FAG

FAG Detector III

The Solution for Monitoring and Balancing

SCHAEFFLER

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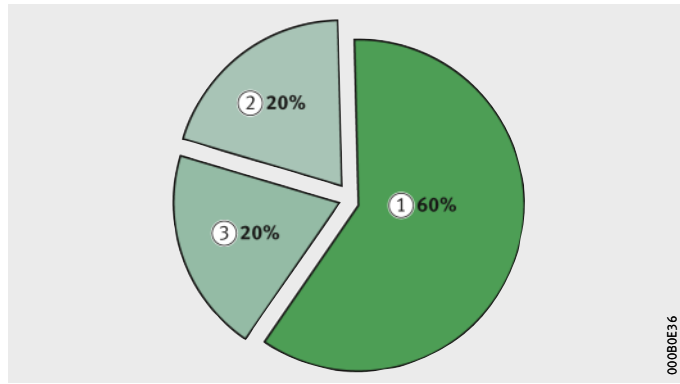
FAG Detector III

Preventing plant downtime

There are many different reasons for unplanned stoppage of machinery, *Figure 1*. However, a not inconsiderable percentage can be attributed, directly or indirectly, to unbalance or misalignment. During operation, unbalance can generate considerable vibrations that lead to secondary damage such as premature bearing wear or fatigue fractures. This results in machine failure and thus unplanned production shutdowns. FAG Detector III was therefore developed to facilitate the reliable detection and subsequent elimination of unbalances.



① Unbalance and misalignments
② Bearing damage
③ Other

Figure 1
Reasons for unplanned downtime

Features
High functionality and simple handling

FAG Detector III is a handy, easy to use vibration measurement device that can be used to reliably identify cases of incipient damage and eliminate their causes.

Preinstalled standard configurations in accordance with DIN ISO 10816 make FAG Detector III a Plug-and-Play solution and allow authoritative information on the machinery condition, entirely without time-consuming training or system configuration.

This allows rapid inspection of machinery and subassemblies. The user simply has to start the measurement process by pressing a few buttons and wait until it is completed.

Interpretation of the measurement results is carried out in a self-explanatory manner by means of simple symbols on the device display, *Figure 2*. For more detailed analysis, the software Trendline with comprehensive functions is available free of charge.

Advantages of the system

- No prior knowledge required for use of basic functions
- Parallel monitoring of vibration and temperature
- Static and dynamic balancing on site
- Wide range of options for analysis and presentation
- Simple and easy to use
- Excellent price/performance ratio
- Limitless possibilities for development while giving maximum investment protection.

① Value OK
② Prealarm
③ Main alarm

Figure 2
Symbols in the device display

FAG Detector III

Areas of application

Machine vibrations are a good indicator of the condition of a machine. FAG Detector III can be used to monitor vibrations, such as machine vibrations according to ISO 10816 and the condition of rolling bearings by means of the demodulated signal detection method, *Figure 3*.

FAG Detector III is thus a highly suitable device for the detection of:

- unbalances and misalignments
- rolling bearing damage
- gearbox damage (tooth sets).

A typical areas of application is the monitoring of:

- pumps
- electric motors
- ventilators
- machine tools
- compressors
- gearboxes
- spindles.

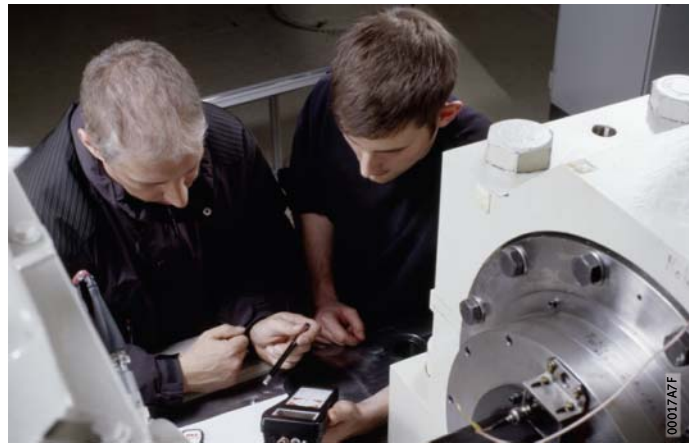


Figure 3
Condition monitoring by means of FAG Detector III

Measurement and analysis of machine condition

FAG Detector III captures vibration signals at predetermined measurement points and calculates the RMS values for velocity, acceleration and the demodulation curve. These parameters describe the condition of the machine and components, see page 14.

