

SKF @ptitude Observer



Condition monitoring software including fully integrated machine diagnostics

SKF @ptitude Observer is a core platform in a family of reliability software applications that work together as SKF @ptitude Monitoring Suite.

SKF @ptitude Observer is a powerful software, for condition monitoring of rotating machinery, built on the latest .NET technology, including fully integrated machine diagnostics for correct assessment of machines and processes. You get expert advice without talking to the expert.

Overview

Successful condition monitoring is based on powerful and user-friendly machine diagnostics software for data management and analysis. SKF @ptitude Observer is internationally recognized for its operator interface and intelligent diagnostics functions.

A handful of powerful Wizards allow the user to build and maintain machine setups and other configurations easily. The system's excellent performance enables the user to monitor several hundreds of machines from a single location.

The SKF @ptitude Observer hierarchy tree enables unlimited number of levels and shows the status of each node. The hierarchy tree enables excellent overview and easy navigation. Using Work Spaces, it is possible to customize extractions of the hierarchy. The number of work spaces is unlimited.

The SKF @ptitude Observer software works together with SKF Multilog On-line System IMx (all versions), SKF MasCon 48 (all versions) and SKF MasCon 16 (all versions).

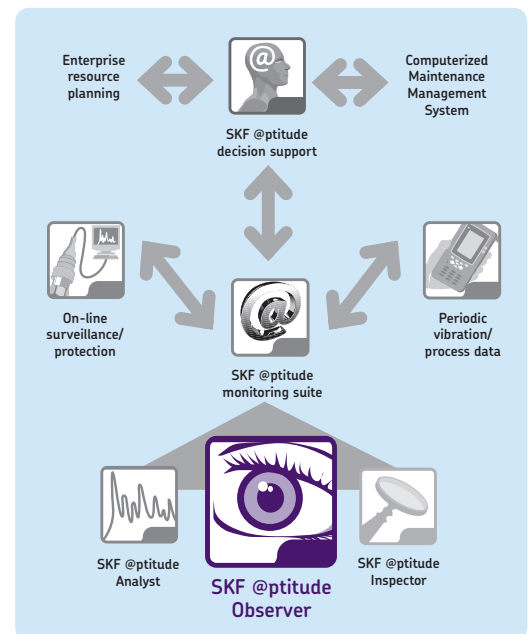


Figure 1

Monitoring features

Measurement data, as well as other relevant information is shown in user-friendly displays. Live data, updated every second*, as well as long term history can easily be displayed in many different formats. In the multi-level process overview window, live data and alarm indications are shown in descriptive control room display pictures for individual machines or groups of machines, easy for the operator to use.

* Depends on the measurement setup.



In the system overview, the status of each of the system hardware components is shown (**Figure 1**), clearly displaying any system component malfunction.

Historical data can be shown in powerful trends, where one or more parameters can automatically be displayed and compared to time, speed or process parameters (power, temperature, water level, etc.). Trends can also be updated live every second*.

* Depends on the measurement setup.

Machine information database

Mechanical data for each machine monitored is stored in a machine information database. Machine components are connected to each other by dragging and dropping components such as shafts, bearings, gear wheels and impellers, in order to build the machine. For each component, relevant information such as bearing code, number of gear teeth and number of vanes, is stored. Based on this information and the actual shaft speeds, all defect frequencies are dynamically calculated and advanced diagnostic rules are applied.

