FAG

FAG Detector III –
The Solution for Monitoring and Balancing
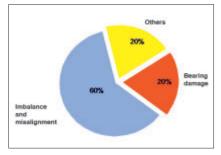
SCHAEFFLER

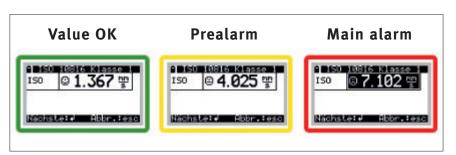# Principle · Operation

Preventing plant downtime

There are many different reasons for unplanned stoppage of machinery.
However, a not inconsiderable percentage can be attributed, directly or indirectly, to imbalance or misalignment.
During operation, imbalance 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.

| Value OK | Prealarm | Main alarm |

Symbols (smileys) in the device display allow rapid interpretation of results

Reasons for unplanned downtime

rapid inspection of machinery and assemblies. 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.
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
– Parallel monitoring of vibration and temperature
– Static and dynamic balancing on site
– Rapid, clear detection of measurement points using RFID technology
– 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.

High functionality – Simple handling

FAG Detector III is a handy, easy to use vibration measurement device that can be used to reliably identify such conditions and eliminate their causes.
Thanks to its preinstalled standard configurations in accordance with ISO 10816, it is a plug-and-play solution and allows initial authoritative information on the condition of the machine – entirely without time-consuming training or system configuration. This allows

Areas of application · Measurement

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.

FAG Detector III is thus a highly suitable device for the detection of
• imbalance and misalignment
• rolling bearing damage
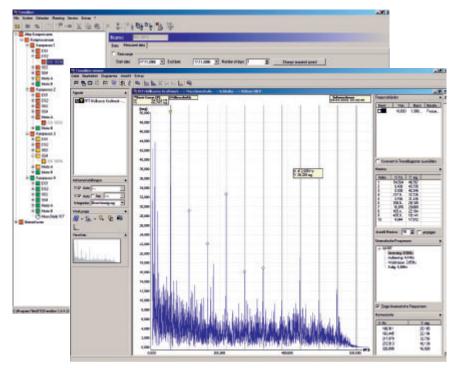• gearbox damage (tooth sets).

Typical areas of application include the monitoring of
• pumps
• electric motors
• fans
• machine tools
• compressors
• gearboxes
• spindles
• etc.

Measurement and analysis of machine condition

FAG Detector III picks up vibration signals at predetermined measurement points and calculates the RMS values for velocity, acceleration and the demodulation curve. These characteristic values describe the condition of the machine and components and are presented in greater detail in the table on page 6. 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 either selects this measurement location in the configuration system of FAG Detector III or the FAG Detector III automatically identifies the measurement point by means of RFID. Measurement is then started. To begin with, the speed is measured, which should be constant during measurement (at least 120 or, in the case of ISO 10816, 600 min^{-1}). The device records the sensor signals according to the selected bandwidths and calculates the parameters. For each configuration, FAG Detector III compares the measured parameters with the main alarm limit values defined for this measurement location.

If a threshold value is exceeded, this is displayed directly on the device. For conspicuous characteristic values, the causes can be recognised from the demodulated and raw signal spectrum.
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. After this, it is very easy to compare values for the same speed, load etc.

Presentation of measurement data in the Trendline software

2

Route planning · Bearing database

Route planning

The user can model the plant structure on a PC using the Trendline software. Within these configurations, routes can be defined, for example for individual days of the week or by machine type. Before measurement, the selected route is transferred to FAG Detector III. After a measurement round, all the recorded data are transferred to the Trendline software for evaluation, analysis and presentation by means of diagrams and tables.

Trendline – Bearing database

The integrated bearing database (approx. 20 000 bearings from various manufacturers) allows considerably simplified and shortened analysis of the measured data. 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. Each user can expand the database by further entries.
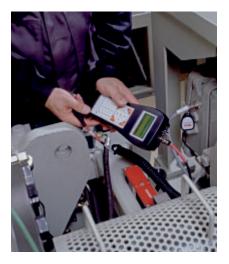

Bearing database

RFID · Run-up/coast-down · Report

Automatic detection of measurement points – RFID

With the optional functionality of automatic measurement point detection*, recording of measurement values using FAG Detector III is faster, more easier and user-friendly. With the aid of RFID technology, the device automatically detects the measurement points if these are equipped with RFID tags and jumps to the corresponding point in the configuration. Measurement of the wrong assembly and erroneous allocation of measurement points are thus a thing of the past. The employee only needs to start and store measurement using FAG Detector III – no other action is required. Nothing could be simpler! The RFID technology can be easily retrofitted to existing FAG Detector III devices.

* This functionality is not available worldwide. Please direct enquiries to: industrial-services@schaeffler.com

Run-up/coast-down

Run-up/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. 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.

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.