The sensor should be positioned as close as possible to the point to be measured. In general, it is attached to the machine by means of the screw-mounted magnetic foot.

For the measurement procedure, the user selects this measurement location in the configuration system of FAG Detector III. Measurement is then started. At the beginning, the speed can be measured, which should be constant during measurement (at least 120 min^{-1} or, for ISO 10816, 600 min^{-1}).

The device captures the sensor signals according to the selected bandwidths and calculates the parameters, *Figure 4*.

For each configuration, FAG Detector III compares the measured parameters with the limit values defined for this measurement location. If a threshold value is exceeded, this is displayed directly on the device.

Trend analysis gives an indication of when an alarm will probably occur. When an alarm is triggered, an alarm report can be automatically generated and printed out. After reference measurement, measurements should be carried out at regular intervals. Subsequently, it is very easy to compare values under identical operating values, such as speed, load etc.

If conspicuous parameters are detected, the causes can be analysed in detail with the aid of the high performance Viewer.

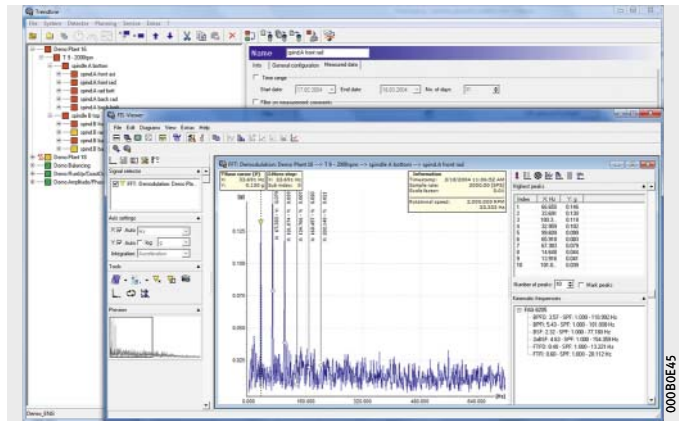


Figure 4
Presentation of measurement data in the Trendline software

Route planning

The user can model the plant structure on a PC using the Trendline software.

Within these structures, routes can be defined, for example for individual days of the week or by machine type.

Before the measurement patrol, the selected route is transferred to FAG Detector III.

After a measurement patrol, all the recorded data are fed back into the Trendline software for evaluation, analysis and presentation by means of diagrams and tables, *Figure 5*.

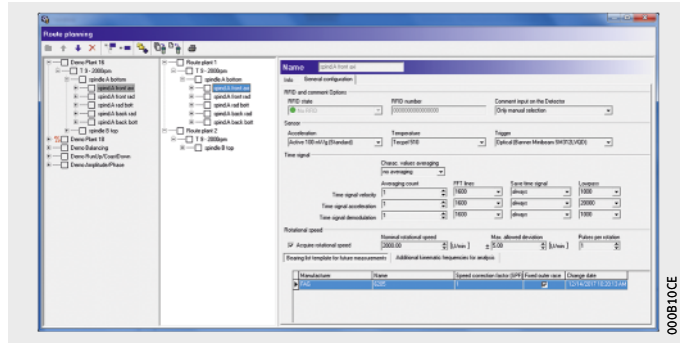


Figure 5
Route planning
in the Trendline software

Bearing database

The integrated bearing database in the Trendline software (containing approx. 20 000 bearings from various manufacturers) allows considerably simplified and shortened analysis of the measured data, *Figure 6*.

In tandem with the Viewer, the bearing database offers a perfect combination for assessing machine condition.

Significant features can be recognised and allocated to the appropriate components at first sight. A separate bearing list can be filed for each measurement point. This offers the option of checking several bearing overrolling frequencies efficiently at one measurement point.

The bearing database can be expanded individually by each user to include further entries.