Root cause analysis

Although some of the measurement devices are equipped with automated advanced diagnosis, the software contains a great variety of tools for advanced root cause analysis, for example:

Defect frequency display

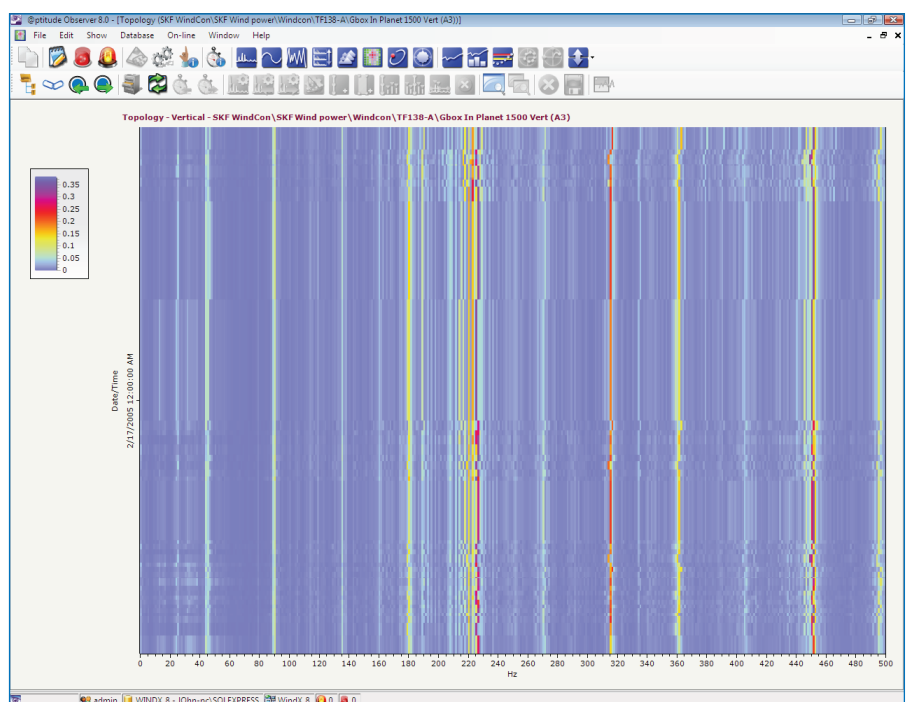
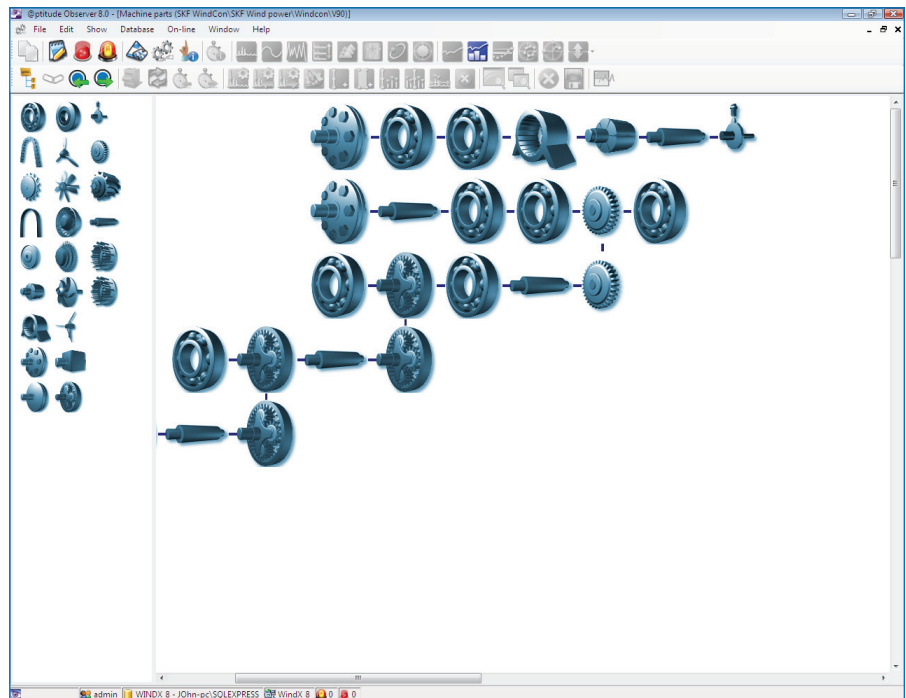
Each machine part and the interaction between parts are defined in the machine information database. Based on this information all machine defect frequencies are dynamically calculated and can be easily displayed in frequency spectra by the user. In spectrum live mode, the defect frequencies are continuously updated based on the instant shaft speed.