Report generation

Features · Ordering designation and scope of delivery

Overview of advantages

- Complete package
- Static and dynamic balancing
  (1 and 2 planes)
- Monitoring functions:
  – ISO 10816
  – temperature
  – general vibration condition
  – rolling bearing condition
  – data collector for up to
    1 600 measurement points
  – storage of up to 300 time
    signals
- Portable, handy, easy to use
  diagnostic device
- Integrated database with
  approx. 20 000 entries
- Operation with one hand using
  21 keys
- Headset jack for acoustic noise
  assessment
- Storage and display of up to
  4 measurement values per
  measurement point for straight-
  forward condition assessment
- Automatic detection of measure-
  ment points (retrofittable)
- E-mail service
- PC software free of charge

Ordering designation and scope of delivery

Detector III is available without and with automatic measurement point detection (RFID) (see footnote on page 4). The Balancing Kit and accessories are equally suitable for both devices.

Ordering designation DETECT3-KIT*

Scope of delivery:
- Basic device with rechargeable
  battery
- Acceleration sensor with
  magnetic foot
- Temperature sensor
- Charger
- PC data cable (serial/USB)
- User manual
- Protective bag with holder
  for temperature sensor
- PC software Trendline
- Case

Ordering designation DETECT3-KIT-RFID**

Scope of delivery:
- As DETECT3-KIT
- RFID Reader
  (integrated in basic device)
- 5 RFID tags

Ordering designation DETECT3.BALANCE-KIT***

Scope of delivery:
- Acceleration sensor with
  magnetic foot and sensor cable
- Trigger sensor
  (optical and inductive)
- Balance
- Magnetic holder for trigger sensor
- Extension for magnetic holder
- Cable for trigger sensor
  (length 10 m)
- Reflex mark for trigger sensor
- Dongle for activation of balancing
  function
- Case

Accessories

- Sensor extension cables for
  lengths of 5 m and 15 m are
  available on request
- Further RFID tags are available
  on request
- Charging station

In some countries, different
ordering designations are still
in use:
*   FIS.DETECTORIII.KIT
**   FIS.DETECTORIII.KIT.RFID
*** FIS.DETECTORIII.BALANCING.KIT

DETECT3-KIT

DETECT3.BALANCE-KIT

Selection of parameters

Selection of parameters			
Possible characteristic values and signal curves for each measurement point	**Measurement range/resolution**	**Frequency range**	**Display**
Characteristic value: vibration velocity to ISO 10816 (VDI 2056) (broadband RMS value for velocity) for general assessment of machine condition to ISO 10816	**ISO 10816** 0 to 5,52 m/s[3] at 10 Hz 0 to 55,2 mm/s[3] at 1 kHz	10 Hz to 1 kHz	Detector and PC
Characteristic value: velocity (freely selectable) (RMS value for velocity, e.g. for detection of imbalance and misalignment)	V_{sel} 0 to 5,52 m/s[3] at 10 Hz 0 to 55,2 mm/s[3] at 1 kHz	Freely selectable up to set TP[1] (max. 20 kHz)	Detector and PC
Characteristic value: acceleration (broadband RMS value for acceleration, e.g. for monitoring of gearboxes)	A_{eff} 0 to 37 g[3]	2 kHz – up to set TP[1] (max. 20 kHz)	Detector and PC
Characteristic value: acceleration (freely selectable) (e.g. for selective gear tooth monitoring)	A_{sel} 0 to 37 g[3]	Freely selectable up to set TP[1] (max. 20 kHz)	Detector and PC
Characteristic value: demodulated signal (RMS value of demodulated signal up to 100/1 000 Hz, e.g. for monitoring of rolling bearing condition)	D_{eff} 0 to 37 g[3]	Freely selectable up to set TP[1] (max. 20 kHz)	Detector and PC
Characteristic value: demodulated signal (freely selectable) (e.g. for selective monitoring of rolling bearing condition)	D_{sel} 0 to 37 g[3]	Freely selectable up to set TP[1] (max. 20 kHz)	Detector and PC
Time signal of acceleration up to set low-pass cut-off frequency, 4 096 or 8 192 values	±50 g[3]	0,1 Hz to 20 kHz[2]	PC
Demodulated time signal up to set low-pass cut-off frequency, 4 096 or 8 192 values	±50 g[3]	0,1 Hz to 20 kHz[2]	PC
Frequency spectrum (Fourier transform) of velocity up to set low-pass cut-off frequency	±5,52 m/s[3], resolution: TP · 2,56 / number of values[4] (0,0625 Hz to 12,5 Hz)	0,3 Hz to 20 kHz[2]	PC
Frequency spectrum (Fourier transform) of velocity up to set low-pass cut-off frequency	±50 g[3], resolution: TP · 2,56 / number of values[4] (0,0625 Hz to 12,5 Hz)	0,1 Hz to 20 kHz[2]	PC
Frequency spectrum (Fourier transform) of demodulated frequency alternatively up to set low-pass cut-off frequency	±25 g[3], resolution: TP · 2,56/ number of values[4] (0,0625 Hz to 12,5 Hz)	0,1 Hz to 20 kHz[2]	PC
Measurement point temperature	**Temp** = −20 °C to +550 °C	–	Detector and PC
Crest factor	–	Calculation from time signal for acceleration (up to TP)	Detector and PC
Speed	120 to 10 000 min^{-1}	2 Hz to 166Hz	Detector and PC