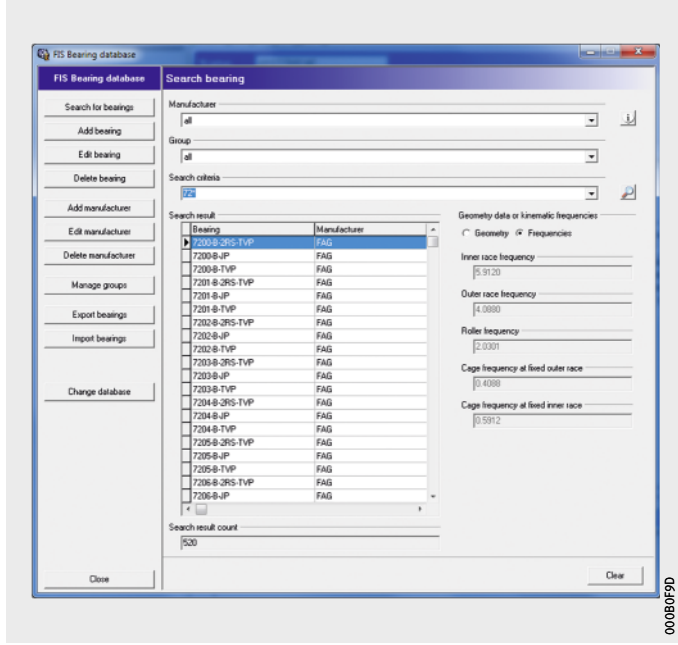


Figure 6
Bearing database

Run-up or coast-down

Run-up or coast-down is used to determine resonance points. In a diagram (Bode plot), both the amplitude and the phase during run-up or coast-down are laid off over speed and presented in diagrammatic form in the Viewer, *Figure 7*.

The resonance ranges determined can then be marked diagrammatically and allocated to any balancing configuration. In the worst case, balancing in the resonance range can lead to machine damage.

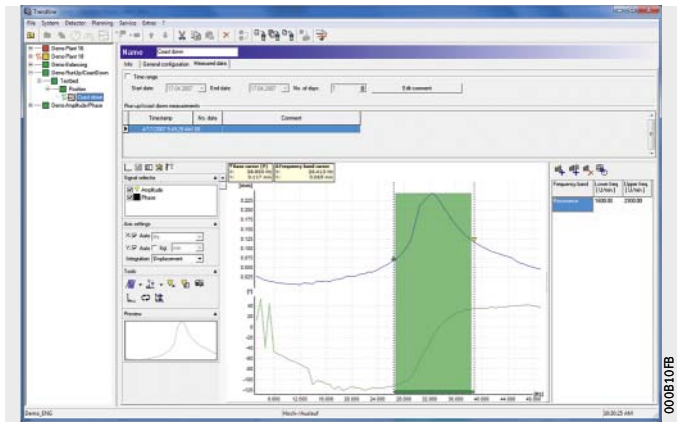


Figure 7
Diagram
for determining resonance points

Configurable report

A very useful feature of the Trendline software is the report generator. This offers maintenance personnel in the company as well as external service providers using FAG Detector III the possibility of achieving seamless documentation of measurement results. The report generator facilitates the preparation of individual reports and allows, for example, the incorporation of customer logos. All the information present in the system can be used for the report, including time signals, trend curves and alarm data, *Figure 8*.

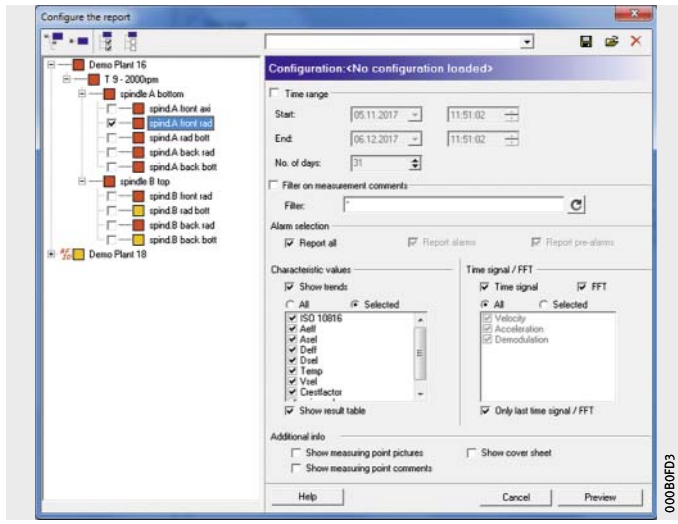


Figure 8
Report generator

FAG Detector III

Features

Overview of advantages:

- complete package
- monitoring functions:
  - temperature
  - general vibration state (vibration values in accordance with ISO 10816)
  - rolling bearing condition
- data collector for up to 16 000 measurement points
- storage of up to 300 time signals
- static and dynamic balancing in one or two planes (optional)
- portable, handy, easy to use diagnostic device, *Figure 9*
- integrated bearing database containing approx. 20 000 entries
- operation with one hand using 21 keys
- headset jack for acoustic noise assessment
- storage and display of up to 4 parameters per measurement point for straightforward condition assessment
- e-mail service
- trendline PC software free of charge.

Figure 9
Diagnostic device:
portable, handy and easy to use

Scope of delivery and ordering designation

For FAG Detector III, the Balance Kit and further accessories are available.

FAG Detector III

Scope of delivery DETECT3-KIT

The following components are included in the scope of delivery, *Figure 10*:

- diagnostic device with rechargeable battery
- accelerometer with two magnetic feet for flat and curved surfaces
- temperature sensor
- battery charger with adapters for worldwide use
- PC data cable (serial, USB)
- user manual
- protective bag with holder for temperature sensor
- PC software Trendline
- case.

Ordering designation **DETECT3-KIT**

Figure 10
Scope of delivery DETECT3-KIT

Accessories

A charging dock is available as an accessory, *Figure 12*.
Further accessories are available by agreement.

Figure 11
Charging dock
DETECT3.BATTERY-DOCKING

Balance Kit

The optional Balance Kit can be used to detect and eliminate unbalances such as those in motors or fans.
The results of the balancing process are transferred to the Trendline software and displayed.

Scope of delivery DETECT3.BALANCE-KIT

The following components are included in the scope of delivery, *Figure 12*:

- accelerometer with magnetic foot and sensor cable
- trigger sensor (optical and induction)
- balance
- magnetic holder for trigger sensor
- extension for magnetic holder
- cable for trigger sensor (length 10 m)
- reflective mark for trigger sensor
- dongle for activation of balancing function
- case.

Ordering designation

DETECT3.BALANCE-KIT

Figure 12
Scope of delivery DETECT3.BALANCE-KIT

Selection of parameters

The Trendline software can be used to freely define which signals and parameters are to be measured.

Signals

Three different signals can be measured.

Vibration acceleration

- Resolution: low-pass cut-off frequency · 2,56
- Frequency range: 0,1 Hz to maximum TP.

Vibration velocity

- Resolution: low-pass cut-off frequency · 2,56
- Frequency range: 0,1 Hz to maximum TP.

Demodulated curve

- Resolution: low-pass cut-off frequency · 2,56
- Frequency range: 0,1 Hz to maximum LP.

Characteristic values

The low-pass cut-off frequency (LP) is adjustable in stages to 200 Hz, 500 Hz, 1 kHz, 2 kHz, 5 kHz, 10 kHz and a maximum of 20 kHz.

Vibration velocity in accordance with ISO 10816 (VDI 2056)

- Definition: broadband RMS value for general assessment of machine condition in accordance with ISO 10816
- Frequency range: 10 Hz to 1 kHz.

V_{sel}

- Definition: RMS value for vibration velocity, e.g. for detection of unbalance and misalignments
- Frequency range: lower and upper frequency range freely selectable up to the set LP.

A_{eff}

- Definition: broadband RMS value for vibration acceleration, e.g. for monitoring of gearboxes
- Frequency range: selectable from 2 kHz to LP_{max}.

A_{sel}

- Definition: RMS value for vibration acceleration, e.g. for selective tooth set monitoring
- Frequency range: freely selectable up to set LP.

D_{eff}	■ Definition:	RMS value for demodulated signal up to 100 Hz, 1 000 Hz, e.g. for monitoring of rolling bearing condition
	■ Frequency range:	freely selectable up to set LP.
D_{sel}	■ Definition:	RMS value for demodulated signal, e.g. for selective monitoring of rolling bearing condition
	■ Frequency range:	freely selectable up to set LP.

