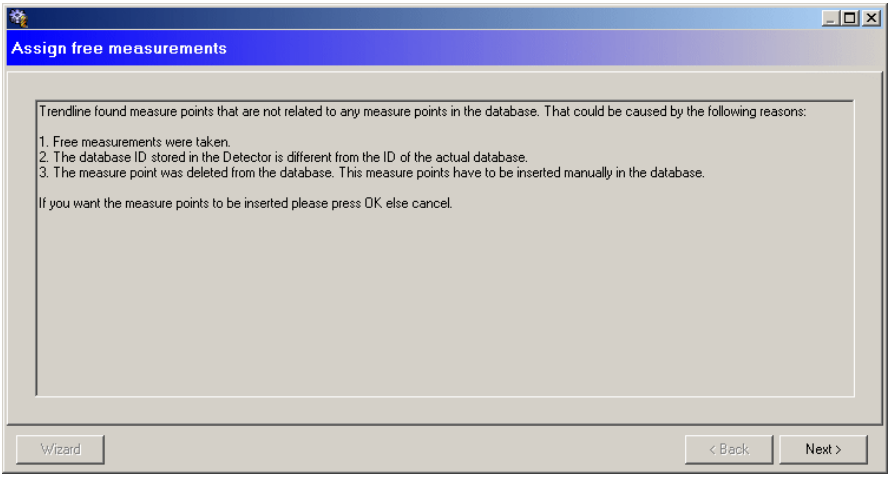
All data, i.e. configurations, time signals and free measurements are downloaded to the PC. This process can take several minutes depending on the amount of data.

Once all data have been received, they are stored in the respective locations in the database. It can happen that the program does not automatically sort the measuring points, e.g. you have taken free measurements or the configuration on the Detector had been created on a different PC. In this case, the sorting wizard 115 will be started automatically for sorting the measurements into your configuration tree.

4.8.1 Sorting Wizard

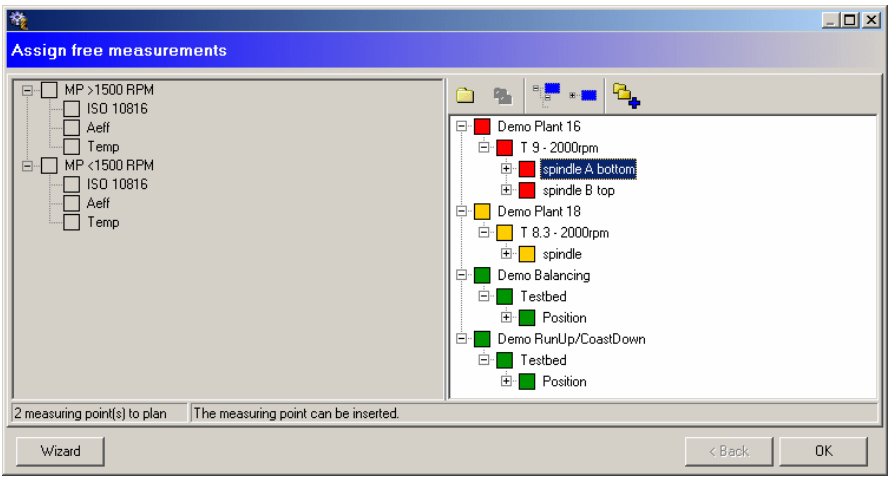
When you start the sorting wizard, Trendline displays an information window showing you why the data cannot be sorted in.

- Click **Next** to continue sorting in the data.



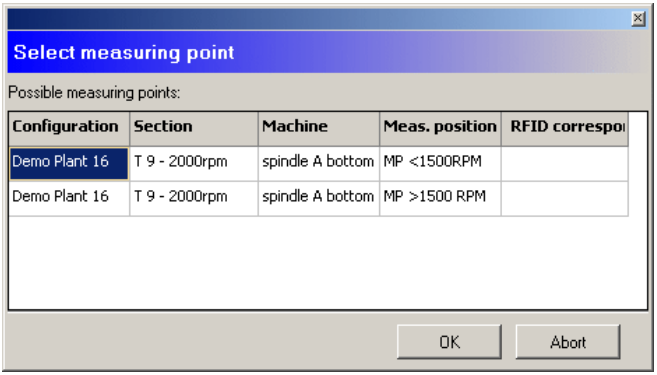
The next window is divided into two parts. On the left-hand side you will find the measuring points that are not yet sorted and on the right-hand side your configuration structure. Here you have two options.

- If there is a measuring point that has not yet been sorted in one of the configurations, drag it with the left mouse button from the left window onto the measuring point in the configuration. If the two really do match, the mouse cursor changes. You can release the mouse button to insert the measurement. In the status bar you can read why it was not possible to insert at a certain point.



- Alternatively, you can use the suggestions of the Trendline software. For this,

click on **Wizard** and select a measuring point from the list of proposals.



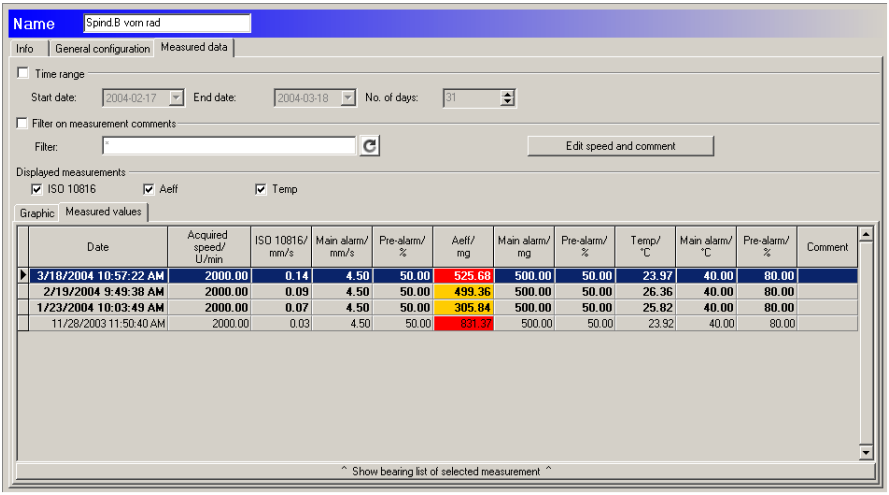
If the measuring point does not exist in the configuration yet, you again have two possibilities.

- If you want to add a measuring point to a machine, drag it into the right-hand window and onto the machine name to which it should be added.
- Additionally, you can add new configurations, sections and machines with the and buttons as you did, when creating the configuration. For information on this topic, see also "Enter system structure 53".

4.9 Viewing measuring data

4.9.1 Measured values

On the **Measured values** tab, the selected measured values are displayed in a table. When a row is displayed in bold, there is at least one time signal for this measurement. The time, the measured values determined and any pre-alarms or alarms that may have been output are displayed for each measurement in the measured values view.



Limit time range

- In order to limit the time range of the measured values displayed, select the **Time range** option.
- Set the desired start and end date.

Filter by comments

- If you want to display measured data with a particular comment, select the option **Filter by measurement comments**.
- Enter the desired comment in the "Filter" field. You can use the wildcards "?" and "*" in the usual way, e.g.
  - "*Pump*" to find all measurements containing Pump or
  - "?200*" to find all measurements whose comment includes the text "200" at position 2-4.
- Click on **Enter** to start filtering or click on **Reload**.

Changing acquired speed and comment

You can also correct rotational speeds in the Measured value view and edit the measured values comment. Proceed as follows:

- Click on an entry in the list of measured values.
- Click **Edit speed and comment**.
- Enter the new values and click **OK**.

Displaying measured values in the Viewer

You can display one or multiple measured values in the FIS Viewer.

- Double-click on a measurement to view it in the Viewer.
- To view multiple measured values, click the desired measured values while holding the CTRL key.
- Then double-click one of the selected measurements while holding the SHIFT key.
- To view the FFTs of one or more measured values, each in an individual window, first select the measured values. Then right click on the selection and then on **Show FFTs in multiple windows**.
- To view the FFTs of one or more measured values as a waterfall graph, first select the measured values. Then right click on the selection and on **Show FFTs as waterfall graph**. In the waterfall graph you can view one or more FFTs in different two or three-dimensional views or as a sonogram. For more information, refer to the chapter "Waterfall graphs".

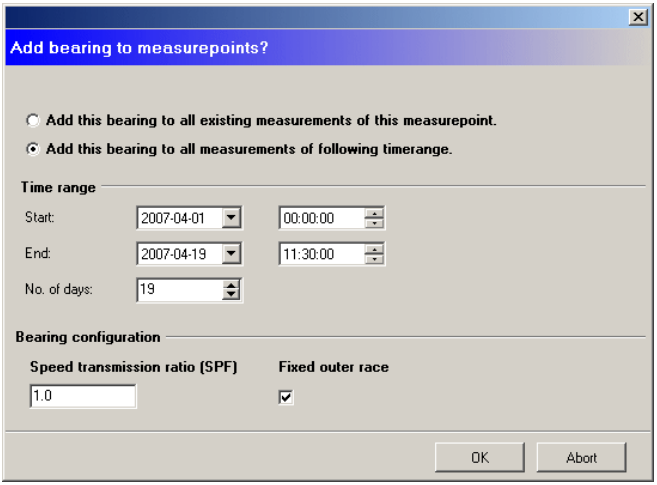
Show/hide bearing data

Click the **Display bearing data for selected measurement** button to display a list of bearings assigned to this measuring point in the configuration 58. You can also assign bearings to measurements or delete assignments here. The activation status of a bearing is indicated by the **disabled** checkbox. Both when making assignments and disabling you can choose whether

- bearing data should apply or not for all measurements already performed, or
- only for measurements from a certain period

Add bearing

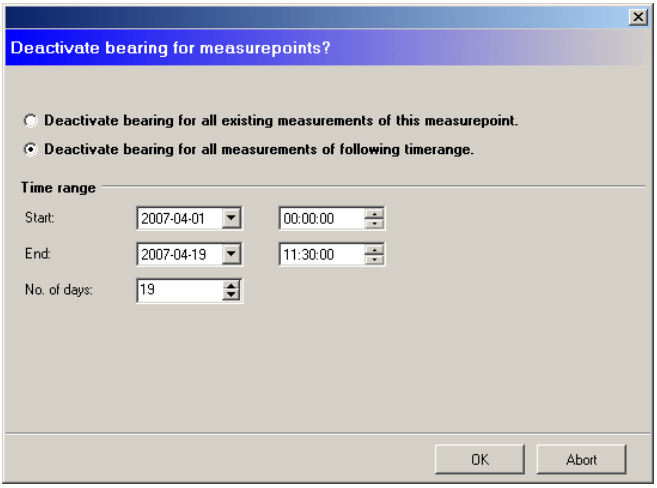
- Click  and select the bearing from the bearing database.



- Selecting measurements:
  - If you want to apply the bearing information to all saved measurements, click **Add this bearing to all existing measurements of this measuring point**.
  - To apply the bearing information to measurements in a certain time range, click **Add this bearing to all measurements of following time range** and select the time range.
- In the **Bearing configuration** section enter the speed transmission ratio (SPF) and select whether the bearing has a fixed outer race.

Disable bearing

- Click on the bearing to delete and then .



- Selecting measurements:
  - To delete the bearing information from all saved measurements of this measuring point, click **Disable the bearing for all existing measurements of this measuring point**.
  - To delete the bearing information from measurements in a certain time range, click **Deactivate bearing for all measurements of following time range** and select the time range.

Displaying bearing information

- Click on the desired bearing and then . This displays the bearing information in the bearing database.

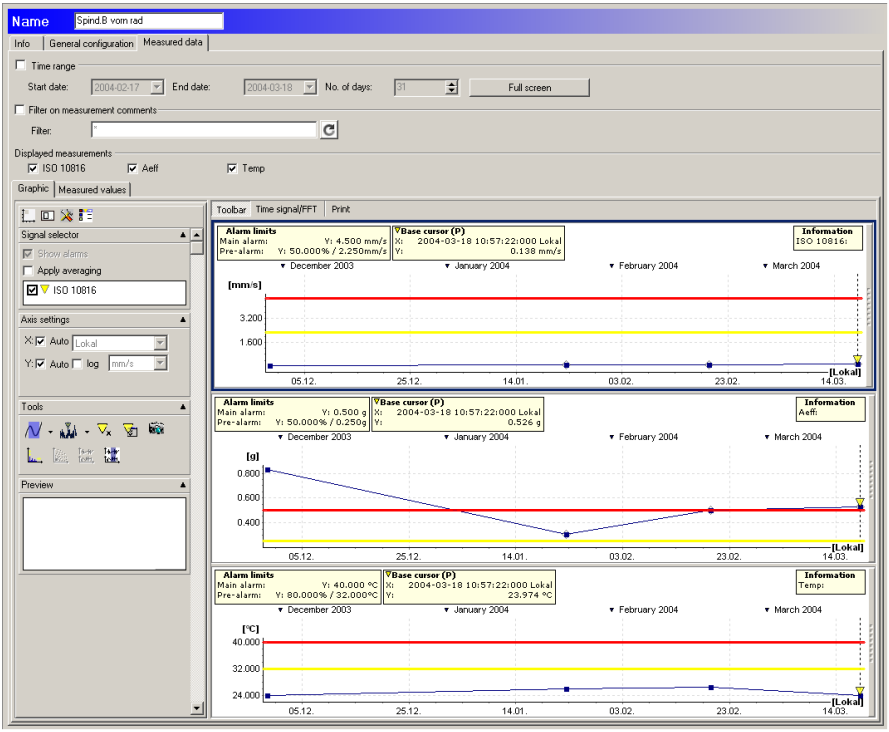
Further information in Evaluating measured data with the FIS Viewer.

4.9.2 Graphic

On the **Diagram** tab, Trendline depicts the measured readings in a trend diagram with the aid of the integrated FIS Viewer. The viewer provides a visual representation of the signals and characteristic values delivered by the Detector:

- Time signals
- Fast Fourier Transformations (FFTs)
- Trend data

Additionally alarm limits are displayed in the diagram. The main alarm limit is marked by a red line, the pre-alarm limit is marked by a yellow line. You can adjust the alarm limits with the mouse.



Time range

Click on **Time range** to limit the shown data to a defined period and enter **Start date** and **End date**.

Alternatively you can select an End date and enter the **Number of days**. In this case, the Trendline sets the Start date automatically.

Full screen

Click on **Full screen** to scale the graphic to the size of your monitor.

Filter by comments

- If you want to display measured data with a particular comment, select the option **Filter by measurement comments**.
- Enter the desired comment in the "Filter" field. You can use the wildcards "?" and "*" in the usual way, e.g.
  - "*Pump*" to find all measurements containing Pump or
  - "?200*" to find all measurements whose comment includes the text "200" at

position 2-4.

- Click on **Enter** to start filtering or click on **Reload**.

Displayed measurements

Activate the check mark in front of the measurements that should be shown additionally.

Toolbar

Click **Toolbar** to show/hide Viewer toolbar. For further information, please refer to the description of the FIS Viewer in the "Toolbar" section.

Time signal, FFT signal

If a certain value on the trend diagram is marked with a small circle, this means that there is a time signal for this measurement. You can view this time signal by marking the value with the cursor and then clicking on **Time signal/FFT**. If there is no time signal for the selected value, this symbol is grayed out and cannot be selected.

Adjust alarm limits with the mouse

The alarm limits are displayed as colored lines in the diagram. The yellow line represents the pre-alarm limit, the red line the main alarm limit. You can adjust the alarm limits directly in the diagram by using the mouse. The changed values will be set automatically to each characteristic value.

- Press left on an alarm limit line.
- Hold the mouse button down while
- dragging the line to the new position.

The originally alarm limit will be displayed as a thin line in the diagram.



A pre-alarm limit cannot be placed above a main alarm limit.

Changes to the alarm limits are not activated till they have been sent with a configuration to the Detector.

Print time signal, print FFT signal

Click these buttons to include the respective signal in the trend report (cf. "Printing").

Print

Click **Print** to create a trend report. The trend report combines the diagrams of the selected measured data for printing. Each diagram is printed on a separate

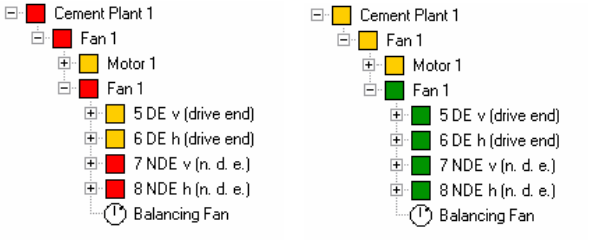
page.

More detailed information on the viewer can be found here.

4.10 Reset alarm status

In the system structure for each element the Trendline software displays whether an alarm or pre-alarm was measured (also see "Main window[39]"). It may be sensible to reset this alarm status if the cause of an alarm has been identified and eliminated. The alarm status must be reset manually by the user as this decision cannot be made by the Trendline software.

- To reset the alarm status for a configurations element (e.g. machine or motor) and the associated sub-elements, click on the element in the system tree.
- Then click **System** > **Reset Alarm Status**.



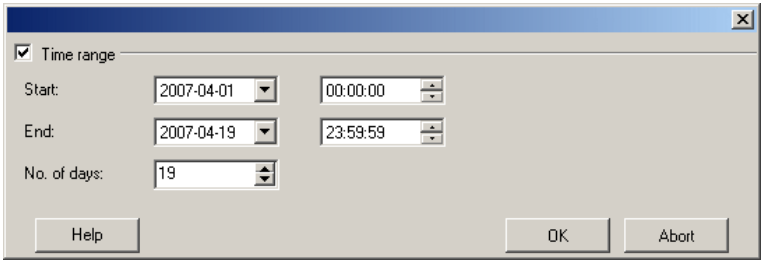
Only the status display in the system structure is affected when the alarm status is reset. The measuring data[117] status displays remain unaffected.

4.11 Delete measured data

You can delete measured data for a particular time range in the database. In doing so, the characteristic values (i.e. trend data) and the time signals recorded during that period of time are deleted. To delete data follow the sequence below:

- Left click the element in the configuration tree, from which you want to start deleting data. All data relating to the measuring points of this machine are deleted for the selected time range.
- Click on **System** > **Delete measured data** or right-click on this point and select **delete measured data**.

Opens the **Delete measured data**:



- Select the date and time for the start and end of the desired time range.
- Click on **Period** to deactivate the option and delete all data.
- Click on **OK** to delete the data for the period selected.

Please observe that the data will be permanently deleted if you click "OK" in the above window and cannot be restored! There is no way of restoring the data!

4.12 Log file

In an internal protocol file (also called log file) are all system messages and additional information on import and export operations are logged. If an error occurs during Trendline or Detector operation, then an error message is recorded along with additional information in an internal log file. You can use the Trendline software to retrieve this log file from the Detector and then send it by e-mail to our Support.

You can open a log file with a text editor or a word program.

Save log file of the Trendline software

- Click on **Extras** > **Save Trendline log file**.
- Select the saving location and
- click on **Save**.

Download log file from Detector

With the Trendline software you can download the log file from the Detector as follows:

- Connect the Detector to your computer with the data cable.
- Click on **Detector** > **Load Detector log file**.
- Click on "...", select the saving location and enter the file name.
- If the log file should be deleted after transferring to the Detector, check the box **Delete log file on the Detector after download**.
- Click **OK**.

4.13 E-Service

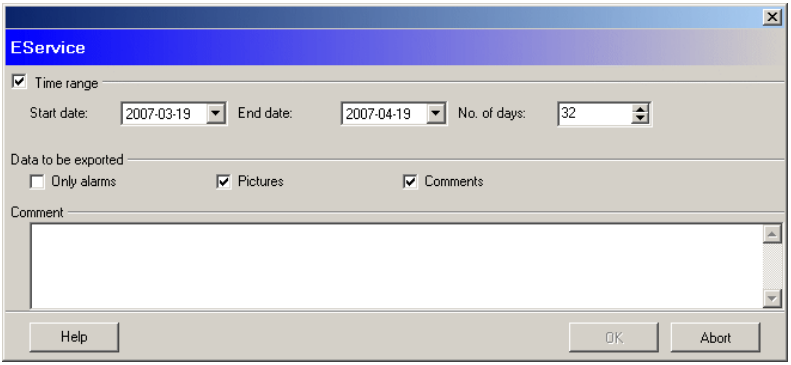
The Trendline software enables you now for the first time to utilize the services of FAG Industrial Services GmbH easily and conveniently. Regardless of whether we can assist you with the selection of measuring points or the analysis of the vibration signals recorded by you, the **E-Services** function allows you to send all data necessary to FAG Industrial Services GmbH by e-mail.

Before you begin

These services are economical, but subject to charge. You will find detailed information on our website www.fis-services.com. Or just contact our sales department (Tel. +49-(0)2407-9149-99 or sales@fis-services.com). If you have a valid service contract, you can enter the contract number in the Options menu (Extras > Options > E-mail). The contract number together with your e-mail address are needed for identification.

Send data

- In the configuration tree, select the first element you would like to use to send data. Now, click on  or on **Service** > **E-Service**. The following window now opens:



At the top of the window you can adjust the time range containing the data you

want to send. If you have unchecked the **Time range** checkbox, all previous data will be sent.

Enter at **Data to be exported**, which data shall be transferred. If no data can be sent via this selection anymore, i.e. if you want to send alarms only, but no alarms are in the selection, the **OK** button will be disabled.

- Now click on **OK** to send the data. Depending on your e-mail settings the data are transferred immediately or they are copied into an Outlook mail, which you will have to send manually.

4.14 Create reports

The Trendline software offers the following report types:

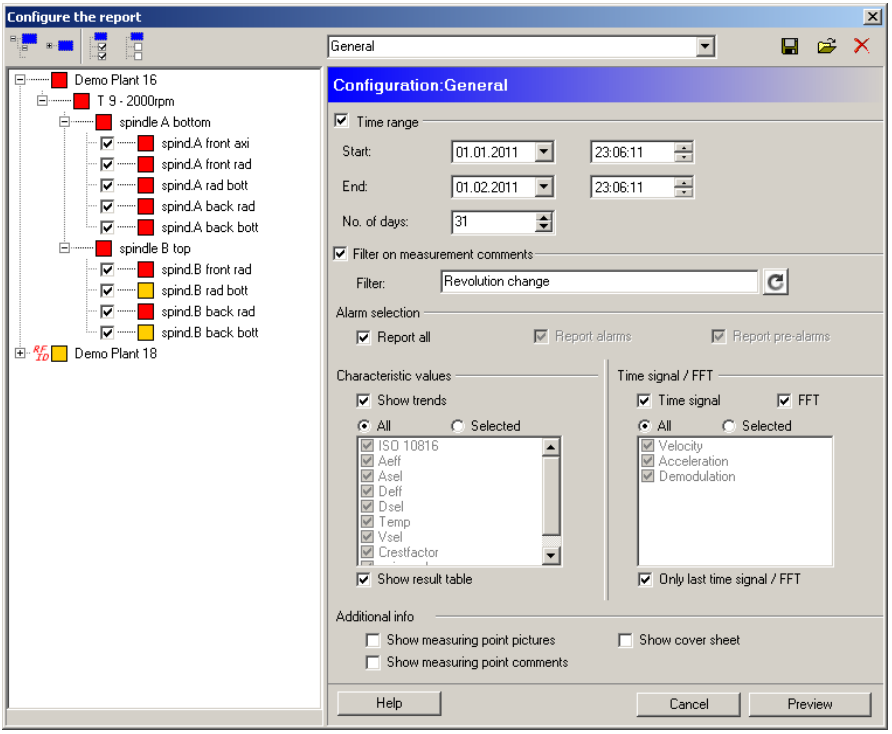
- The measurement report[127] provides a comprehensive overview of the measured values for the sensors defined in the configuration in tabular and graphic form.
- You can use the alarm report[132] to create an overview of pre-alarms and main alarms accumulated to date for freely selectable elements in your configuration.
- The route report[133] presents all measuring points and corresponding measurement signals for a given route in the form of check lists. You can systematically and reliably "work through" the measuring point of a route with the aid of the route report.
- The balancing report[133] provides you with a clear overview of balancing measurements carried out for one element of your configuration.
- The run up/coast down report[135] creates an overview of the run up/coast down configuration settings and the associated amplitude/phase diagrams.
- The amplitude/phase report[134] creates an overview of the amplitude/phase configuration settings and the associated amplitude/phase diagrams.



Also see report options[149].

4.14.1 Measurement report

To create a measurement report click on **Measurement report** in the **Service** menu. The **Configure report** window opens.



In this window, you can:

- select which measuring points from the configuration should be displayed;
- specify the scope and content of the report;
- save the report configuration or load a previously saved configuration.

Select measuring points

Trendline displays all available measuring point configurations in the left-hand area of the configuration window.

- Select individual measuring points to display the corresponding measured values in the report.
- Click on  to select all measuring points.
- Click on  to delete the selection.

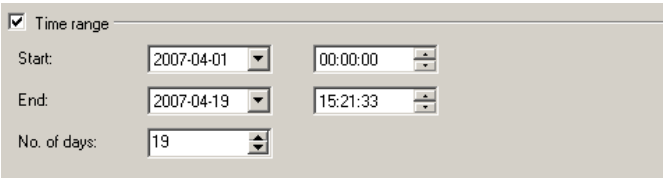
Scope and content

In the right-hand area of the configuration window you can specify the settings for

the scope and content of the measurement report:

Specifying a report time range

- Select the **Time range** option to restrict the period that is reported.



- Enter the start and end time. Alternatively, you can enter the end time and specify the duration in whole days in the **No. of days** input field. In this case the start time will be determined automatically.

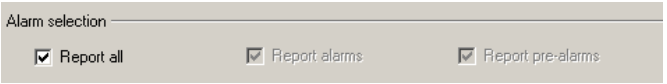
Filter by comments

- If you want to display measured data with a particular comment, select the option **Filter by measurement comments**.
- Enter the desired comment in the "Filter" field. You can use the wildcards "?" and "*" in the usual way, e.g.
  - "*Pump*" to find all measurements containing Pump or
  - "?200*" to find all measurements whose comment includes the text "200" at position 2-4.
- Click on **Enter** to start filtering or click on **Reload**.

Alarm selection

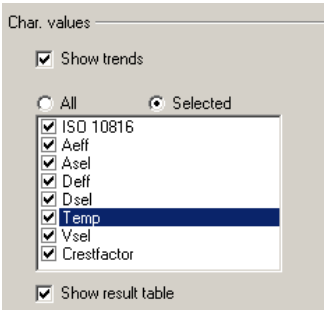
Pre-alarms and main alarms can be displayed separately or together.

- Click on **Report all** to select all alarms; to select individual alarm types click on **Report alarms** or **Report pre-alarms**.



Select characteristic values

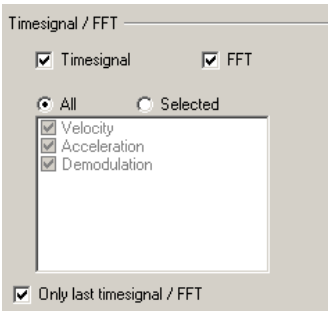
- Under **Char. values**, select which characteristic values should be displayed.



- Click on **Show trends** to create a trend graph that of the measured values for the period specified.
- Click on **Selected** to display only a selection of available characteristic values and select the required characteristic values from the list.
- You can use the **Show table of results** option to instruct Trendline to create a table containing the measured values.

Select time signal / FFT

In the **Time signal / FFT** area you can specify which time signals are displayed and also whether their corresponding frequencies should be included in the report.

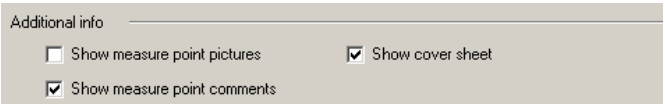


- Click on **Time signal** or **FFT** to activate the corresponding display.
- Click on **Selected** to display only a selection of available signals and select the required signals from the list.
- Click on **Last time signal / FFT only** to display only the last signals saved in each case. All previous measurements will be ignored.

Display additional information

The following options can be selected under **Additional info**:

- **Show measuring point pictures** to include the pictures inserted in the measuring point configuration 58;
- **Show measuring point comments** to have the report include comments entered in the measuring point configuration 58;
- **Show cover sheet** to output a cover sheet.



Save / load report settings

You can save the report settings for use at a later date.



- To do this, click on the diskette symbol. The **Insert configuration name** window opens.
- Enter the name of the configuration you would like to save in the **Configuration name** field. If this name already exists, you can either overwrite the existing configuration or cancel this operation.

Create report

- Click on **Preview** to create the report. The report window opens.



Trendline outputs a warning if your chosen settings will cause a substantial report to be generated accompanied by a time-consuming calculation.

You still have the option of canceling the operation at this stage in order to reduce the report period or the quantity of data that will be output.

You can use the toolbar to control the screen display:

- The display size can be defined in **View**. Select **Percent adjustable** to enter a zoom factor expressed as a percentage in the **Percent** input field.
- You can navigate forwards or backwards through the report and also jump to the start or end of the report using the arrow buttons.
- Click on  to print out the report.

4.14.2 Alarm report

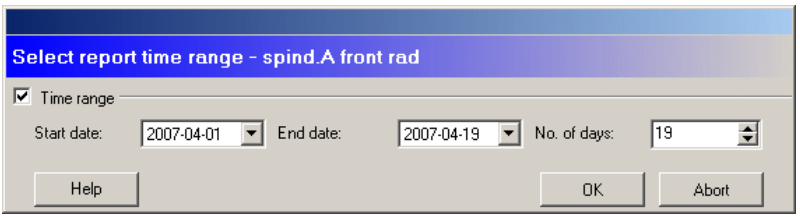
You have the option of displaying main alarms and pre-alarms in an alarm report using the Trendline software.

The alarm report incorporates sections for main alarms and pre-alarms. All characteristic values for a given measuring point will be displayed in the main alarm section where at least one main alarm exists for this measuring point. Characteristic values having a main alarm are displayed in bold; for pre-alarms they are in italics. If neither a main alarm nor pre-alarm exists, the relevant characteristic value is displayed in gray.



Where a main alarm exists for a characteristic value, the main alarm threshold is used as reference for the exceeding value, and where a pre-alarm exists the pre-alarm threshold is used as reference.

- To do this, select the element in the configuration tree from which you wish to create the report.
- Click on **Service** > **Alarm report** or click on  in the Toolbar .



- Select the **Time range** option to define the limits for the report period. Enter the start and end time. Alternatively, you can enter the end time and specify the duration in whole days in the **No. of days** input field. In this case the start time will be determined automatically.
- Deactivate the **Time range** option to incorporate all available data in the report.
- Click on **OK** to create the report. The report window opens.

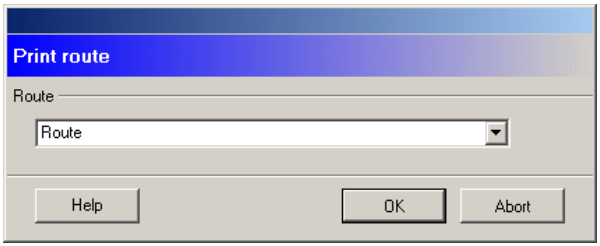
You can use the toolbar to control the screen display:

- The display size can be defined in **View**. Select **Percent adjustable** to enter a zoom factor expressed as a percentage in the **Percent** input field.
- You can navigate forwards or backwards through the report and also jump to the start or end of the report using the arrow buttons.
- Click on  to print out the report.

4.14.3 Route report

You can use the Route report to create an overview of settings and measuring points for a specific route.

- Click on **Route report** in the **Service** menu and select a route that has been defined in your configuration.



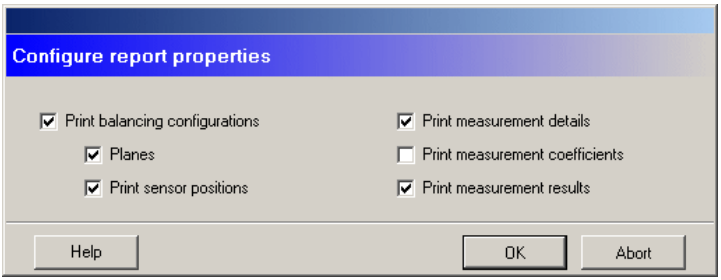
- Click on **OK** to create the report. The report window opens.

You can use the toolbar to control the screen display:

- The display size can be defined in **View**. Select **Percent adjustable** to enter a zoom factor expressed as a percentage in the **Percent** input field.
- You can navigate forwards or backwards through the report and also jump to the start or end of the report using the arrow buttons.
- Click on to print out the report.

4.14.4 Balancing report

To create a balancing report, click on an element of your system structure. Next click on **Balancing report** in the **Service** menu. The **Configure report properties** window opens.



- **Print balancing configurations**: If this option is selected the settings for the balancing configuration 69 are printed with the report.
- **Print planes**: Information on the planes is included in the report.

- **Print sensor positions**: Information on the trigger sensor and vibration sensors is included in the report.
- **Print measurement details**: The individual steps of the balancing measurement, the amplitude and phase of the vibration, the time of measurement and the rotational speed are documented in the report.
- **Print suggested weights:** The suggested weights are documented.
- **Print measurement coefficients**: The coefficients determined during balancing are also displayed.
- **Print measurement results**: The start and end of the imbalance amplitude, the imbalance reduction and information on the balance weights determined are included.
- Click on **OK** to create the report. The report window opens.

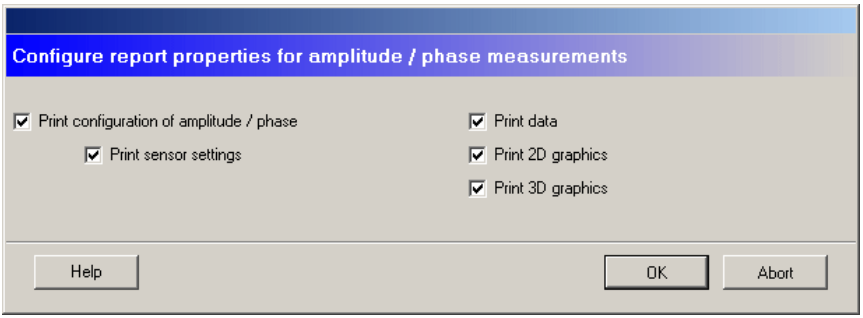
You can use the toolbar to control the screen display:

- The display size can be defined in **View**. Select **Percent adjustable** to enter a zoom factor expressed as a percentage in the **Percent** input field.
- You can navigate forwards or backwards through the report and also jump to the start or end of the report using the arrow buttons.
- Click on to print out the report.

Further information under Add balancing configuration 69.

4.14.5 Amplitude/phase report

To create an amplitude/phase report, select an element in your system tree and click **Amplitude/phase report** in the **Service** menu. The report will be created for all amplitude/phase configurations contained in the element that is selected.



Selecting data for the report

- **Print amplitude/phase configuration**: If this option is selected the settings for the amplitude/phase configuration are printed. In order to print the sensor

settings, choose the option **Print sensor settings**.

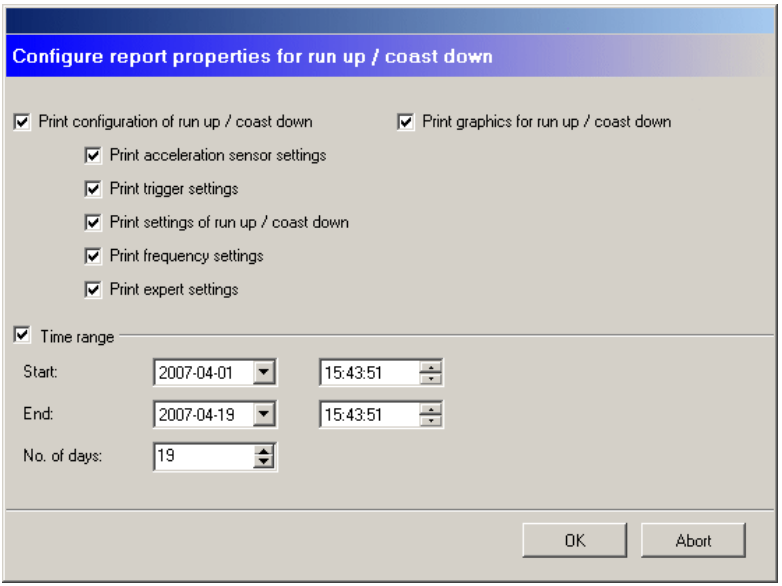
- **Print data**: Choose this option to print the measured data available for the particular measuring point.
- **Print 2D graphics/Print 3D graphics: Select this option to print the corresponding amplitude/phase graphs.**
- Click on **OK** to create the report. The report window opens.

