FAG

FAG DTECT X1 s
Continuous Monitoring of
Plant and Machinery

SCHAEFFLER

Reliable machine protection through vibration diagnosis · FAG DTECT X1 s areas of application

Increasing plant availability

Anyone with responsibility for the maintenance of complex plant knows the challenges involved in the planning of maintenance measures. Through permanent, seamless monitoring of installations, the operator has access at any time to information on the condition of the most important components of his plant. It is thus possible to avoid unplanned machine downtime and the associated costs. At the same time, the early detection of damage makes it possible to implement measures at an appropriate time. This gives the operator a high degree of investment security as well as active machinery protection.

Advantages of the FAG DTECT X1 s

– Reliable machinery protection by means of vibration diagnosis
– Space saving due to compact construction
– Suitable for harsh conditions (−20 °C to +70 °C, IP67)
– Diverse monitoring tasks due to larger number of measurement channels
– Increased reliability through combination of various process parameters
– Versatile communication interfaces and connection options
– Increased operational security due to better availability of the equipment to be monitored
– Flexible and simple installation at the location due to standardised connection systems

Continuous plant monitoring by means of vibration diagnosis

Vibration diagnosis by means of frequency-selective monitoring is a measurement method that allows objective assessment of complex plant.
Envelope analysis plays an important role here. This can be used to detect periodic shock impulses from the vibration signal of a machine, such as those that occur in gearbox and rolling bearing damage. Damage can be detected at an early stage through characteristic patterns in the frequency spectra of the machine vibration. By means of defined, narrow frequency bands, the amplitudes of individual components can be specifically monitored.

Online monitoring system FAG DTECT X1 s

The FAG DTECT X1 s is a flexible online system for the monitoring of components and devices, machinery and plant.

Typical applications include:
• fans
• gearboxes
• compressors
• roll stands
• mills
• drives.
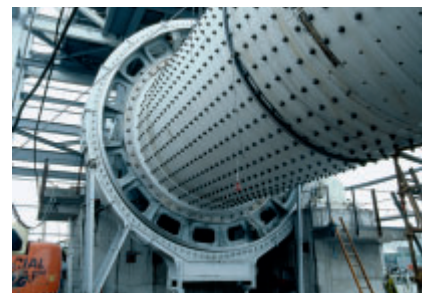
FAG DTECT X1 s Examples of sectors and applications

Digital vibration monitoring with FAG DTECT X1 s

Digital vibration monitoring with FAG DTECT X1 s

FAG DTECT X1 s allows connection of all common IEPE acceleration sensors. The signal from these sensors is recorded and broken down into its frequency components by means of Fast Fourier Transformation (FFT). It is thus possible to monitor amplitudes within fixed and very narrow frequency bands for specified limit values. An alarm is triggered if these are exceeded. With FAG DTECT X1 s, two different parameter types can be recorded from the vibration acceleration signal. Firstly the RMS value, which is detected from the spectrum of the raw signal and secondly the LDZ value (bearing diagnostic parameter) which is generated from the envelope signal.

Depending on the width of the frequency components which are used for calculation based on the relevant spectrum, these are referred to as broadband or frequency-selective parameters. In the case of broadband parameter monitoring, the overall vibration behaviour of a machine is determined. The condition of the individual components can be analysed precisely by means of narrowband, frequency-selective monitoring.

FAG DTECT X1 s

FAG DTECT X1 s calculates various parameters:
• RMS
• IEPE
• peak value
• peak-to-peak value
• steady component
• crest factor.

FAG DTECT X1 s has two additional channels, which can be used to record process variables such as
• speed
• torque
• temperature
• pressure
and can be used for validation of the parameters.
This method is used in practice to achieve, for example, the speed-dependent tracking of the frequency bands and the setting of load-dependent and speed-dependent alarm limits.

As standard, the FAG DTECT X1 s is supplied in an IP67 housing for installation.
The standard M12 plug-in connectors are advantageous in allowing simple installation. A top hat rail adapter is available as an option.