Signal curves

The signals are measured using a 100 mV/g sensor.

The set low-pass cut-off frequency determines the lower limit frequency (lower limit frequency: low-pass cut-off frequency/number of values · 2,56).

The number of values is respectively 4 096 (with 1 600 FFT lines) or 8 192 (with 3 200 FFT lines).

Time signal of vibration acceleration	■ Definition:	time signal of vibration acceleration up to set low-pass cut-off frequency, 4 096 or 8 192 values
	■ Measurement range:	±50 g
	■ Frequency range:	0,1 Hz to 20 kHz.
Time signal of demodulated curve	■ Definition:	time signal of demodulated curve up to set low-pass cut-off frequency, 4 096 or 8 192 values
	■ Measurement range:	±50 g
	■ Frequency range:	0,1 Hz to 20 kHz.
Frequency spectrum of vibration velocity	■ Definition:	frequency spectrum (Fourier transform) of vibration velocity up to set low-pass cut-off frequency
	■ Measurement range:	±5,52 m/s
	■ Resolution:	LP · 2,56/number of lines (1 600 or 3 200), minimum line width 0,0625 Hz, maximum line width 12,5 Hz
	■ Frequency range:	0,3 Hz to 20 kHz.

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Frequency spectrum of vibration acceleration	■ Definition:	frequency spectrum (Fourier transform) of vibration acceleration up to set low-pass cut-off frequency
	■ Measurement range:	±50 g
	■ Resolution:	LP · 2,56/number of lines (1 600 or 3 200), minimum line width 0,0625 Hz, maximum line width 12,5 Hz
	■ Frequency range:	0,1 Hz to 20 kHz.
Frequency spectrum of demodulated curve	■ Definition:	frequency spectrum (Fourier transform) of demodulated curve up to set low-pass cut-off frequency
	■ Measurement range:	±25 g
	■ Resolution:	LP · 2,56/number of lines (1 600 or 3 200), minimum line width 0,0625 Hz, maximum line width 12,5 Hz
	■ Frequency range:	0,1 Hz to 20 kHz.
Other parameters		
Temperature	■ Definition:	temperature of measurement point
	■ Measurement range:	–20 °C to +550 °C
	■ Display:	Detector and PC.
Crest factor	■ Definition:	crest factor of measurement point
	■ Frequency range:	Calculation from time signal for acceleration (up to TP)
	■ Display:	Detector and PC.
Speed	■ Definition:	speed at measurement point
	■ Measurement range:	120 min^{-1} to 10 000 min^{-1}
	■ Frequency range:	2 Hz to 166 Hz
	■ Display:	Detector and PC.

Technical data

General

Description	Characteristic	
Separate measurements	Temperature, speed, headset (demodulated signal)	
Keyboard	Soft keyboard with 21 keys	
Display	Illuminated graphic display (LCD) 128×64 pixels, 55 mm×33 mm	
Memory	1 600 measurement points plus 270 time signals (max. 300 time signals)	
Power supply	NiMh 1 900 mAh (low discharge)	
	Voltage 6 V	
Dimensions L×W×H	Diagnostic device	240×95×55 mm
	Case	435×385×130 mm
Mass	Diagnostic device	approx. 0,5 kg (including rechargeable battery)
	DETECT3-KIT	4,6 kg
	DETECT3.BALANCE-KIT	4,7 kg
Operating temperature	0 °C to +50 °C	
Operating duration	approx. 6 hours to 8 hours in continuous operation	
Housing	ABS, IP40	
Protective bag	Two compartments, black nylon, carry strap	
EMC standards	ETSI EN 301489, ETSI EN 300330, EN 61000-6-2, EN 61000-6-4, EN 60950-1, FCC Part 15	
Firmware	Free of charge firmware updates on the Internet	
	Available languages: German, English, Finnish, French, Italian, Dutch, Portuguese, Swedish, Slovenian, Spanish and Turkish	
Software	Trendline (updates on the Internet)	
	Compatible with	Windows 7 64 Bit, Windows 10 64 Bit
	Available languages: German, English, French, Portuguese and Spanish	
	▫ configuration of measurement task ▫ bearing database containing approx. 20 000 bearings ▫ graphic presentation of measurement values and curve ▫ trend analysis ▫ presentation of time signals and FFT ▫ display of balancing in tabular and diagrammatic format ▫ configurable report generator	