You can use the toolbar to control the screen display:

- The display size can be defined in **View**. Select **Percent adjustable** to enter a zoom factor expressed as a percentage in the **Percent** input field.
- You can navigate forwards or backwards through the report and also jump to the start or end of the report using the arrow buttons.
- Click on to print out the report.

4.14.6 Run up/coast down report

To create a run up/coast down report, select a run up/coast down configuration in your system tree and click **Run up/coast down report** in the **Service** menu. This displays the Run up/coast down configuration.



Selecting data for the report

- **Print configuration of run up / coast down**: If this option is enabled, all

amplitude/phase diagram and run up/coast down test settings are also printed. To hide/show specific sections of this configuration 82, please use the other options.

- **Print run up/coast down diagrams**: The run up/coast down measured data 85 available for the measuring point are also printed as an amplitude/phase diagram, including any frequency bands.

Specifying a report time range

- Select the **Time range** option to restrict the period that is reported.
- Enter the start and end time. Alternatively, you can enter the end time and specify the duration in whole days in the **No. of days** input field. In this case the start time will be determined automatically.
- Click on **OK** to create the report. The report window opens.

You can use the toolbar to control the screen display:

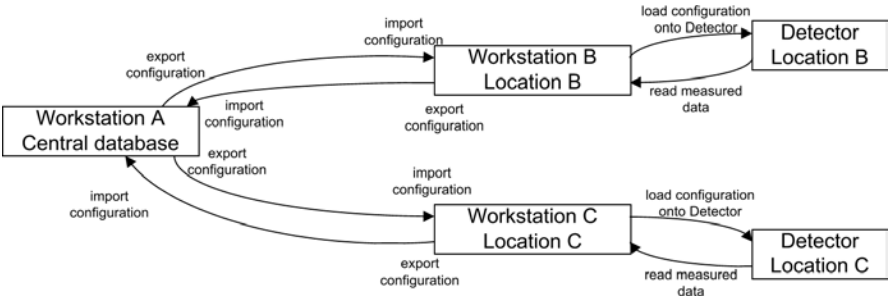
- The display size can be defined in **View**. Select **Percent adjustable** to enter a zoom factor expressed as a percentage in the **Percent** input field.
- You can navigate forwards or backwards through the report and also jump to the start or end of the report using the arrow buttons.
- Click on  to print out the report.

4.15 Importing and exporting data

Import and export between different workstations

In Trendline every measuring point in the database has a unique number, the so-called GUID (Global Unique Identifier). This number is only stored in the database and is not displayed in the software. This allows configurations and measuring points to be identified unambiguously among several computers. Consequently, when exporting data from one computer and then reimporting it, the data will be automatically recognized and sorted correctly. This will be explained in more detail using an example.

The data that has been measured is evaluated at a central location. However, this should be measured on several locations. This exports a part of the configuration containing the measuring points for location B and imports it to a computer at location B in Trendline. The data are imported into the Detector, the measuring points are measured and the measured data are read back into the computer. The configuration is now exported from computer B and imported into the Trendline at the central location. The following is an graphic illustration of this behavior.



4.15.1 Export wizard

The Export Wizard allows for the flexible selection of export data. For example, you can include pictures and comments, specify a period for the data to be exported or export only selected data objects.

To export data, proceed as follows:

- Click on **Export** > **Export wizard** in the **File** menu.

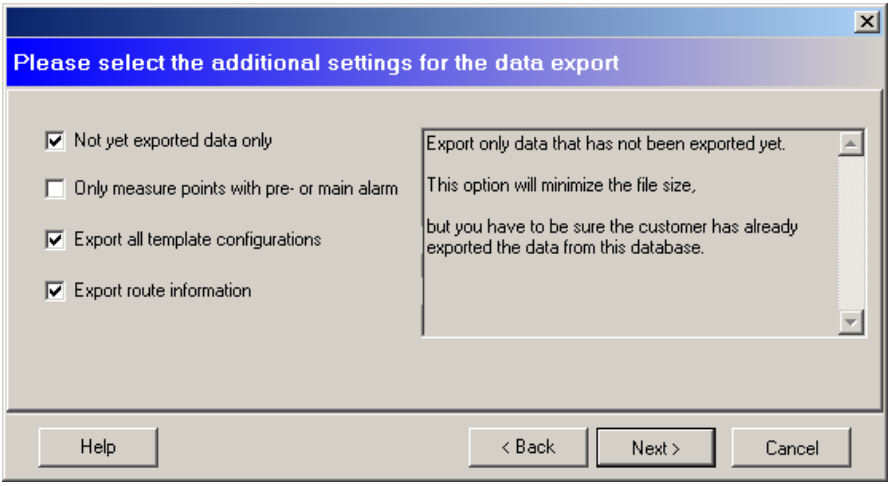
This launches the Export Wizard, which guides you step by step through the export function. First select an export file.

- To do so, click **File name** and enter a name.
- Next decide whether **pictures** and **comments** should also be exported.



Note that pictures in particular can increase file size dramatically. Make sure that there is enough memory available.

- Now decide whether Trendline should export **All Data** or just a **Selection**. If you select "All data" the exported file may be very large.



In the next step you can define the export data:

- Activate the checkbox before **Not yet exported data only**, **Only measure points with pre- and main alarm** and/or **Export all template configurations**.
  If you selected "All data", you can also **Export route information**.
- Click on **Next**.
- To export data of a specific time range activate **Time range** and define the range.
- Click on **Next**.
- Click on **Finish** to apply your settings and create the export file.

The data is exported in the Trendline 3 format (tr3).

4.15.2 Export a single measuring point

You can export the data assigned to an individual measuring point to a text file to edit them with another program. The Trendline software saves the export files in one or several files in CSV format ("comma separated values"), i.e. data on a line are separated by semicolon. You can open files in CSV format with any common spreadsheet software to get a clear overview of the data in a table.

In addition to the measuring point data proper, the Trendline software also saves a file called "VersionInfo.csv" containing details on the program version and the database used.

Proceed as follows to save a measuring point:

- Click on the measuring point in the configuration tree.
- Click on **File** > **Export** > **Measuring point**.
- Select the directory where you want to save the file and enter a file name. The

program automatically adds the .csv ("comma separated variables") extension.

- Click on **OK** to export the data.

Below is a description of the contents of the export file depending on the type of measuring point.

Measuring point from a Cm configuration

If you export a measuring point from a CM configuration, the Trendline software saves a general export file with details of the configuration and other files with the time signals.

The general export file contains a line for each measurement containing the following:

Heading	Contents
idx	Measurement identification number.
State	Alarm Status: 0 – no alarm, 1 – pre-alarm, 2 – main alarm
Timestamp	Measurement timestamp.
Velocity	Export file with velocity time signal (the signal is an acceleration signal, see also "Time signals 271").
Acceleration	Export file with the acceleration time signal.
Demodulation	Export file with the demodulation time signal.
Data x	Characteristic value measured
Name x	Name of characteristic value
Type x	Type of characteristic value 269.
Prealarm x	Pre-alarm threshold in % of the main alarm threshold.
Alarm x	Main alarm threshold.
Measuring point	Name of measuring point
export_timestamp	Export time
Comment	Measuring point comment
used_revolution	The rotational speed input by the user after the measurement. This value is identical to the rotational speed actually measured until it is changed.
config_revolution_delta	The maximum rotational speed deviation set in the measuring point configuration
config_revolution	The rotational speed set in the measuring point configuration.

Heading	Contents
revolution	The acquired speed on the Detector.
viewer_config_x	Configuration data for the FIS Viewer.

- The entries "Name", "Type", "Prealarm", "Alarm" and "Data" are created for every existing characteristic value, i.e. a maximum of four times. **x** designates the serial number of the characteristic value.
- The entries "Velocity", "Acceleration" and "Demodulation" refer to other CSV files with the data of the measured time signals.

The time signal files are structured as follows:

- The file header contains the data.

Heading	Contents
idx	Measurement identification number.
Internal Number	Internal number identifying the measuring point.
Timestamp	Timestamp.
ValueUnit	Detector channel (velocity, acceleration or demodulation) of the measurement, as a figure and in plain text.
length	Column 1: Internal control index, Column 2: Number of FFT lines set in the configuration.
Ampl	Amplifier setting used in the measurement. Amplification factor = 2^{Ampl}, where 0 means amplification factor 1, 6 amplification factor 64. This constant is already considered in the time signal values.
Scale factor	Scale factor for the measurement. This has been worked into the time signal value already just as well.
Sample rate	Sample rate in samples per Second.
Rotational speed	The acquired speed on the Detector.
GUID	Global unique identification number of the measuring point.
Timesignal count / FFT count	Number of time signals and FFT values

- The time signals and FFT values are stored in four columns under the header.
  - Column 1 contains the time of the measurement in seconds from the start of the time signal, column 2 contains the time signal measurement.
  - Column 3 contains the frequencies of the FFT in Hz, column 4 the

amplitudes.

Measuring point from a balancing configuration

If you export a measuring point from a balancing configuration, the Trendline software saves a general export file with details on the configuration, the balancing jobs and the weights. In addition, the program creates one file per balancing step ("Data File<n>.csv") containing the associated sensor data.

The general export file contains the following details:

Heading	Contents
Data File	Export file with the sensor data.
Balancing measurepoint	Name of measuring point
Job Number	Number of the balancing job.
App. weight 1 amplitude	Amplitude of the weight used in plane 1.
App. weight 1 angle	Position angle of the weight used in plane 1.
App. weight 2 amplitude	Amplitude of the weight used in plane 2.
App. weight 2 angle	Position angle of the weight used in plane 2.
comment	Measurement comment.
step_type_text	Type of balancing step (reference run, trial run, etc.).
remove_weights_text	Indicates what weights were removed.

The sensor data files contain the following details:

Heading	Contents
Sensor position	Name of sensor position.
Amp. Coeff. plane 1	Amplitude of the coefficients in plane 1.
Ph. Coeff. plane 1	Angle of the coefficients in plane 1.
Amp. Coeff. plane 2	Amplitude of the coefficients in plane 2.
Ph. Coeff. plane 2	Angle of the coefficients in plane 2.
Speed	Rotational speed.
Amplitude	Amplitude of the vibration.
Phase	Phase of the vibration.

Heading	Contents
Timestamp	Measurement timestamp.
export_timestamp	Export time

Measuring point from a run up/coast down configuration

If you export a Measuring point from a balancing configuration, the Trendline software saves a file containing the values of the amplitude/phase diagram in addition to a general export file with details of the configuration.

The general export file contains the following details:

Heading	Contents
id	Identification number
Run up / coast down measuring point	Name of measuring point
timestamp	Measurement timestamp
Comment	Measurement comment
No. data points	Number of values measured in run up/coast down.
bodeplot data file	File with values from the amplitude/phase diagram
export timestamp	Export time

The file with the amplitude/phase diagram values contains the following details for each diagram value:

Heading	Contents
Amplitude	Vibration amplitude
Phase	Phase of the vibration
Frequency	Rotational speed

4.15.3 Importing data from a Trendline database

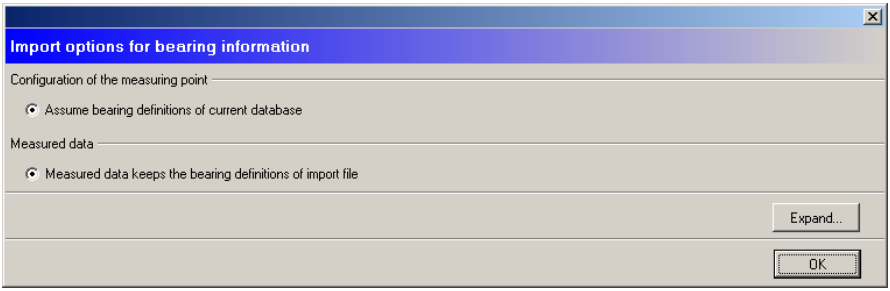
You can import configurations and measurement data that have been exported with the Export Wizard 137 in the Trendline software.

Import data of Trendline software from version 3.2

- Click on **File** > **Import** > **Trendline data (.tr3)**.

- Select the import file with the extension "tr3".
- Click on **OK**.

The import window opens.



By default bearing information

- of measurement data will be kept
- at configurations will be overwritten with those from the current database.

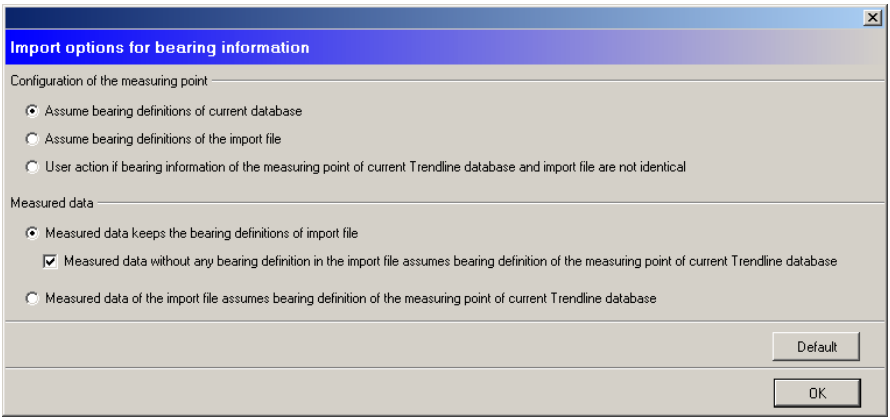
- To adopt the default import options click on **OK**.

The imported data will be added in the tree view.

Or:

- Click on **Expand** to define other import options.

Advanced settings



For the import of measurement configurations you can

- keep the bearing information of the current Trendline database or

- keep the bearing information of the import file or
- require a new user request if the Trendline software detects different bearing information.

In addition, during the import of measurement data you can
- keep the bearing information of the import file and
- replace missing bearing information with those of the current Trendline database or
- adopt bearing information of the current Trendline database.



If you use other settings than the default import options, maybe data are not comparable!

- Select the import options.

Or:

- Click on **Default** to use the default import options.
- Click on **OK** to start the import.

The imported data will be added in the tree view.

Import data of Trendline software from version 2.0.x up to 3.0.x

- Click on **File** > **Import** > **Import data from an old database (Version 2.x/3.0.x)**.
- Select the directory with import files.
- Click on **OK**.

The data will be imported. In the measurement view a vertical line indicates the import time and the border between old and new measurement data.

4.15.4 Export and import templates

To export and import templates 109 proceed as follows:

Export templates

You can export one or more templates from the Trendline software.

- Click in the menu **Planning** on **Template**.
- Click in the toolbar on .
- Enter a file name and click on **Save**.
- Activate the checkbox next to the templates that should be exported.
- Click on **OK**.

The templates are exported in the Trendline 3 format (tr3).

Import templates

If you want to import templates in the Trendline-3 format,

- click in the menu File on **Import** and
- select **Trendline data (.tr3)**.
- Select the import file in .tr3 format.
- Click on **Open**.

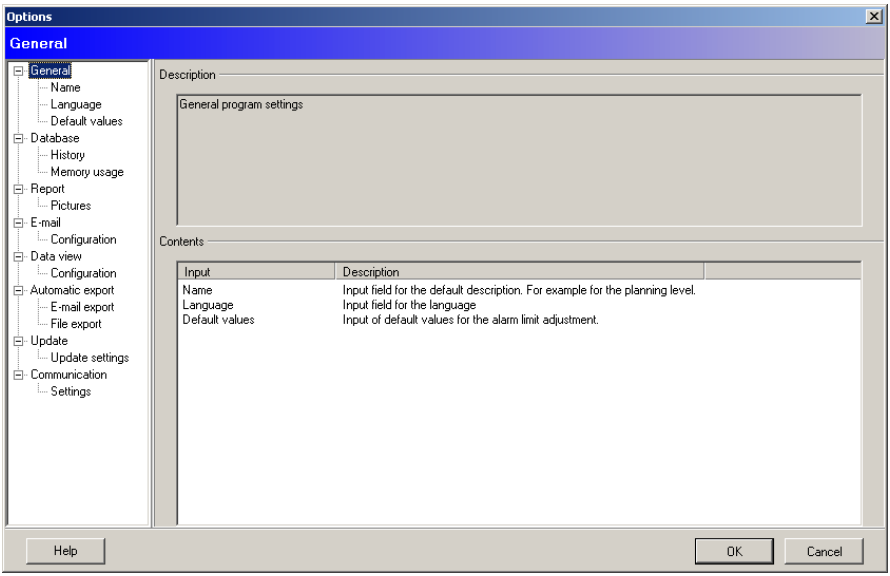
The dialog "Import options for bearing information" opens.

- Accept the default settings.
- Click on **OK**.

The templates will be imported to the Trendline software.

4.16 Program settings

You can open the general program settings configuration window via the **Extras** > **Options** menu item.



A tree view is displayed on the left-hand side of the window and shows a range of configuration options arranged in groups. You can expand the view and configuration options by clicking the symbols in front of the groups.

Information on the individual configuration options is provided or input masks are

displayed on the right-hand side of the window.

Edit program settings

- Select a group.
- Change settings and
- click on **OK**.

4.16.1 General

Name

- Click on **Name** to specify how new configurations, sections, routes, etc. should be named when you click on **New entry** or **New sub-entry**.



Please note that balancing plane identifiers on the Detector is limited to four characters.

Language

- Click on the **Language** selection box and select the dialogue language for the Trendline software.

System of units setting

In this section you can set the units system for the measured values listed.

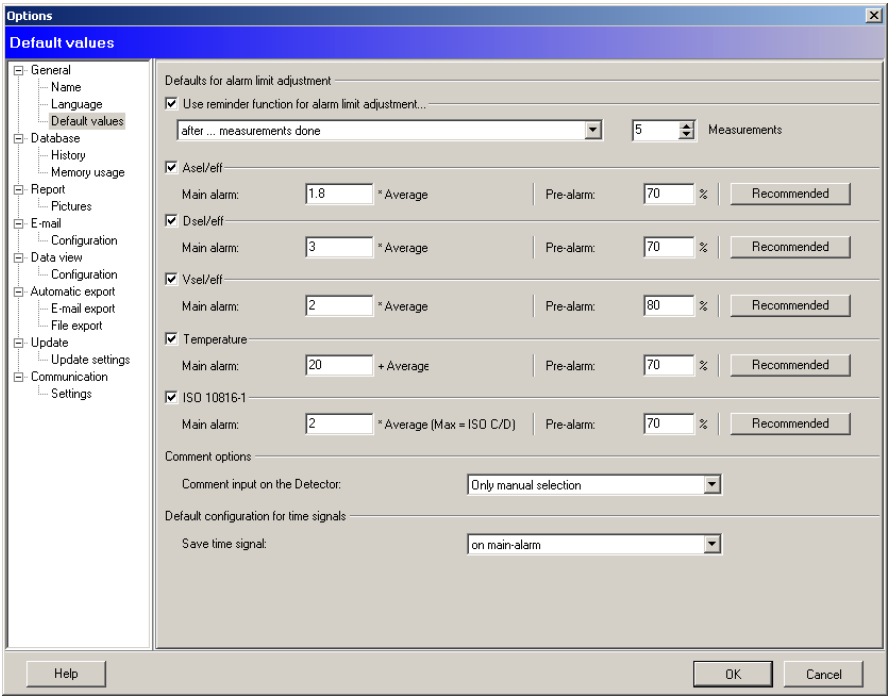
The following options are available:

- **Standard SI units,**
- **Standard US units** or
- **User-defined units**. When making these settings you can assign units from the range of available units to each measured variable individually.

Default values

- Click on **Default values** to set the standards for the alarm threshold adjustment, comment options and the time signal configuration.

If you create a new measuring point, the following values will be automatically set.



Reminder function for alarm limit adjustment

The Trendline software can remind you about the alarm limit adjustment 87.

- Activate the checkbox **Use reminder function for alarm limit adjustment** and
- choose when you want to be reminded.

Adjust alarm limits

- Configure the alarm limit settings as described in "Adjust alarm limits automatically" 87.

Comment input on the Detector

Here you can specify whether you want to enter a comment for each measurement on the Detector. Select

- "Only manual selection" if you want to select a comment manually,
- "Display after each measurement" if you want to be asked after each measurement or
- "Enforce after each measurement" if you definitely want to enter a comment to each measurement.

Default configuration for time signals

Here you can configure when time signals should be saved with measurements.

- Select "Never", "Always", "On main alarm" or "On pre-alarm".



If the "Always save" option is selected for more time signals in the configuration that you wish to send to the Detector than are permitted in the Detector memory an error message will be output and the data will not be transferred. For more on this, see also chapter "Frequency analysis" (see PDF "General information on vibration monitoring" on the delivered CD-Rom).

4.16.2 Database

History

- Click **History**.

In the **Number** field you can adjust how many entries the list of recently opened databases in the **File** menu will contain. The default value is 10.

Memory usage

- Click on **Memory usage**.

The following information to the used database will be displayed:

- Name of database program
- Name of database server
- Name of database
- used space
- free space

The ratio of free to used memory is also presented as a diagram.



The displayed free space and the diagram can only provide plausible information when the database and database server are installed on the same system.

Database optimization

You should run the database optimization periodically. This helps to accelerate the database access and minimizes the used space.

- Click on **Database optimization**.

4.16.3 Report

Pictures

- Click on **Pictures**.

You can specify what pictures to print on a Trendline report[127] cover sheet here. The pictures are scaled automatically for the printout.

If you select **a picture** in the Vignette area this is printed at the bottom of the cover sheet on the left.

You can specify which picture is to be printed in the center of the cover sheet in the **Large picture** area.

In the **Logo section** you can specify what logo to print on the top right of all pages except for the cover sheet.

To change the pictures, proceed as follows:

- Click **Edit** and select the desired graphics file. Trendline displays a preview and the file name.
- To remove a graphic file again click on **Delete**.

4.16.4 E-mail

Configuration

In order for Trendline to be able to send data by e-mail (see also E-Service[126] or Automatic export[150]), you must enter the name of the sender, the recipient and the contract number.

- Click on **Configuration**.
- Enter your own e-mail address in **From**.
- Enter the e-mail address specified in the contract (e.g. nemo@fis-services.de) in **To** and the number of your service contract in **Contract number**.
- You can enter a text in the **Comment** field which will appear by default when the e-mail window is opened.

Advanced settings

- Click **Configure** to set the protocol for Trendline to send e-mails. Trendline supports **Microsoft Outlook**, **MAPI** or **SMTP**. Consult your network administrator to obtain the correct settings.
- To test whether e-mails are being transferred correctly click **Test connection**.
- Click **OK**.

4.16.5 Data view

Configuration

- Click **Configuration** > **Configure**.

This opens the **Configuration window of the Viewer**. For further details, refer to Viewer section "Program settings".

4.16.6 Automatic export

The Trendline software can automatically export data from CM measurements 223 as soon as the Detector receives them. It can automatically send the exported data by e-mail or save them to a compressed ZIP file.

E-mail export

- Click on **Automatic** to activate automatic export and subsequent dispatch by e-mail.
- Click on **Only on alarms** to carry out the automatic e-mail export only if the data received from the Detector contains alarms.

File export

- Click on **Automatic** to tell the software to export data automatically to a file.
- Click on **Only on alarms** to perform the automatic file export only if the data received from the Detector contains alarms.
- In **Default file name (.tr3)** enter a name for the ZIP file to be saved. The file name must include the ".zip" file suffix.
- Select the storage location for the exported file at **Default directory**.

4.16.7 Update

Update settings

The Trendline software can check in user-defined intervals whether an update for the Trendline of Detector firmware is available for download from our Internet server.

- Click on **Update settings**.
- Configure the settings as described in "Automatic notification for updates 36".

4.16.8 Communication

Settings

On the Detector, a Trend of 2 to a maximum of 20 characteristic values can be shown. In addition, you can send the latest trend data from the Trendline software to the Detector. The number is limited to a maximum of 10 values. The trend data will be send with a configuration to the Detector.

- Click on **Settings**.
- Activate **Send trend data to Detector** and
- select how many trend data should be send to the Detector.

4.17 Exit program

To exit the program,

- click **File** > **Close**.

5 FIS Viewer

5.1 About the FIS Viewer

FIS Viewer displays the signals and characteristic values provided by the FIS hardware. With the aid of the various Viewer navigation and cursor tools you can change the display of the data and perform an error analysis. The aim of the analysis is to identify possible damage as exactly as possible so as to be able to perform repairs in good time and thus avoid downtimes.

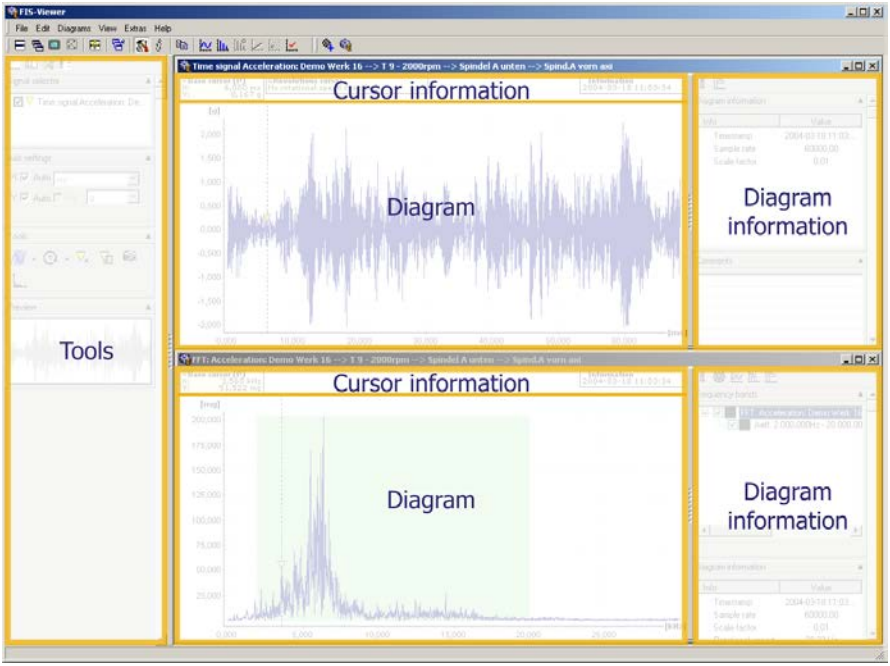
The following chapter explains the work interface 152. It goes on to provide more information about working with the Viewer 161.

5.2 The work interface

5.2.1 Work interface areas

- The toolbar 153 contains various tools which can be used to arrange the diagrams and display/remove the tool area and diagram information bar as well as other tools which can be used to export measurement data, display the corresponding configuration for the data set selected and create a measurement report.
- You will find a range of navigation tools in the tools 154 working area which can be used to modify the way in which the diagrams are presented and also find a number of different cursor tools for carrying out fault analyses. The choice of tools which can be used varies according to the type of diagrams displayed (FFTs, time signals or trend data).
- The main area of the work interface contains the diagram 158 and the cursor and measuring information 158 area, in which the corresponding values for the selected cursor are displayed.
- You will find additional information in the diagram information bar 159 area (on measurement data for example) depending on the diagram type displayed. You can use the tools in this working area to do the following:
  - enter comments into the diagram
  - select frequency bands with FFTs in order to determine characteristic values for the fault analysis
  - determine the maximum, harmonic or sideband values from the diagram depending on the cursor type.

The diagram information bar area for each diagram can be displayed or hidden as required and can be used to zoom in on the diagram area.



5.2.2 Toolbar



You can use the **Tile windows horizontally** button to arrange open windows vertically above one another in the working area of the Trendline Viewer.



You can use the **Cascade windows** button to arrange open windows so they overlap in the working area of the Trendline Viewer.



You can use the **Show current diagram in full screen** button to fill the entire screen of the Trendline Viewer working area with the current diagram selected.



You can use the **Arrange icons** button to arrange minimized windows horizontally from left to right in the working area of the Viewer.



If the **Arrange diagrams automatically** button is activated the size of the diagram always adjusts automatically to fit the available working area (when the tool area is displayed or removed, for example).



You can view a list of the windows that are currently open and make your selection using the **Show list of all diagrams** button. The selected diagrams are arranged horizontally and the rest of the diagrams are minimized.



You can use the **Show toolbar** button to display/hide the tool bar in the working interface of the Trendline Viewer.



You can display/remove the information bars of all open diagrams using the **Show diagrams information bars**.



You can open a list of the windows that are currently open using the **Paste selected diagrams to clipboard** button. From this list you can also select whether the accompanying information text should be copied together with the diagram and define the size of the diagram. The diagrams selected are copied together to the clipboard as one graphic object.



You can use the **Show time signals** button to only show the time signal windows. All other windows will be minimized.



You can use the **Show FFTs** to only show the FFT windows. All other windows will be minimized.



The **Show all diagrams** button maximizes all diagram windows.



The **Add additional bearing to the FFT** button adds a bearing to the current FFT from the bearing database.



You can use the **Switch back to trendline** button to switch directly from the Viewer to the Trendline.

5.2.3 Tools

The **tools** area contains a range of adjustments which you can use to set the display area for the diagrams. A range of different individually tailored tools is available depending on the type of data set displayed (time signals, FFT or trend data). These tools can be used for example to do the following:

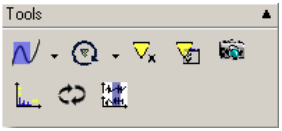
- display/hide signals within a series of signals when working with trend data,
- modify the scale of measuring ranges,
- integrate the velocity and displacement from the acceleration,
- modify the display of the measuring range to suit your individual requirements,
- navigate through a diagram easily using the navigation overview.

List of the tools available in conjunction with the corresponding diagram type

Tool	Time signal	FFT	Trend data
Automatic scaling 161	✓	✓	✓
Manual scaling 161	✓	✓	✓
Logarithmic display of axes 161	✓	✓	✓
Integration of y-axis 161		✓	
Free zoom 165	✓	✓	✓
Horizontal zoom 165	✓	✓	✓
Vertical zoom 165	✓	✓	✓
Keyboard zoom 165	✓	✓	✓
Base cursor	✓	✓	✓
Measure cursor	✓		
Difference cursor	✓	✓	✓
RMS/AMV cursor	✓	✓	
Harmonics cursor	✓	✓	
Sideband cursor		✓	
HS cursor		✓	
Revolutions cursor	✓	✓	
Positioning of base cursor	✓	✓	✓
Modify cursor properties	✓	✓	✓
Copy to clipboard	✓	✓	✓
Modifying coordinates of axes	✓	✓	✓
Signal distribution			✓
Trend filtering			✓

Zoom tools

In order to optimize the display you can enlarge any part of the diagram using the various zoom tools. You can use one of the predefined zoom tools for this or define the zoom area numerically via a dialogue window.

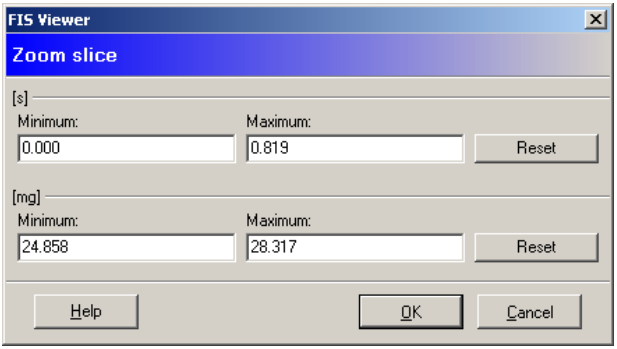


Zoom tools

Tool & symbol		Description
Free zoom		You can use the **Free zoom** tool to enlarge any given rectangular area on the x- and y-axis within a diagram.
Horizontal zoom		You can enlarge any part of a diagram in a horizontal direction using the **Horizontal zoom** tool. The range of values and scaling of the y-axis remain unchanged.
Vertical zoom		You can enlarge an area inside a diagram in a vertical direction using the **Vertical zoom** tool. The range of values and scaling of the x-axis remain unchanged.
Keyboard zoom		You can use the **Keyboard zoom** feature to enlarge an area of the diagram using the keyboard instead of the mouse.

Specifying zoom selection in dialogue window

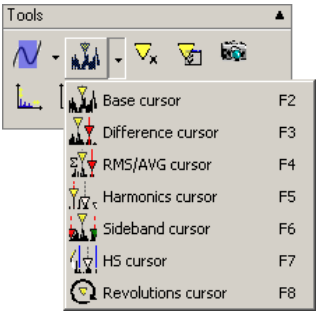
In addition to using the various zoom tools you can also specify the zoom selection via a dialogue window. To open the dialogue window which is currently active click on the zoom tool symbol.



Cursor tools

You can specify the values from a diagram to be used for an analysis with the

cursor tools. Depending on the type of diagram which has been opened appropriate cursor tools are made available which can be used to obtain individual measuring and characteristic values directly from the diagram.



Information on the current cursor is displayed above the diagram. You can show/ hide these value fields and the cursor by clicking on the cursor tool symbol that is currently active.

Tool & symbol		Description
Base cursor (FFT, time signals, Trend data)		You can use the base cursor to determine the measured values on the x- and y-axis of a measuring point.
Measure cursor (Time signals)		You can use the measure cursor to calculate the difference, the effective value (root mean spare) and the arithmetic mean between two measured values as well as the minimum/maximum value.
Difference cursor (FFT, time signals, Trend data)		You can use the difference cursor to calculate the difference between two measured values.
RMS/AMV cursor (FFT, time signals)		You can calculate the effective value (root mean square) and the arithmetic mean between two measuring points using the RMS/AMV cursor.
Harmonic cursor (FFT)		You can use the harmonic cursor to determine measured values at points in the diagram where harmonics (multiples of the basic frequency) are likely to occur.
Sideband cursor (FFT)		You can use the sideband cursor to determine additional measured values in definable sidebands starting from the base cursor.
HS cursor (FFT)		The HS cursor (Harmonic with Sidebands) combines both cursor types described above which means that both the harmonics and their sidebands will be displayed.

Tool & symbol		Description
Revolutions cursor (FFT, time signals)		The revolutions cursor marks the frequency that is assigned to a specific speed with a line.



A cursor can only be placed at a measuring point that exists. If you click on a position in the diagram where no measured value exists the cursor automatically jumps to the nearest existing measuring point.

Additional tools

In addition to the zoom and cursor tools you can use a range of further tools to change the manner in which signals or cursors are displayed and transfer data to other programs via the clipboard.

Tool & symbol		Description
Positioning of base cursor		Places the base cursor at a point in the diagram specified via numeric input. The base cursor jumps to the measuring point nearest the value entered.
Cursor properties		Opens the cursor properties dialogue window where you can change the properties of the cursor currently used.
Clipboard		Copies an image of the current diagram view into the clipboard (additional information 185).
Change diagram boundaries		Changes the display of minimum/maximum values for the x- and y-axis (additional information 186).

5.2.4 Diagram display

The diagram area shows the FFT, time signals and trend data diagrams. You can specify the desired zoom area inside the diagrams and adjust the position of the cursor using the mouse or keyboard.

5.2.5 Cursor and measuring information

The **cursor information** for the Trendline Viewer shows important values and measurement data that vary depending on the cursor tool used. Each item of cursor information contains either the value pairs for a measured value or calculated characteristic values that are obtained by combining different cursors within the diagram such as the difference cursor or RMS/AMV cursor. The cursor

information can be displayed or removed for each diagram with **Ctrl+U**.

The **measuring information** for the Trendline Viewer shows important measurement data according to the diagram type. This measuring information is always visible in the diagram and cannot be removed.

The table below shows the corresponding values displayed in the cursor information for the currently active cursor type:

Cursor type		Displayed cursor information
	Base cursor	▽Base cursor (P) X: 0.000 s Y: 0.025 g
	Measure cursor	▽Base cursor (P) X: 0.050 s Y: 43.488 mg △Measure cursor X: 0.100 s Y: 27.466 mg △Delta: X: 0.050 s Y: -16.022 mg Frequency: 19.841 Hz Min/Max Min: 25.940 mg Max: 49.210 mg RMS/AMV: RMS: 36.863 mg AMV: 35.941 mg
	Difference cursor	▽Base cursor (P) X: 0.000 s Y: 0.289 g △Measure cursor X: 0.000 s Y: 0.289 g △Delta: X: 0.000 s Frequency: 0.000 Hz Y: 0.000 g
	RMS/AMV cursor	▽Base cursor (P) X: 0.000 kHz Y: 0.000 µm/s △Measure cursor X: 0.000 kHz Y: 0.000 µm/s RMS/AMV: RMS: 0.000 µm/s AMV: 0.000 µm/s
	Harmonic cursor	▽Base cursor (P) X: 0.015 kHz Y: 3.14658E-004 g △Micro step: X: 0.015 kHz Sub index: 0
	Sideband cursor	▽Base cursor (P) X: 0.015 kHz Y: 3.14658E-004 g △Sideband delta: X: 0.015 kHz
	HS cursor	▽Base cursor (P) X: 0.001 kHz Y: 0.038 g △Sideband delta: X: 0.001 kHz
	Revolutions cursor	▽Base cursor (P) X: 0.000 kHz Y: 0.017 g △Revolutions cursor Delta x: 0.033 kHz Rotational speed: 2,000.000 RPM

5.2.6 The diagram information bar

You can find the diagram information bar in the right-hand column of the working area. This column contains additional information on the diagram currently selected and can be displayed or hidden as required.