Acceleration enveloping

Acceleration enveloping represents a major advancement in early detection of bearing faults which is superior to previous techniques for bearing fault detection.

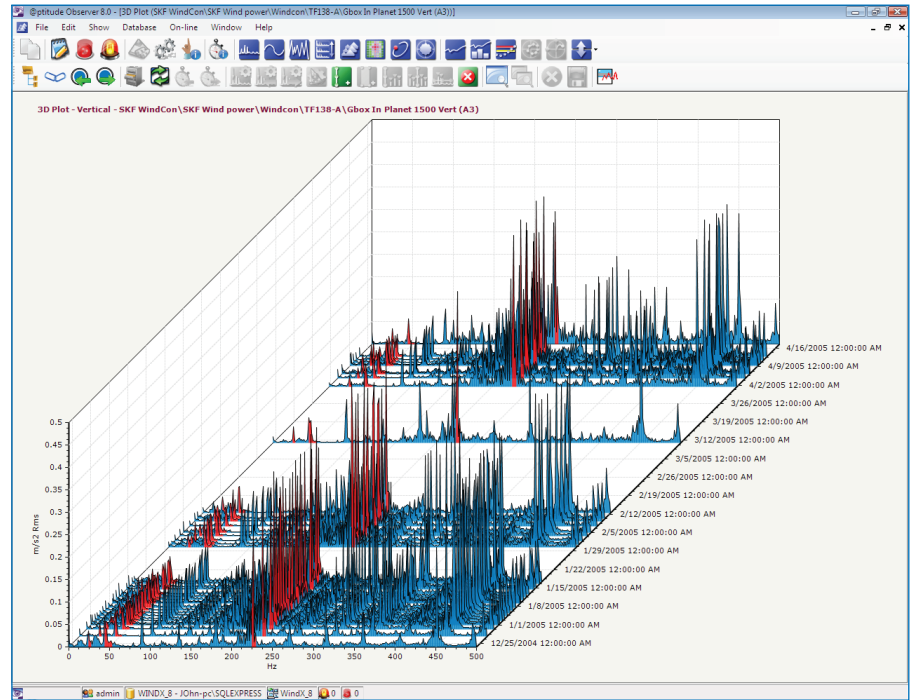
Topology

Topology diagram is a powerful tool that illustrates frequency spectra vs. speed or time by using color separation enabling easy identification of variations in machine behavior. This can be used with any historical data or during run-up/coast-down.