Broadband monitoring

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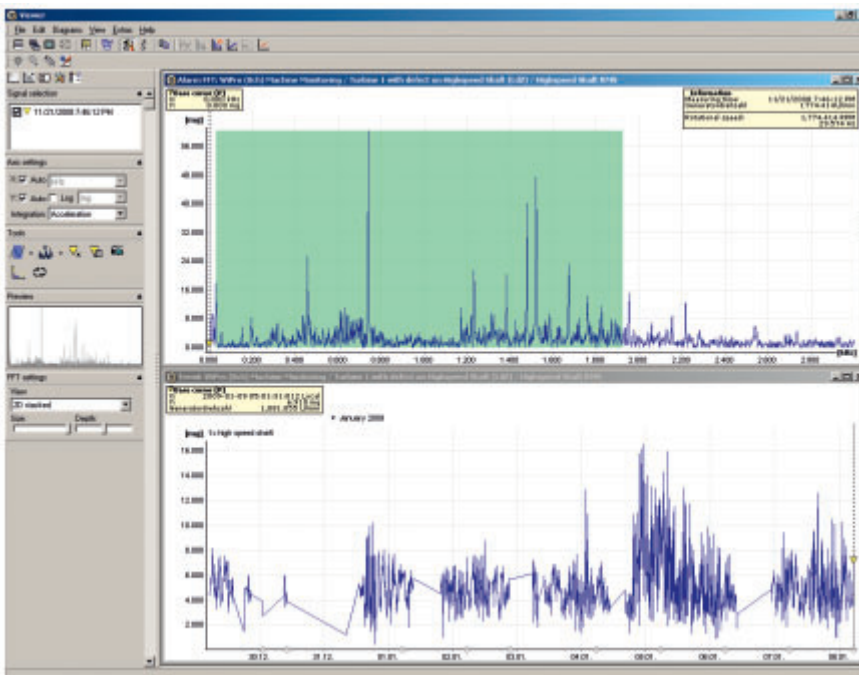
Alarm warnings · Remote monitoring with FAG DTECT X1 s

Alarm warnings

In terms of adjustable limit values, a distinction is drawn between prealarm and main alarm thresholds. Each alarm can trigger a switching relay.
To avoid false alarms, a delay can be set on the main alarm.
FAG DTECT X1 s has two analogue outputs and two relay outputs.
If the limit value is exceeded, the analogue outputs can relay the parameters to a higher level control system (PLC system).
The relay outputs are used for the direct control of machinery.

A "traffic light" display on the front panel of the housing with red, yellow and green lights gives an immediate indication of the monitoring condition.

The user is given further information on a four line LCD display.

Remote monitoring with FAG DTECT X1 s

FAG DTECT X1 s allows remote monitoring of plant and machinery.

Changes to components are reliably detected by the monitoring system and can be reported to different recipients by various communication channels:
• operator
• plant manufacturer
• service provider.

Advantages of remote monitoring

• Increased machine availability
• Prevention of unplanned downtime
• Worldwide, economical plant monitoring
• No vibration expert required on site
• Continuous availability of monitoring data
• Immediate alarm activation via telecommunications systems
• User administration and password protection.

Measurement data can be remotely retrieved at any time and evaluated by the actual customer or by the Schaeffler Monitoring Center.
As a result, it is possible to changes can be made from any location to the parametrisation where these are necessary to carry out suitable measurements on a current problem.

FAG DTECT X1 s in use

Monitoring Center

Variable system · Monitoring configuration · Data storage concept

FAG DTECT X1 s –
a variable system

FAG DTECT X1 s is available in two designs:
• 2 channel system
• 8 channel system

Signals with an output voltage of ±10 V can be connected, irrespective of the number of channels.
The recorded signals are transmitted to the signal-processing elements of the device via an internal multiplexer.

Monitoring configuration

Establishing a monitoring configuration provides the basis for subsequent evaluation.
A monitoring configuration defines the:
• channel
• value to be measured
• type of characteristic value
• size of the characteristic value
• frequency bands (max. 12)
• alarm thresholds.

It is possible to define several monitoring configurations for an input channel.
For each of these configurations, FAG DTECT X1 s determines characteristic values from the time and frequency signals and saves them in the configuration's ring buffer. For speed-tracked characteristic values, the speed is also recorded as a separate trend.

Data storage concept

Large volumes of data are not a problem for FAG DTECT X1 s. The flexible storage concept allows the user to decide what data he wishes to store, along with the degree of frequency.

Communication

**Communication
with a higher level system**

For communication with a higher
level system, various inputs and
outputs are available.
Additional signals can be recorded
using analogue inputs and used
for measurement purposes.
These signals can thus be used as
command variables for dependent
signal analysis such as alarm
threshold control. These signals
can also be used to initiate
measurement tasks and thus
facilitate automation of data
logging in certain applications.

On the other hand, information
such as alarm status can be trans-
ferred to a higher level system and
held there for further processing.