The table below provides an overview of the corresponding information displayed with the active cursor type for FFT diagrams in the diagram information bar:

Information displayed in the diagram information bar	 **Base cursor**	 **Difference cursor**	 **RMS/AMV cursor**	 **Harmonics cursor**
Diagram information	✓	✓	✓	✓
Comments	✓	✓	✓	✓
Frequency bands	✓	✓	✓	✓
Highest peaks	✓	✓	✓	✓
Harmonics				✓
Sidebands				
Kinematic frequencies	✓	✓	✓	✓

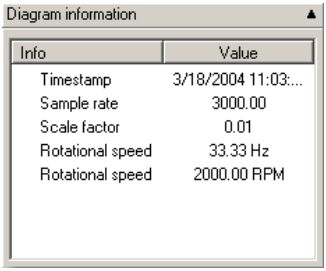
Information displayed in the diagram information bar	 **Sideband cursor**	 **HS cursor**	 **Revolutions cursor**
Diagram information	✓	✓	✓
Comments	✓	✓	✓
Frequency bands	✓	✓	✓
Highest peaks	✓	✓	✓
Harmonics		✓	
Sidebands	✓		
Kinematic frequencies	✓	✓	✓

The **Measure cursor** shows the same information as displayed by Difference and RMS/AMV cursor plus Min/Max. Diagram information and comments for time signals and trend diagrams are displayed in the diagram information bar irrespective of the cursor type selected. Further, information on the alarm values of the data set currently open is displayed in the trend diagrams.

Diagram information

This field contains general information about the measurement data including

- Information on the measuring process such as the low pass or sample rate
- Further information included in the data sets.



5.3 Working with the Viewer

5.3.1 Displaying several diagrams simultaneously

You can open several diagrams in the FIS Viewer simultaneously and arrange these in the working area according to your needs.

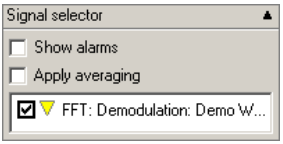
Select one of the following options from the **Diagrams** menu: **Tile horizontally**, **Cascade**, **Full screen**, **Arrange icons** or **List…**.

➔The windows are rearranged accordingly.

5.3.2 Modifying the appearance of a diagram

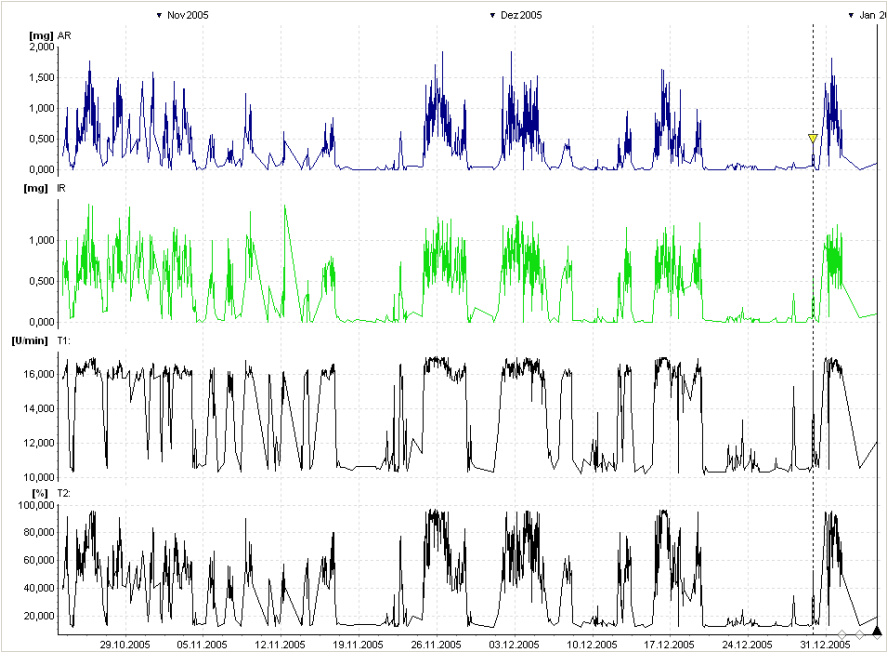
Displaying and removing signals

When a new data set is opened the Viewer simultaneously displays all signals contained in the data. In order to obtain a clearer overview you can activate or deactivate individual **Signal selection** in the list shown below. All series of measurements included in the current data set are listed in the Trendline software signals field. The options **Show alarms** and **Averaging**, are only available in Trend.

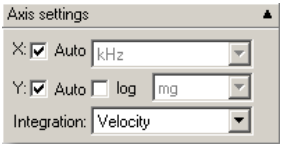


1. Click on the **checkbox** in front of the signal.

➔This signal will be displayed or removed.



Axis settings



Automatic scaling of axes

The **Automatic scaling** option sets the scaling of the diagram axes to the next 1000 scale (10^3). Based on the base unit of the diagram for measured values < 1 this automatically selects the next smaller unit (e.g. g → mg or m → mm) and, inversely, for values > 1000 the next greater unit (e.g. ms → s or Hz → kHz).

1. Click the **"Auto"** checkbox to activate it.

➔The scaling of the diagram will be adjusted automatically.

Manual scaling of axes

If you disable the **Automatic scaling** option, you can select one of the preset, equivalent units for axis scaling. The available scaling units depend on the type of diagram (e.g. Hz or kHz with FFTs for frequencies, g, mg, m/s² or mm/s² for acceleration values, "orders" for order spectrums, rotations for angular signals, s or ms for time signals, etc.). The scaling for the axes can be set independently of one another, i.e. you can specify any desired unit for the x- and y-axes individually.

1. Click the **"Auto"** checkbox to deactivate it.
2. Select one of the units provided in the **X unit** field.
3. Select one of the units provided in the **Y unit** field.

➔The axes are scaled independently of one another and can be modified according to the settings that are selected.

Logarithmic scaling of the y-axis

It may be possible under certain conditions to present signals more clearly using a logarithmic scale if they do not contain zero values or negative values. You can therefore switch over to logarithmic scaling in the diagram.

1. Click on the **Log** checkbox to activate the logarithmic scaling of the y-axis.

➔The scaling of the diagram will be modified according to the settings selected.



This option is deactivated if the measurement data cannot be presented logarithmically (if the it contains values smaller than or equal to zero, for example).

Displaying y-axis integrations

You have a number of display options for the integration of signals in FFT diagrams that contain an acceleration signal, for example:

- No integration: Acceleration
- Velocity
- Displacement

1. In the **Integration** field, select the **Acceleration** option to not integrate the signal.
2. In the **Integration** field, select the **Velocity** option to display the first integration of the signal.
3. In the **Integration** field, select the **Path** option to display the second integration of the signal.

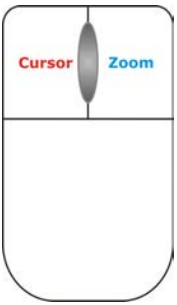
➔The scaling and display of the diagram will be modified based on the selected settings.

- *Once you have selected the integration option for the y-axis you can also modify the scaling of the axes here (automatic, manual or logarithmic) and display any desired part of the diagram using the zoom tools.*
- *No integration is possible in order spectrums.*

5.3.3 Using the mouse to control the cursor or zoom function

General

- You can position the various cursors by left clicking the mouse.
- You can adjust the zoom selection setting by right clicking the mouse.
- With the scroll wheel you can zoom and scroll in diagrams.



Zooming with the scroll wheel

If your computer mouse has a scroll wheel, you can use it to zoom-in or zoom-out of diagrams. The zoom area is changed in 10% steps.

- Click on the diagram which you want to zoom.
- Roll the scroll wheel away from you to zoom in.

Or:

- Roll it towards you to zoom out.

Scrolling in a zoom area with the scroll wheel

- Click with the **scroll wheel** in a zoom area and
- move the mouse to the left or right without releasing.

Mark zoom area with mouse

- Select one of the zoom tools 165 from the selection list.
- Mark a zoom area in the diagram using the **right mouse button**.

Your selection is marked in the diagram.

Reset zoom

- **Right click** on the diagram if you wish to return to the previous zoom selection.

Or:

- If you wish to return to the full view of the diagram hold down the **Shift-key** and **right click** on the diagram

Assign zoom area to other diagrams (Synchronous zoom)

You can assign the zoom area of all diagrams automatically, which have identical type and base units. Proceed as follows:

If you opened several datasets in the FIS Viewer,

- select one of the zoom tools 165 and
- click on the diagram type whose zoom area you want to change.
- Hold down the **Alt-key** and span the area with the **right mouse button**.

The zoom area of all diagrams with identical type and base units will be assigned.

Reset synchronous zoom

- Hold down the **Alt-key** and right click on the diagram if you wish to return to the previous zoom selection.

Or:

- To reset all by synchronous zoom changed diagrams, press Ctrl+Alt+Space.

5.3.4 Zoom tools

1. Select one of the zoom tools from the selection list.
2. Mark a zoom area in the diagram using the **right-hand mouse button**.

➔Your selection is marked in the diagram.

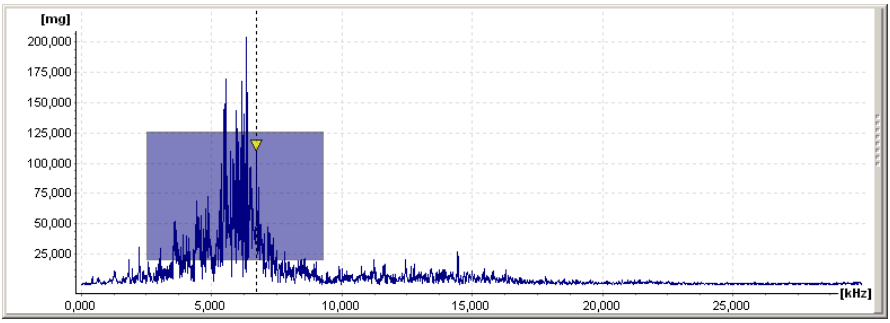
3. Right click on the diagram if you wish to return to the previous zoom selection.
4. If you wish to return to the full view of the diagram hold the **Shift button** down and **right click** on the diagram.

Free zoom

You can use the **Free zoom** tool to enlarge any chosen rectangular area within a diagram:

1. Select the **Free zoom** tool from the zoom tool selection list using the mouse or press the **F9** .
2. While holding down the right mouse button, drag the mouse across the section of the diagram you wish to enlarge.

➔The zoom selection is now marked dark blue in the diagram.



3. Release the right-hand mouse button.

➔Your selection is marked in the diagram.

4. Right click once again on the diagram if you wish to return to the previous zoom selection.

or

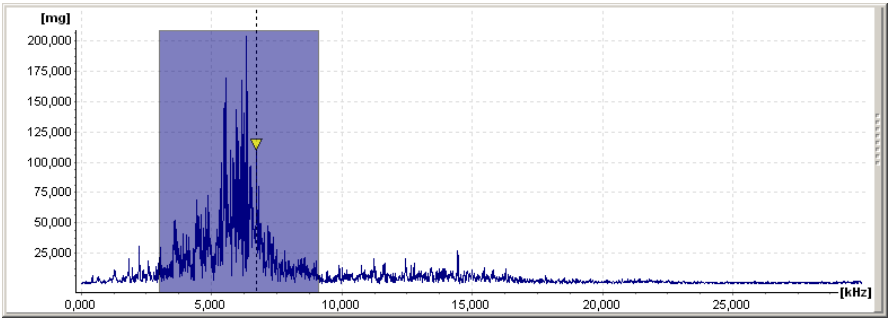
5. To return to the full view of the diagram hold the Shift button down and right click on the diagram

Horizontal zoom

You can enlarge any part of a diagram in a horizontal direction using the **Horizontal zoom** tool. The range of values and scaling of the y-axis remain unchanged:

1. Select the **Horizontal zoom** tool from the zoom tool selection list using the mouse or press the **F10** .
2. Keeping the right-hand mouse button pressed down, drag the mouse across the horizontal section of the diagram you wish to enlarge.

➔The zoom selection is now marked dark blue in the diagram.



3. Release the right-hand mouse button.

➔Your selection is marked in the diagram.

4. Right click once again on the diagram if you wish to return to the previous zoom selection.

or

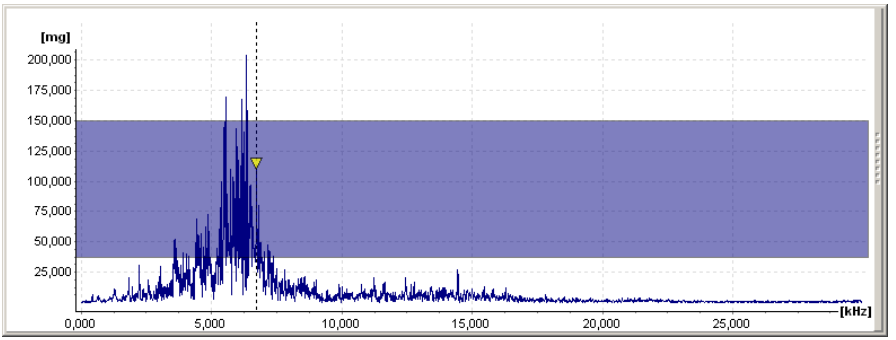
5. To return to the full view of the diagram hold the Shift button down and right click on the diagram

Vertical zoom

You can enlarge an area inside a diagram in a vertical direction using the **Vertical zoom** tool. The range of values and scaling of the x-axis remain unchanged:

1. Select the **Vertical zoom** tool from the zoom tool selection list using the mouse or press the **F11** .
2. Keeping the right-hand mouse button pressed down, drag the mouse across the vertical section of the diagram you wish to enlarge.

➔The zoom selection is now marked dark blue in the diagram.



3. Release the right-hand mouse button.

➔Your selection is marked in the diagram.

4. Right click once again on the diagram if you wish to return to the previous zoom selection.

or

5. To return to the full view of the diagram hold the Shift button down and right click on the diagram

Keyboard zoom

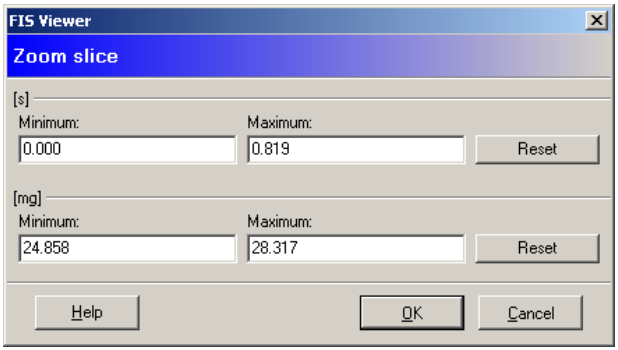
You can use the **keyboard zoom** feature to enlarge an area of the diagram using the keyboard instead of the mouse.

1. Select the **Keyboard zoom** tool from the zoom tool selection list using the mouse or press the **F12** button.
2. Use the **Ctrl+Q** and **Ctrl+W** buttons to shift the start of the zoom selection.
3. Use the **Ctrl+A** and **Ctrl+S** buttons to shift the end of the zoom selection.
4. Use the **Ctrl+Y** and **Ctrl+X** buttons to shift the highlighted zoom selection to the right or the left.
5. You can enlarge a section of the diagram by pressing **Ctrl+Enter** (zoom in).
6. You can reduce a section of the diagram by pressing **Ctrl+Backspace** (zoom out).
7. You can return to the full view of the diagram by pressing **Ctrl+Space bar**.

Defining the zoom selection by inputting values

1. Click the left-hand mouse button on the current zoom tool.

➔The zoom selection dialogue window opens and shows the current settings for the boundary values.



2. Enter a minimum and maximum for the X axis in the appropriate field.

3. Then enter a minimum and maximum for the Y axis in the appropriate field.
4. Click **OK**.

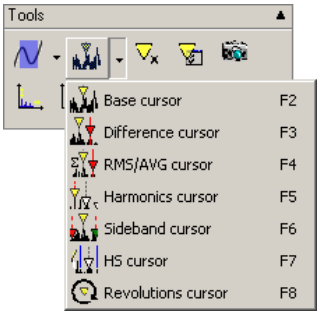
➔The diagram displays your defined zoom selection.

With **Reset** you can undo your settings.

5.3.5 Cursor tools



A cursor can be positioned in the diagram by clicking near a measured value or moved by dragging the dotted vertical line along the diagram axis keeping the mouse button pressed down.
Sliding cursors are always represented by a dotted vertical line whereas fixed cursors or automatically calculated data displays are represented by a continuous vertical line.

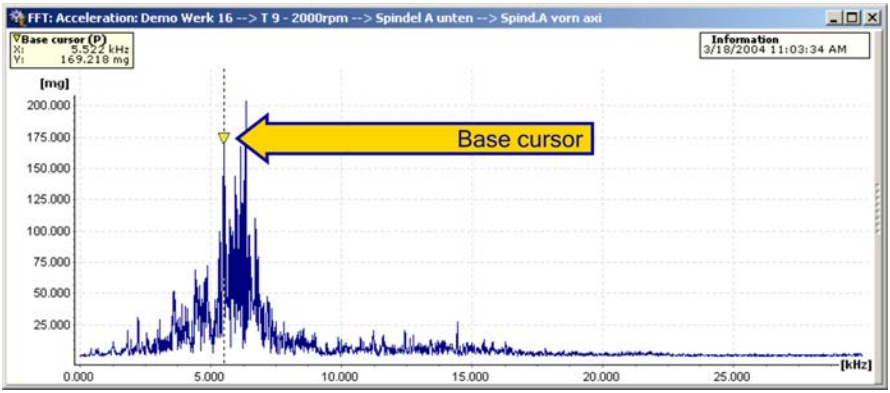


Base cursor



You can use the **base cursor** to determine the measured values on the x- and y-axis of a measuring point.

To do this, place a base cursor at any desired measuring point in the diagram. The corresponding measured values are displayed in the cursor information.



1. Select the **base cursor** option from the cursor selection list or press the **F2** button.
2. Position the base cursor by **left clicking the mouse** near a measuring point in the diagram.

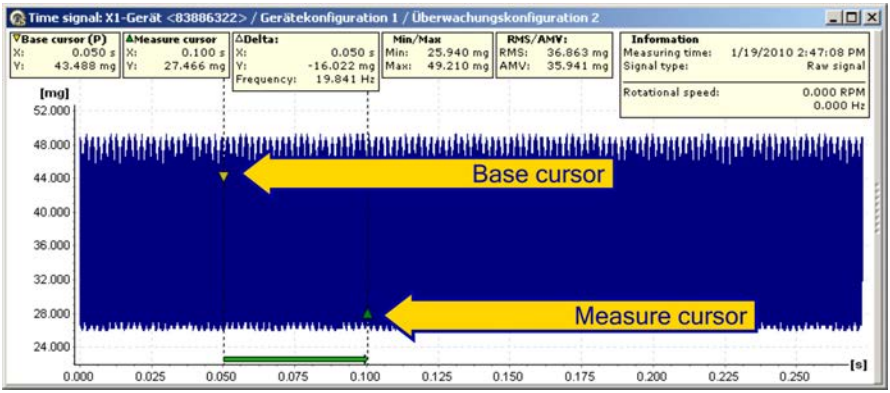
➔The base cursor jumps to the nearest measuring point in the diagram. The current position in the diagram is represented by a vertical dotted line. The measured values for this measuring point are displayed in the cursor information above the diagram.

Measure cursor



You can calculate the difference, the effective value (root mean square) and the arithmetic mean between two measuring points with the **measure cursor**. Min/max displays the smallest and biggest measure value of the selected area.

To do this, place the base cursor and a difference cursor at the desired measuring points in the diagram. The distance between the cursors is indicated by a colored bar directly above the x-axis. Both measured values obtained with the cursors and the resulting differential values, Min/Max and RMS/AMV are displayed in the cursor information.



1. Select the **measure cursor** option from the cursor selection list or press the **F3** button.

➔The base cursor and the measure cursor are displayed in the diagram, these are connected by a colored bar that runs along and slightly above the x-axis.

2. You can place the base cursor at any desired measuring point in the diagram by **left clicking**.
3. You can position the measure cursor at any desired measuring point in the diagram by **left clicking** while holding down the **Shift button**.

➔The cursor information above the diagram displays the measured values for the base cursor and measure cursor as well as the delta value with frequency, minimum/maximum values as well as the arithmetic and RMS value for the selected area.

Calculate spectrum

Another preview is shown in the work interface area, If you select the measure cursor in the time signal diagram. Under "FFT preview" the spectrum of the time signal is displayed and updated in real-time. You can calculate a spectrum of the time signal or a spectrum of definied values of the time signal.

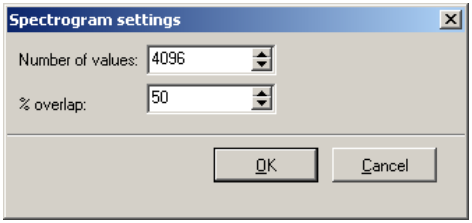
Spectrum of the time signal

1. Select the measure area as described above.
2. Double click on **FFT preview**.

➔The spectrogram is displayed in the "Calculated FFT" diagram.

Spectrum of time signal values

1. Click on **Create spectrogram from time signal** in the **Edit** menu.



2. Enter the **Number of values** you want to calculate the spectrum for. The pre-set value is equal to the maximum applicable value.



The number values you enter for the calculation will be increased automatically to the next power of two.

Example: If you want to calculate a spectrogram for 1000 measure values, the calculation value will be set to 1024 automatically. The calculated FFT will contain 512 measure values.

3. Define **% overlap**.
4. Click on **OK**.

➔The spectrogram is shown in the "Calculated FFT" diagram.

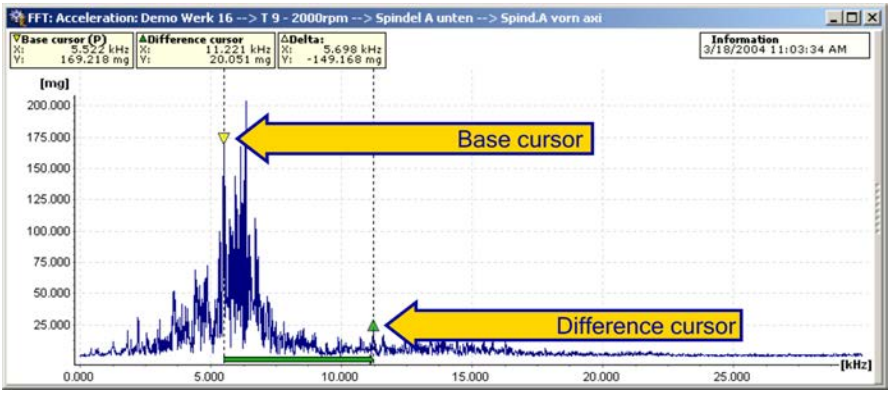
You can change the display under **FFT settings** in the work interface area (see Waterfall charts 198).

Difference cursor



You can use the **difference cursor** to calculate the difference between two measured values.

To do this, place the base cursor and a difference cursor at the desired measuring points in the diagram. The distance between the cursors is indicated by a colored bar directly above the x-axis. Both measured values obtained with the cursors and the resulting differential values are displayed in the cursor information.



1. Select the **difference cursor** option from the cursor selection list or press the **F3** button.

➔The base cursor and the difference cursor are displayed in the diagram, these are connected by a colored bar that runs along and slightly above the x-axis.

2. You can place the base cursor at any desired measuring point in the diagram by **left clicking**.
3. You can position the difference cursor at any desired measuring point in the diagram by **left clicking** while holding down the **Shift button**.

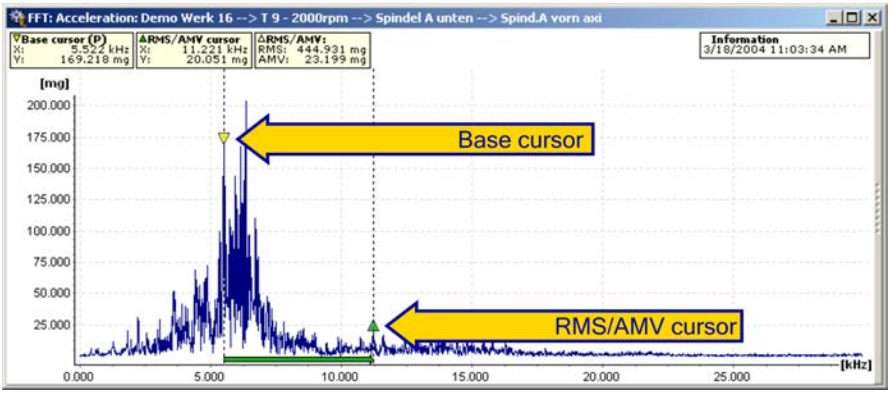
➔The cursor information above the diagram displays the measured values for the base cursor and difference cursor as well as the delta value.

RMS/AMV cursor



You can calculate the effective value (root mean square) and the arithmetic mean between two measuring points using the **RMS/AMV cursor**.

To do this, place the base cursor and an additional averaging cursor at any desired measuring point in the diagram. The distance between the cursors is indicated by a colored bar directly above the x-axis. Both measured values obtained with the cursors and the resulting mean values are displayed in the cursor information.



1. Select the **RMS/AMV cursor** option from the cursor selection list or press the **F4** button.

➔The base cursor and the averaging cursor are displayed in the diagram, these are connected by a colored bar that runs along the x-axis and slightly above it.

2. You can place the base cursor at any desired measuring point in the diagram by clicking the left-hand mouse button.
3. You can position the RMS/AMV cursor at any desired measuring point in the diagram by clicking the left-hand mouse button with the Shift button pressed down.

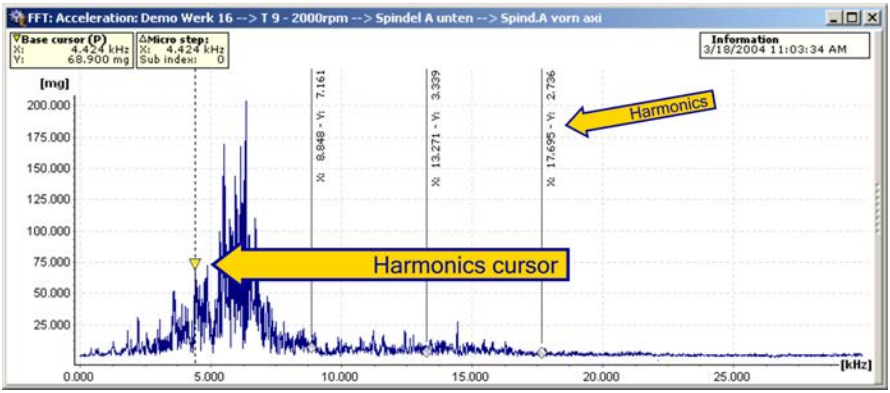
➔The measured values of the base cursor, the averaging cursor as well as the arithmetic and RMS value for the area specified are displayed in the cursor information above the diagram

Harmonics cursor



You can use the **harmonics cursor** to determine whether harmonics are present in the diagram (integer multiple of a vibration).

To do this, place the base cursor at any desired measuring point in the diagram. The harmonics are displayed in each case as drawn-through vertical lines. The corresponding measured values are displayed at the upper end of the vertical lines, and the measured values for the base cursor are displayed in the cursor information.



1. Select the **harmonic cursor** option from the cursor selection list or press the **F5** button.

➔The base cursor and vertical lines are displayed at the harmonic of the basic frequency.

2. You can shift the base cursor to any desired measuring point in the diagram using the left-hand mouse button.

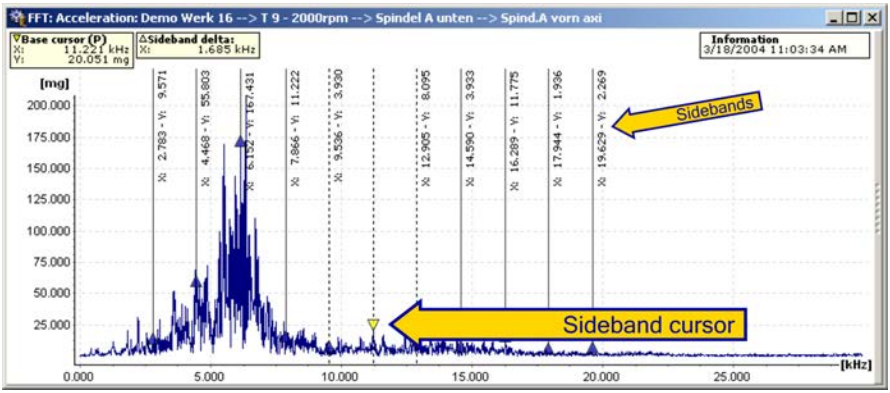
➔When the position of the harmonic cursor is changed the harmonics are automatically shifted. The cursor information above the diagram displays the measured values for the base cursor and the micro-increments that were set. The measured values of the harmonics are each displayed as vertical text next to the corresponding vertical line.

Sideband cursor



You can use the **sideband cursor** to determine additional measured values in definable sidebands starting from the base cursor.

To do this, the base cursor must first be placed at any desired measuring point in the diagram. You can then shift the nearest sideband to another measuring point in the diagram. All other sidebands that are displayed are simultaneously adjusted.



1. Select the **sideband cursor** option from the cursor selection list or press the **F6** button.

➔The base cursor and vertical lines are displayed at the sidebands of the frequency.

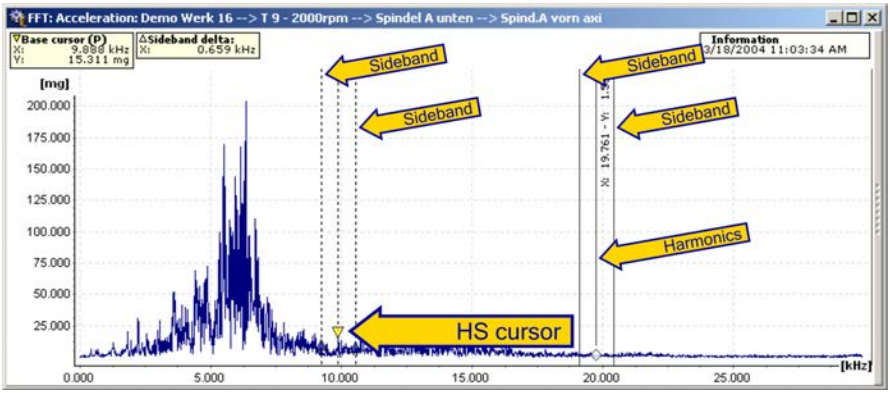
2. You can use the left-hand mouse button to shift the base cursor to any desired measuring point in the diagram and also modify the position of the sidebands.

➔The cursor information above the diagram displays the measured values for the base cursor as well as the differential delta of the sideband frequencies. The measured values of the sidebands are each displayed vertically as text next to the corresponding vertical line.

HS cursor



The **HS cursor** (**H**armonic with **S**idebands) combines both cursor types described above. This means that the measured values of the harmonics and their sidebands will be displayed.



1. Select the **HS cursor** option from the cursor selection list or press the **F7** button.

➔The base cursor and vertical lines are displayed at each harmonic of the base cursor frequency as well as its sidebands.

2. You can use the left-hand mouse button to shift the base cursor to any desired measuring point in the diagram and also modify the position of the sidebands.

➔The cursor information above the diagram displays the measured values for the base cursor as well as the differential delta of the sideband frequencies. The measured values of the harmonics are each displayed as vertical text next to the corresponding vertical line.

Revolutions cursor

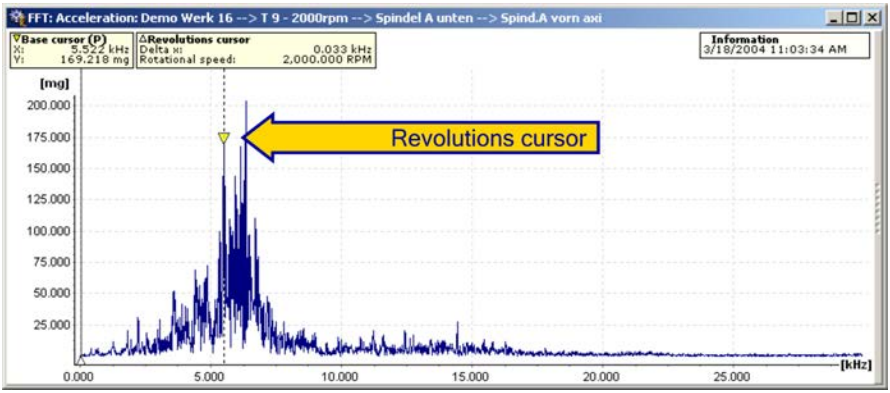
The **revolutions cursor** marks the frequency that is assigned to a specific speed with a line.
The revolutions value is calculated as follows: Revolutions n [Rpm] = 60 * Frequency f [Hz]

1. Select the **revolutions cursor** option from the cursor selection list or press the **F8** button.

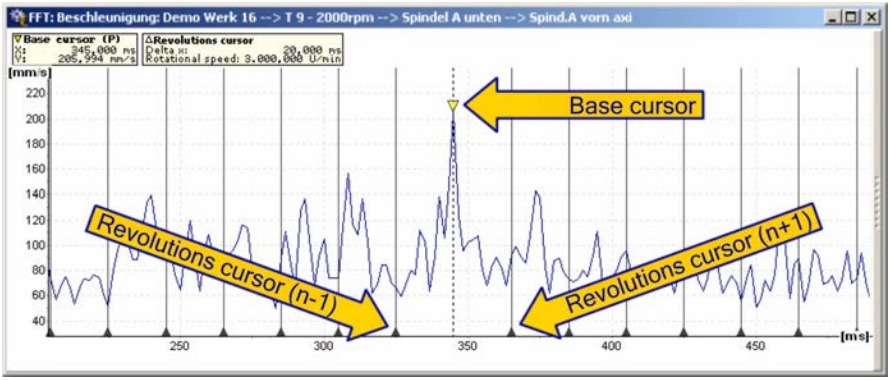
➔The "revolutions cursor" dialogue opens.

2. Activate or deactivate the options for the cursor settings in the "revolutions cursor" dialogue.
3. Enter any desired speed in the **rpm** field and click **OK**. The revolutions cursor is displayed differently, depending on the type of diagram (FFT or time signal):

➔In an FFT diagram, a single revolutions cursor is displayed at the point previously specified for the speed in the dialogue. The cursor information above the diagram shows the base cursor value as well as the speed setting.

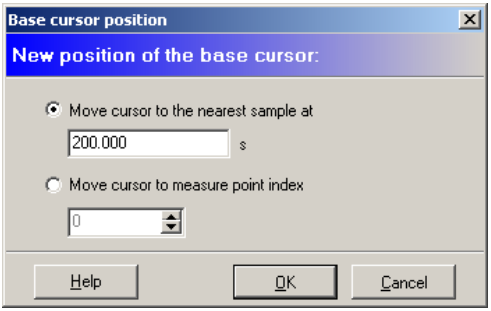


➔For a time signal a speed field with a series of revolutions cursors is displayed. In this case the individual lines correspond to an additional revolution before or after the current position of the base cursor. If you move the base cursor or position it at another measuring point, the speed field moves automatically with it.



5.3.6 Positioning of base cursor

You can position the base cursor at a point in the diagram defined via numeric input in the base cursor positioning dialogue box. The base cursor jumps to the measuring point nearest to this position.



1. Click in the toolbar.

➔The base cursor positioning dialogue is displayed.

2. Select the **Move cursor to the nearest sample at** option and enter any desired value inside the diagram area in the input field.

or

3. Select the **Move base cursor to measure point index** option and enter an index value for the corresponding measured value in the input field.
4. Click **OK**.

➔The base cursor is now positioned at the position you entered numerically.

5.3.7 Modify cursor properties

Using the cursor properties dialogue, you can change the properties of the cursor currently selected.