Data collection

Description	Characteristic	
Characteristic values	ISO 10816	RMS value for vibration velocity (10 Hz to 1 kHz)
	V_{sel}	RMS value for vibration velocity in freely definable frequency range (frequency band as a function of low-pass cut-off frequency)
	A_{eff}	RMS value for vibration acceleration (2 kHz to max. low-pass cut-off frequency)
	A_{sel}	RMS value for vibration acceleration in freely definable frequency range
	D_{eff}	RMS value for demodulated signal
	D_{sel}	RMS value for demodulated signal in freely definable frequency range
	Others	Crest factor, speed, temperature, universal parameter
Measurement ranges	Low-pass cut-off frequencies (LP) 200 Hz, 500 Hz, 1 kHz, 2 kHz, 5 kHz, 10 kHz, 20 kHz	
	Acceleration, vibration velocity 0,1 Hz to TP, 0,1 Hz to 200 Hz, 0,1 Hz to 500 Hz, ...	
	Demodulated curve 0 Hz to LP	
	High-pass (demodulated curve branch) 750 Hz	
	Temperature –20 °C to +550 °C (temperature range as a function of sensor used, freely configurable input)	
Window function	Hanning	
Averaging in the frequency range	1 to 9 (FFT, parameters per channel)	
	Linear	
Sampling rate	max. 51,2 kHz, as a function of the set LP	
A/D converter	16 Bit (autoranging), dynamic range > 90 db	
Frequency resolution	1 600, 3 200 lines (0,0625 Hz to 12,5 Hz, as a function of the set LP)	
Run-up and coast-down	Configurable (1 024, 2 048 and 4 096 measurement points)	
	Automatic start/stop function	

Data collection (continued)

Description	Characteristic
Inputs	2 × BNC jacks (multiplexer) - ICP (4,7 mA), steplessly adjustable sensitivity, sensor tester - AC/DC ±5 V, impedance > 100 kΩ
	1 × AUX - Tachometer 5 V bis 24 V, < 10 000 min^{-1} (rising or falling flank selectable) - IR temperature sensor ±5 V, impedance > 100 kΩ (freely configurable)
	Battery charger
Outputs	Headset (demodulated signal)
	RS 232 for data transmission (38,4 kb/s, 57,6 kb/s)
	AUX: Supply for trigger sensor (5 V max. 200 mA, 12 V max. 50 mA)

Balancing

Description	Characteristic
Function	- balancing in one or two planes - up to 4 sensor positions - weight positions: continuous (0° to 359°) or discrete (4 to 99 positions) - remove weights: yes, no
Balancing measurement type	Acceleration, velocity, travel
Measurement	Peak, peak-to-peak, RMS
Balancing units	g, mm/s, inch/s, µm, mil
Weight units	gr., oz. (up to 9 999,99 gr. or respectively oz.)

Services

The Service Division of Schaeffler is a full service supplier in the field of condition-based maintenance.

Everything from a single source

With the sourcing of high quality FAG products, the customer thus gains access to a range of product-related services:

- e-service, e-mail service for analysis of measurement data (transfer to diagnosis experts by means of automated data export)
- support hotline
- training
- software updates free of charge.

Based on many years' experience, Schaeffler knows that customers wishing to change to the concept of condition monitoring have differing needs and requirements.

Schaeffler therefore offers, in relation to the product and service range, both standard training and customer-specific solutions, *Figure 13*.

Figure 13
Training as a service

Customised monitoring solutions for everyone

The service portfolio in the field of regular condition monitoring encompasses five interlocking packages of solutions that introduce the customer step by step to the overall subject. These packages make it possible even for beginners to carry out measurements for themselves and gain information about the condition of machinery. At the same time, they offer the maximum potential for development, right up to the level of vibration expert.

Figure 14
Independent checking of machine condition

The customer decides which of the available services he wishes to use. In this way, he can for example decide how far into the subject of vibration monitoring he wishes to progress. Whichever service is selected, the Schaeffler team of experts is available to assist the customer at any time.

Further information

If you have any further questions about our services, please contact us direct or visit our website:

- www.FAG-DetectorIII.de

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