Communication with FAG DTECT X1 s
can be carried out via the following
channels:
• network (TCP/IP)
• serial
• modem.

Cloud

A new addition is the free-of-charge
program Transfer Link, which facili-
tates data transfer via conventional
Cloud service providers. These
include: Own Cloud, Microsoft
Cloud, Google Drive or Amazon
Cloud Drive.
If remote service from FAG is
required, all data are stored on an
in-house Cloud server in Germany.

Simple data exchange via the Cloud

Software · Functionality

Software

Successful vibration monitoring of plant is dependent to a large extent on the software. In addition to simple configuration and use of the software, the various analysis and data presentation options are of decisive importance. In order to fulfil these requirements as well as possible, the software Administrator for FAG DTECT X1 s is divided into the following modules:
• Configuration Manager
• Remote Server
• Data Link
• E-Mail Link
• Transfer Link

Configuration Manager

• Allocation of connected sensors to particular monitoring configurations
• Allocation of additional channels (inputs/outputs) to existing configurations
• Definition of the frequency bands to be monitored
• Definition of the alarm thresholds.

Remote Server/Data Link/ E-Mail Link/Transfer Link

Remote Server is used to transfer data from FAG DTECT X1 to the software F'IS Administrator. This software module offers the option of transmitting data on either a time-controlled or event-controlled basis. The user can
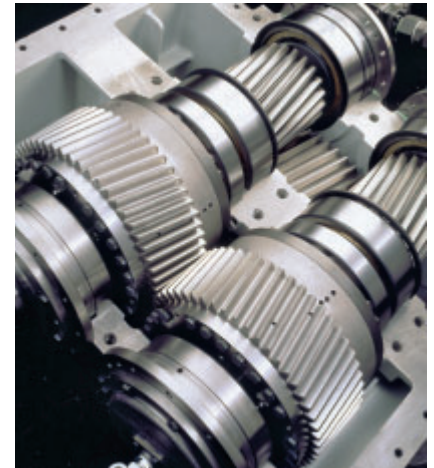
select which measurement values (time signals, frequency spectra or trend values) are transferred from FAG DTECT X1 and stored in the appropriate database by means of Data Link. This functionality ensures seamless data storage. In order to provide FAG DTECT X1 data held in the database to other people, the E-Mail Link and Transfer Link functionality is available. E-Mail Link allows the user to define automatic data export by e-mail. The data can be sent to any number of mailboxes required. At the recipient's end, all incoming e-mails are checked and, if these contain measurement data, they are automatically transferred to the corresponding database. Alternatively, the data can be transferred using Transfer Link via conventional Cloud services.
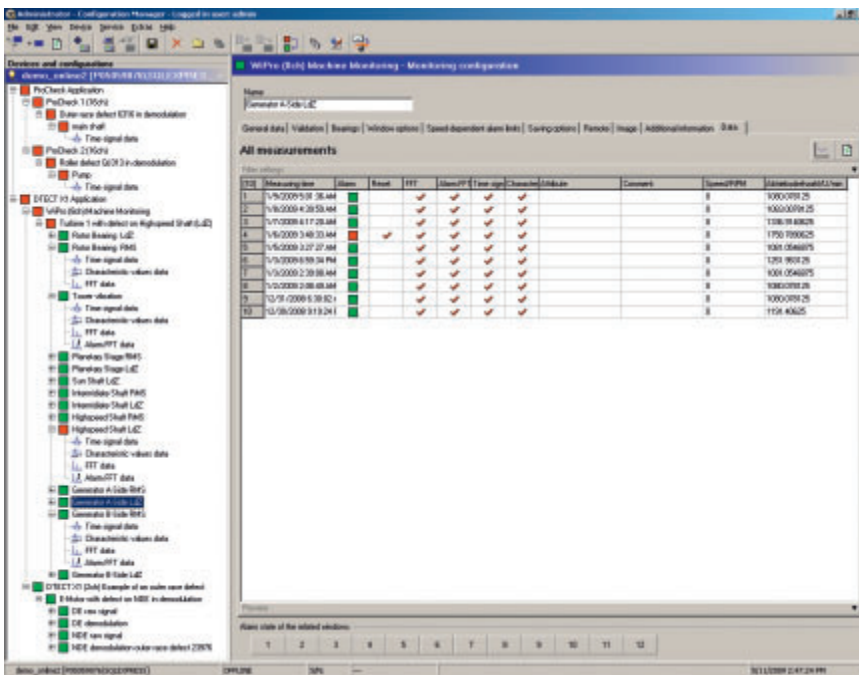
Configuration Manager: Alarm list

Software · Functionality

User management

- Installation and management of users
- Allocation of access rights
- Allocation of rights to individual program functions (Edit, Start Services, Import and Export...).