1. Click in the toolbar.

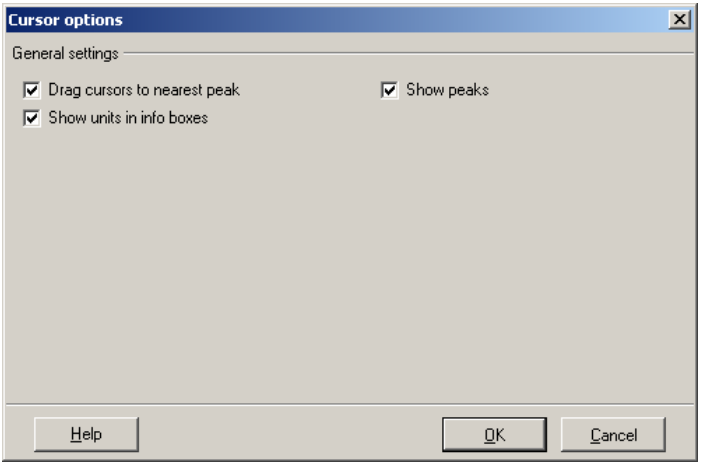
➔A dialogue showing the currently selected properties of the cursor tool will open.

2. Activate or deactivate the relevant fields in the dialogue window and pick one of the values in the selection boxes or enter the respective value in the input fields provided.
3. Click **OK**.

➔The cursor properties are applied and saved.

General cursor properties

You can modify the general cursor options described below. These properties apply to all available cursor types. To do this, activate or deactivate the corresponding checkboxes in the dialogue window.



Drag cursors to nearest peak

Switched on: the cursor jumps to the maximum value which is nearest the mouse pointer. If no maximum value can be found immediately near the mouse, the cursor remains in its previous position.

Switched off: the cursor jumps precisely to the measuring point in the diagram which is nearest the mouse pointer.

Show peaks

Switched on: in addition to the vertical lines current symbols are used to label measured values at the characteristic points of the various cursors in the diagram.

Switched off: the symbols that identify measured values at characteristic points are removed. The vertical lines will still be displayed.

Show units in info boxes

This option is only relevant for the cursor information display which must also be switched on.

Switched on: numerical values and units for the current cursor are displayed in the information boxes at cursor information.

Switched off: only the numerical values for the current cursor are displayed in the information boxes at cursor information.

Modifying the properties of the base cursor

When using the base cursor you can only modify the general cursor options 179 described above. To do this, activate or deactivate the corresponding checkboxes

in the dialogue window.

Modifying the properties of the measure cursor

When using the measure cursor you can only modify the general cursor options [179] described above. To do this, activate or deactivate the corresponding checkboxes in the dialogue window.

Modifying the properties of the difference cursor

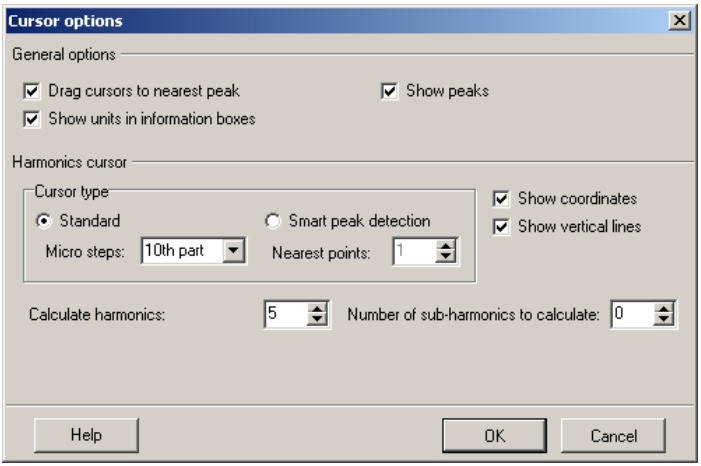
When using the difference cursor you can only modify the general cursor options described in Modify cursor properties [179]. To do this, activate or deactivate the corresponding checkboxes in the dialogue window.

Modifying the properties of the RMS/AMV cursor

Similarly, when using the RMS/AMV cursor you can only modify the general cursor options described in Modify the cursor properties [179]. To do this, activate or deactivate the corresponding checkboxes in the dialogue window.

Editing the properties of the harmonic cursor

In addition to the general cursor options described in Modify the cursor properties [179] you can also modify the additional options for the harmonic cursor (described below). To do this, activate or deactivate the appropriate fields in the dialogue window or select the respective value from the selection boxes.



Cursor type:

Standard

The harmonics are precisely calculated for the current cursor. The indicators for the harmonics are set so they

locate the **nearest measured value** for the harmonics calculated.

Micro steps

Micro steps are necessary to allow the basic frequency to be more precisely defined. In this selection box you can enter the increment between two measured points that will be used to specify the basic frequency and also calculate the harmonic.

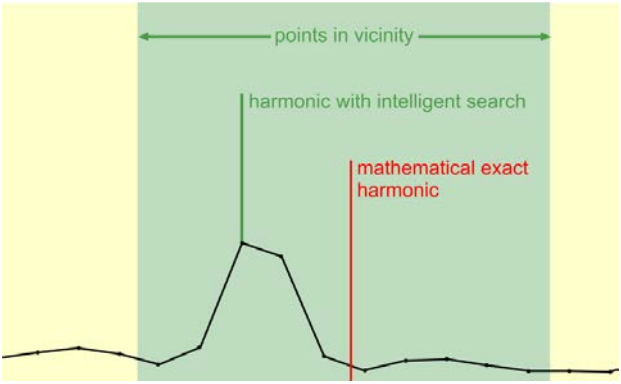
Cursor type:

Smart peak detection

The harmonics are precisely calculated for the current cursor. The indicators for the harmonics are set so they locate the **nearest maximum value** for the harmonics calculated.

Nearest points

The Trendline Viewer calculates the precise mathematic values of the harmonics. The intelligent cursor analyses the number of nearest points specified in this field (measuring points in the diagram in both directions) for maximum values and positions the indicator for the harmonic at the nearest maximum value.



Calculated harmonic

In this field you can enter the number of harmonics that must be calculated in each case.

In this field you can enter the number of sub harmonics that must be calculated in each case.

Show coordinates

Switched on: the coordinates (value pairs) of the harmonics are displayed in the diagram.

Switched off: the coordinates (value pairs) of the harmonics are removed from the diagram.

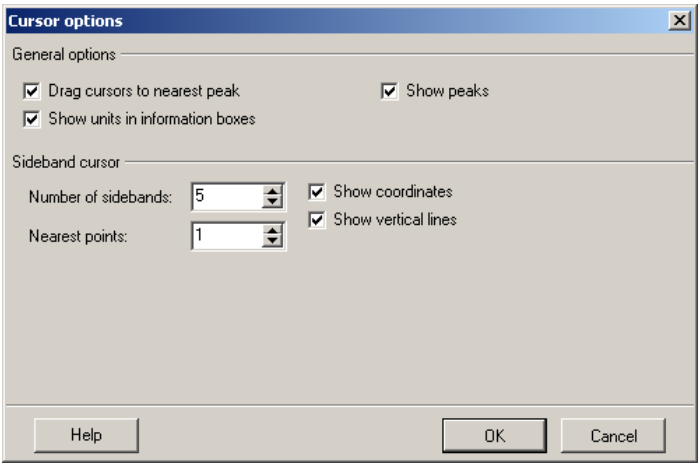
Show vertical lines

Switched on: the harmonics are identified in the diagram using the cursor symbol and a vertical line.

Switched off: the harmonics are identified using only the corresponding cursor symbol.

Modifying the properties of the sideband cursor

In addition to the general cursor options described in Modify the cursor properties [179] you can also modify additional options of the sideband cursor (described below). To do this, activate or deactivate the appropriate fields in the dialogue window or select the respective value from the selection boxes.



Number of sidebands

In this field you can enter the number of sidebands that must be calculated for the current cursor in each case.

Nearest points

The Trendline Viewer calculates the precise mathematic values of the sidebands. The number of nearest points specified in this field (existing measuring points in the diagram) are then analyzed for maximum values and the sideband marker is positioned at the nearest maximum value.

Show coordinates

Switched on: the measured values of the respective sidebands on the x- and y-axes are displayed at the vertical lines.

Switched off: the measured values of the sidebands are removed from the display.

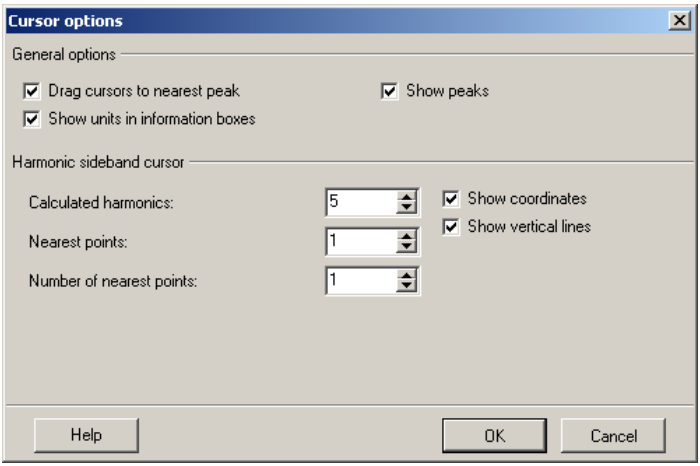
Show vertical lines

Switched on: the harmonics are identified in the diagram using the cursor symbol and a vertical line.

Switched off: the harmonics are identified using only the corresponding cursor symbol.

Editing the HS cursor properties

In addition to the general cursor options described in Modify the cursor properties 179 you can also modify the options for the HS cursor (described below). To do this, activate or deactivate the appropriate fields in the dialogue window or select the respective value from the selection boxes.



Calculated harmonic — In this field you can enter the number of harmonics that must be calculated in each case.

Nearest points — Each harmonic is determined precisely using a mathematical formula. You can enter the number of nearest points to the left and right of the harmonic identified to be analyzed for maximum values. The highest value in each case is then labeled as a harmonic and displayed.

Number of nearest points — Each sideband is also determined precisely using a mathematical formula. You can enter the number of nearest points to the left and right of the sideband identified to be analyzed for maximum values. The highest value in each case is then labeled as a sideband and displayed.

Show coordinates — **Switched on**: the measured value for each harmonic and sideband on the x- and y-axes is displayed at the vertical line.

Switched off: the measured values of the harmonics

and sidebands are removed from the display.

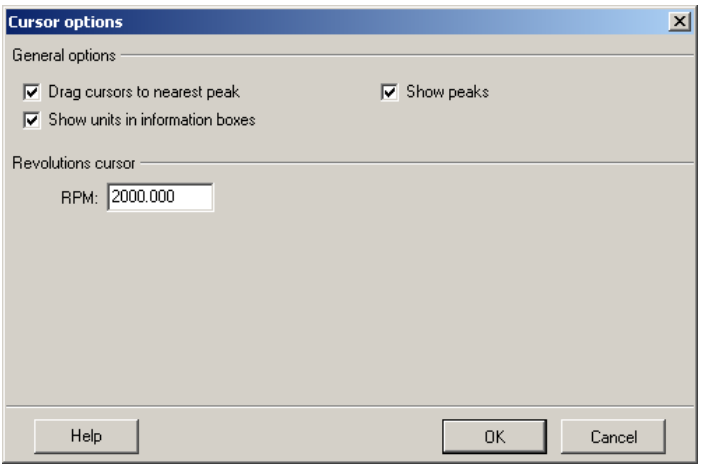
Show vertical lines

Switched on: the harmonics and sidebands are identified in the diagram using the cursor symbol and a vertical line.

Switched off: the harmonics and sidebands are identified using only the corresponding cursor symbol.

Modifying the properties of the revolutions cursor

In addition to the general cursor options described in Modify the cursor properties 179 you can also modify the additional option for the revolutions cursor – this is described below. To do this, activate or deactivate the appropriate fields in the dialogue window or enter the appropriate value in the input field.



RPM

Enter a rotational speed [rpm] in the input field. The Trendline Viewer uses this value to calculate the corresponding frequency and positions the revolutions cursor at the appropriate location in the diagram.

5.3.8 Other tools

Copying a diagram as a graphic to the clipboard



You can use this tool to copy the current diagram view to the clipboard.

1. Click on the **Copy diagram to clipboard** symbol.
2. Switch to the application in which you would like to insert the image.

3. Select the **Paste** option from the **Edit** menu for the application or use the shortcut **Ctrl+V**

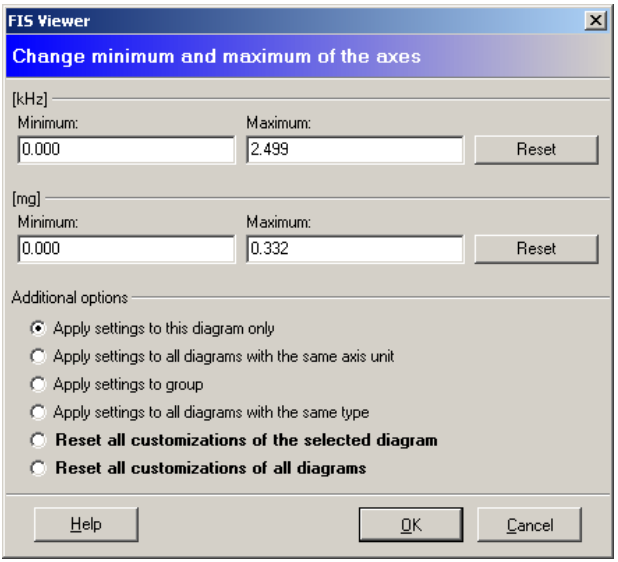
Change diagram boundaries



You can use this tool to change the minimum/maximum values displayed on the x- and y-axis.

1. Click on the **Change diagram boundaries** symbol.

➔The "Modify maximum values" dialogue is displayed.



2. Enter a new minimum/maximum value for the X and/or Y axis in the appropriate boxes. Click **Reset** to restore values automatically calculated by the Viewer.
3. Select an additional option:
   - **Apply settings to the selected diagram only**: Only the diagram activated in the signal selection (see "Displaying and removing signals" 161) is changed.
   - **Apply settings to all diagrams with the same axis unit**: All diagrams with the same axis unit – e.g. "g" – are changed.
   - **Apply settings to group**: All diagrams belonging to the same configuration as the selected signal are changed.
   - **Apply settings to all diagrams with the same type**: All diagrams of the same type – e.g. "time signals" – are changed.
   - **Reset all customizations of the selected diagram**: The settings for all

diagrams of the active window are reset to the values automatically calculated by the Viewer.

- **Reset all customizations of all diagrams**: The settings for all diagrams in all Viewer windows are reset to the values automatically calculated by the Viewer.

4. Click **OK**.

➔The diagram (and other diagrams if relevant) is displayed with the chosen settings applied.

Or:

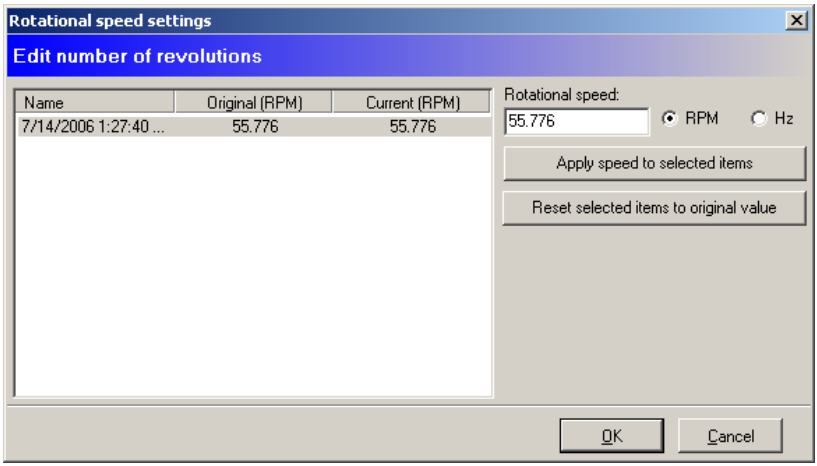
- Click on **Cancel** to discard the changes.

Edit rotational speed

Use this tool to change the rotational speed information in an FFT or time signal.

1. Click on the **Edit rotational speed** symbol.

➔The "Edit rotational speed" dialogue is displayed.



2. Click on the signal whose rotational speed you wish to change. If there are multiple signals, you can right-click to select or deselect them all.
3. Enter the appropriate speed in the **Rotational speed** box and select the unit (rpm or Hz). The rotational speed is automatically converted when you change the unit.
4. Click **Apply rotational speed to selection** to allocate the new speed to the selected signals.
5. Click **Reset select to defaults** to undo the change of speed.

6. Click **OK** to apply the changes or **Cancel** to discard them.

5.3.9 Using the diagram information bar

Displaying the diagram information bar of the viewer

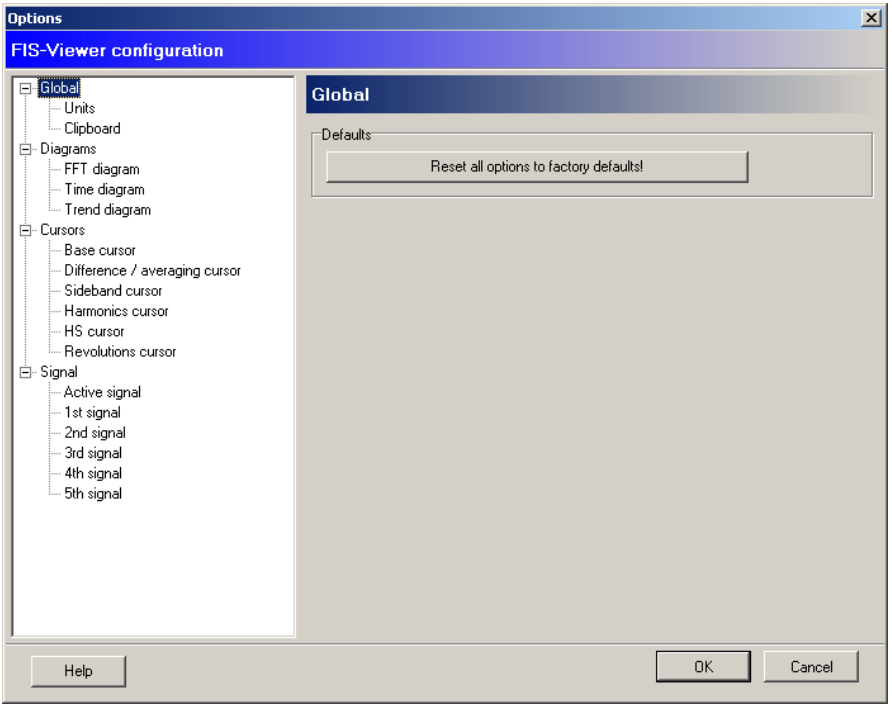
The diagram information bar contains additional information on the diagram displayed and outputs the relevant characteristic measured values in tabular form depending on the cursor selected. There are a number of ways in which the diagram information bar can be displayed.

Adjusting the default setting for the diagram information bar display via the Viewer options

The default setting for the diagram information bar display can be adjusted with the Viewer options. The settings can be configured individually for each diagram type (FFT, time signal or trend data). This default setting is used when new diagrams are opened.

1. Click on the **Extras** menu.
2. Select the **Options** menu item.

➔The Viewer options dialog opens.



3. Select the **Diagrams** heading in the left-hand column. Open the navigation menu by clicking the mouse on the "+" symbol.
4. Select the desired diagram type (FFT diagram, time signal diagram or trend diagram) you want to change the setting for.

➔The options for the selected diagram type are displayed in the right-hand field.

5. Activate the **Show diagram info bar at startup** checkbox in the **Diagram information bar** field.

➔The changes are applied the next time this diagram type is opened.

Displaying the diagram information bar with the mouse

1. Click the mouse on the slim grey bar to the right of the diagram display.

➔The diagram information bar appears.

2. Once the diagram information bar is displayed, click on the narrow grey bar to the left of the diagram display.

➔The diagram information bar is hidden.

Displaying the diagram information bar with the keyboard

1. Use the keyboard shortcut Ctrl+I to display the diagram information bar.

➔The diagram information bar appears.

Displaying frequency bands

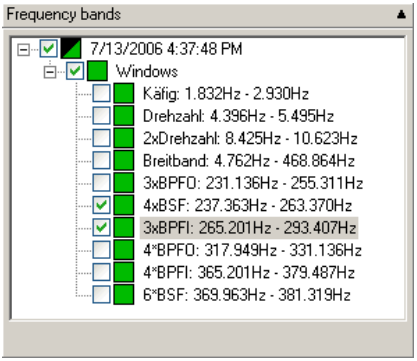
The diagram data in an FFT diagram contain important frequency bands from which characteristic values may be determined. The frequency bands which are defined by the higher-level application are highlighted in color in the diagram. These frequency bands cannot be edited in the Trendline Viewer but can be displayed or hidden as required. Frequency bands are only displayed in FFTs.

Double-click on a frequency band to zoom in. If **Select characteristic value in trend diagram** is enabled, clicking on a frequency band automatically selects the appropriate signal in the trend diagram.

Frequency bands are only displayed in FFTs.

1. To activate or deactivate a frequency band in an FFT diagram click the checkbox ☑in front of the preferred frequency band in the list.

➔The frequency bands selected are displayed in the diagram as colored fields



You can switch the display of all frequency bands in an FFT diagram on or off via the context menu in the frequency band information window.

1. Right click the mouse at any desired point in the frequency band window in the diagram information bar.
2. Click **Select all** in the context menu to display all available frequency bands.

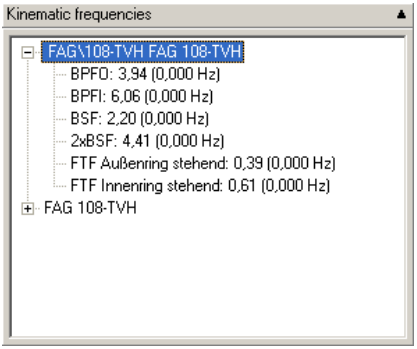
Or:

3. Click **Remove all** in the context menu to remove all available frequency bands from the diagram.

➔The frequency bands are displayed or removed depending on the setting.

Kinematic frequencies

If you have added one or multiple bearings to a spectrum from the bearings database using the Add bearing [185] tool, the characteristic bearing data are displayed in the **Kinematic frequencies** box.



The following information is displayed:

- Manufacturer / Bearing designation
- BPFO: Outer race frequency
- BPFI: Inner race frequency
- BSF / 2xBSF: Single and double roller frequency
- FTF fixed outer race: Cage frequency at fixed outer race
- FTF fixed inner race: Cage frequency at fixed inner race

If a rotational speed is available for the spectrum (see Other Tools ➔ Add bearing [185]), the FIS Viewer can also display the bearing frequencies in the spectrum.

1. Check the **Bearing frequencies** checkbox to do so.
2. Click on the bearing frequency in the **Kinematic frequencies** box to display in the spectrum.

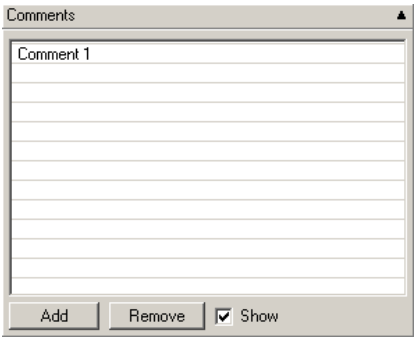
➔ The selected frequency is displayed in the spectrum. The bearing frequencies multiplied by the current rotational speed are displayed in parentheses in the **Kinematic frequencies** box.

Inserting comments into the diagram

You can assign comments to individual measuring points in the diagram. The comments in the diagram are presented at the corresponding measuring point in an information field if the display field is activated.

You can move the comment dialog by left-clicking on the dialog and dragging it to the desired position.

1. Select the preferred measuring point using the **base cursor**.
2. Click the **Add** button in the **Comments** field in the right-hand section of the Trendline Viewer information area.



3. Enter a comment for the measuring point selected at the line provided for this in the table.

➔The comment is displayed in the diagram next to the appropriate measuring point and can be moved by left-clicking and dragging it.

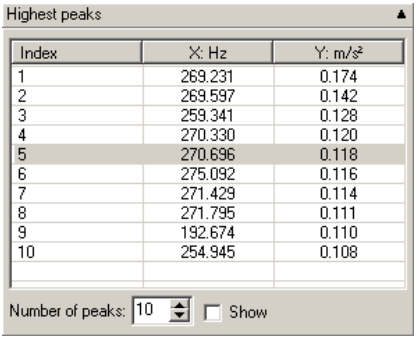
➔To change the allocation of the comment to the measuring point (shift on the X axis), click on the black triangle for the comment and drag it to the appropriate measuring point.

➔When you select a comment in the list, it is displayed on a colored background in the diagram.

➔Hover the mouse over a comment in the list of comments to display the comment details in a tooltip at the mouse position.

Displaying maximum values

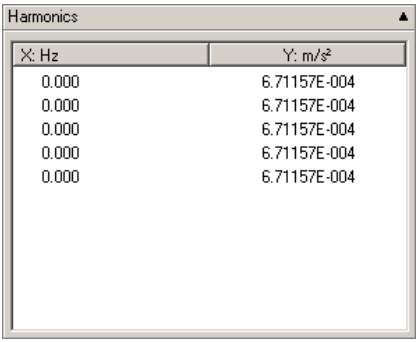
The **Highest peaks** box shows the highest measured values on the Y axis of the diagram. You can define the number of maximum values displayed via the selection box. You can use the checkbox provided to display the maximum values in the diagram view.



1. If you wish to modify the number of maximum values displayed, click the **Number of maximum values** radio button in the **Highest peaks** box.
2. Check the **Mark peaks** checkbox to display the corresponding maximum values in the diagram.

Displaying the measured values of harmonics

If the **Harmonic cursor** is selected, this diagram information area is displayed. The table shows the measured values that most closely correspond to the harmonic.



The **Harmonics** table displays the measured values for each harmonics value calculated.

Modifying the settings for the harmonic cursor

You can modify the settings used to calculate the harmonics via the harmonic cursor properties.

1. To modify the settings click on the **Cursor properties** symbol in the "Navigation

and Tools" field .

2. Modify the settings in the cursor properties dialogue field.

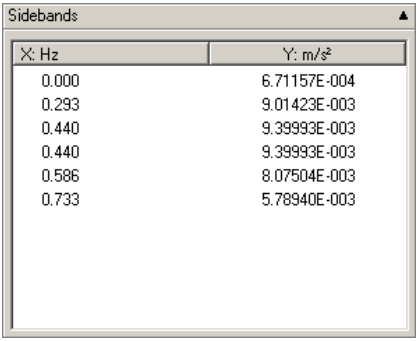
Copying measured values for the harmonics using the clipboard

You can transfer measured values for the harmonics to other applications using the clipboard.

1. Highlight each measured value you wish to transfer to another application in the table or right click on the table and choose the **Select all** menu item from the context menu.
2. To copy the measured values you have selected to the clipboard, **right click** on the table. Pick the **Copy selected values to the clipboard** menu item from the context menu.
3. Switch to the other application and click the paste symbol or select the **Paste** menu item from the **Edit** menu.

Displaying the measured values of sidebands

If the sideband cursor or HS cursor is selected, this field is displayed in the information area. It contains the measured values that most closely correspond to the defined sidebands.



The **Sidebands** table displays the measured values for the relevant sidebands calculated.

Modifying the settings for the sideband cursor

You can modify the settings used to calculate the sidebands via the sideband cursor properties.

1. To modify the settings click on the **Cursor properties** symbol in the "Navigation and Tools" field .

2. Modify the settings in the **cursor properties** dialogue field.

Copying measured values for the sidebands via the clipboard

You can transfer measured values for the sidebands to other applications via the clipboard.

1. Highlight each measured value you wish to transfer to another application in the table or right click on the table and choose the **Select all** menu item from the context menu.
2. To copy the measured values you have selected to the clipboard, **right click** on the table. Pick the **Copy selected values to the clipboard** menu item from the context menu.
3. Switch to the other application and click the paste symbol or select the **Paste** menu item from the **Edit** menu.

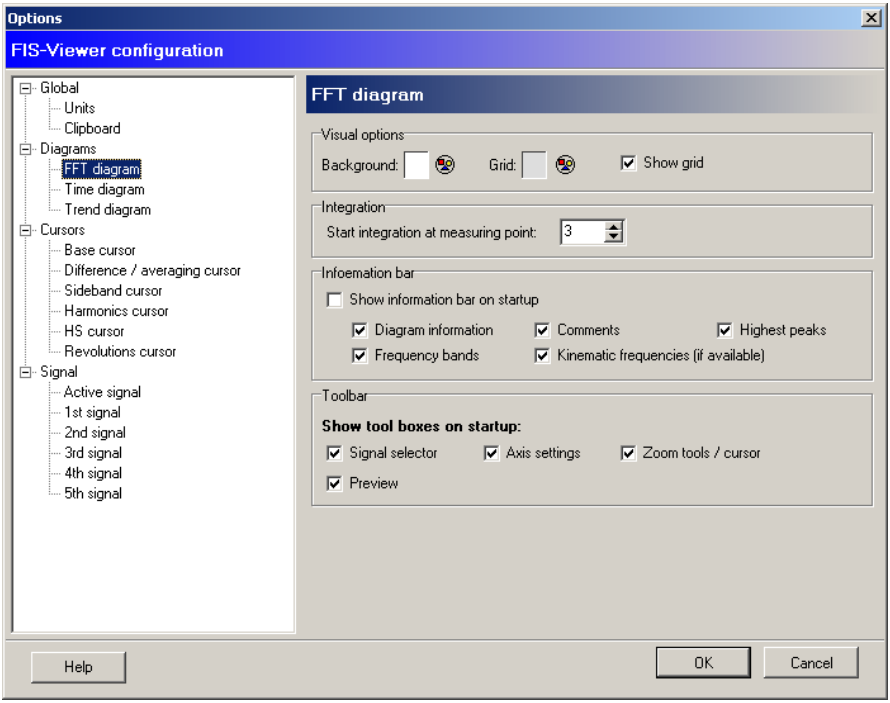
Hiding diagram information bar of the Viewer

Adjusting the default setting for removing the diagram information bar from the display via the Trendline Viewer options

The default setting for the diagram information bar display can be adjusted with the Trendline Viewer options. The adjustments can be made for each diagram type individually (FFT, time signal or trend data diagrams). This default setting is used when new diagrams are opened.

1. Click on the **Extras** menu.
2. Select the **Options** menu item.

➔The options dialog for the Trendline Viewer opens.



1. Select the **Diagrams** heading in the left-hand column. Open the navigation menu by clicking the mouse on the "+" symbol.
2. Select the required diagram type (FFT viewer, time signal viewer or trend viewer) you want to change the setting for.

➔The options for the selected diagram type are displayed in the right-hand field.

3. Deactivate the **Display right diagram information bar at start up** checkbox in the **Diagram information bar** field.

➔The changes are applied the next time this diagram type is opened.

Hiding the diagram information bar with the mouse

1. Click on the narrow grey bar to the left of the diagram information bar.

➔The diagram information bar is hidden.

Removing the diagram information bar using the keyboard

1. Use the keyboard shortcut **Ctrl+I** to hide the diagram information bar in the display.

➔The diagram information bar is hidden.

5.3.10 Export diagrams and information

With the FIS Viewer, you can copy diagrams to the clipboard or save diagrams in JPG or BMP format. The exported diagrams contain the cursor and measurement information and optionally an information text with the diagram titel. The diagram information bar is not exported. Diagram dimensions and further options can be specified in the program settings 205. Furthermore you can copy measuring data and the content of the diagram information bar to the clipboard, to insert it in an other application.

- Modify the diagram appearance and proceed as follows.

Copy current diagram to clipboard

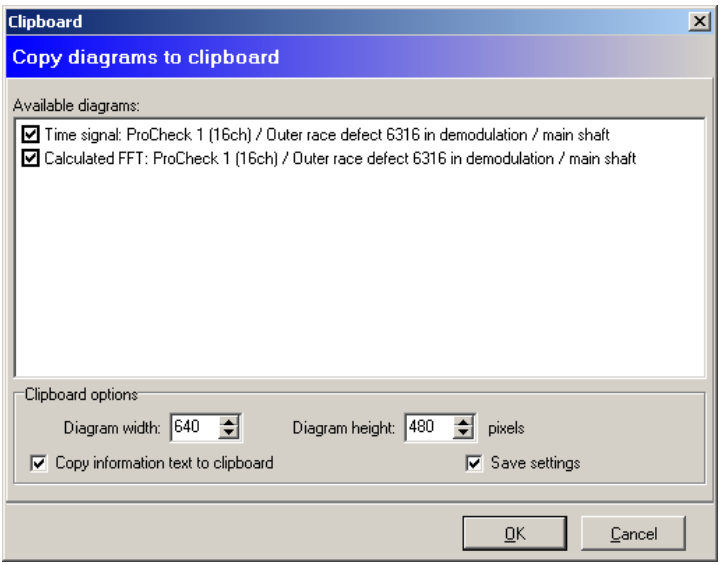
- Select a diagram by clicking on the diagram windows.
- Click on **Copy current diagram to clipboard** in the **Edit** menu.
- Switch to the application in which you would like to insert the diagram.
- Select the **Paste** option from the **Edit** menu for the application or use the shortcut **Ctrl+V**.

Copy selected diagrams to clipboard

- Click on **Copy selected diagrams to clipboard** in the **Edit** menu.

Or:

- Click on in the toolbar.



- Activate the check box in front of the available diagrams, to select diagrams to be copied.
- If you want to adjust the clipboard settings, click on "Save settings" if wanted to adopt changes in the program settings 205.
- Click on **OK**.
- Switch to the application in which you would like to insert the diagram.
- Select the **Paste** option from the **Edit** menu of the application or use the shortcut **Ctrl+V**.

Save current diagram as image

- Select a diagram by clicking on the diagram window.
- Click on **Save current diagram as image** in the **Edit** menu.
- Select the saving directory,
- enter a file name and
- select the file type **JPG** (JPEG format) or **BMP** (Windows Bitmap format).
- Click on **Save**.

Copy diagramm information to clipboard

All diagram information of a selected diagram can be copied to the clipboard.

- Select a diagram by clicking on the diagram windows.
- Click on **Copy diagram information to clipboard** in the **Edit** menu.
- Switch to the application in which you would like to insert the diagram information.
- Select the **Paste** option from the **Edit** menu of the application or use the shortcut **Ctrl+V**.

Copy measuring data to clipboard

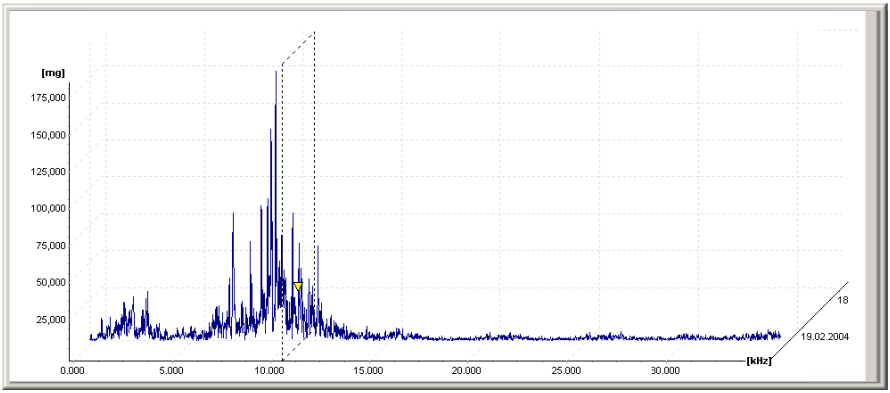
You can copy the measuring data of a diagram to the clipboard.

- Select a diagram by clicking on the diagram window.
- Press **Ctrl+V**.
- Switch to the application in which you would like to insert the diagram information.
- Select the **Paste** option from the **Edit** menu of the application or use the shortcut **Ctrl+V**.

5.3.11 Waterfall charts

FFTs and order spectrums can be displayed as three-dimensional waterfall charts. For this type of display, the same tools 154 are available as for the two-

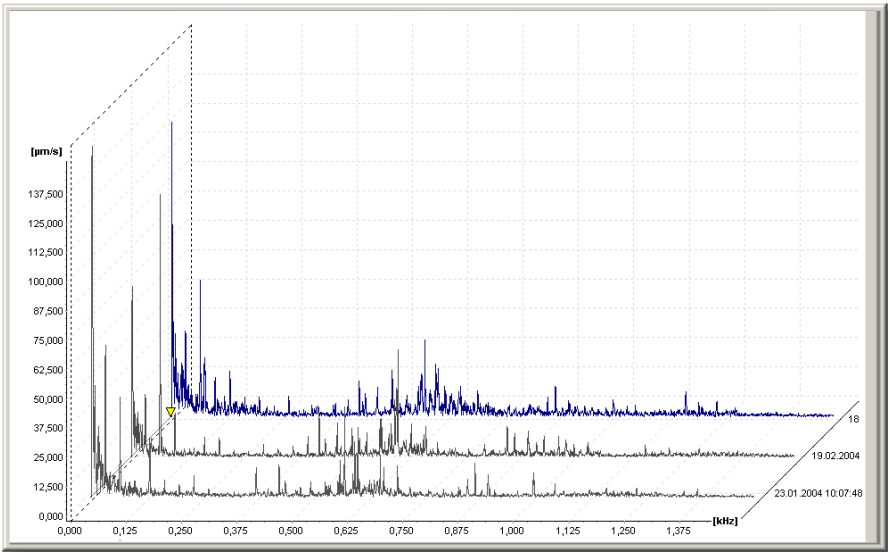
dimensional display. If you have selected multiple datasets, the corresponding FFTS are also displayed in a window.