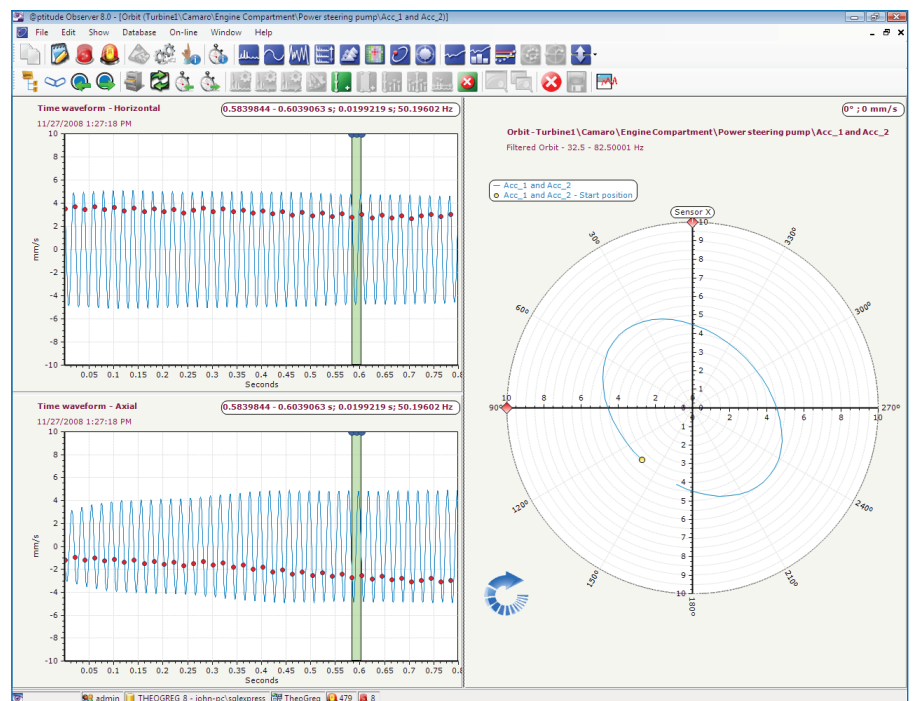
3D plot

A 3D plot illustrates frequency spectra vs. speed, process data or time. The user can freely zoom, rotate or elevate the plot in order to view the diagram from any position. The 3D plot can be used with any historical data or during run-up/coast-down.



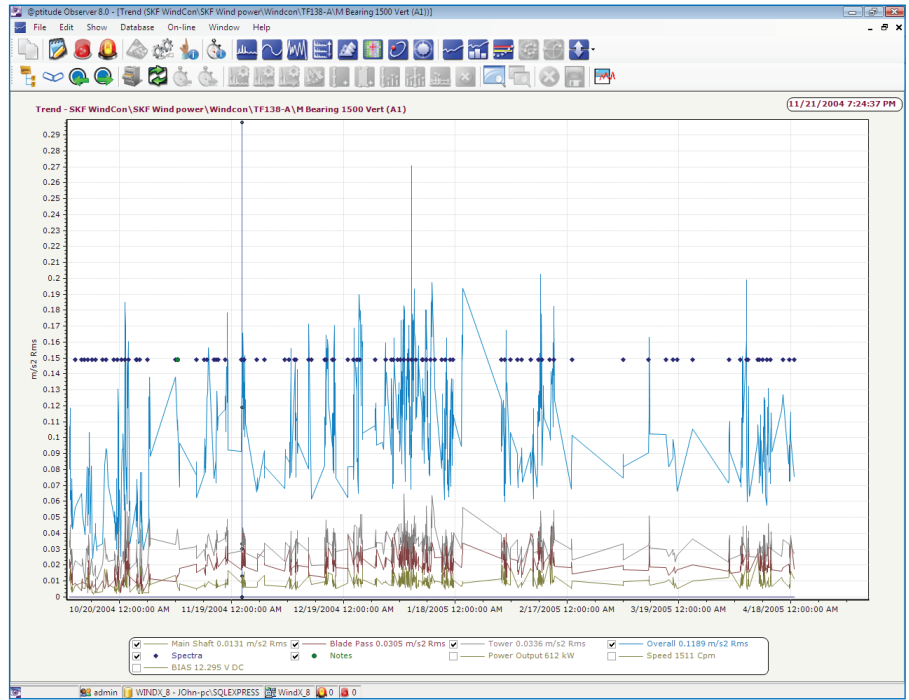
Orbits

Using signals from two perpendicularly mounted transducers, the shaft orbital movement can be displayed and analyzed. Orbits can be performed using the raw signal (true orbit), or using a filtered signal (filtered orbit) at shaft speed or shaft speed harmonics as well as at a user defined frequency range.