Bearing database

- Contains 20 000 bearings from various manufacturers
- Reduces data analysis
- Simplifies the process for determining the cause of damage in conjunction with the Viewer
- Facilitates the diagnosis of multiple bearing overrolling frequencies for a monitoring configuration, as a bearing list can be stored for each monitoring configuration
- Can be extended to individual requirements.

Alarm list

- Record of all status changes in the Configuration Manager.

Viewer

- Diagramatic preparation of the measured data
- Extensive analysis and display options facilitate the assessment and evaluation of measurement data
- Intuitive operation, additionally benefiting from various zoom and cursor functions
- Simple comparison of process data and vibration data (temperature and vibration curve)
- Unique range of services despite simplicity of simple operation.

Trend analysis

Trend analysis is a simple and reliable method for detecting changes in the vibration behaviour of machinery at an early stage, allowing action to be taken quickly. The trends can be based on parameters in broadband monitoring as well as on narrowband parameters of individual components such as a rolling bearing outer ring or a gear tooth set. For example, monitoring of an outer ring may be carried out by bringing together several narrowband frequency bands for overrolling frequency and the harmonics to form one parameter. Incipient damage or a forthcoming problem becomes apparent in an increase in the trend values for a monitored component or machine.

FFT analysis

FFT analysis subdivides the recorded signals into their individual frequency components. It is therefore possible to monitor the amplitudes of individual frequencies within narrow bands for specified limit values and trigger an alarm if these are exceeded. It is possible to precisely allocate the frequencies to particular components such as bearing rings, gear teeth or to phenomena such as misalignment, imbalance etc.

Software · Functionality · Server variants

Waterfall diagram and sonogram

The waterfall diagram is a presentation method in which the individual FFTs are presented behind each other „spatially" to give a three-dimensional image. In the sonogram, the development of the spectrum over time is presented by means of colour.
The two display options also allow novices to gain a rapid graphical overview of the temporal development in vibration behaviour.

Expanded analysis

• Automatic detection of defective components
• Provides authoritative parameters (spectral flatness, kurtosis, ISO 10816, RMS, LDZ)
• Assists beginners and experts in data analysis.

Server variants

From software version 4.10, the Administrator is supplied with the Microsoft® SQL Server® 2012 Express. The user then has access to a storage capacity of 10 GB.
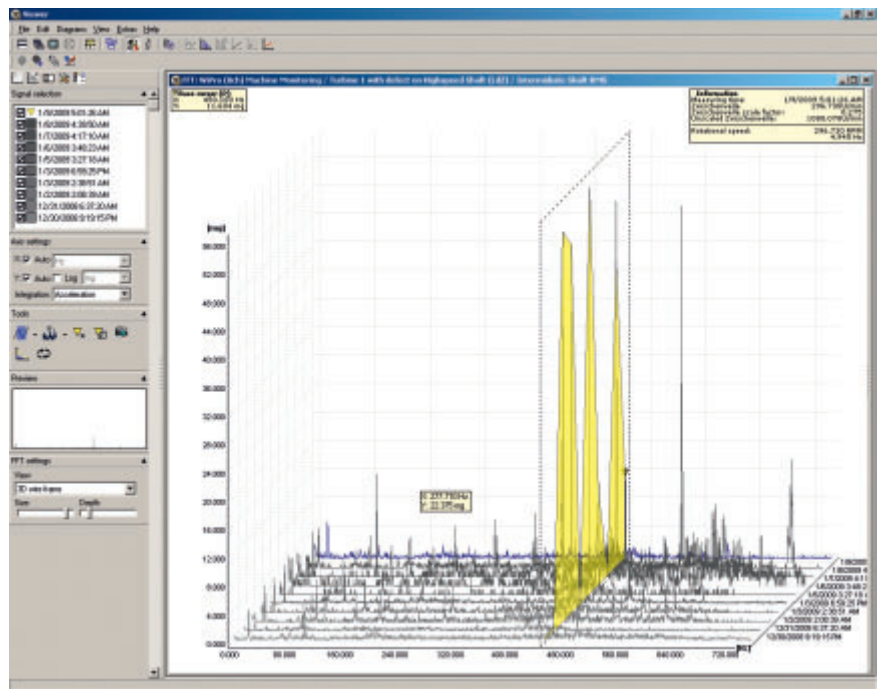
Viewer: Waterfall diagram