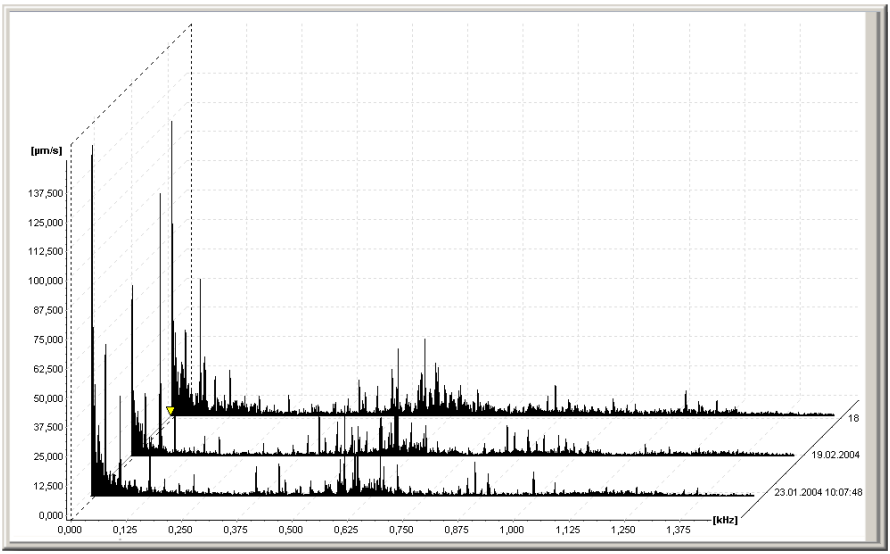
You can configure the display under **FFT settings** with **Display mode**.

Display mode

- **2D stacked (only in case of multiple diagrams)**: The diagrams are displayed two-dimensionally with separate axes on top of each other.
- **2D stacked (only in case of several diagrams)**: The diagrams are displayed in a diagram with the same axes.
- **3D Wireframe**: The diagrams are displayed spatially behind each other, sorted by date (the "oldest" value at the front). The order of the curves can be changed by pressing CTRL+F.

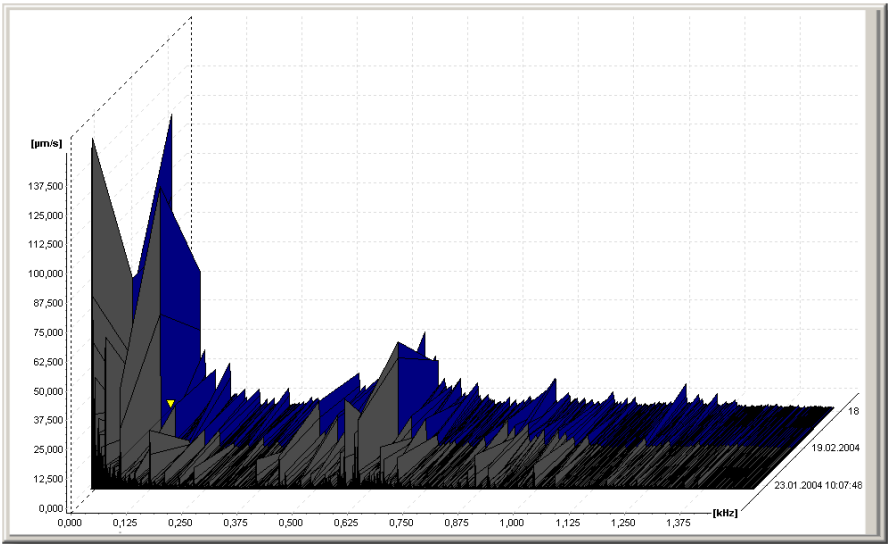


- **3D Area**: The surfaces under the signal curves are displayed in a completed fashion. The order of the curves can be changed by pressing CTRL+F.

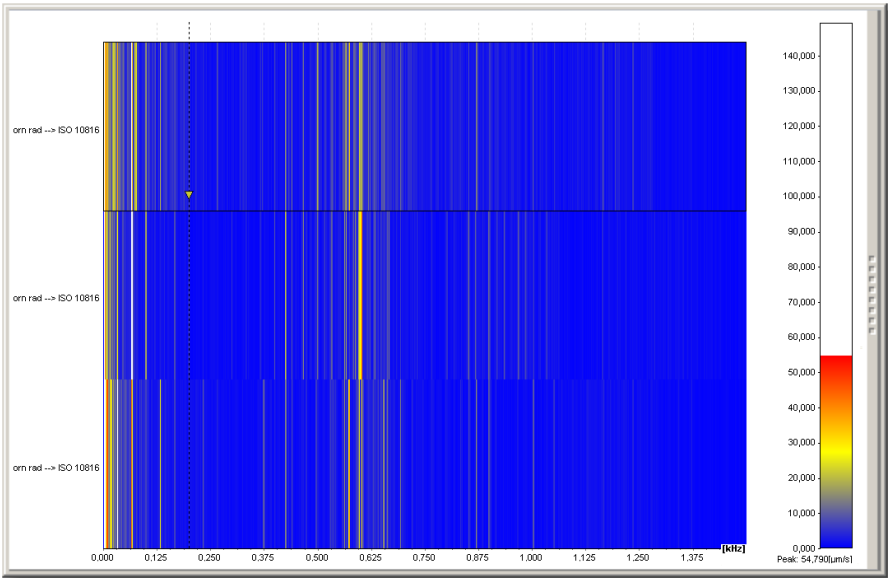


- **3D Mountains**: For this type of display, the surfaces under the signal curves are displayed in a completed fashion. In addition, the peaks between the individual diagrams are connected by planes. The order of the curves can be changed by

pressing CTRL+F.



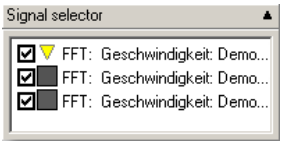
- **Sonagram**: For this type of display, the diagrams are displayed as colored surfaces on top of each other in which the signal values are indicated as a color value. This type of display is especially well-suited for comparing a large number of measurements across a long timeframe. Here, the sonogram makes it easy to recognize whether a machine is running at a decreasing speed in a resonance range. If the speed is dropping, the peaks of the FFT will normally be smaller; in the resonance range they will be larger.



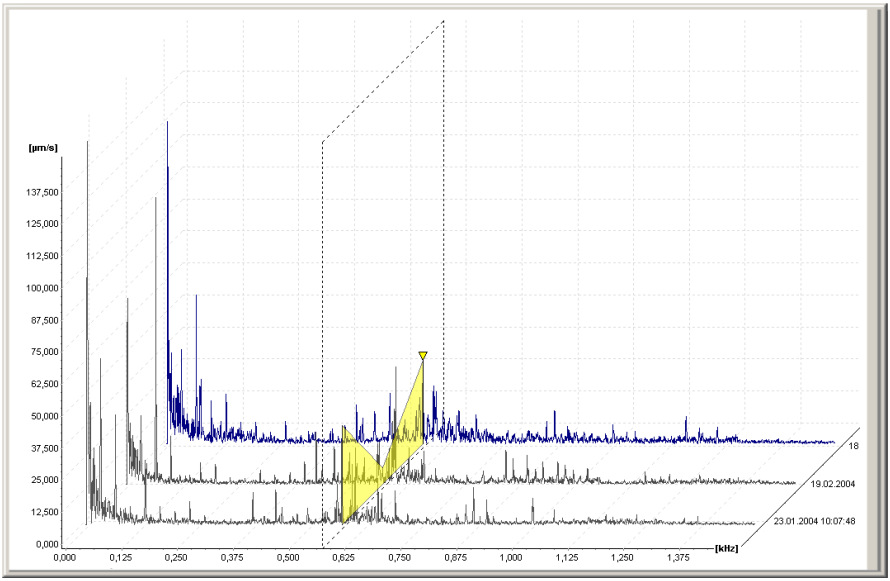
The assignment of colors to signal values can be changed in the color scale on the right-hand side of the window. Click and hold down the mouse button in the color scale and drag the colored bar up or down. The diagram is updated in real time. In this way you can quickly distinguish relevant areas for your analysis.

Using zoom and cursor tools

In the waterfall diagram you have the same zoom and cursor tools as for two-dimensional diagrams (for more on this, see Zoom tools 165/cursor tools 169). If multiple diagrams are displayed, you can select the signal you would like to edit with the cursor tool in the **Signal selector**.



Click the preferred signal. The signal you have chosen is highlighted by the cursor signal (yellow triangle). As soon as you have positioned the basis cursor on a diagram value, the corresponding values are connected in the other diagrams by a transparent yellow plane.



5.3.12 Program settings

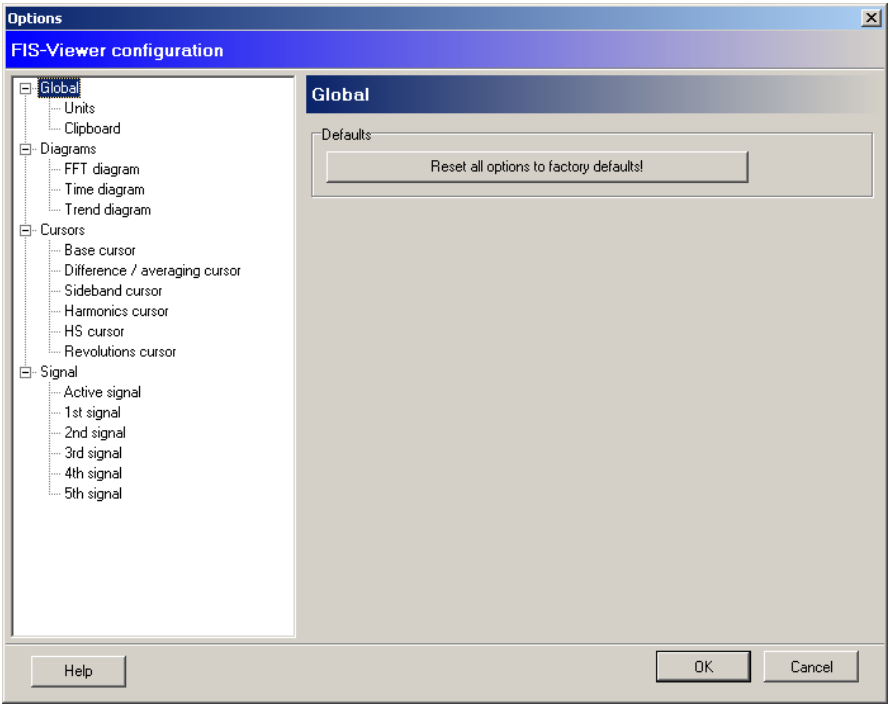
To edit program settings for the Viewer, click **Options** in the **Extras** menu.

Modifying the global settings

You can restore the factory settings for the Trendline Viewer using the **Global** dialogue window (status following initial installation of the software).

- Click the **Reset all options to factory defaults!** button
- and confirm by clicking **OK**.

➔The settings are reset.

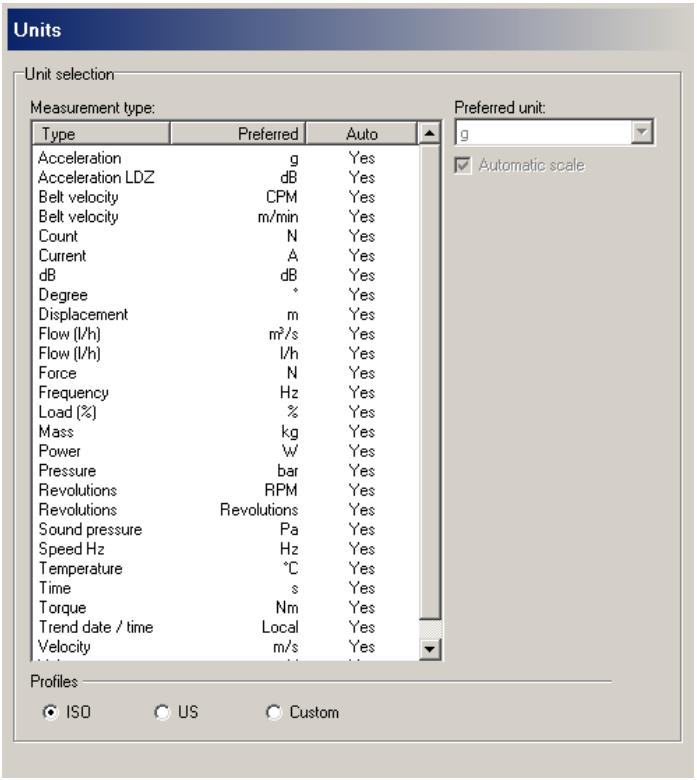


Units

In the **Units** dialogue window, you can specify the options for scaling units used in the diagrams.

In the **Unit selection** area all measurement types are listed. Besides the preferred unit and an information about scaling are shown. The preferred unit cannot be changed at ISO and US units. The automatic scaling is activated by default at this profiles.

By selecting "custom" you can assign the preferred unit depending on the measurement type. Here the automatic scaling can also be set.



- Select the units profile.

To change the preferred unit or automatic scaling,

- select the profile **Custom** and
- define the settings for single measurement types.

Clipboard

You can select the options for transferring the diagrams to the clipboard in the **Clipboard** dialogue window.

1. Select the preferred dimensions for the diagram display in the **Diagram width** and **Diagram height** fields.
2. Activate the **Copy information text to clipboard** checkbox if you also wish the diagram title to be copied with the graphic.
3. Click on **OK** to apply these settings.

Modifying the diagram settings

In the **Diagrams** dialog you can specify whether new diagram windows are automatically displayed horizontally in the Viewer.

1. You can specify whether diagrams belonging to the same data set should be identified using color in the **Diagram grouping** field.
2. If required, activate the **Tile diagrams horizontally if new diagram is displayed** checkbox.

   If this option is activated the Trendline Viewer arranges the diagram windows horizontally (below one another) and the new diagram is opened at the lowest position in the diagram window.

   If this option is deactivated, new diagram windows are cascaded.
3. Click on **OK** to apply these settings.

FFT diagram

You can select the various FFT diagram display options in the **FFT diagram** dialogue window.

1. You can specify the background color for the FFT diagram in the **Visual options** field. You can also define here whether you wish the grid to be displayed in the background and also its color.
2. In the **Integration** field you can specify the measuring point in the diagram from which the integration should be performed
3. In the **Information bar** field you can specify what information (cf. Using the diagram information bar 188) to display when a new diagram is opened.
4. In the **Toolbar** field you can specify whether **Signal selection**, **Preview**, **Axis settings**, **FFT settings** and **Zoom tools** should be displayed when you open a new diagram.
5. Click on **OK** to apply these settings.

Time signal diagram

In the dialog window **Time signal diagram**, you can define certain options for displaying a time signal diagram.

1. The section **Visual options** allows you to adjust the background color of the time signal diagram. You can also define here whether you wish the grid to be displayed in the background and also its color.
2. In the **Information bar** field you can specify whether **diagram information** and **comments** should be displayed when a new diagram is opened.
3. In the **Toolbar** field you can specify whether **Signal selection**, **Preview**, **Axis settings**, and **Zoom tools** should be displayed when you open a new diagram.

4. Click on **OK** to apply these settings.

Trend diagram

In addition to the display settings already presented with the **FFT diagram** and the diagram information bar option the settings for the trend display and smoothing can also be specified in the Trend diagram 206 dialogue window.

1. The section **Display options** allows you to adjust the background color of the time signal diagram. You can also define here whether you wish the grid to be displayed in the background and also its color.
2. In the **Trend display settings** you can specify field whether each characteristic value should be displayed in a separate diagram (**Stacked view**) or whether all characteristic values should be displayed in one diagram (**Overlapped view**).
3. You can specify which function and which period length should be used to carry out the smoothing calculation in the **Smoothing** field.
4. In the **Information bar** field you can specify whether **diagram information** and **comments** should be displayed when a new diagram is opened.
5. In the **Toolbar** field you can specify whether **Signal selection**, **Axis settings**, and **Zoom tools** should be displayed when you open a new diagram.
6. In the **Trend limitation on load** field you can specify how many trends of the last days and maximum data sets should be load in the Viewer.
7. Click on **OK** to apply these settings.

Modifying the cursor options

You can modify how each individual cursor is displayed in the dialogue windows for the various cursors.

1. Select the cursor you wish to modify from the list of cursors on the left.
2. Select the preferred cursor shape for the cursor specified above from the **Symbol** drop-down menu.
3. Select the symbol and **color** to be used for the cursor as well as the color for vertical cursor **line**.
4. Because the differential and averaging cursors work in pairs, you can also modify the appearance of the second cursor in this field accordingly.
5. Click on **OK** to apply these settings.

Modifying the signal settings

You can select measurement data display options in the signal dialogue windows.

1. If fewer than 50 measuring points are displayed in the diagram window, each measuring point can be made clearly visible as a dot. If greater than 50

measuring points are displayed in the diagram window, the display of individual measuring points is automatically deactivated and only the diagram of the function and not the measuring points remains visible.

2. Click on **OK** to apply these settings.

Active signal / 1st - 5th signal

Under the signal options you can modify the display of the individual signals.

1. Select a **line type** for the signal from the drop-down menu.
2. Specify a **line width** for the signal in pixels from the field provided.
3. Click on the palette to select a **color** for the signal.
4. Click on **OK** to apply these settings.



You can also apply these settings for additional signals.

5.4 Keyboard shortcuts

Cursor selection

Key	Function
F2	Activating the base cursor
F3	Activating the difference cursor
F4	Activating the RMS/AMV cursor
F5	Activating the harmonic cursor
F6	Activating the sideband cursor
F7	Activating the HS cursor (Harmonic with sideband)
F8	Activating the revolutions cursor

Move cursor

Key	Function
Cursor left	Moves the basic cursor left to the next measuring point
Cursor right	Moves the basic cursor right to the next measuring point
Cursor up	Moves the extended cursor left to the next measuring point
Cursor down	Moves the extended cursor right to the next measuring point
CTRL + cursor left	Moves the basic cursor to the first measuring point in the diagram
CTRL + cursor right	Moves the basic cursor to the last measuring point in the diagram
CTRL + cursor up	Moves the extended cursor to the first measuring point in the diagram
CTRL + cursor down	Moves the extended cursor to the last measuring point in the diagram
ALT + cursor left	Moves the basic cursor 10 measuring points to the left
ALT + cursor right	Moves the basic cursor 10 measuring points to the right
ALT + cursor up	Moves the extended cursor 10 measuring points to the left
ALT + cursor down	Moves the extended cursor 10 measuring points to the right
CTRL + K	Moves the cursor one microstep left (only for harmonic cursor if standard detection is enabled)
CTRL + L	Moves the cursor one microstep right (only for harmonic cursor if standard detection is enabled)

Key	Function
CTRL + D	Hides or shows the cursor
CTRL + P	Opens the dialog for numeric cursor positioning
CTRL + O	Opens the cursor options dialog

Zoom selection

Key	Function
F9	Activates free mouse zoom
F10	Activates horizontal mouse zoom
F11	Activates vertical mouse zoom
F12	Activates keyboard zoom

Keyboard zoom

Key	Function
CTRL + Q	Moves the start of the zoom area left
CTRL + W	Moves the start of the zoom area right
CTRL + A	Moves the end of the zoom area left
CTRL + S	Moves the end of the zoom area right
CTRL + Y	Moves the set zoom area left
CTRL + X	Moves the set zoom area right
CTRL + Enter	Displays the set zoom area
CTRL + Backspace	Displays the previous zoom area
CTRL + Space	Displays the whole diagram
CTRL + Z	Opens the dialog for numeric zoom area input

Diagram scrolling

Key	Function
CTRL + B	Moves the diagram display left
CTRL + N	Moves the diagram display right

Key	Function
CTRL + J	Moves the diagram display up
CTRL + M	Moves the diagram display down

Trend diagram

Key	Function
CTRL + H	Calls another record from the trend display
CTRL + G	Toggle axis view between "cascaded" and "tiled".

Other keyboard shortcuts

Key	Function
CTRL + R	Reset comment position
CTRL + U	Show/hide right info box at top edge of diagram.
CTRL + T	Show/hide toolbar
CTRL + I	Shows/hides the diagram information bar on the right edge of the diagram
CTRL + C	Copies a screenshot of the diagram to the clipboard

6 Detector III

Detector III is a hand-held measuring instrument with data recording function for offline monitoring of systems and machinery (condition monitoring). For this purpose, the instrument senses vibrations at pre-determined measuring points using a Detector and works out the RMS values of vibration velocity, acceleration in vibration and demodulation, the so-called characteristic values, for characterizing machine or component condition. In addition, Detector can measure temperatures using an infra-red sensor.

6.1 Operation

6.1.1 Keypad

Detector III is exclusively operated via the keys on the membrane keypad. The following table explains the meaning of the different keys:

Key	Meaning
	On/off key: Switches device on and off.
	Time signal key: To display the time signal, FFT and Trend after measurements.
	Lighting key: Switches the display lighting on and off.
	Esc key (Escape/Cancel key): Cancels an action, goes back one menu level.
	Enter key: Confirm selection. Both input keys perform the same function and are equally valid.
	Cursor keys: Moves cursor in direction of arrow.
	HOME key: Go directly to the main menu from any menu.
	Function key: Call up special functions or to set a decimal point when entering numbers.

Navigating in the menus

Menu items can be marked using the cursor key ▲ or ▼. To select a menu item use the enter key ◄┘. You can go back one level using the ESC key esc.

Switch display lighting on and off

Press the lighting key .

Keyboard entries

In the Detector you can type in both numbers and texts. You can enter numerical values directly by pressing the corresponding number on the keypad. In the text edit field you can enter letters and special characters by pressing the number keys multiple times. For example:

- If you want to type in the letter "k", press the button 5 twice.
- To enter a space character press the button 0 once.
- To set the upper or lower case for a single character, select the character with the cursor keys ◀ or ▶ and press the cursor keys ▲ or ▼.

The following table provides the keys and their functions:

Key	1x	2x	3x	4x	5x	6x	7x	8x	9x	10x	11x	12x
1 HOME	.	,	-	?	!	1						
2 abc	a	b	c	2	ä	á	à	â	ã	å	æ	ç
3 def	d	e	f	3	ë	é	è	ê	ð			
4 ghi	g	h	i	4	ï	í	ì	î				
5 jkl	j	k	l	5	£							
6 mno	m	n	o	6	ö	ó	ò	ô	ø	ñ		
7 pqrs	p	q	r	s	7	ß	$					
8 tuv	t	u	v	8	ü	ú	ù	û				
9 wxyz	w	x	y	z	9	ÿ	ý	Þ				
0 ␣	␣*	0										
F :,	Opens the character map with other special characters.											
▲ ▼	Alternates between upper and lower case											
◀┘	Confirms the entry.											

* Space character

To edit entries, select the appropriate position using the cursor keys ◀ or ▶ and overwrite the following positions.

6.1.2 Switching on and off

Switching on

Keep the on/off button pressed for one second to switch on the Detector. Right after switching on, the system checks the accumulator charge level. If it is not sufficient for a measuring process, i.e. of battery charge is less than 5% of maximum capacity, you are prompted to recharge the accumulator. The Detector shuts down after this error message.

If no new action is performed within a certain time after the Detector's last action, the device automatically shuts down. You must switch it back on to perform a new action. The power down time can be configured in the system menu 220.



If the accumulator is completely empty, you will not be able to switch on the Detector at all (without an error message). This prevents the accumulator from deep discharging. Recharge the accumulator to work with the Detector again.

Switching off

Press the on/off button again to switch off the Detector.

6.1.3 Display and icons

All information necessary for operating the device is shown to the user on a display. This includes

- selection of measuring points,
- user guidance while measuring,
- display of measured values,
- status display of data transfer between computer and Detector
- and system settings.



The accumulator symbol (top left in the display) informs you about the current accumulator 217 condition.

Display of longer lines

The Detector can display names that are up to 49 characters long. However, because the Detector can only display a maximum of 21 characters in a line, longer lines are indicated by an ellipsis ("..."). This indicates that there are additional characters to the left or right of the text currently being displayed.

To display parts of the line that are not currently visible, navigate in the display using the cursor keys ◀ and ▶ until you see the desired portion of text.



Icon explanation

Several icons are used in the Detector to guide the user. In the following table these icons are explained:

Symbol	Meaning
esc	Esc key
↵	Enter key
▲	Cursor key
▼	Cursor key
▲▼	Cursor keys
◀▶	Cursor keys
◢	• sub-tree has been measured partially, or • the balancing job has been started, but has not yet finished.
■	• sub-tree has been measured completely, or • a balancing job has been finished.
tw	Time signal key 212
›	is displayed in front of a menu entry if this entry can be selected.
-	is displayed in front of a menu entry if this entry cannot be selected.

6.2 Connectors

The Detector has a total of 6 connectors on the top or shaft end:

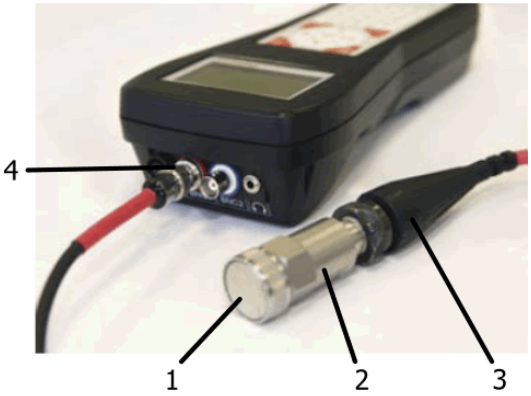
<table>
<tr><th>Connector</th><th>Meaning</th></tr>
<tr><td>BNC connectors 1/2</td><td>Each connection accommodates one active sensor with excitation current (4.7 mA).
Port 1 is always used for CM measurements. Port 2 can be used for two-plane balancing measurements.

Because the Detector is a single-channel device it cannot perform measurements at both ports simultaneously!</td></tr>
<tr><td>3.5 mm jack</td><td>Connection for headset or analog recording device. The headset connection can only be activated via the "Single measurements" menu.</td></tr>
<tr><td>9-pin sub-D socket</td><td>Connection for a serial data line to facilitate exchange of data with the computer (RS 232 interface).</td></tr>
<tr><td>AUX socket
(8p socket)</td><td>A temperature sensor or trigger sensor may be connected to the AUX socket. It is assigned as follows:


<table>
<tr><td>1: Output</td><td>12 V supply for trigger sensors (12 V against DGND)</td></tr>
<tr><td>2: Input</td><td>GND Temperature sensor</td></tr>
<tr><td>3: Input</td><td>+ Temperature sensor</td></tr>
<tr><td>4: Output</td><td>DGND</td></tr>
<tr><td>5: Input</td><td>+ Trigger sensor signal</td></tr>
<tr><td>6: Input</td><td>GND Trigger sensor signal</td></tr>
<tr><td>7: Output</td><td>5 V supply for trigger sensors (5 V against DGND)</td></tr>
<tr><td>8: -</td><td>Not used</td></tr>
</table></td></tr>
<tr><td>Charging port
(4-pin socket next to serial port)</td><td>For connection of battery charger.</td></tr>
</table>

Connect vibration sensor to BNC connector

On the top end of the Detector are two BNC connectors for connecting vibration sensors.



Mounting a vibration sensor

- Screw the magnet (1) on the sensor (2).
- Connect the sensor (2) to the sensor cable (3).
- Connect the sensor cable (3) with the corresponding BNC connector (4) of the Detector device, e.g. red cable to red BNC connector.

6.3 Accumulator

The power supply of the Detector is provided by a removable accumulator. The Detector constantly checks the accumulator charge level. If the accumulator is not sufficiently charged, the device issues a warning message and then shuts down automatically.

After Charging 218 the accumulator, the Detector is ready for use again. The accumulator stays connected to the device during charging.

Checking accumulator charge level

Click **Battery status** in the System menu to check the accumulator charge level. The accumulator charge level is displayed graphically and in % of maximum capacity.



During normal operation, the accumulator symbol (top left of display) indicates the charge level.

Charging the accumulator

- *Only use the included charger for charging the battery!*
- *Note that the Detector cannot be switched on during the charging process.*

In order to charge the accumulator

- connect the included battery charger to a supply voltage outlet and
- connect the Detector to the battery charger via the charge connector.

The charging process starts automatically as soon as the Detector is connected to the battery charger and depending on the current accumulator charge level.

The temperature of the accumulator must be between 2 °C and 44 °C. Outside of this range, the charging process is delayed until the accumulator has reached the appropriate temperature.

The LEDs on the battery charger indicate the charge level. Please refer to the battery charger manual for further information.

Recharge the accumulator regularly even when it is not in use so that the Detector is always ready for use.

Because of the physical characteristics by self discharge, a accumulator can lose its stored energy within a time period of three to four month. If you don't use the accumulator for a longer time period, please do several charge/decharge procedures at times.

6.4 Data transfer

Data are exchanged in both directions between Detector and the computer on which the Trendline software is installed. With the help of the Trendline software measuring configurations and routes are created and administrated on the computer, and measuring data are stored and evaluated.

On the one hand, measuring configurations and routes created and administrated on the computer are transferred to the Detector. On the other hand,

recorded measuring data are downloaded from the Detector to evaluate and store them using the Trendline software.

The data transfer between Detector and PC is controlled by the Trendline software.

- Connect the serial interface of Detector (9-pin sub-D-connector at the instrument shaft) with a free serial interface of the computer Trendline software is installed on.
- Follow the sequence as described in the Trendline software help menu.
- You can interrupt the data transfer between Detector and computer at any time by pressing the Esc key .



The transfer of a new route or configuration to Detector deletes all data stored on the instrument.

6.5 Device menu

When switching on the Detector, the main menu shows the following menu items: Condition monitoring 219, Balancing 220, Run up/coast down 220, Amplitude/phase 249, Single measurements 220 and System menu 220.



The menu items "Balancing" and "Amplitude/Phase" are only available if the balancing function is enabled 50 on the Detector.

Condition monitoring

Measurements are performed using the **Condition Monitoring** menu and its submenus. Here you can decide whether you want to perform a pre-configured or free measurement as well as which measuring points should be used to record data. After selecting desired the measuring point, you can begin the measurement and then decide if you want to save or discard the data. During the measurement operation, the measured results and system messages are shown on the display. You can find a more detailed description in "Measuring procedure 222".

Balancing

You can use this option to select the measuring point for the balancing measurement 234.

Run up/coast down

Use this menu item to select the run up/coast down for determining resonant ranges 247.

Amplitude/phase

Use this menu item to select the amplitude/phase measurement 249.

Single measurements

Use this menu item to do single measurements 258.

System menu

From the system menu you can specify global settings for the Detector.

Change language

Select display language. You can currently choose from the following languages: German, English, French, Italian, Dutch, Spanish, Portuguese, Swedish, Finnish, Slovenian and Turkish.

Set backlight delay

In order to save battery running time the display lighting switches off automatically once the time preset here has elapsed. The following settings are available: 30 s, 60 s, 90 s and no automatic deactivation.

Contrast settings

Press "cursor right" to increase and "cursor left" to decrease display contrast.

Memory manager

Shows the current amount of memory occupied by configuration and measuring data. See "Dynamic memory management[272]".

Battery status

Displays the charge remaining in the battery[217].

Detector information

Displays the date and time as well as the serial number and software version of the Detector. The date of the last successful calibration check is also displayed here.

Calibration

Displays the date of calibration and the date and status of the last calibration check. If the status of the last calibration check is OK, a "Yes" is displayed. "No" displays that a deviation was detected. The calibration check is password protected. If you want to perform a check, please contact support@fis-services.com.

Keep menu position

If you choose **Yes** here, the Detector will automatically display the most recently accessed menu after switching off.

Sensor power supply

This menu item lets you activate or deactivate the constant supply of the sensor. If the constant supply is always activated, the sensor is not initialized before the measurement (except for with Balancing measurements[234]), which saves time when there are many measuring points. However, the constant supply to the sensor will reduce the battery life of the Detector.

WARNING ***Damage to sensors when continuous operation is activated***



If you would like to connect passive sensors to the Detector, the continuous operation of the sensor must be deactivated to avoid damaging the sensor.

Activate constant supply of the sensor:

- Select **Sensor supply** > **Always on** and confirm the warning for passive sensors.
- The sensor is initialized. If an error occurs during the sensor initialization, the Detector will signal a sensor error and retain the **If required** setting.

Deactivate constant supply of the sensor:

- Select **Sensor supply** >**If required**.

Power down time

Here you can configure when the device should switch off automatically after the last action.

- Select **Power down time**.
- Press the Enter button ↵ and
- set the power down time in minutes.

"0" deactivates this function. In order to save battery running time, set the power down time as short as possible.

Bias voltages

For ICP sensors you can define the minimum and maximum value of the bias voltage. Minimum bias voltage must be at least 3, maximum bias voltage must not be greater than 17. The difference between the two values must not be less than 10. The default setting is min. 5 V and max. 17 V.

This values will be used for the free measurements "ISO 10816" and "Headset" as thresholds for the sensor test.

RFID settings

This menu item is only visible if the Detector has an RFID reader.

Select whether the Detector should confirm successful import of an RFID tag. The following settings are available: optical, acoustic, both.

6.6 Measuring procedure

During a measuring round the sensor signals are recorded at all measuring points and the characteristic values calculated. The measuring points can be measured in random order.

Before you perform a round of measurements with your Detector, you should

- You should mark the measuring position, where the sensor should be mounted for the measurement, in a suitable way. (only then will you get comparable results usable for trend analysis), and

- label the measuring points (only then can a measuring point be clearly identified)
- If you are using the RFID add-on for the Detector (see also "Automatic assignment of RFID tags to measuring points 54"), make sure that all measuring points have been assigned RFID tags.

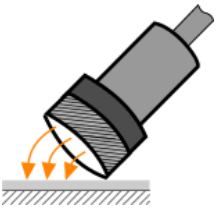
Please ensure before each round of measurements

- that the measured data stored from the previous round of measurements are transferred to the computer, as these will be overwritten by new data (only after being warned accordingly),
- that the proper configuration for the system to be measured has been transferred to Detector.
- that the battery is charged.

Fix vibration sensor at measurement point

The measurement sensor is placed with a magnet at the measurement point. Therefore the measurement point should have a good metallic contact with bearing and shaft. If this is not possible due to the housing material (e.g. aluminum), attach an iron plate or a washer the size of the magnetic at the measuring point. This is easiest done with the help of a fast-curing superglue (e. g. cyan acrylate glue).

Place the sensor as "soft" as possible. Take the sensor tightly in your hand and set it with an edge on the measurement point. Then tilt the sensor over the edge on the measuring point.



After the measurement, you can remove the sensor by tilting it over one side.

6.7 CM measurement

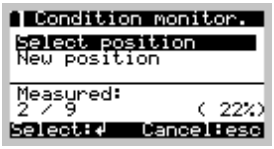
CM measurement procedure

1. First select the measuring point on the Detector at which you wish to perform the measurement. You can use the optional RFID reader for this purpose (see also ""Automatic assignment of RFID tags to measuring points" 54").

2. The rotational speed is determined at the start of a CM measurement if so specified in the Measuring point configuration [58]. If the rotational speed is outside the defined band, the Detector displays an error message. Then you can adopt the determined rotation speed. If no signal is measured for the rotational speed, you can enter the speed manually.
3. If active sensors are used, the Detector initializes the sensor and measures the bias voltage. This must reach the defined range [45] within 10 s. Otherwise the Detector cancels the measurement.
4. The Detector then uses the values last transferred by the Trendline software to initialize the PGAs in the following order: main PGA -> demodulation PGA (also see Analog branches in the Detector [273]. If these values are not suitable, the Detector defines new settings for the PGAs.
5. Measurement and determination of characteristic values:
   a) The Detector measures the specified channels.
   b) The time signals are used to calculate the FFT.
   c) The Detector uses the FFT to calculate the characteristic values.
6. If you selected the averaging function [58] for this measuring point in Trendline the measurements are repeated according to the number selected:
   a) The average value of all FFT values calculated is used for FTT averaging. This is then used as the basis for calculating the characteristic values.
   b) When averaging the characteristic values, the characteristic values for each measurement calculated first. The average value for all characteristic values calculated is then determined (steps 5a-5c are repeated).
7. If you have set universal characteristic values in the configuration, they will be queried sequential. The capture can be canceled by the Esc button.
8. Finally, the temperature is measured providing this has been specified in the configuration. The measurement can be canceled by the Esc button.
9. The measured values are displayed in an overview [226].