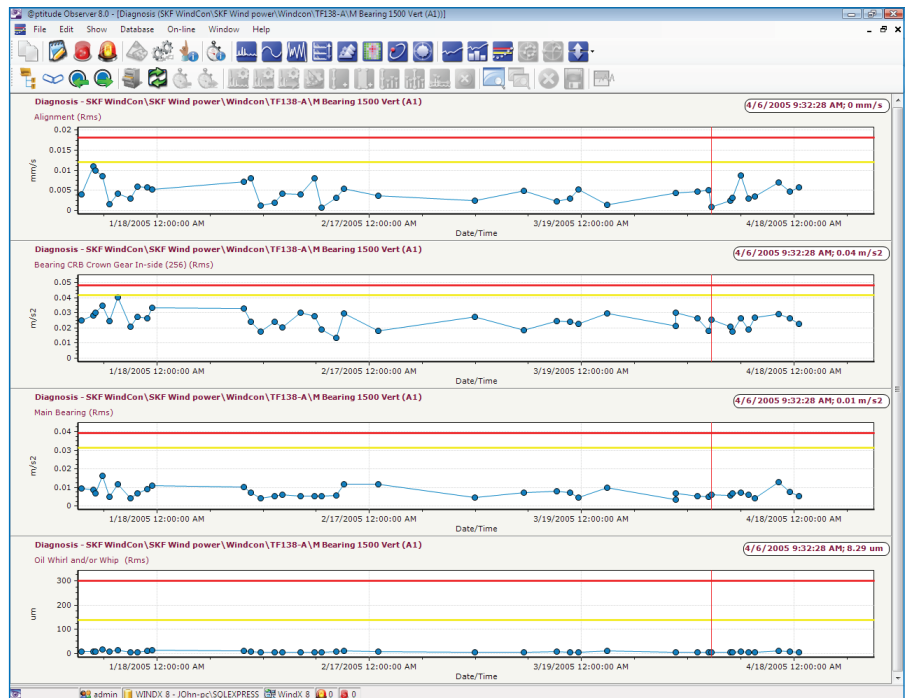
Trend/bode

Vibration amplitude/phase can be trended as a function of time, speed or any process parameter recorded. It is possible to trend discrete frequencies (fixed or speed following) with a user selected number of harmonics, as well as a user selected frequency range. Measurement data from different points can be overlaid in the same diagram for easy comparison.



Machine diagnostic

The powerful machine diagnostics includes standard rules for common faults such as unbalance, misalignment, various bearing faults, gear faults, cavitation, etc. User defined diagnosis rules can easily be designed. The machine diagnostics is always active, constantly monitoring incoming data, detecting machine faults and displaying clear text alarms.



Historical comparison of data

Frequency spectra taken at different times can be displayed and be individually compared. In addition, subtraction of a selectable measurement can be done. The selected reference data may be fixed and automatically matched with new or earlier measurements.

Harmonic analysis

For any given frequency, harmonic frequencies can be displayed. The system automatically calculates the best fit for the harmonics, making harmonic effects much more visible. This is often used together with machine component defect frequencies.

Sideband analysis

For any given frequency, sideband frequencies can be displayed making sideband effects much more visible. This is often used together with machine component defect frequencies.

Multi-parameter analysis

The SKF @ptitude Observer provides a wealth of tools and features for sophisticated multi-parameter analysis. For example, the software supports oil quality monitoring displays, blade monitoring displays, and more.

Alarms and warnings

In SKF @ptitude Observer there are two types of alarms – primary alarms (checked typically every second*) and secondary alarms (checked at every event and at a time interval selected by the user).

For acceleration enveloping and vibration measurement points, primary alarms perform at four different frequencies, fixed or speed dependent, with a selectable number of harmonics, and one frequency range. All measurement values can be exponentially averaged. Alarm levels can be configured to follow speed and/or load dynamically. Primary alarms can also be set to detect process measurement points for both high and low alarms with two levels each.

Secondary alarms are performed by advanced machine diagnostics, with sophisticated alarm conditions chosen from an alarm condition library or created by the operator. Secondary alarms make prognostics three months ahead. If a primary alarm is triggered, secondary alarm diagnostics are automatically performed.

For vibration measurements, both primary alarms and secondary alarms can be calculated in acceleration, velocity or displacement, regardless of sensor type.