Versions and ordering designations

FAG DTECT X1 s Versions and ordering designations		
	DTECTX1-S-2CH	**DTECTX1-S-8CH**
IEPE channels	2	8
Configurations	16	16
Frequency windows	12	12
Others	Speed tracking of frequency windows, envelope detector	Speed tracking of frequency windows, envelope detector

Technical data of FAG DTECT X1 s

Inputs/sensors	Inputs for IEPE sensors power supply 24 V, 4 mA Convertible to a voltage input ±10 V (optionally coupled DC or AC) Amplifier: 1 ~ to 1 024 ~ or autoranging with switchable overvoltage detection Additional channel (validation) ±10 V with optional isolation amplifier 4 mA to 20 mA, 0 mA to 20 mA, 0 V to 10 V, for example for speed, load or other freely definable values Speed input for conventional speed sensors from > 1 min^{-1} to 30 000 min^{-1} Connectors with industrial M12 connectors (exception: Power)
Temperature range	−20 °C to +70 °C
Measurement values	Measurement value for vibration pickups: acceleration (standard) convertible to vibration velocity and vibration displacement by means of integration Measurement values such as displacement, velocity, force, pressure, temperature etc. by means of appropriate sensors Optional: oil quality
Diagnostic methods	Time signal, frequency spectrum, trend analysis, frequency range monitoring (fixed or speed-tracked)
Parameters	Parameters in frequency range: RMS, peak, peak to peak, steady component, crest factor Parameters in frequency range: effective value for vibration acceleration (RMS), vibration velocity and vibration displacement, broadband or freely definable frequency bands (DIN/ISO 10816) Effective value for demodulation (envelope generation) Broadband or freely definable frequency bands Speed-dependent tracking of frequency bands in RMS and demodulation including speed-variable alarm level
Number of channels	2 channels or 8 channels with up to 16 monitoring configurations and, per channel, up to 12 individually adjustable frequency bands, additionally 2 trigger/validation channels, in each case also with sensor signal
FFT	2 048 lines, variable frequency range
Filter	Analogue antialiasing filter for band restriction, Butterworth 24 db/octave limit frequences 5 Hz, 10 Hz, 20 Hz, 50 Hz, 100 Hz, 200 Hz, 500 Hz, 1 kHz, 2 kHz, 5 kHz, 10 kHz and 20 kHz Filter for envelope analysis: high pass, Butterworth 12 db/octave switchable between 750 Hz and 2 kHz
Outputs	2 switching outputs for pre-alarm and main alarm 2 analogue outputs 4 mA to 20 mA or 0 mA to 20 mA, all connections with industrial M12 connectors

Technical data of FAG DTECT X1 s

Communication	Ethernet or RS232 for connection of modem/GSM/ISDN
Display	LCD display, alphanumeric 4 lines each with 20 characters with display of current measurement and status of all monitoring configurations, LED traffic light system red/green/yellow for alarm status
Control system	3 keys for confirming alarms, call-up of current measurement values and setup of rotational frequency input
Memory	For device/monitoring configuration, spectrum and time signal as well as parameter storage of up to 3 834 data records (depending on the number of parameters and additional information)
Housing	Dimensions: W×H×D = 260 mm×150 mm×90 mm Protection class: IP67
Mounting	Mounting by means of closed housing cover (optional top hat rail mounting)
Current consumption	24 V: < 350 mA, 230 V: < 40 mA
Electromagnetic compatibility	EN 61000-6-2/1999, EN 61326/1997, EN 55011-A

FAG DTECT X1 s Administrator software

Operating system	Windows 7 (32bit and 64bit); Windows 8 (32bit and 64bit)
Features	Database: Microsoft SQL-Server 2012 Express, 10 GB Software available in various languages Various connection options (Ethernet, GSM modems, fixed network modems, Internet etc.) Configurable remote operation with automatic data transmission via Cloud Notification of alarm by e-mail Continuous recording and storage of all operating data Option of data export (ASCII) for further processing by external programs Optimised Viewer for analysis of data

Options

Isolation amplifier	Ordering designation: DTECTX1-S.ISOAMP-UNIVERSAL
Top hat rail adapter	Ordering designation: DTECTX1-S.RAILMNT-AL

Approval

– CE
– GOST

Notes