6.7.1 Selection of the measuring point

Using the menu **Condition monitoring** you decide first of all if you want to record data at a measuring point of a pre-configured measuring route or at a new measuring point (see "Free measurement [252]"). In the lower area a statistic shows how many measurement points of the pre-configured measurement route were already measured.



Measuring at a pre-configured measuring point

Fix the sensor to the pre-determined point.

- Start with the menu item **Condition Monitoring** > **Select position**.
- If you have marked your measuring points with RFID tags (see Automatic assignment of RFID tags to measuring points 54), the Detector automatically recognizes the measuring point as soon as you move the area under the display near to the RFID tags.



If the Detector recognizes more than one RFID tag, it displays a list of all tags found for selection. If the configuration does not contain one or more of the tags, the Detector displays an error message to indicate this.

- If no RFID tag is available, select then the name of the measuring point you have fixed the sensor to using the subsequent menus.
- Then mark **Start measurement** and
- confirm your selection using the Enter key ↵.



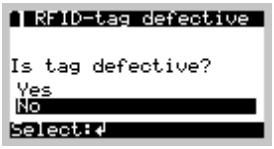
Starting the measurement after selecting a measuring point

A measuring point that has already been measured is indicated in the menu with the symbol ■.

When all measuring points in a sub-tree of a configuration (e.g. a machine) have been measured, this is also marked like this. Is the subtree only partially measured, then the Detector shows the symbol ◢.

If a line in the menus is crossed out, a data error has occurred at this point. It cannot be selected. For this, see "System messages and their meaning 263" as well.

Are at the selected measuring point still data from the last measurement stored in Detector, you can view the measuring results again before starting the new measurement.

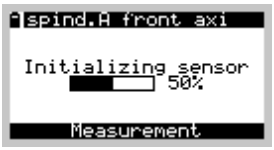


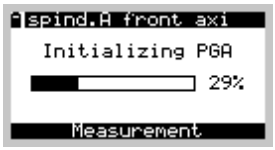
In addition, you can mark an RFID tag as defective with **RFID defective** if the Detector could not recognize it and you manually selected the measuring point.

6.7.2 Performing the measurement

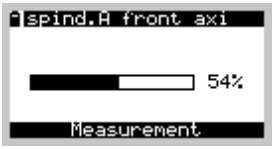
The measuring procedure consists of several steps and runs off automatically as described in CM-measurement 223.

- Initialize the sensor and set the amplification factor





- Record the time signals, calculate the FFTs and the characteristic values.



After the measurement is complete, the measured values are displayed 226.

6.7.3 Display of values measured

You can view measured time signals or trends directly once the measurement has been carried out or by selecting previous measurements in the display.

All time signals used to calculate the characteristic values (depending on the configuration) are available directly after the measurement has been carried out, also if the option "Do not save time signals“ is selected in the configuration. Depending on the configuration, it is possible when viewing a previous measurement 228 to view certain time signals or trends.



In the "Alarm" line, an alarm status overview of all characteristic values is displayed. A scrollbar is displayed on the right of the display if more than one characteristic value exists. Characteristic values with exceeded main alarm limits are highlighted.

In the following table the used icons are explained:

Symbol	Meaning
	This characteristic value is OK. No alarm occurred.
	For this characteristic value the pre-alarm threshold has exceeded. A pre-alarm occurred.
	For this characteristic value the main alarm threshold has exceeded. A main alarm occurred.
	For this characteristic value the alarm status could not be assessed (e.g. because of canceling the temperature measurement).

- Press the time signal button to switch to the Time signals or Trend display 229. In the time signal display you can switch to the FFT display 230.

In the Detector, you now have the possibility to add a measurement comment:

- Press the Function button F.



- In the comment list, you can create a new comment or select an existing one (see "Managing comments for measurements 68"). If no comments exist in the list, the edit field for the comment input is shown. To change comments with the Detector key pad proceed as follows:

You can move the cursor into the required position using the cursor keys ◀ and ▶. You can set the the upper or lower case for each position by using the keys ▲ and ▼. Additionally, you can open a character map in the edit field with the function button F. You can enter max. 49 characters, which are shown on the

Detector display in abbreviated form. Confirm your entry with the Enter button ↵.

- If you have selected a comment, it will be shown at the end of the measurement view.



- To save the measurement press the Enter button ↵. If you want to discard the measurement press the Esc button esc.



If you have set "Comment input on the Detector"59 in the Trendline software, the comment selection will appear automatically. If you selected "Enforce after each measurement" you must select a comment to continue.

- If you have already carried out a measurement at this point the Detector asks whether the last measurement should be overwritten (also following a multiple measurement231!) or whether the latest measurement should be saved or discard.
- The measurement is saved.

Once the characteristic values have been saved the Detector jumps to the **Select measuring point** menu item to enable you to record data at an additional measuring point on the same machine (see "Selection of measuring point224").

If no further measurements need to be made to the machine, you can switch the device off and move on to the next machine.

Display previous measurements

If measurements of a measurement point have been carried out earlier, you can display the time signals and trends in the Detector.

- Select **Condition monitoring** > **Select position**.
- Select plant, machine and measurement position and
- select **Previous data**.
- Select the desired measurement from the list and
- press the Enter button ↵.

The measurement view will be displayed. The heading shows date and time of the selected measurement.

6.7.3.1 Display of time signals / trends

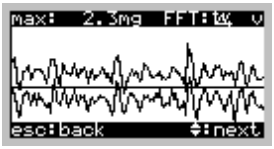
You can go to the time signal/trend selection by pressing the time signal button 212 in the measured value view.



- *The time signal and trend selection is available when time signals or trends for at least one characteristic value exist.*
- *Time signals and Trends are only displayed on the Detector to give a first quality assessment of measured data. The detailed analysis is performed with the Trendline software.*

Display time signals

- Select **Time signals** and
- press the Enter button ↵.



When viewing the time signal, press the cursor key ▲ or ▼ to switch between the several time signals. A horizontal line in the diagram indicates the zero line. At the top right side a character is displayed (a for acceleration, v for velocity and d for demodulation) to indicate the type of time signal. At the top left the maximum value of the highest peak of all measured values is displayed.

Pressing the time signal button 212 opens the FFT display 230.

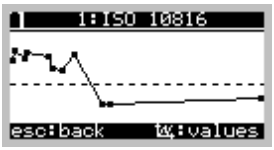
Display trends

- Select **Trends** and
- press the Enter button ↵.

On the Detector, a Trend of 2 to a maximum of 20 characteristic values can be shown. Once a characteristic value is measured at least twice, a trend can be displayed. If you want to show a trend from previous measurements 228, the selected measurement is adopted as the last current value. Recent

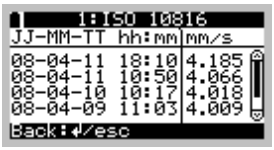
measurements are not included.

In addition, you can send the latest trend data from the Trendline software to the Detector (see Communication settings 151). The number is limited to a maximum of 10 values. These values are considered in the trend display ever! If you use for example 10 values from the Trendline, there are remaining at most 9 values for previous measurements and 1 for the current measurement.



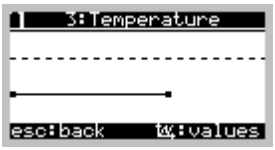
In the trend view you can use the cursor key ▲ or ▼ to switch between the several trends. A horizontal line in the diagram indicates the main alarm limit. A horizontal broken line indicates the pre-alarm limit. In the middle of the window number and type of the characteristic value are displayed. Individual measurement points (■) are joined by lines.

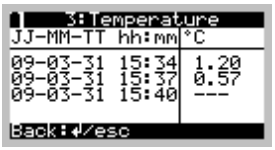
Pressing the time signal button 212 opens a table with measured values that are used for the trend view. Table values are sorted in descending order by date, time and measured value.



Press the Enter button ↵ or the Esc button, to change to the trend view.

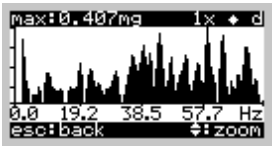
If you canceled measuring of temperature or the "universal" characteristic value, only the existing values are shown in the trend. The missing value is shown by three dashes in the table of measured values.





6.7.3.2 FFT display

You can go to the FFT display by pressing the time signal button 212 in the time signal view.



The following data is displayed:

Symbol position	Description
Top left	The value of the highest peak is displayed in the current window.
Top center	This shows the zoom factor, which can be changed by pressing the Enter button (zoom in) and Esc button (zoom out). The zoom factor can be set to 0.1x – 0.4x – 1x – 2x – 4x – 8x. With a zoom factor of 8x it is possible to read the frequency value for each peak. When pressing the Esc button in the FFT overview window (zoom factor 0.1x), the Detector leaves the FFT display and returns to the time signal display.
Top right **From the middle**	When the symbol is displayed, the auto-scaling mode is enabled. If so, the peaks in a window are scaled in a way to fit the largest peak in the display. If the symbol is not shown, the scaling remains the same for all screens and zoom factors. Press the function button F to enable/disable auto-scaling. When switching off auto-scaling, the zoom factor is set back to 0.1x.
Top right	This character shows which FFT is displayed: a: acceleration v: velocity d: demodulation
Below the FFT	Here you can see the frequency range of the window, which is currently being displayed. Press the cursor key ▲ and ▼ to scroll left or right resp. This does not work when the zoom factor is 0.1x, because the whole frequency range is already shown.

FFTs are only displayed on the Detector to give a first quality assessment of measured data. The detailed analysis is performed with the Trendline software.

6.7.4 Multiple measurements

You can measure the same measuring point multiple times using the Detector. For this select a measurement which you have already measured and measure again like described before. After the measurement, press the Enter button to save the data. Then the following menu appears:



You can now choose from three options in this menu:

Overwrite old data	The last saved measurement of this measuring point will be overwritten. The time signals that belong to the last measurement will also be overwritten.
Save as extra data	If you select this item and confirm with the Enter button ↵, this measurement is saved as an additional measurement. In the Trendline software it appears as an additional measurement of the same measuring point. The time signals are also saved, when this is required.
Discard measurement	The measurement is not saved. This corresponds to pressing the Esc button immediately after the measurement.

Bear in mind that multiple measurements can be saved only if sufficient memory is available. If insufficient space is available in the memory for additional time signals these will not be saved, even if the option "Always save time signals" is activated in the configuration. If the memory no longer has the capacity to store characteristic values it will not be possible to save the values obtained during multiple measurement.

6.7.5 Measuring with universal characteristic value

To enter a characteristic value at a selected measuring point that is not measured by the vibration or temperature sensor, you can set up 65 a **universal characteristic value** in the Trendline software. After the Detector recorded all vibration values, you will be requested to enter a value for the universal characteristic value.



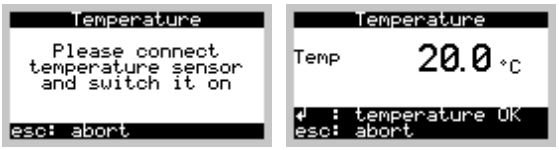
Accept this value by pressing the Enter button ↵. If you have configured several universal characteristic values for a measurement, they will be requested sequentially.

Universal characteristic values are displayed in the Detector without unit. To assign later what has been measured with this parameter, you should entitle the characteristic value accordingly (e.g. "Machine temp. [C]"). In the Trendline software you can edit the name in the "General settings" tab. On the Detector you can only change the name in the settings of free measurements.

6.7.6 Measuring with temperature sensor

If you want to measure the temperature of a selected measurement point in addition to other characteristic values, the characteristic value **Temperature** has to be set up for this measuring point using the Trendline software.

First, the Detector will record all vibration values. Prior to measuring the temperature you will be prompted to connect, or switch on respectively, the temperature sensor. The Detector takes about 5 seconds between connecting and switching on for initializing the temperature sensor. The current temperature value is displayed during the measurement. You can accept this value by pressing the Enter button ↵.



- The temperature sensor Raynger IP-M switches itself off automatically after a couple of minutes, even if the switch remains ON. If the display prompts you to turn on the temperature sensor, even though the switch is ON, turn it off and on again. If that does not help either, the battery of the temperature sensor is probably dead. Please replace it.
- You can see from the display that the Tecpel temperature sensor has switched itself off. You can switch this sensor back on immediately if required.

Further information about the temperature sensor in the manual "Principles of non-contact temperature measurements".

6.7.7 Using the headset

When using the headset, first the sensor is initialized and the amplifier set, the same as with any measuring procedure. You will then be prompted to connect the headset. The amplification factor of the signal is set automatically, shown in

the display and can be adjusted manually by the cursor keys ▲ or ▼. If this value is shown with an exclamation mark and inverted, the amplifier is over range.



6.8 Balancing measurement

The purpose of balancing is to compensate for imbalances in rotating parts through the precision attachment of balance weights in order to extend their service life. You can use the Detector III to quickly and reliably determine the best location of up to two counterweights.

WARNING ***Damage due to balancing in the resonance range***



If you are balancing a machine in the resonance range, even the smallest changes of weight may lead to severe fluctuations of the vibration amplitude. This may cause serious damage to the machine and operator injuries.

- *Therefore, do not perform balancing in the machine resonance range.*

If you do not know the resonance ranges,

- *ask the manufacturer or consult the enclosed documents about the resonance range of the device being monitored*
- *or determine the resonance range by means of a run up/coast down (see "Determining the resonance range of a machine* 247*").*

If you use the weights suggested by the Detector, it is imperative that you check the plausibility of these weights. In the balancing settings, ensure that you have entered the correct values for the rotor mass and radius because these are factored into the calculation.

Procedure for a balancing measurement

1. Measurement of rotational speed 239: The Detector initially measures the rotational speed of the component: the trigger sensor counts the revolutions using a reflex mark which is attached to the component as a reference.
2. Reference run 240: During the referencing measurement the amplitude and phase of the existing imbalance is measured at the sensor positions. This serves as the basis for the calculation of positions of weights.

3. Trial run 241: plane 1 (additional test measurement at plane 2 where two-plane balancing is carried out): During the test measurement the response of the rotor to defined weights is analyzed. The imbalance in the machine is altered by attaching the test weights. The Detector now determines the change with reference to the last measurement (for the first trial run, this is the reference measurement) and calculates the coefficients used to determine the optimum position of the balance weights.
4. Display of coefficients and attachment of balance weights 244: The Detector displays the calculated influence coefficients. To perform the trim run, attach the weights at the positions calculated by the Detector.
5. Trim run 245: The Detector now performs a measurement to check whether or not the vibration caused by the imbalance exceeds the limit defined by Trendline 69. If the balancing procedure was successful, the Detector displays a table of results and exits the balancing menu. If not, you can attach weights using the existing coefficients, then repeat the check or determine new coefficients by performing a new test measurement.

The Detector guides you through the individual steps of the balancing measurement and marks the menu items that are currently selectable. If the › symbol is displayed in front of the menu item it can be selected, otherwise the Detector shows a -.

Important information

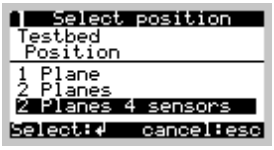
- If a balancing measurement has been already carried out for a component the Trendline software sends the coefficients of the last trim run to the Detector. Once the reference measurement has been carried out you can decide whether you wish to proceed with the trial run in order to determine new coefficients. Alternatively, you can view the "old" coefficients directly and attach the weights accordingly. However, this is only possible if the current rotational speed corresponds to the speed measured during the previous balancing measurement.
- If the test weights selected during the trial run are too small, the coefficients are calculated inaccurately. The suggested balancing weight is probably too large in this case, which can result in damage to the machine during the trim run. If, however, the test weights selected are too large, damage can occur as early on as during the trial run. During the trial run, the Detector therefore checks whether the test weights being used effect a large enough change in the vibration. If the change in vibration from all of the sensors is too low, the Detector will return a warning message. You can then decide whether to repeat the trial run with larger weights or accept these without making any changes. Always check whether the test weights selected for your machine are plausible.
- The Detector also calculates a suggested value for the test weights if the rotor mass and radius to which the weights can be attached were specified in the

Balancing settings [69]. In addition to the geometrical values, the Detector uses the imbalance measured in the previous run in order to calculate the suggested value. This is a reference or trim run for Plane 1 and for Plane 2 if the test weight has been removed. The following applies for Plane 2: If the weight has not been removed from trial run 1, the Detector takes the imbalance from Trial run 1 in order to calculate the suggested weight value.

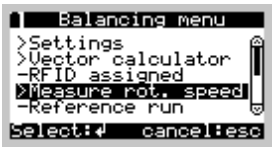
- The Detector compares the calculated balance weights using a prescribed safety limit that applies to the test weights. If the values calculated for the weights exceed the safety limit, a warning message is displayed.
- If the balancing measurement is performed using at least two sensors, after each trial run for Plane 1 the Detector evaluates whether the number of balancing planes should be modified. In the Balancing settings [69] a value greater than 0 must be entered for the balancing threshold (input field **Balancing OK at**). If you adjust the plane number based on the Detector's recommendation, the settings of the balancing measurement are copied along with the reference run and trial run into a free measurement. This then allows you to continue the balancing measurement. For the transmission to the Trendline you must sort this measurement using the Wizard [115] because the measurement can no longer be assigned to the machine automatically.
- If the coefficients determined after a trial run are used multiple times with different balance weights for the trim runs, under some circumstances they may no longer be meaningful. The Detector therefore checks the measured result after each trim run using the calculated expected values and displays a warning message if these values deviate from one another by more than 20 %. If this is the case, you should first perform a new trial run.
- As a general rule the amplitude units you specified in the Trendline program settings [146] will be displayed during balancing. If a value in the current unit is too large for the Detector display, the Detector will round this up automatically to the next higher unit of measurement, for example, from 1050 µm to 1.05 mm.
- During balancing the internal amplifier is adapted to the input signal before the start of each measuring procedure to optimize performance. However, if the signal overmodulates during the measurement, the Detector displays a message accordingly and reduces the amplification factor. This message remains displayed if the input continues to overmodulate once the amplification has been reduced. You will not be able to save the measurement and must cancel it using the Esc button .

Starting the balancing measurement

- Select the **Balance** menu item in the Detector.
- Select the measuring point with the RFID Reader or manually (see "Selection of measuring point [224]").



The **Balancing** menu is shown. Depending on the status of the balancing process, you can only select certain menu items. The Detector therefore guides you through the entire balancing process. You can only select lines preceded by a › symbol in this menu. Lines with a - can only be selected later during the balancing process.



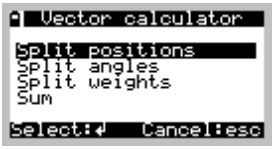
Settings

You can use this menu item to display the settings you specified for the measuring point in the Trendline balancing configuration 69.

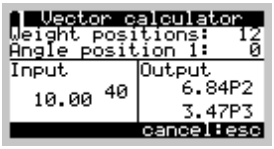


You can also restart the balancing measurement (menu item **Restart balancing**). This resets all balancing measurement data.

Vector calculator



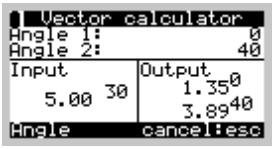
You can carry out calculations with vectors quickly and easily in the Detector using the vector calculator to distribute a weight across different positions or combine several distributed weights, for example.



Split position

Divides the vector of a weight between two positions. In relation to a full circle, enter the number of possible positions (at least 4), the angle of the first position and the weight to split. The Detector shows where the two resulting weights must be attached.

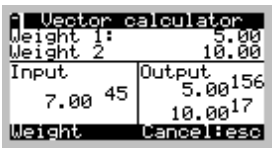
Example: Weights can be attached with a spacing of 30° between weights, meaning that 12 positions are available. A weight of 10g and an angle of 40° was determined for the weight to be attached. The Detector determines the following: A weight of 6.8 g must be attached at position 2 (at 30°) and a second weight of 3.5 g attached at position 3 (at 60°).



Split angle

Divides one weight into two with predefined angles. To do this enter both new angles as well as the weight and angle of the original vector. The Detector calculates both resulting weights. If the angle of the original vector is not between the two new angles, the Detector automatically jumps to the smaller of the two angles so that you can correct your input.

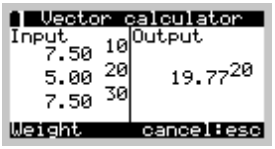
Example: You have a fan with 18 blades, the first blade at 0°, the second at 20°, etc. You want to attach a weight of 5 g at 30°, but you don't have any room left at the 20° blade. Enter 0° at "Angle 1", 40° at "Angle 2" and 5 g at 30° at "Input" in the **Split angle** function. The resulting weights at 0° and 40° are 1.4 g and 3.9 g, respectively.



Split weights

Split one weight into two weights with predefined weights. To do this enter both predefined weights as well as the weight and angle of the original vector. The Detector displays where the two predefined weights must be attached.

Example: The Detector suggests a balancing weight that you cannot select (e.g. 7 g at 45°). You can, however, replace the suggested weight with two available weights (e.g. 5 and 10 g) if the vectorial addition corresponds exactly to the suggested weight. In the function **Split weights** , enter 5 g for "Weight 1", 10 g for "Weight 2" and 7 g at 45° for "Input". You will obtain the weights 5 g in 156° and 10 g in 17° as a result.



Sum

You can use this function to determine the sum of up to three weights.

Example: You are balancing a shaft that allows you to screw on balance weights at 36 positions. You have already attached several weights during the balancing process. The Detector suggests that an additional balance weight should be attached at a position that is already occupied. You can now combine three existing weights to produce one new weight. For example: you have 7.5 g at 10°, 5 g at 20° and 7.5 g at 30°. The sum function then produces a total weight of 19.8 g at 20°. You can then remove the three weights at 10°, 20° and 30° and replace them with a new weight of 19.8 g at 20°.

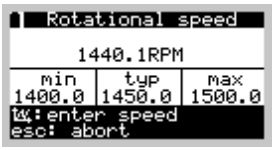
Assign RFID

Select this menu item to assign an RFID tag placed at the measuring point (see "Automatic assignment of RFID tags to measuring points 54").

In the next step you measure the rotational speed 239.

6.8.1 Measuring rotational speed

The Detector measures the rotational speed at the start of the balancing measurement via the trigger sensor. To do this, select **Measure rot. speed** from the balancing menu.



The Detector returns an error message if the acquired speed

- is outside the range defined in the Trendline software (see "Rotational speed settings 70") (speed out of range, see also "System messages and their meaning 263"),
- or is within a specified resonance frequency range (see "Resonance frequency ranges 71").

You can then cancel the measurement or apply the current rotational speed as new speed.

Press the Enter button ↵ to apply the rotational speed displayed.

If you repeat balancing using a balancing configuration and the rotational speed is outside of the selected range, the calculated coefficients are no longer meaningful. In this case, the Detector will display a warning and you can use the differing speed or abort the measurement.

- *To use the differing rotational speed, confirm this by pressing the Enter button ↵. The coefficients can now no longer be used; you must first perform a Trial run 241 for all planes.*
- *To abort the measurement of the rotational speed, press the Esc button esc. The Detector jumps to the Balancing menu. Now you can, for example, bring the machine to the correct rotational speed before repeating balancing procedure.*

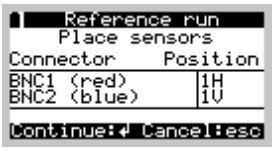
The rotational speed measurement is followed by the reference run 240.

6.8.2 Reference run

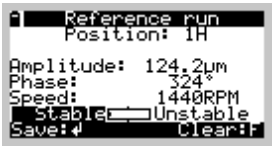
To perform the reference measurement, select **Reference run** from the balancing menu.

The rotational speed is monitored during the reference measurement. If this falls outside the defined band, the Detector displays an error message.

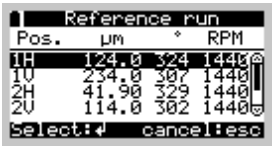
- Attach the sensors to the component and connect these to the BNC connectors of the Detector as specified in the balancing configuration 69.



- The Detector guides you through the measurement and determines the amplitude and phase of the vibration at the sensor positions. A bar showing mean variance displays the stability of the values. You can reset the mean by pressing the function button F to restart mean calculation.



- Press the Enter button ↵ once amplitude and phase have stabilized after a time.
- Once you have measured all sensor positions, the results are displayed in a table. If the measured values are OK, select the **Values are OK** menu item and press the Enter button ↵ to save the measured values. If you are not satisfied with a measured value, you can use cursor keys ▲ and ▼ to select this value and the Enter button ↵ to repeat this individual measurement.



- At this point, you can select a comment. In the comment list, you can create a new comment 227 or select an existing one (see "Managing comments for measurements 68"). If no comments exist in the list, the edit field for the comment input is shown. Confirm your settings with the Enter button ↵.



The measured values obtained during the reference run are only saved after you confirm by clicking ***Values are OK*** *by pressing* the Enter button ↵. *In the table of results, click the Esc button* esc *to discard the measured values and the Detector returns the Balancing menu. Repeat the reference run if necessary.*

Now you can proceed with the trial run 241.

6.8.3 Trial run

To perform the trial run select **Trial run** from the balancing menu. With two-plane balancing the Detector initially guides you through the test measurement at plane 1 then continues with plane 2. In the trial runs, apply a known weight to a known position. With this information, the Detector determines the change between reference run and trial run and can thus determine the influence coefficients. These indicate how machine imbalance changes with a certain weight and are used calculate the balancing weights.

If the change in vibration is too little because the test weights selected were too small (see also "Important information" in "Balancing measurement" 234, the

Detector will return an error message. You can then decide whether to repeat the trial run with larger weights or accept these without making any changes.

- Attach the sensors to the component and connect these to the BNC connectors of the Detector as specified in the balancing configuration 69.
- Based on the geometrical values specified in the balancing configuration as well as the imbalance measured in the reference run, the Detector calculates a suggested value for the test weight. If one of the geometrical values or the measured imbalance is zero, no suggested value is calculated (display "--").



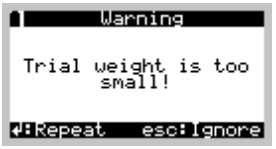


- Enter the data, attach the weights and confirm this on the Detector. The position of a test weight is counted from the rising or falling edge of the trigger mark (depending on which one you selected in the configuration 73). You can check it up in the Balancing menu **Settings** -> **Trigger sensor** -> **Trigger pos.**. The angle of the weight is always counted AGAINST the direction of shaft rotation. You can specify it in degrees or, if you have set discrete positions, as a position number. Here, P1 is the first position from the trigger mark AGAINST the direction of rotation, P2 the second, etc. When using discrete positions, you can apply one or two test weights.





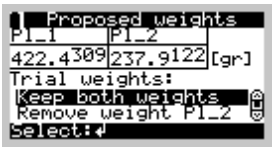
- The Detector guides you through the measurement, determines the amplitude and phase of the vibration at the sensor positions and displays the values.
- If the change in vibration is less than 20% with respect to the reference run for all sensors, the Detector will warn you that the test weights may be too small.



- For two-plane balancing, the Detector also checks whether the test weights are possible too small. In doing so, the change in vibration in Plane 2 is calculated with respect to the reference run if you have removed the test weight for Plane 1. If you have kept the test weight for Plane 1, the change in vibration is calculated with respect to the first test run.
- If the minimum required change in vibration is exceeded only at one sensor for 2-plane balancing in the trial run for Plane 1 and subsequently for Plane 2, a defect is likely the cause. The Detector will return a warning if this is the case.
- If the Detector found that the number of balancing planes was probably insufficient (1-plane balancing) or unnecessarily large (2-plane balancing), a warning message is displayed. You can then modify the number of balancing planes. Please note that the measurement is resumed as a free measurement, and you must then sort this with the wizard 115 when transferring to the Trendline software.
- At this point, you can select a comment. In the comment list, you can create a new comment 227 or select an existing one (see "Managing comments for measurements 68"). If no comments exist in the list, the edit field for the comment input is shown. Confirm your settings with the Enter button ↵.
- However, you can still apply the measured values or repeat the trial run with other weights. If you repeat the trial run, the weight used in the previous trial will be used as the start value when entering the weight. Please ensure that you also take this weight into consideration when repeating the trial run and not only the weights that have been added!
- Then the Detector asks whether you want to remove the test weight. If you have screwed the test weight on, it is an advantage to unscrew it so as to keep the number of weights on the shaft as small as possible. If you welded it on, it is easier to leave the test weight on the shaft.

- In two-plane balancing, you can specify what weights you want to remove after the second trial run. You can
  - keep both weights,
  - remove the weight last used, or
  - remove both test weights,

  if you have not removed the test weight in plane 1. Otherwise, you can only choose whether to remove the weight in plane 2 or not.



*The measured values obtained during the trial run as well as the attached test weight are only saved once you have provided the **Values are OK** confirmation with* the Enter button ↵. *Once this confirmation has been given this step of the balancing measurement can be read out in Trendline.*

- After the last trial run, the program displays suggestions for weights to apply.
- Next step: display coefficients and attach balance weights 244.

6.8.4 Display coefficients and apply balance weights

Display coefficients

The Detector displays the influence coefficients from the test measurements in this overview. These are used to calculate the balance weights. They describe the change in vibration in relation to a weight and have vibration unit / weight unit as their unit of measurement, for example µm/g. For 1-plane balancing, there is only one coefficient, while two coefficients are determined per sensor position for two planes.

Applying balance weights

WARNING ***Damage caused by balancing with weights that are too heavy***

If you are operating a machine with balance weights that are too heavy, the resulting imbalance can cause severe damages to the machine and injuries to the operating personnel. It is therefore imperative that you observe any warnings from the Detector and operate the machine only within the operating margins specified by the manufacturer.

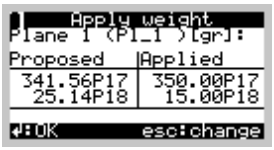
In the **Apply weight** menu the Detector shows which balancing weights are calculated for the respective plane. If the suggested values exceed the safety limits, the Detector will return a warning:

- If the previous balancing procedure was a trial run and the test weight was **not** removed, the safety limit will be twice the weight of the test weights.
- In all other cases, the safety limit is three times the weight of the test weights.



You can now restrict the calculated suggested weight to the particular safety limit. The following input of the weights actually applied remains unaffected by this.

Now the weights have to be attached. If you attach weights different from the suggested values (e.g. because you do not have the needed weights), please enter the value of the weights actually attached along with their position. On a 2-plane balancing job, this step is done separately for every plane. If you are using discrete positions, the program always displays two weights. Together they equal the required balancing weight.



You can abort input of weights at any time by pressing *the Esc button* in order to use to the vector calculator, for example. When you click **Apply weight** again, the previous inputs are still there, so you can continue at the same point.

Here again, weight positions are counted AGAINST the direction of rotation starting from the set edge of the trigger mark.

The coefficients calculated and balance weights entered are saved together as part of the subsequent Trim run 245. *This data can only be read out using Trendline once the trim run has been carried out and the* ***Values are OK*** *confirmation has been provided with* the Enter button ↵.

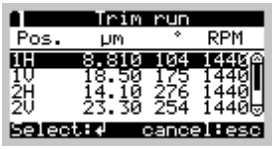
6.8.5 Trim run

To perform the trim run select **Trim run**.

- Attach the sensors to the component and connect these to the BNC connectors of the Detector as specified in the balancing configuration 69.
- The Detector guides you through the measurement and determines the amplitude and phase of the vibration at the sensor positions as well as the

rotational speed. Next, it displays the resulting measurements.

- Here you can enter a comment, either accept these measurements or discard them and repeat the measurement.



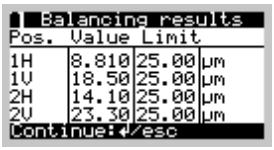
For balancing you will usually need more than one run. If the result is not sufficient after the trim run, the Detector returns to the Balancing menu. You can now reduce imbalance in two ways:

- Use the existing influence coefficients and apply balancing weights calculated with these coefficients again.



- *If you repeat the steps of applying weights and trim run with existing influence coefficients and you notice that the imbalance does not improve, this is a sign that the influence coefficients are no longer good and that you need to re-determine them with a new trial run.*

If the amplitudes measured at all sensor positions in the trial run are smaller than the balancing threshold defined in Trendline (**balancing OK at**), the balancing process is finished. The Detector displays the table of results displaying the last measured values and the balancing threshold. Then, the Detector returns to the menu, where you can select a new measuring point.





*The measured values obtained during the trim run, the coefficients calculated and attached weights are only saved once the **Values are OK** confirmation has been provided using* the Enter button ↵. *Once this confirmation has been given this step of the balancing measurement can be read out in Trendline.*

6.9 Run up/coast down (Determining the resonance range)

Background

Balancing a machine with the aid of the Detector must not be performed in the resonance range as the vibration amplitude increases severely and the phase changes considerably when the machine is operated at or near resonant frequencies. Even the smallest weight changes may lead to severe amplitude changes so that, if the worst comes to the worst, a balancing attempt may even destroy the machine.

In order to avoid such damage, you can determine the resonant ranges of a machine using the Detector and the Trendline software. To do so, the machine is started up and shut down in a controlled manner (run up/coast down test) while the Detector continuously measures the amplitude and phase of the vibration and rotational speed at the measuring point. The data measured in this test are displayed in an amplitude/phase diagram.

For the measurement, you can specify a rotational speed range to automatically start and stop the measurement. Alternatively, you can start and stop measuring manually.

WARNING ***Damage due to operation outside manufacturer's specifications***



The machine must be operated within rotational speed limits permitted by the manufacturer for normal operation while determining resonant ranges. Therefore, always observe these rotational speed limits when performing the run up/coast down test. Determination of resonant range is always performed at the system operator's own risk!

Conditions

- Run up/coast down must be set up in the configuration 58.

Other notes

- The Detector performs the measurement with only one vibration sensor. If you want to determine the resonant ranges at multiple sensor positions, you must repeat the entire run up/coast down procedure there.

Determining resonant range of a machine

Proceed as follows to carry out the measurement with a defined rotational speed range:

- Select the **Run up/coast down** menu item in the Detector.

- Select the measuring point with the RFID Reader or manually (see "Selection of measuring point 224").
  The **Run up/coast down** menu is shown.
- Press **Start measurement**.
- Perform the run up/coast down test on the machine.
  a) If you pre-set the rotational speed range, the Detector automatically measures in the defined rotational speed range.
  b) Otherwise, press **Start** once the desired start speed has been reached and **Stop** once the desired end speed has been reached.
- You can now select a comment. In the comment list, you can create a new comment 227 or select an existing one (see "Managing comments for measurements 68"). If no comments exist in the list, the edit field for the comment input is shown. Confirm your settings with the Enter button ↵.
- Select **Finalize measurement**. The Detector saves the measured values. Transfer the data from the Detector to the Trendline software.

Proceed as follows to perform the measurement manually:

- Select the **Run up/coast down** menu item in the Detector.
- Select the measuring point (see "Selection of measuring point 224").
- Perform the run up/coast down test on the machine.
- Once the desired starting speed has been reached, press **Start measurement** . The Detector starts measuring.
- Once the desired ending speed has been reached, press **Stop**.
- You can now select a comment. In the comment list, you can create a new comment 227 or select an existing one (see "Managing comments for measurements 68"). If no comments exist in the list, the edit field for the comment input is shown. Confirm your settings with the Enter button ↵.
- Select **Finalize measurement**. The Detector saves the measured values. Transfer the data from the Detector to the Trendline software.



- *For measurements below 300 RPM no results are displayed or stored on the Detector.*
- *You can display the run up/coast down settings made in the Trendline software in the Detector by pressing **Settings** after selecting the measuring point.*

Further information in the chapters Transferring the data to the Trendline software 218 and Creating an amplitude/phase diagram in the Trendline software 117.

6.10 Amplitude/phase measurement

Background

Experienced users can use the amplitude/phase measurement to determine changes in the stiffness of a component that are caused by structural breakage in the material, for example. To do this, you first use the Detector to perform vibration measurements at different points along the component. After transferring to the data to the Trendline software you can then analyze the amplitude/phase graph to determine whether there are any changes in stiffness. For example, if the phase jumps 180° from one measuring point to the next, this indicates structural breakage between the two points. If, however, the phase values of the particular measurement are not significant, this generally means that there is only an imbalance running down the length of the entire component.

If you have discovered a "critical" spot, you can narrow it down by performing additional measurements between the two originally measured points. In this way you can "feel out" the damages of components step by step.

Conditions

- Balancing must be enabled on the Detector (see "Balancing activation" 50).

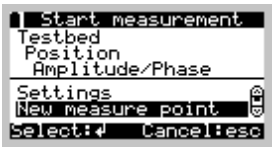
Other notes

- The number of measuring points is limited to 255.