[1] TP = low-pass cut-off frequency (200, 500 Hz, 1, 2, 5, 10, 20 kHz)
[2] Lower limit frequency as a function of set low-pass cut-off frequency (lower limit frequency = TP/number of lines · 2,56)
[3] 100 mV/g – sensor
[4] Number of values: 4 096 (at 1 600 FFT lines) or 8 192 (at 3 200 FFT lines)

On the PC, the user can specify for each measurement point whether and under what conditions certain time signals are to be stored. Three different time signals can be measured:
– 2 × acceleration (0,1 Hz to TP; scan rate = 2,56 · TP; 0,1 Hz to TP; scan rate = 2,56 · TP). One is used for calculating the velocity spectrum.
– Demodulated signal (0 Hz to TP; scan rate = 2,56 · TP).

Technical data

Data collection	
Measurement ranges	Acceleration/velocity 0,1 Hz to TP[1] 0,1 Hz to 200 Hz; 0,1 Hz to 500 Hz; … Demodulated signal 0 Hz to TP[1] Low-pass cut-off frequencies 200, 500 Hz, 1, 2, 5, 10, 20 kHz High-pass (demodulated signal branch) 750 Hz Temperature −20 °C to +550 °C (temperature range as a function of sensor used, freely configurable input)
Characteristic values	A_{eff} (2 kHz to TP[1]), RMS value for acceleration A_{sel} RMS value for acceleration in freely definable frequency range ISO 10816 (10 kHz to 1 kHz), RMS value for velocity V_{sel} RMS value for velocity in freely definable frequency range (frequency band as a function of TP[1]) D_{eff} RMS value for demodulated signal D_{sel} RMS value for demodulated signal in freely definable frequency range Crest factor, speed, temperature, universal characteristic value
Window function	Hanning
Averaging in frequency range	1–9 (FFT, characteristic values per channel) Linear
Sampling rate	max. 51,2 kHz, as a function of the set TP[1]
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 TP[1])
Automatic measurement point detection	RFID 13,56 MHz, ISO 15693, compatible with RFID tags of stated specification
Ramp-up/Coast-down	Configurable (1024, 2048 and 4096 measurement points) Automatic start/stop function

Inputs	2 × BNC jacks (multiplexer)
	   ICP (4,7 mA), steplessly adjustable sensitivity, sensor tester
	   AC/DC ±5 V, impedance >100 kΩ
	1 × AUX
	   Tachometer input 5 to 24V, $\&\lambda\tau;10\,000$ 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 kps, 57,6 kps) AUX: supply for trigger sensor (5 V max. 200 mA, 12 V max. 50 mA)

[1] TP = low-pass cut-off frequency

Technical data

Balancing	
	1 or 2 plane balancing Up to 4 sensor positions Weight positions: Continuous (0 to 359º) or discrete (4 to 99 positions) Removal of weights: yes/no
Balancing measurement type	Acceleration, velocity, travel
Measurement	peak, peak-to-peak, RMS
Balance units	g, mm/s, inch/s, µm, mil
Weight units	gr., oz. (up to 9 999,99 gr. or oz.)

General	
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 (maximum 300 time signals)
Power supply	NiMh 2 100 mAh (low discharge), voltage 6 V
Dimensions and mass	230 × 70(53) × 45(53) mm (L × B × H), approx. 500 g (including rechargeable battery)
Temperature range	0 ºC to 50 ºC (working temperature)
Operating life	approx. 6 to 8 hours continuous operation
Housing	ABS, IP 40
Protective bag	Two compartments, black nylon, carry strap
EMC standards	ETSI EN 301 489, ETSI EN 300 330, EN61000-6-2, EN61000-6-4, EN60950-1, 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 XP, Windows 7 64-Bit Available in: German, English, French, Portuguese and Spanish – Configuration of FAG Detector III via RS 232 interface – Bearing database of 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

Everything from a single source – Customised monitoring solutions for everyone

Everything from a single source – Customised monitoring solutions for everyone

The Service Sector of Schaeffler is a full service supplier in the field of condition-based maintenance. With the sourcing of high quality FAG products, the customer thus gains access to a range of product-related services (see diagram). Based on many years' experience, Schaeffler knows that customers wishing to change to the concept of condition monitoring have differing needs and requirements. It there-fore offers, in relation to the product and service range, both standard training and customer-specific solutions.

The service portfolio in the field of regular condition monitoring encompasses solutions that intro-duce the customer step by step to the overall subject. This makes it possible even for beginners to carry out measurements for themselves and gain information about the condition of machinery. At the same time, the solutions also offer the maximum potential for development, right up to the level of vibration expert.

It is of course the customer who 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. If you have any further questions on our services, please contact us direct or visit our website www.FAG-DetectorIII.com

E-mail service for analysis of measurement data (transfer to experts by automated data export)

E-service

Support hotline

Training

Free software updates

Services for FAG Detector III