Starting the amplitude/phase measurement

- Select the **Amplitude/Phase** menu item in the Detector.
- Select the measuring point with the RFID Reader or manually (see "Selection of measuring point 224").

The **Amplitude/Phase** menu is displayed.



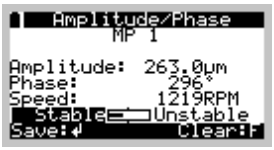
New measuring point

- Attach the sensor to the point provided for this purpose.
- Name of the measuring point: The Detector suggests the names specified in the Trendline software (see "Setting up the amplitude/phase configuration" 76) and adds a space and consecutively increasing number to these (e.g. "MP 1).

You can accept the suggested name or enter a different name.

- Pitch: The pitch at the reference point is needed to display the position of the measuring point in the amplitude/phase graph. If at least two measuring points are already available, the Detector automatically suggests a value composed of the pitch of the last measuring point and the pitch between the two last measuring points. You can accept the suggestion or enter a different value.

The measurement is started. The Detector measures the rotational speed as well as amplitude and phase of the vibration. A bar showing mean variance displays the stability of the values. You can reset the mean by pressing the function button F to restart mean calculation.



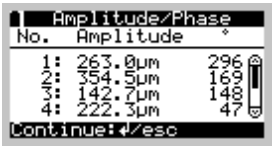
- Press the Enter button ↵ once amplitude and phase have stabilized after a time.
- After completing the measurement, you can select a comment. In the comment list, you can create a new comment 227 or select an existing one (see " Managing comments for measurements 68 "). If no comments exist in the list, the edit field for the comment input is shown. Confirm your settings with the Enter button ↵.
- Select **Values are OK**.

The values for the measuring point are saved along with the comment. You can now continue or stop the measurement at the next measuring point.



- *The number of measuring points is limited to 255. Once this number is reached, the Detector displays a warning and automatically stops the measurement.*
- *If there is not enough memory for an additional measuring point, the Detector also displays a warning and automatically stops the measurement.*

After completing the measurement, the Detector displays all measured values in a table.



You can repeat a measurement (completely or at particular measuring points) before you transfer the measurement data to the Trendline software. To do this, select **Repeat measurement** in the **Amplitude/phase** menu. The Detector displays a table containing all of the available measuring points. A measuring point that has already been measured is indicated in the menu with the symbol ■ . Select the desired measuring point in order to repeat a measurement.

Settings

You can use this menu item to display the settings you specified for the measuring point in the Amplitude/phase configuration 76 of the Trendline software. In the case of a free measurement, you can also modify the settings from here as long as no measurement has been taken.

General

Select this menu item to display the amplitude/phase and the rotational speed settings of the configuration.



Trigger sensor / vibration sensor

Select this menu item to display the particular sensor setting from the Amplitude/phase configuration 76.

Remove all

Select this menu item to delete all previous measured values as well as the name and pitches for this configuration.

Clear measured values

Select this menu item to clear all previously measured values for this configuration, i.e. amplitude/phase values, rotational speed. Names and pitches are not deleted such that you can repeat the measurement at all measuring

points without having to reenter names and pitches.

Delete measuring point

Select this menu item to delete particular measured values.

The Detector displays a table containing all of the available measuring points. A measuring point that has already been measured is indicated in the menu with the symbol ■.



- Select the measuring points you would like to delete and confirm the delete process with the Enter button ↵.

6.11 Free measurement

In addition to the planned route 112 measurements you can also use the Detector to carry out what are known as free measurements. For CM, balancing, amplitude/phase measurements and run up/coast down measurements, select the **New measuring point** menu item.

> **Example**: You are in the process of taking a round of measurements. You notice an unusual noise or unusually high temperature on a machine that is not included in this round of measurements. You can use the **New position** option to carry out an additional on-the-spot measurement.

In these situations measurement templates must be defined using the Trendline - Software. The templates you create depend on your particular circumstances. The procedure for creating and transferring measurement templates is described in detail under "Create template 109". If there isn't a template from the Trendline software on your Detector, you can select a default template on the device.



*The Detector displays all velocity values during the free measurement. These values are in the units selected in the Trendline software for the template being used. In the **Settings** menu you can also change almost all settings during the free measurement.*

Free CM measurement

- Position the sensor at the desired measuring point.

- Select **Condition monitoring** > **New position**.
- Then go to **Select template** to choose a suitable template. You can select the template of a previous measurement, alternatively.



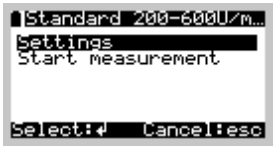




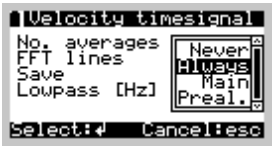
In the next menu you can change the template name so that the free measurement can later be assigned to the measuring point at which it was recorded.

- If you accept the name without changing it, the free measurement is assigned the template name and also a reference number that increases by one each time a new measurement is taken using this template (<Name> 1, <Name> 2, ...).
- To change the name select **Change name** and confirm your choice with the Enter button ↵. On the next screen, the name of the template selected and the current order number are displayed, and a cursor is positioned under the first letter. Change the name as described in Key pad entries 213.

- After changing the name select **Continue**.
- Select **Settings** to adopt the configuration of the template.







When carrying out a free measurement all other values can be changed in addition to the template name. To do this, select the **Settings** item in the menu. You can now select the relevant values using the Enter button ↵. Depending on the type of setting, you can now type in a new value directly, make a selection from a drop-down menu or modify an item of text as described above. Leave the settings menu with the Esc button.

- Select **Start measurement** to begin the measuring procedure.

From this point onwards the sequence of the measuring process is identical to the Standard measurement 223 process (initialization of hardware, recording of characteristic values, display of measuring results with comment selection, storage of measured data).

Show previous measurements

In order to view the results for free measurements previously carried out select directly after the measurement **Previous data** and select the desired measurement from the list.

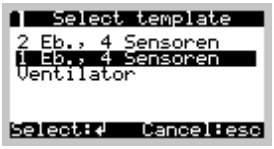
Multiple measurements

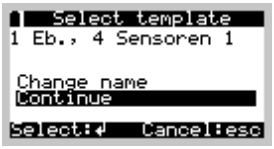
You can repeat a free CM measurement just like a CM measurement. For more information on multiple measurements, see the section Multiple measurements 231.

Free balancing measurement

- Position the sensor(s) at the desired measuring point.
- Select **Balancing** > **New** measuring **point**.
- Then go to **Select template** to choose a suitable template. You can select the template of a previous measurement, alternatively.



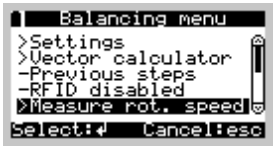




In the next menu you can change the template name so that the free measurement can later be assigned to the measuring point at which it was recorded.

- If you accept the name without changing it, the free measurement is assigned the template name and also a reference number that increases by one each time a new measurement is taken using this template (<Name> 1, <Name> 2, ...).
- To change the name select **Change name** and confirm your choice with the Enter button ↵. On the next screen, the name of the template selected and the current order number are displayed, and a cursor is positioned under the first letter. Change the name as described in Key pad entries 213.

- After changing the name select **Continue**.
- Select **Settings** to adopt the configuration of the template.







When carrying out a free measurement all other values can be changed in addition to the template name. To do this, select the **Settings** item in the menu. You can now select the relevant values using the Enter button ↵. Depending on the type of setting, you can now type in a new value directly, make a selection from a drop-down menu or modify an item of text as described above. Leave the settings menu with the Esc button ⏏.

- Select **Measure rotation speed** to begin the measuring procedure.

From this point onwards the sequence for the measuring procedure is identical to the performing a balancing measurement 234.

*If you modify the balancing unit while performing a free measurement (**Type of vibration unit**), the limit value for the balancing measurement (**Balancing OK at**) is reset to 0. The previous value is no longer applicable for the new balancing unit. You should always adjust the limit value in this case; otherwise, the Detector will never be able to complete the balancing measurement and you would have to complete balancing manually.*

You can change the settings for the free balancing measurement until the first reference run 240 has been completed and saved. Afterwards, your settings are locked and can no longer be changed.

Continue balancing measurement

Once the Detector has been switched on, you can resume a free measurement that was started previously. To do this, select **Balance** > **New position** > **Previous data** and then the required measurement. You can now continue with balancing process as usual.

Free run up / coast down measurement

- Position the sensor at the desired measuring point.
- Select **Run up / coast down** > **New measuring point**.

- Then go to **Select template** to choose a suitable template. You can select the template of a previous measurement, alternatively.



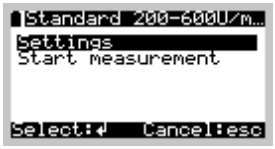




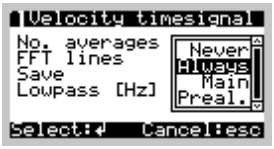
In the next menu you can change the template name so that the free measurement can later be assigned to the measuring point at which it was recorded.

- o If you accept the name without changing it, the free measurement is assigned the template name and also a reference number that increases by one each time a new measurement is taken using this template (<Name> 1, <Name> 2, ...).
- o To change the name select **Change name** and confirm your choice with the Enter button ↵. On the next screen, the name of the template selected and the current order number are displayed, and a cursor is positioned under the first letter. Change the name as described in Key pad entries 213.

- After changing the name select **Continue**.
- Select **Settings** to adopt the configuration of the template.







When carrying out a free measurement all other values can be changed in addition to the template name. To do this, select the **Settings** item in the menu. You can now select the relevant values using the Enter button ↵. Depending on the type of setting, you can now type in a new value directly, make a selection from a drop-down menu or modify an item of text as described above. Leave the settings menu with the Esc button ◢.

- Select **Start measurement** to begin the measuring procedure.

As of here, the procedure corresponds to the run up / coast down test (see " Determining the resonant range of a machine 247").

Continue free run up / coast down measurement

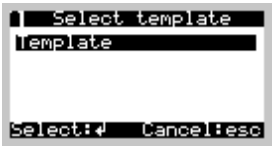
Once the Detector has been switched on, you can resume a free measurement that was started previously. To do this, select **Run up / coast down** > **New position** > **Previous data** and then the required measurement. You can now

continue with balancing process as usual.

Free Amplitude/Phase measurement

- Position the sensor at the desired measuring point.
- Select **Amplitude/Phase** > **New position**.
- Then go to **Select template** to choose a suitable template. You can select the template of a previous measurement, alternatively.



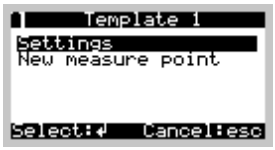




In the next menu you can change the template name so that the free measurement can later be assigned to the measuring point at which it was recorded.

- o If you accept the name without changing it, the free measurement is assigned the template name and also a reference number that increases by one each time a new measurement is taken using this template (<Name> 1, <Name> 2, ...).
- o To change the name select **Change name** and confirm your choice with the Enter button ↵. On the next screen, the name of the template selected and the current order number are displayed, and a cursor is positioned under the first letter. Change the name as described in Key pad entries 213.

- After changing the name select **Continue**.
- Select **Settings** to adopt the configuration of the template.







When carrying out a free measurement all other values can be changed in addition to the template name. To do this, select the **Settings** item in the menu. You can now select the relevant values using the Enter button ↵. Depending on the type of setting, you can now type in a new value directly, make a selection from a drop-down menu or modify an item of text as described above. Leave the settings menu with the Esc button.

- Select **New measure point** to begin the measuring procedure.

From this point onwards the sequence of the measuring process is identical to

the Standard amplitude/phase measurement 249 process.

Multiple measurements

You can repeat a free measurement just like a measurement. For more information on multiple measurements, see the section Multiple measurements 231.

6.12 Single measurements

With the Detector, you can perform single measurements to the ISO 10816 characteristic value determination, for "listening" to the measurement point, for temperature and rotational speed measurements as well as for the ICP sensor test.

- Press on **Single measurements** in the main menu.



Please note that single measurements cannot be saved.

ISO 10816

This menu item allows you to perform a single CM measurement for recording characteristic values as per ISO 10816 (class 1-4). Please note that you cannot save this measurement!

The following fixed settings are used to perform for the ISO 10816 single measurement:

	Class 1	Class 2	Class 3	Class 4
Pre-alarm threshold	1.8 mm/s	2.8 mm/s	4.5 mm/s	7.1 mm/s
Main alarm threshold	4.5 mm/s	7.1 mm/s	11.2 mm/s	18.0 mm/s
Sensitivity of sensor [mV/g]	100			

ISO 10816 classes

RMS mm/s	I	II	III	IV
0,28	A	A	A	A
0,45	A	A	A	A
0,71	A	A	A	A
1,12	B	A	A	A
1,80	B	B	A	A
2,80	C	B	B	A
4,50	C	C	B	B
7,10	D	C	C	B
11,20	D	D	C	C
18,00	D	D	D	C
28,00	D	D	D	D
45,00	D	D	D	D

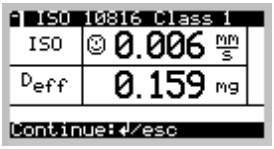
A	OK	Typical for a new machine.
B	OK	Condition of machine is suitable for continuous operation.
C	Pre-alarm	Condition of machine is no longer suitable for continuous operation; limited operating duration possible in this state.
D	Main alarm	Hazardous vibrational state, damage to the machine may be imminent.

(Source: ISO 10816-1)

Classes	Explanation
I	Components of motors and machines rigidly connected with the complete machine under the usual operating conditions (typical: drive motor up to 15 kW output).
II	Medium-sized machines (typical: 15 kW to 75 kW output) without special foundations, rigidly constructed motors and machines (up to 300 kW) on special foundations.
III	Large motors and other large machines with rotating masses, constructed on rigid and heavy foundations that are relatively stiff in the direction of the vibration that is measured.
IV	Large motors and other large machines with rotating masses, constructed on foundations that are relatively forgiving in the direction of the vibration (e.g. turbo generating sets and gas turbines with an output greater than 10 MW).

- Select **Single measurements** > **ISO 10816** and then the desired class.

The measurement is performed accord to the CM measurement 223. Finally a summary of the results including the alarm status 226 is displayed. The demodulation value is shown without alarm status.



The measurement cannot be saved and you also cannot view any time signals, FFTs or Trends. You can, however, perform an additional measurement:

- Press the Enter key ↵ in order to take a measurement for the same class.
- Press the Esc key to select another class.

Headset

The headset function can be activated under **Single measurements** > **Headsets**. Here you can "listen to" a measuring point and adjust the amplification factor for this option. The headset cannot be used in the Detector during a measurement.

In addition to headset, an analog recorder may also be connected to the 3.5 mm jack. Measurement with headset is described in more detail in using a headset 233.

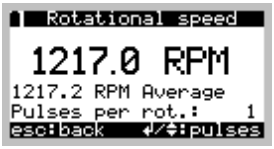
Temperature

The temperature can be measured directly via **Single measurements** > **Temperature** without requiring prior configuration. The procedure is the same as for a normal Temperature measurement 233. The only difference here is that the temperature cannot be saved.



Rotational speed

The rotational speed can be measured directly by selecting **Single measurements** > **Rotational speed**. The Detector shows the current and the average rotational speed. If you want to set pulses per rotation, press on ▲ or ▼ or press the Enter button ↵ and enter the number of pulses.



ICP sensor test

The ICP sensor test checks the following cases based on the bias voltage of the sensor connected to the BNC1 connector:

- The voltage is within the specified range: The sensor is functional.
- The voltage is greater than maximum sensor voltage: The sensor cable is defective or no sensor is connected.
- The voltage is between 0 and minimum sensor voltage: The sensor is defective.

After starting the ICP sensor test, it may take a few seconds, until all transient effects are concluded in the sensor.

6.13 Delete measured data

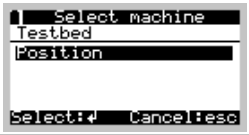
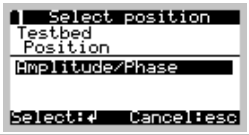
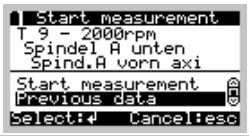
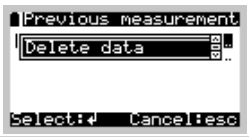
You can delete the measuring data of a CM, balancing, run up/coast down or amplitude/phase measurement on the Detector. Therefore select the desired level (hall, machine or measuring point) or mark directly a measurement to delete.

Please note, that the measurement data will be irrevocably lost if you confirm the deleting process. You cannot recover the data!

Delete measurement data on the Detector

- Select the level below which the measured data should be deleted.
- Press the function button F.
- Select **Delete data** and
- confirm the deleting process with the Enter button ↵.

The following table describes the deleting of CM measurement data on each level. The deleting procedure is the same for balancing, run up/coast down or amplitude/phase measurements.

Level	Step and description
Delete measurement data of a configured measurement point	
	**Select position** mark: All measurement data of the associated measurement places will be deleted.
	Select position > **Plant** mark: All measurement data of the selected hall will be deleted.
	Select position > Plant > **Machine** mark: All measurement data of the selected machine will be deleted.
	Select position > Plant > Machine > **Position** mark: All measurement data of the selected measurement place will be deleted.
Delete previous measurement data of a configured measurement point	
	Select position > Plant > Machine > Position > Previous data > Mark measurement to be deleted: All measurement data of the selected previous measurement will be deleted.
Delete free measurement data	
	**New position** mark: All measurement data of the associated free measurements will be deleted.
	New position > Previous data > Mark measurement to be deleted: All measurement data of the selected free measurement will be deleted.

In balancing measurements the last coefficient provided by the Trendline will be kept, so the trial run will not be restarted at the next balancing process. In amplitude/phase measurements all measurement points that are saved to a configuration or free measurement will be deleted also.

6.14 System messages and their meaning

Error message	Description	Cause of the fault / solution
Sensor error	An error occurred during the initialization phase of the measuring process. With active sensors: the measured bias voltage is not within the specified range.	The sensor (or sensor cable) is defective or not properly connected. If the voltage is not within the valid range for active sensors, this may be because: • the sensor is not connected, • the sensor has short circuited, • the sensor has a defective cable, • the set bias voltages 46 are wrong for the sensor being used. For more detailed troubleshooting, perform a ICP sensor test 261.
Measuring point is crossed out	The current measuring point has a data error. You cannot start this measurement. If you try to start the measurement, the "CRC error" message is displayed.	If there are still measured data saved in the Detector, use Trendline to collect them. Only those measurements are transferred that do not have an data error. Measurements with data errors are lost. The send a new configuration to the Detector.
Input overmodulated! Please measure again.	The measurement amplifier settings are optimized before the measurement is carried out. If the strength of the measured signal increases after this setting increases, the input may become overmodulated.	If this error occurs, you must repeat the measurement. If this error occurs frequently you are probably carrying out measurements at a machine that is turning quite slowly (< 120 revolutions per minute). The Detector is not designed to carry out these kinds of measurements.
Connect temperature sensor and switch it on	Before performing a temperature measurement you will be prompted to connect	If you are using a Raytek sensor and its switch is ON, switch it off and on again.

Error message	Description	Cause of the fault / solution
	or switch on the temperature sensor.	
Temperature too high	The measured temperature is beyond the technical limit of the temperature sensor.	Temperature measurement range: -15 °C to +550 °C
No memory left for saving data	Cannot create any more measurement, balancing step or new data block for run up/coast down because memory is full.	Transfer the data to Trendline and transfer the last balancing configuration or route back to the Detector.
Warning: battery low	The battery is nearly empty.	Please recharge 218 the accumulator before continuing to work with the Detector. Otherwise, the Detector could shut down without any warning so as to protect the accumulator.
The battery is empty Please charge	The battery is empty, the Detector cannot be switched on.	The battery must be recharged 218.
No memory allocated	No memory has been allocated for configurations that have been sent to the Detector.	The Trendline database may contain an error. Please contact support@fis-services.com.
No template loaded	No balancing, CM or run up/coast down template has been saved.	You are trying to perform a free measurement, but there is no template is stored in the Detector. Templates are only attached if you click in Trendline on **Detector** > **Send route** .
No configuration loaded!	No balancing, CM or run up/coast down configuration has been saved.	You wish to carry out balancing, a CM measurement or a run up/coast down procedure but have not yet transferred a configuration to the Detector. In Trendline click on **Detector** > **Send configuration** or **Detector** > **Send route**.
No free measurements saved	No free measurements have been performed yet.	You are attempting to view free balancing, CM measurements or run up/coast down measurements on the Detector although neither of these types of measurement has been carried out.
No balancing configuration stored.	The Detector is attempting to save time signals but cannot because of insufficient memory.	Send a balancing configuration to the Detector (click in **Trendline on Detector** > **Send configuration** or **Detector** > **Send route**) before you select a configuration from the balancing menu of the Detector.
No memory available for time	The Detector is attempting to save time	This can occur if you want to save only those time signals occurring in the event of an alarm. It is also possible that

Error message	Description	Cause of the fault / solution
signals	signals but cannot as there is not enough memory.	you have taken multiple measurements at this measuring point. The characteristic values are always saved, but none or only some of the time signals are saved.
Input overmodulated!	The vibration signal is too large to be measured by the Detector.	There are two possible causes for this: • The input signal is very large (>50 g). Use another sensor (with a sensitivity of 10 mV/g, for example). • The strength of the signal increased after the amplifier was adjusted due to an impact on the machine, for example. The vibrations must remain more or less constant throughout the entire measurement.
No RPM signal!	The rotational speed signal is missing.	Possible causes: • The trigger sensor is not correctly aligned with the reflex mark. • The reflex mark was not glued on. • The trigger sensor is too close to the reflex mark (<10 cm). Increase the distance. • The trigger sensor has been incorrectly configured 45 in Trendline (incorrect supply voltage, for example). • You have not connected the trigger sensor to the AUX port 216 of the Detector.
Rotational speed unstable!	The rotational speed signal is fluctuating.	Possible causes: • The trigger sensor is not correctly aligned with the reflex mark. • The trigger sensor is too close to the reflex mark (should be at least 10 cm). • Machine rotational speed fluctuates.
The rotational speed not within range.	The acquired speed is outside the rotational speed band defined in .	Reduce the speed of the machine or use the current rotational speed as the new nominal rotational speed.
No conf. for RFID	No configuration found for the RFID entry.	This error occurs when Trendline sends the RFID status for a measuring point before a balancing, CM or run up/coast down configuration was sent. Make sure that there is a configuration for the measuring point on the Detector. The Trendline database may contain an error. Please contact support@fis-services.com.
Could not find at least one configuration	Detected RFID tags and configured measuring points do not match.	The Detector found at least one RFID tag without a measuring point configuration. The missing measuring point is therefore not offered for selection for the measurement.
Multiple IDs read. Please repeat	Two or more tags were found while trying to assign an RFID tag.	The assignment is not possible as the Detector found at least two tags in the RFID Reader read area. Remove the unnecessary RFID tags from the read area.

Error message	Description	Cause of the fault / solution
ID already in use. Please repeat	An RFID tag was read that is already assigned to another measuring point.	Assign a new RFID tag to the current measuring point.
Change sensor to: ...	The next measurement must be performed with a different sensor.	If you have configured sensors with different sensitivities for measuring points, you may need to change the sensor between two measurements. In this case, the Detector tells you which sensor you need to connect for the next measurement.
Maximum number of data reached!	Maximum number of data points reached (in run up/coast down).	The system aborts after 65535 values in a run up/coast down. The values measured so far are saved.
Resonant frequency!	Machine in resonant range for balancing measurement.	If you have defined one or more resonant ranges for a machine in the Trendline software (see "setting up run up/coast down 82" and "determining the resonant range of a machine 247"), the Detector displays this message during balancing if the current rotational speed is within such a resonant range. You can continue the balancing measurement. However, observe the information given in balancing measurement 234.
Rotational speed to high (low) for Autostart / Autostop	Rotational speed already exceeds the selected autostart and/or autostop speed at run up. Or: Rotational speed is already lower than the selected autostart and/or autostop speed at coast down.	Run up: If rotational speed is too high for an automatic start and/or automatic stop, the system stops the automatic measurement start and/or stop. You can start and/or stop manually by pressing Enter. Coast down: If rotational speed is too low for an automatic start and/or automatic stop, the system stops the automatic measurement start and/or stop. You can start and/or stop manually by pressing Enter.
HW0 to HW2 (backup battery)	Self-test error	At start-up, the Detector performs a self-test to check internal voltages. If one of these three messages is displayed, you must replace the backup battery. Please contact support@fis-services.com and tell us the error number. We will then give you further details on how to replace the battery. You can bypass the error message by pressing Enter.
HW3 to HW7 (Internal error)	Self-test error	This is a critical error. Please contact support@fis-services.com and tell us the error number. We will then give you further information.



The Detector records error messages and additional information in a log file that you can open with the Trendline software (see "Download log file from Detector"125).

6.15 Update firmware

The internal software of the Detector is saved in what is known as the firmware. FAG Industrial Services is constantly expanding and improving the Detector firmware. You should therefore update this in the Detector as soon as a new release becomes available. The current version is available for download from our website at (www.fis-services.com).

ATTENTION ***Loss of measurement data is possible!***



When you update the Detector firmware, all data will be deleted on the Detector!

Before you start...

1. All data on the Detector is deleted when the firmware is updated. You should therefore transfer your data from the Detector to the Trendline software, as described at Read measuring data from Detector115.
2. Download the current firmware file from our website: www.fis-services.com.
3. Start the Detector FlashUpdater (in the start menu under **Programs** > **FIS** > **Detector FlashUpdater3**). If it is not installed, install it from the Trendline CD or download it from our website.
4. Have a thin object to hand - an unbent paper clip for example.
5. Connect the Detector to your Windows computer using the enclosed serial cable. Alternatively, you can use the USB serial adapter48, although communication is more reliable via a serial interface.
6. Ensure that the battery217 is charged to at least 25% of its capacity.

Update the Detector firmware

Click on **Start** > **Programs** > **FIS** > **DetectorFlashUpdater3** > **Detector Flash Updater 3** and follow the instructions given by the program. The update comprises the following steps:

1. Initialization of Detector
   a) Remove the battery for at least three seconds.
   b) Put the battery back in and connect the Detector to the PC.

2. Select the interface connected to the Detector.



The "Installing USB serial adapter[49]" section explains how to determine the interface number of the USB serial adapter.

3. Select the downloaded firmware file ("Detector_3_x_x.dup"). If you downloaded the firmware from the web page, you must also unpack the zip archive. The FlashUpdater displays information on the changes made since the previous release.
4. Prepare the Detector
   a) Switch off the Detector.
   b) Insert a thin object (a bent open paper clip, for example) into the small opening on the left-hand side of the Detector, and hold it in this position until it encounters resistance.
   c) Switch the Detector on and hold down the power-on button. Wait for three seconds before removing the paper clip. Now release the power-on button.
5. The new firmware is now transferred to the Detector. This may take several minutes depending on the speed of the interface.



*You can abort the update as long as the firmware upload has not begun. Click **Cancel** to abort.*

7 Special information

7.1 Characteristic values

Detector III can store up to 4 different (or same just as well) characteristic values per measuring point. The following characteristic values can be selected:

Characteristic value	Meaning
ISO 10816	RMS value of vibration velocity Frequency range: 10 Hz to 1 kHz Unit: mm/s
v_{sel}	RMS value of vibration velocity with freely selectable upper and lower limiting frequency Frequency range: 0.3 Hz to 20 kHz (depending on the lowpass frequency) Unit: mm/s
a_{eff}	RMS value of acceleration in vibration Frequency range: 2 Hz to 20 kHz (depending on the lowpass frequency) Unit: g
a_{sel}	RMS value of acceleration in vibration with freely selectable upper and lower limiting frequency Frequency range: 0.1 Hz to 20 kHz (depending on the lowpass frequency) Unit: g
d_{eff}	Demodulation signal of acceleration in vibration with switchable low-pass Frequency range: 0.1 Hz to 20 kHz (depending on the lowpass frequency) Unit: g
d_{sel}	RMS value of demodulation in vibration with freely selectable upper and lower limiting frequency Frequency range: 0.1 Hz to 20 kHz (depending on the lowpass frequency) Unit: g
T	Temperature Range: -20°C to +550°C Unit: °C
Crest factor	Ratio between peak value and RMS value (Crest factor = peak value / RMS value)
Universal	Universal characteristic value Range: 0 to 99999 Unit: none



In addition to the aforementioned characteristic values, you can also measure rotational speed.

7.2 Frequency selective characteristic values

For characteristic values designated by the "sel" code, you can define a frequency band within a range. This is used for the value calculation.

In Trendline the low pass cutoff frequency up to which measurements are to be taken is defined for each channel. The sampling rate is always 2.56 times the value of this cutoff frequency. The time signal that is recorded in this way is used to calculate a frequency spectrum by means of an FFT calculation. This is then used to recalculate the characteristic values within the defined limits. An a_{eff} value of between 2 kHz and 5 kHz is therefore calculated for a low pass filter setting of 5 kHz, for example.

Characteristic value	Analog channel	Frequency range
a_{eff}	Acceleration	2 kHz - low pass acceleration channel
a_{sel}	Acceleration	f_{min_a} - low pass a (both frequencies adjustable, see table below)
ISO 10816	Speed	10 Hz - 1 kHz
v_{sel}	Speed	f_{min_v} - low pass velocity channel (both frequencies adjustable, see table below)
d_{eff}	Demodulation	f_{min} - low pass demodulation channel
d_{sel}	Demodulation	f_{min} - low pass demodulation channel (both frequencies adjustable, see table below)

The low pass and FFT length can be adjusted for each channel. Both of these factors affect the sampling rate, the minimum possible frequency and frequency resolution.

Lowpass	Sampling rate	FFT-length	f_{min}	f_{min_v} (*$\sqrt{271}$)	Frequency resolution
200 Hz	512 SPS	1600 lines	0.125 Hz	0.375 Hz	0.125 Hz
200 Hz	512 SPS	3200 lines	0.1 Hz	0.19 Hz	0.0625 Hz
500 Hz	1.28 kSPS	1600 lines	0.3125 Hz	0.94 Hz	0.3125 Hz
500 Hz	1.28 kSPS	3200 lines	0.156 Hz	0.47 Hz	0.156 Hz
1 kHz	2.56 kSPS	1600 lines	0.625 Hz	1.875 Hz	0.625 Hz
1 kHz	2.56 kSPS	3200 lines	0.3125 Hz	0.94 Hz	0.3125 Hz
2 kHz	5.12 kSPS	1600 lines	1.25 Hz	3.75 Hz	1.25 Hz

2 kHz	5.12 kSPS	3200 lines	0.625 Hz	1.875 Hz	0.625 Hz
5 kHz	12.8 kSPS	1600 lines	3.125 Hz	9.375	3.125 Hz
5 kHz	12.8 kSPS	3200 lines	1.56 Hz	4.7 Hz	1.56 Hz
10 kHz	25.6 kSPS	1600 lines	6.25 Hz	18.75 Hz	6.25 Hz
10 kHz	25.6 kSPS	3200 lines	3.125 Hz	9.375 Hz	3.125 Hz
20 kHz	51.2 kSPS	1600 lines	12.5 Hz	37.5 Hz	12.5 Hz
20 kHz	51.2 kSPS	3200 lines	6.25 Hz	18.75 Hz	6.25 Hz

(SPS = Samples per second)

(*) In the case of characteristic values for speed the minimum frequency is the third line in the spectrum as the first lines may become overly large as a result of the integration.

7.3 Time signals

You can select in Trendline software, which time signals should be stored. The Detector can save up to 300 time signals and up to 1600 measuring points. Give careful consideration to what signals you need. You can select, when configuring the measuring point (see "Create a measuring point"58), if a certain time signal should be stored all the time, or only, if the characteristic value shows a main alarm.

If a configuration or route is sent to the Detector, the Detector checks how many time signals have to be stored at all times. For these time signals the right amount of memory is allocated right after the data transfer to ensure that these time signals are guaranteed to be stored. However, this automatically means that no more time signals than the Detector memory can accommodate must be marked with "Save always" in a configuration or route. Before sending a configuration or route to the Detector, the Trendline software checks if the available memory of the Detector is sufficient to store the data. If this is not the case, an error message is displayed and the data is not sent to the Detector.

For time signals that are to be stored only in the event of an alarm, the Trendline software cannot check whether they would fit in the memory, because it is not possible to know how many measuring points have an alarm. In an extreme case, one could click "Save in the event of alarm" for all time signals. Even if one of the characteristic values has an alarm and a time signal therefore has to be saved, this is stored only when sufficient memory is actually available. If there is not enough memory, the user will get a message notifying him that there is insufficient memory and the time signal was not stored. You can find more information on this under "Dynamic memory management"272.

Bear in mind that a time signal may NOT have been recorded when an alarm was output for a characteristic value even if the field "Save in the event of main alarm" was activated. Time signals that should be saved in the event of an alarm can only be saved if sufficient memory is available.

The recorded time signals are always acceleration signals, which are each filtered and sampled differently. The Detector can measure three different time signals. Here you can choose from three different measuring branches [273].

For the calculation of the characteristic velocity values ISO10816 and V_{sel} the transformation from the acceleration signal into the velocity signal is done in the frequency domain. Therefore, for these characteristic values the acceleration signal is always stored and displayed for the time signal. The time signal sampling rates are set for each channel by the lowpass settings.

7.4 Dynamic memory management

The Detector offers dynamic memory management. Because of this, the partitioning of the memory is not defined in the firmware. For measuring points, time signals, etc. there is a memory block of 2.7 MB. You can set in the Trendline software whether many configurations or many time signals are needed when taking the next measurements. The required memory can be calculated as follows:

Memory element	Memory usage
Configuration	CM configuration: 572 bytes Balancing configuration: 394 bytes Run up/coast down: 272 bytes Amplitude/phase configuration: 290 bytes
Free measurement	CM measurement: 588 bytes Balancing measurement: 408 bytes Run up/coast down: 286 bytes Amplitude/phase measurement: 304 bytes
Templates	CM configuration: 588 bytes Balancing configuration: 410 bytes Run up/coast down: 288 bytes Amplitude/phase configuration: 306 bytes
Time signal	8244 bytes (1600 lines), 16436 bytes (3200 lines)
Balancing step	244 bytes
Run up/coast down	94 bytes + (n * 12) bytes per Amplitude/phase value (n = number of reference points)

Amplitude/phase	92 bytes

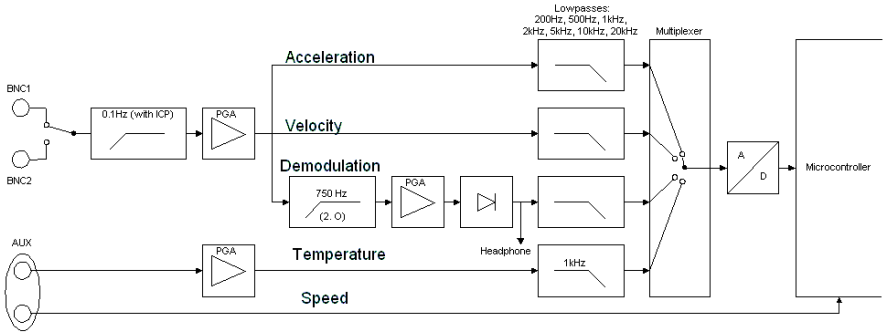
Additionally, the following memory is required depending on the Detector configurations:

- 131 kilobytes if at least one balancing or run up/coast down configuration exists on the Detector.
- 30 bytes for each unit used. As a rule 5-10 units are stored on the Detector.
- 54 bytes for each comment used.

> **Example:** 500 CM configurations are sent to the Detector (500 * 572 bytes = approx. 286 kB), leaving 2.7 MB - 0.286 MB = 2.414 MB for time signals and free measurements. This means, that 2,414 MB / 16436 bytes (@ 3200 lines) = 146 time signals can still be stored. The remaining memory of about 14 kB can then be used for about 23 free CM measurements.

7.5 Analog branches in the Detector III

Depending on the selected characteristic value the sensor signals are preconditioned by different signal paths in the Detector.



The measuring signal reaches the Detector via the sensor module (BNC1 or BNC2, see "Connectors" 216), where it passes a highpass filter (0.1 Hz) when the sensors are active. The signal is then amplified in a PGA (

programmable gain amplifier

). After the amplifier the signal is subdivided into three branches, each of which can have a different filter.

- The acceleration and velocity branch both have their own lowpass filter with a selectable corner frequency, so only the part of the signal below this frequency can pass. In spite of its name, the acceleration is what is actually measured in the velocity branch. This signal is integrated into the spectrum to calculate the characteristic velocity values.

- The demodulation signal passes through a high-pass filter first (only frequencies higher than the cut-off frequency of 750Hz can pass). Next, the signal is then amplified in a PGA, then rectified and finally low-pass filtered. The frequency of this lowpass filter can also be set in the Trendline software 58. The signal to the headset connector is branched off before that low-pass filter.

The Detector can measure temperature and rotational speed via the AUX connector (see "Connectors" 216). The signal from the temperature sensor is amplified in a PGA and filtered with a cutoff frequency of 1 kHz in a lowpass.

7.6 Connecting

When connecting to the Trendline software will try to connect to the serial port used the last time with the baud rate used the last time.

If not successful it searches for the communication parameters by itself and connects to the Detector.

If connection is not possible, it is due to the following causes:

- The Detector is not switched on. Switch on the Detector.
- The data cable between Detector and PC is not connected. Connect the Detector with the 9-pin data cable supplied to a serial interface at your PC.
- The Detector is switched on and properly connected. If you still cannot make a connection, it may be because the Detector is still measuring or a warning message on the display waits to be confirmed by you. Wain until the measurement ends or confirm the warning message. If there is still no communication possible, please turn the Detector off and on.
- If a connection can be established, but it brakes down before all data are transferred, the accumulator may be empty. For sizeable data transfers the remaining charge in the battery should be at least 10 %.

8 Maintenance and repairing

The Detector is virtually maintenance-free. If a defect in the Detector device is ascertained, please contact your customer adviser 277.

Cleaning

If necessary, you can make an external cleaning of the device.

- Disconnect the accumulator from device.
- Clean the device with a soft, lint-free cloth.

CAUTION



Damage to the device can result from improper handling!

Do not use any chemical solvents, such as alcohol, acetone, cellulose thinner or the like. These solvents can dissolve the labeling or damage the housing.

9 Taking out of service and disposal

Taking out of service

If danger-free operation of the Detector device is no longer possible, the device must be taken out of service and secured against unintentional operation. Danger-free operation is no longer possible if the device

- evidences visible damage
- no longer functions
- was stored under damage-inducing conditions
- was subject to severe transport stresses.

Disposal

Neither the Detector device nor the associated components may be disposed of via domestic waste as they contain electronic components and accumulators that must be disposed of in the proper manner. Please return them to us so that we can ensure disposal in keeping with legal and environmental requirements. Returning used devices is an important contribution to environmental protection.

10 Manufacturer / Support

Manufacturer

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Germany

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Support free of charge

Hotline: +49 (0) 2407 9149-99 (*only the usual telephone charges are incurred)
E-Mail: support@fis-services.com

11 Appendix

11.1 CE-Declaration of conformity

The manufacturer

F'IS, FAG Industrial Services GmbH, Kaiserstraße 100,
D-52134 Herzogenrath

declares that the product

Detector III

Serial number: xxxxxx/F4 labelled without "RFID"

meets the requirements, which have been set by the Electromagnetic Compatibility Directive (2004/108/EG), if the product is installed properly according to the installation guidelines listed in the manual.

For assessment of the product the following standards were used:

EN 61000-6-2:2001
EN 61000-6-4:2001
EN 55022:2003

Measuring device identifier: CE

Herzogenrath, 2010-01-22

Dipl.-Ing. Armin Kempkes
Managing Director

p.p. Dipl.-Ing. Götz Langer
Head of Research & Development

11.2 CE-Declaration of conformity (RFID)

Declaration of conformity as per the Radio and Telecommunication Transmitter Devices Act (FTEG) and Directive 1999/5/EG (R&TTE)

The manufacturer

F'IS, FAG Industrial Services GmbH, Kaiserstraße 100,

D-52134 Herzogenrath

declares that the product

Detector III

Serial number: xxxxxx/F4 labelled with "RFID"
Radio installation of device category 1
Purpose: RFID application

meets the requirements, which have been set by the Electromagnetic Compatibility Directive (2004/108/EG) and by the standards on 1999/5/EG (R&TTE), if the product is installed properly according to the installation guidelines listed in the manual.

For assessment of the product the following standards were used:
ETSI EN 300 330-2 V1.3.1 (2006-04)
ETSI EN 301 489-3 V1.4.1 (2002-08)
EN 55022:2003
EN 60950-1:2001 and A11:2004 + Corrigendum:2004
EN 61000-6-2:2005
FCC 47 Part 2 and Part 15
ANSI C63.4:2003

The Detector III with RFID application is a radio device that operates at 13.65 MHz. This product may be operated in the countries of the European Union, Switzerland, USA, Canada and Australia.

Measuring device identifier: CE

Herzogenrath, 2010-03-02

A. Kempkes

Dipl.-Ing. Armin Kempkes
Managing Director

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Head of Research & Development

11.3 Principles of non-contact temperature measurement

(Dr.-Ing Gruner, Raytek)

Introduction

This manual was written for people who are unfamiliar with noncontact infrared temperature measurement. A conscious attempt has been made to present the subject matter as briefly and simply as possible. Readers who wish to gain more in-depth knowledge can follow the suggestions for further reading in the bibliography. This manual focuses on the practical operations of noncontact temperature measurement devices and IR thermometry, and answers important questions that may arise. If you plan to use a noncontact temperature measurement device and require further advice, send us the completed questionnaire (in the appendix) prior to use.

Advantages of using IR thermometers

Temperature is the most frequently measured physical quantity, second only to time. Temperature plays an important role as an indicator of the condition of a product or piece of machinery, both in manufacturing and in quality control. Accurate temperature monitoring improves product quality and increases productivity. Downtimes are decreased, since the manufacturing processes can proceed without interruption and under optimal conditions.

Infrared technology is not a new phenomenon - it has been utilized successfully in industrial and research settings for decades - but new innovations have reduced costs, increased reliability, and resulted in noncontact infrared sensors offering smaller units of measurement. All of these factors have led infrared technology to become an area of interest for new kinds of applications and users.

What are the advantages offered by noncontact temperature measurement?

- It is fast (in the ms range) - time is saved, allowing for more measurements and accumulation of data (determination of temperature field).
- It facilitates measurement of moving targets (conveyor processes).
- Measurements can be taken of hazardous or physically inaccessible objects (high-voltage parts, great measurement distance).
- Measurements of high temperatures (greater than 1300°C) present no problems. In similar cases, contact thermometers cannot be used, or have a limited life. There is no interference - no energy is lost from the target. For example, in the case of a poor heat conductor such as plastic or wood, measurements are extremely accurate with no distortion of measured values, as compared to measurements with contact thermometers.

- There is no risk of contamination and no mechanical effect on the surface of the object; thus wear-free. Lacquered surfaces, for example, are not scratched and soft surfaces can also be measured.

Having enumerated the advantages, there remains the question of what to keep in mind when using an IR thermometer:

The target must be optically (infrared-optically) visible to the IR thermometer. High levels of dust or smoke make measurement less accurate. Concrete obstacles, such as a closed metallic reaction vessel, allow for only topical measurement - the inside of the container cannot be measured.

- The optics of the sensor must be protected from dust and condensing liquids. (Manufacturers supply the necessary equipment for this.)
- Normally, only surface temperatures can be measured, with the differing emissivities of different material surfaces taken into account.

Summary: The main advantages of noncontact IR thermometry are speed, lack of interference, and the ability to measure in high temperature ranges to 3000° C. Keep in mind that only the surface temperature can be measured.

Infrared measuring system

An IR thermometer can be compared to the human eye. The lens of the eye represents the optics through which the radiation (flow of photons) from the object reaches the photosensitive layer (retina) via the atmosphere. This is converted into a signal that is sent to the brain. Fig. 1 shows an infrared measuring system process flow.

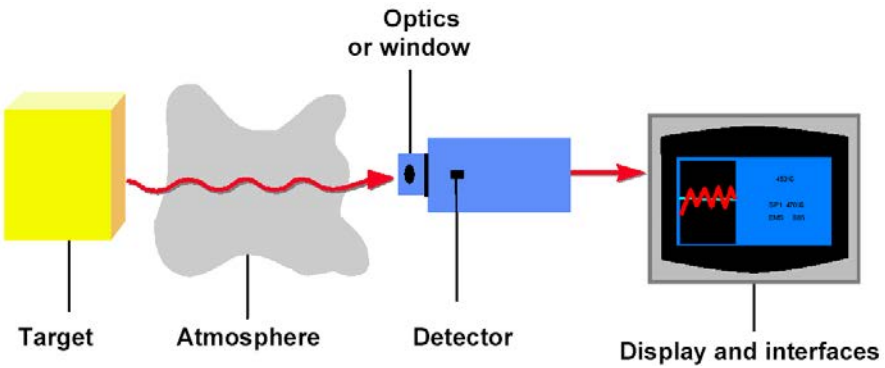


Fig. 1 Infrared measuring system

Target

Every form of matter with a temperature (T) above absolute zero emits infrared radiation according to its temperature. This is called characteristic radiation. The cause of this is the internal mechanical movement of molecules. The intensity of this movement depends on the temperature of the object. Since the molecule movement represents charge displacement, electromagnetic radiation (photon particles) is emitted. These photons move at the speed of light and behave according to the known optical principles. They can be deflected, focused with a lens, or reflected from reflective surfaces. The spectrum of this radiation ranges from 0.7 to 1000 µm wavelength. For this reason, this radiation cannot normally be seen with the naked eye. This area lies within the red area of visible light and has therefore been called "infra"-red after the Latin. (See Fig. 2).

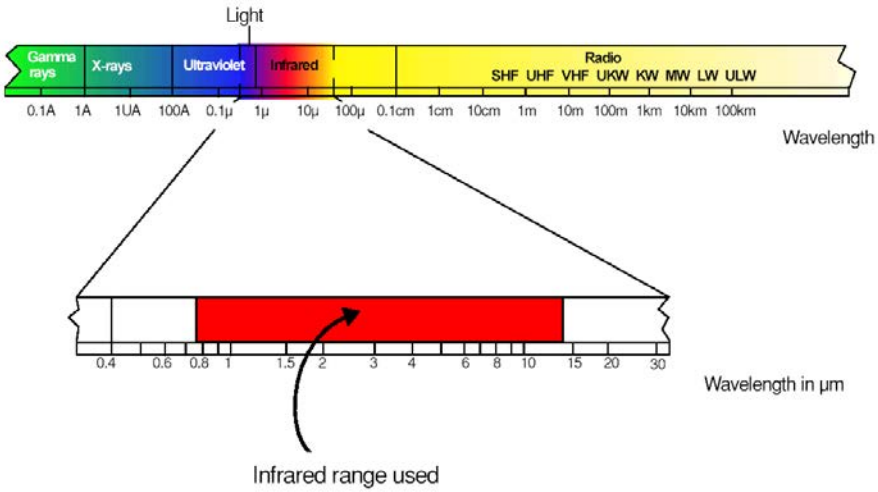


Fig. 2 The electromagnetic spectrum, with range from around 0.7 to 14 µm useful for measuring purposes

Fig. 3 shows the typical radiation of a body at different temperatures. As indicated, bodies at high temperatures still emit a small amount of visible radiation. This is why everyone can see objects at very high temperatures (above 600°C) glowing somewhere from red to white. Experienced steelworkers can even estimate temperature quite accurately from the color. The classic disappearing filament pyrometer was used in the steel and iron industries from 1930 on. The invisible part of the spectrum, however, contains up to 100,000 times more energy. Infrared measuring technology builds on this. It can likewise be seen in Fig. 3 that the radiation maximum move toward ever-shorter wavelengths as the target temperature rises, and that the curves of a body do not overlap at different temperatures. The radiant energy in the entire wavelength range (area beneath

each curve) increases to the power of 4 of the temperature. These relationships were recognized by Stefan and Boltzmann in 1879 and illustrate that an unambiguous temperature can be measured from the radiation signal. /1/, /3/, /4/ and /5/.

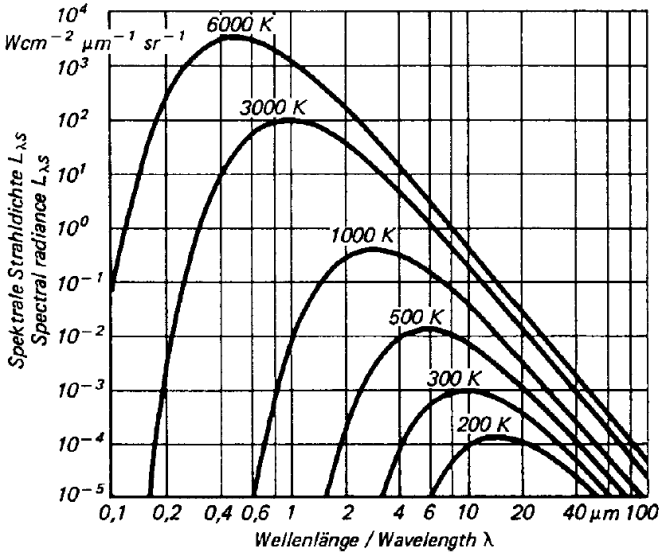


Fig. 3 Radiation characteristics of a blackbody in relation to its temperature. /3/.

Looking at Fig. 3, then, the goal should be to set up the IR thermometer for the widest range possible in order to gain the most energy (corresponding to the area below a curve) or signal from the target. There are, however, some instances in which this is not always advantageous. For instance, in Fig. 3, the intensity of radiation increases at 2 µm - much more when the temperature increases than at 10 µm. The greater the radiance difference per temperature difference, the more accurately the IR thermometer works. In accordance with the displacement of the radiation maximum to smaller wavelengths with increasing temperature (Wien's Displacement Law), the wavelength range behaves in accordance with the measuring temperature range of the pyrometer. At low temperatures, an IR thermometer working at 2 µm would stop at temperatures below 600°C, seeing little to nothing since there is too little radiation energy. A further reason for having devices for different wavelength ranges is the emissivity pattern of some materials known as non-gray bodies (glass, metals, and plastic films). Fig. 3 shows the ideal - the so-called "blackbody". Many bodies, however, emit less radiation at the same temperature. The relation between the real emissive power and that of a blackbody is known as emissivity å (epsilon) and can be a maximum of 1 (body corresponds to the ideal blackbody) and a minimum of 0. Bodies with emissivity less than 1 are called gray bodies. Bodies

where emissivity is also dependent on temperature and wavelength are called non-gray bodies. Furthermore, the sum of emission is composed of absorption (A), reflection (R) and transmission (T) and is equal to one. (See Equation 1 and Fig. 4).

$$A + R + T = 1 \qquad (1)$$

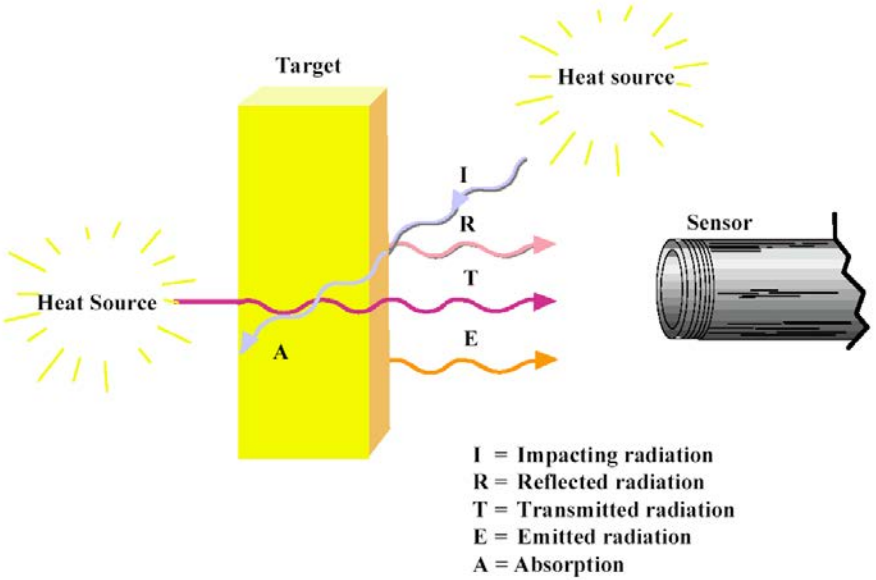


Fig. 4 In addition to the radiation emitted from the target, the sensor also receives reflected radiation and can also let radiation through.

Solid bodies have no transmission in the infrared range (T = 0). In accordance with Kirchhof's Law, it is assumed that all the radiation absorbed by a body, and which has led to an increase in temperature, is then also emitted by this body. The result, then, for absorption and emission is:

$$A <=> E = 1 - R \qquad (2)$$

The ideal blackbody also has no reflectance (R = 0), so that E = 1.

Many non-metallic materials such as wood, plastic, rubber, organic materials, rock, or concrete have surfaces that reflect very little, and therefore have high emissivities between 0.8 and 0.95. By contrast, metals - especially those with polished or shiny surfaces - have emissivities at around 0.1. IR thermometers

compensate for this by offering variable options for setting the emissivity factor. (See also Fig. 5).

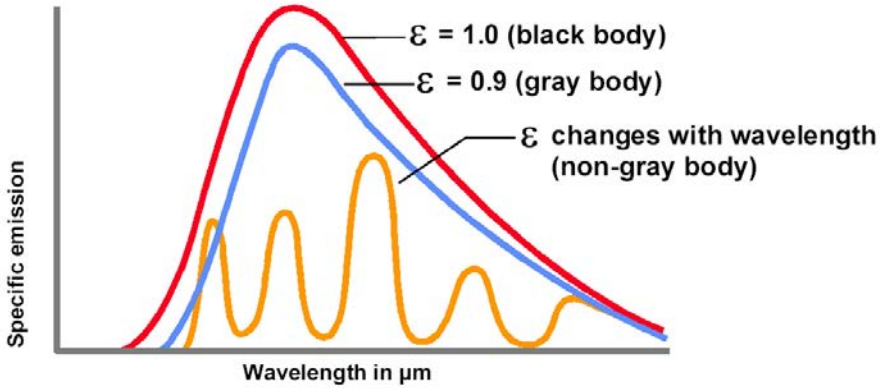


Fig. 5 Specific radiation at various emissisivity

11.3.1 Handling the pyrometer

Distance to spot size ratio

Distance to spot ratio (or field of view) refers to the diameter of the spot that the probe is sensing at a given distance. The closer you are to the object (or target), the smaller the area (or spot) the probe is sensing. For example when the probe is held at a 200 mm (8 in.) distance from the target, the spot size is approximately 50 mm (2 in.); at 100 mm (4 in.) the spot size is approximately 25 mm (1 in.), and with the probe held at 50 mm (2 in.) distance from the target, the spot size is approximately 13 mm (½ in.).

Hot spots can be missed if too large an area is included in the field of view, so get as close as possible! (See Fig. 6 and Fig. 7).

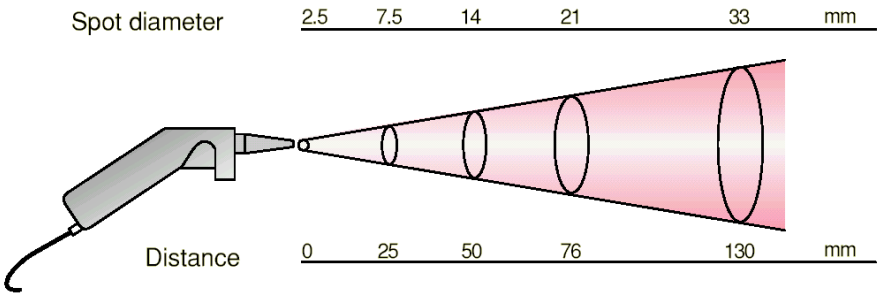


Fig. 6 Spot size

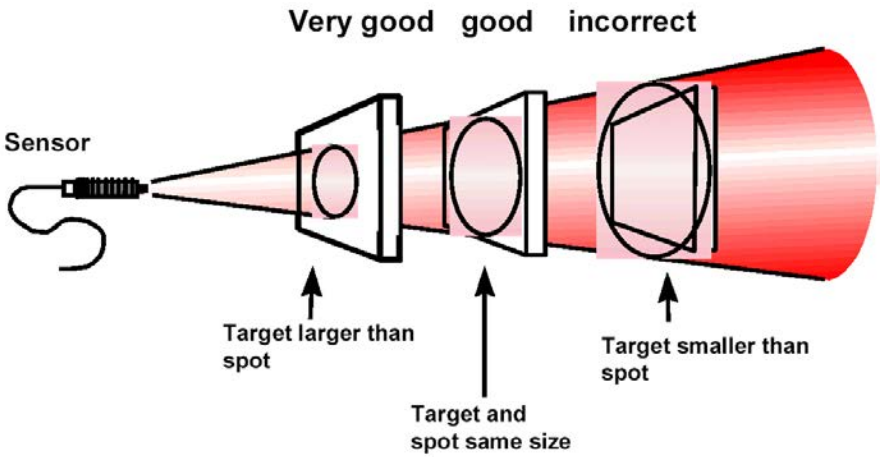


Fig. 7 Size of the measuring object

Emissivity

All objects emit invisible infrared energy. The amount of energy emitted is proportional to the object's temperature and its ability to emit IR energy. This ability, called emissivity, is base upon the material that the object is made of and its surface finish. Emissivity values range from 0.10 for a very refective object to 1.00 for a black body. The probe senses this energy and calculates the temperature base on the amount of IR energy it receives and the factory set emissivity value of 0.95, which will cover 90% of typical applications.

Measurement considerations

- If the surface to measured is small [13 mm (½ in.) or less], hold the probe as close as possible to the surface [no more than 50 mm (2 in.) away].
- If the surface to be measured is covered by frost or other material, clean it to expose the surface.
- If the surface to be measured is highly refective, apply masking tape or a matte finish black paint to the surface.
- If the probe seems to be giving incorrect readings check the front of the probe. There may be condensation or debris obstructing the sensor; clean according to maintenance instructions.

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FAG Detector battery pack and charger

FAG Detector battery pack

The battery pack is for use as an exchange battery for the FAG Detector II & III.

General description of function

The battery pack in NiMH-technology with low self-discharge has a nominal capacity according to the type plate and a nominal voltage of 4.8 V. This battery pack may only be charged with the FAG Detector or the accessory FAG battery charging station and the accessory connector charger, otherwise the warranty will be considered invalid.

The battery pack has in each case 3 terminal contacts on the inside and outside. The contacts on the inside serve the supply of electronics of the FAG Detector and are protected by in battery pack inserted fuse element from circuit-proof. The contacts on the outside are exclusively for charging the battery pack in the accessory charging station.



The contacts on the inside of the battery pack are protected against short circuit by an inner fuse element. Generally a short circuit may cause a very strong heating. This is to be avoided by all means.

An inappropriate use of the battery pack may cause an exorbitant rise of temperature, fire and/or explosion and personal injury. Please note the following instructions:

- *Charge the battery pack only the way described above.*
- *Do not heat or burn the battery pack.*
- *Do not modify, fractionalize, wrap or short circuit the battery pack.*
- *Do not short circuit the contacts (Attention with conducting undergrounds).*
- *Do not drop or blow the battery pack.*
- *Do not suspend battery pack into direct sunlight. Do not let lie battery pack in proximity of heating elements or for longer in the car.*
- *Protect battery pack from humidity of fluid.*
- *Protect contacts from dirt, fluids or other substances.*
- *Protect the appliance from oil, grease, aggressive detergents or thinners as they may destroy the appliance.*
- *If the appliance fell down, e.g. from table, the safety of the Detector must be checked immediately by a trained professional.*

Instructions of operation

- The battery pack is pre-charged and can be used instantly.
- Always keep the battery pack contacts and the charging station clean.
- Charge the battery pack at an ambient temperature of 0°C (32°F) to 25°C (77°F) and use it at a temperature of 0°C (32°F) to 40°C (104°F).
- Keep the battery pack in dry and cool places.



- *The battery pack is an expendable part. The original performance of the battery pack will reduce with the times, resulting in shorter operating times. If necessary, replace the entire battery pack.*
- *The battery pack may not be disposed of in normal domestic refuse.*
- *Please return used or damaged batteries to the collecting points provided.*

Charger for FAG Detector battery pack (ANSMANN ACS310)



- *The charger is only intended for charging the FAG Detector battery pack. Use the battery pack and the charger only for their intended purpose.*
- *Make sure that the charger is not damaged. Please contact your account manager if necessary at FAG Industrial Services GmbH.*

Use

This charger is provided for charging the battery packs of the FAG Detector. The charging time of empty battery packs can take up to 4 hours.

Features

- Microcontroller controlled charging
- Battery test phase at the start of each charging cycle to detect faulty battery packs
- Faulty battery pack detection and charging current cut off
- Short circuit detection

- After charging automatic switching over to trickle charge, thus overloading is not possible.

Operation

1. Select the appropriate primary plug and connect it to the charger until it clicks into place and is locked (see section Set primary plug).
2. Connect the charger to an convenient mains socket.
3. Connect the battery pack to the FAG Detector: Usually the battery pack is brought into contact by pushing the battery pack onto the bottom of the FAG Detector until it clicks in place.
4. Connect the charger with the FAG Detector: Connect the plug of the charger cable into the socket of the FAG Detector (next to the serial socket) and lock it.

The battery pack will be charged after the battery test phase has finished (LED lights green).



If the LED still keeps flashing red after the test phase, the battery pack is faulty and you have to throw it away in a special container for small chemical waste.

After the charging procedure the charger switches automatically over to trickle charge (LED lights green). Overloading is not possible.

Stop charging by disconnecting the the plug of the charger cable from the socket of the FAG Detector.

Indicators

- LED is off: The battery pack is not connected or the charger is not supported with current.
- LED flashes red: An error occurred or the battery pack is faulty.
- LED flashes green: The battery pack will be charged.
- LED lights green: The battery pack is fully charged and the trickle charge is active.

Safety



- *Only charge battery packs of the FAG Detector.*
- *Do not open the charger.*
- *Repairs may only be done by the manufacturer.*

Environment

Batteries are small chemical waste. Throw away faulty or used up batteries in a special container or hand them in at a recycling centre.

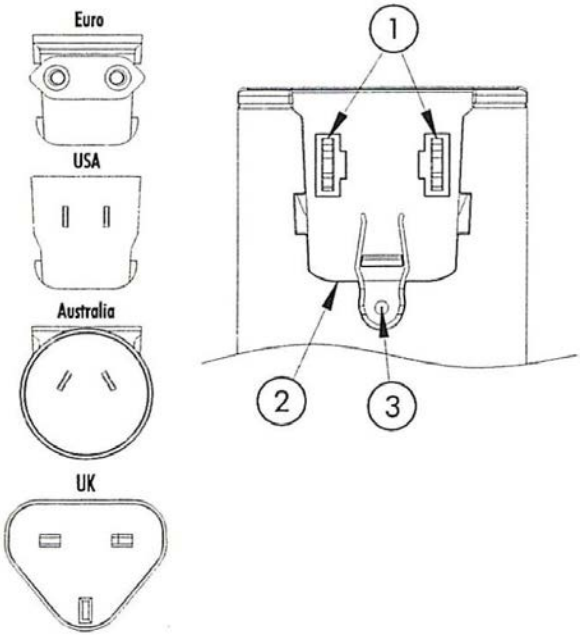
Technical specifications

Input: 100-240 V AC, 50/60 Hz

Charging current: 800 mA +/- 10%

Set primary plug

The charger is delivered with 4 interchangeable primary plugs and the electronic power supply (100-240 V AC). Thus, the appliance is worldwide usable.



Changing primary plug

- Insert the relevant primary plug and connect it to the primary contacts (1).
- Push the plug to the stop position (2). Please ensure that the input plug clicks audibly into housing.

Release primary plug

- Push the release button (3) down (with a pen for example).
- Move the plug backwards.

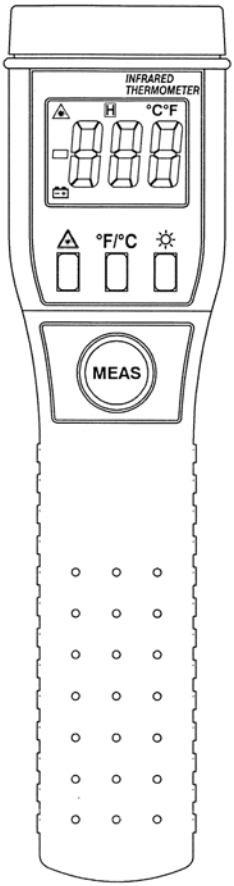
For use in the USA and Canada

Caution 	• *Risk of electric shock.* • *Dry location use only.* • *This power unit is intended to be correctly oriented in vertical or floor mount position.*
Attention 	• *Pur utilisation a l'interieur seulement.*

OPERATING INSTRUCTIONS

TECPEL 510LB CE

INFRARED THERMOMETER WITH LASER MARKER



INTRODUCTION

This instrument is a portable easy to use 3½ digit, compact-sized digital infrared thermometer with laser marker designed for simple one hand operation. Meter with Backlit LCD display, Auto-hold function and auto power off (15 seconds approx.) feature after releasing MEAS button to extend battery life.

SAFETY INFORMATION

It is recommended that you read the safety and operation instructions before using the infrared thermometer.

⚠ DANGER

Pressing the ⚠ button turns the laser marker on and off. Exercise extreme care and do not allow the laser beam to enter your eyes or those of any other person or animal.

- Do not look directly into the laser light from the optical system.
- When measuring the temperature of an object which has a mirror finish, be careful not to allow the laser light beam to be reflected off the surface into your eyes or those of another person.
- Do not allow the laser light beam to impinge upon any gas which can explode.

CAUTION

- Do not use the unit near any device which generates strong electromagnetic radiation or near a static electrical charge, as these may cause errors.
- Do not use the unit where it may be exposed to corrosive or explosive gases. The unit may be damaged, or explosion may occur.
- Do not keep or use this unit in an environment where it will be directly illuminated by sunshine, or where it will be exposed to high temperatures, high humidity or condensation. If you do, it may be deformed, its insulation may be damaged, or it may no longer function according to specification.
- Do not point the lens at the sun or at any other source of strong light. If you do, the sensor may be damaged.
- Do not contact the lens against the object whose temperature is to be measured, or get it dirty, allow it to be scratched, or allow any foreign material to adhere to it. Doing so may cause errors.
- Do not touch or hold by the front cone. Temperature reading can be affected by heat from hand.
- Do not place the meter on or around hot objects (70°C/158°F). It may cause damage to the case.
- If the meter is exposed to significant changes in ambient temperature (hot to cold or cold to hot). Allow 20 minutes for temperature stabilization, before taking measurement.
- Condensation may form on the lens when going from a cold to hot environment-wait 10 minutes for condensation to dissipate before taking measurements.
- This unit is not constructed to be water proof or dustproof, so do not use it in a very dusty environment or in one where it will get wet.

SPECIFICATIONS

GENERAL

Display: 3½ digit liquid crystal display (LCD) with maximum reading of 1999.

Low battery indication: The "" is displayed when the battery voltage drops below the operating level.

Measurement rate: 2.5 times per second, nominal.

Operating Environment: 32°F to 122°F (0°C to 50°C) at <75% R.H.

Storage Temperature: -4°F to 140°F (-20°C to 60°C), 0 to 80% R.H. with battery removed from meter.

Auto power off: 15 seconds approx.

Battery: 4 pcs 1.5V (AAA size) UM-4 R03.

Battery Life: 100 hours (continuity) typical with carbon-zinc battery (Laser marker and Back-Light not illuminated)

Dimensions: 170mm(H) x 44mm(W) x 40mm(D).

Weight: 152g including batteries.

ELECTRICAL

Temperature Range: -4°F to 1022°F / -20°C to 550°C.

Display Resolution: 1°F / 1°C.

Accuracy: ±2% of reading or ±6°F /3°C, whichever is greater @ 64.4 to 82.4°F (@ 18 to 28°C) ambient operating temperature.

Temperature Coefficient: ±0.2% of reading or ±0.36°F /0.2°C, whichever is greater, change in accuracy per °F /°C change in ambient operating temperature above 82.4°F/28°C or below 64.4°F/18°C.

Spectral Response: 6 to 14μm nominal.

Emissivity: Preset 0.95.

Analog Output: 1mV/°F.

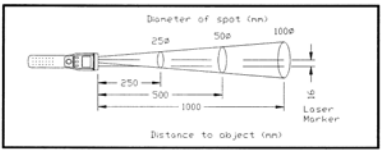
Output Impedance: 2KΩ approx.

Detection Element: Thermopile.

Optical Lens: Fresnal Lens.

Sighting: 1-beam laser marker <1mW (class 2).

Field of View: 100mmØ at 1000mm.



Spot size increases with distance from the probe tip as shown

OPERATING INSTRUCTIONS

Push buttons

☼ Display Back-Light Button

Release MEAS button then press "☼" button to toggle between turn on and turn off the Back-Light. When releasing MEAS button Back-Light will turn off automatically after 15 seconds to extend battery life.

Laser Marker Button

Release MEAS button then press "⚠" button to toggle between turn on and turn off the Laser Marker annunciator, If "⚠" annunciator turn on, press MEAS button the laser marker beam is being emitted, releasing MEAS button turn off the laser marker beam.

MEAS (MEASURE) Button

Depress MEAS button to turn on the meter for measuring temperature. Releasing MEAS button to stop measuring temperature and automatically hold the display reading, the meter turns off automatically after 15 seconds.

OPERATION

1. When the power is off, pressing the MEAS button turns on the power.
2. Use "☼" button to select turn on or turn off the display Back-Light.
3. Use "⚠" button to select turn on or turn off the Laser Marker.
4. Use "°F /°C" button to select °F or °C the Temperature Range.
5. Point the lens at the object whose temperature is to be measured.
6. Press the MEAS button. Measurement is performed as long as the MEAS button is kept pressed.
7. Referring to the spot size figure, aim the laser beam at the object whose temperature is to be measured.
   NOTE: Although the field of measurement (or Field of View) and the spot almost coincide, actually the field of measurement corresponds to the diameter for 90% optical response. The object whose temperature is to be measured needs to be larger than the measurement diameter (spot of size) by an adequate margin at least 1.5 to 2 times larger.
8. Read the display.

MEASUREMENT CONSIDERATIONS

1. Theory of Measurement
   Every object emits infrared energy in accordance with its temperature. By measuring the amount of this radiant energy, it is possible to determine the temperature of the emitting object.
2. About Infrared
   Infrared radiation is a form of light (electromagnetic radiation), and has the property that it passes easily through air while it is easily absorbed by solid matter. With an emission thermometer which operates by detecting infrared radiation accurate measurement is possible, irrespective of the air temperature or the measurement distance.
3. Emission Thermometer Structure
   Infrared radiation which has been emitted from the object is focused upon an infrared radiation sensor, via an optical system. This includes a lens which is transparent to infrared radiation, and 5.3μm cut off filter. The output signal from the infrared radiation sensor is input to an electronic circuit along with the output signal from a standard temperature sensor (Thermopile).
4. Emissivity
   All objects emit invisible infrared energy. The amount of energy emitted is proportional to the object's temperature and its ability to emit IR energy. This ability, called emissivity, is based upon the material that the object is made of and its surface finish. Emissivity values range from 0.10 for a very reflective object to 1.00 for a black body. Factory set emissivity value of 0.95, which cover 90% of typical applications.
5. If the surface to the measured is covered by frost or other material, clean it to expose the surface.
6. If the surface to be measured is highly reflective, apply masking tape or matt finish black paint to the surface.
7. If the meter seems to be giving incorrect readings check the front cone. There may be condensation or debris obstructing the sensor; clean per instructions in the maintenance section.

MAINTENANCE

Battery Replacement

Power is supplied by four 1.5V (AAA size) batteries. The "" appears on the LCD display when replacement is needed. To replace the batteries, remove the screw from the back of the meter and lift off the battery cover case. Remove the batteries from battery contacts.

Cleaning

Periodically wipe the case with a damp cloth and detergent, do not use abrasives or solvents.

Substance	Thermal emissivity	Substance	Thermal emissivity
Asphalt	0.90 to 0.98	Cloth (black)	0.98
Concrete	0.94	Human skin	0.98
Cement	0.96	Lather	0.75 to 0.80
Sand	0.90	Charcoal (powder)	0.96
Earth	0.92 to 0.96	Lacquer	0.80 to 0.95
Water	0.92 to 0.96	Lacquer (matt)	0.97
Ice	0.96 to 0.98	Rubber (black)	0.94
Snow	0.83	Plastic	0.85 to 0.95
Glass	0.90 to 0.95	Timber	0.90
Ceramic	0.90 to 0.94	Paper	0.70 to 0.94
Marble	0.94	chromium oxides	0.81
Plaster	0.80 to 0.90	Copper oxides	0.78
Mortar	0.89 to 0.91	Iron oxides	0.78 to 0.82
Brick (red)	0.93 to 0.96	Textiles	0.90