All alarms are transferred to the SKF @ptitude Observer Monitor and stored in the database together with corresponding measurement data. The SKF @ptitude Observer Monitor computer can be equipped with relay cards containing 16 relays each, fully programmable to show any type of alarm. Additionally, alarm information can also be distributed via e-mail or SMS.

Reports

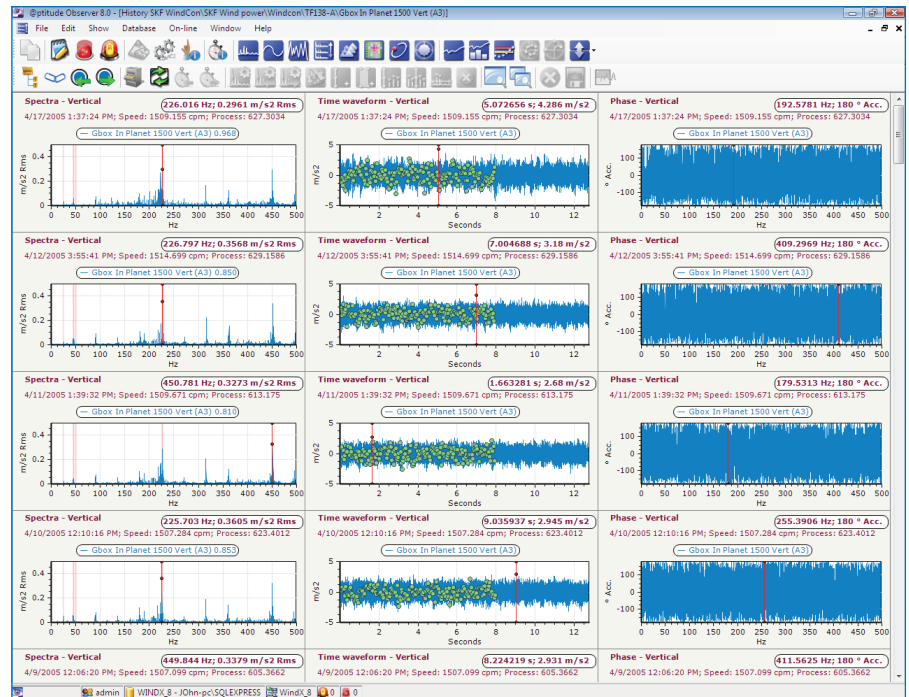
The SKF @ptitude Observer software has the capability to generate many different reports. All diagrams, plots and images can be used in various reports together with tabular data and notes. It is possible to pre-configure and store different types of reports like:

- Last measurement report
- Exception report
- History report
- Inspection report
- Work notification report

Generated reports can also be stored in order to maintain a history of reports.

All reports can be sent to screen, PDF file, Word document, RTF, Open Office or Printer and also posted to Internet, intranet or e-mailed.

Report templates allow quick and easy report configuration for use and reuse.



* Depends on the measurement setup.

Storage

The SKF @ptitude Observer software has the capability to store the evaluated data in a Microsoft SQL Server database. Using the royalty free Microsoft SQL Server Express, the database size can be up to four gigabytes. Using a full version of Microsoft SQL Server, the size is almost unlimited.

All stored data is marked with identification stating date and time for later use in troubleshooting and trend analysis.

Storage is made in the following form:

Trend storage

The trend data consists of different trend buffers storing data typically once every 10 seconds. Data is also stored in the archive buffer once every ten minutes. All trend buffers and the archive buffer are using FIFO (first-in, first-out). Data is also stored in transient mode (see transient analysis).

Spectrum and Time Domain storage

At a user defined time interval, manually or upon an event (see below), vibration spectrum and time domain data is stored. Spectrum and time domain data can be enabled for:

- vibration
- vibration, harmonic
- acceleration enveloping
- process FFT

Event related storage

The measurement points can be configured as members of event groups. An event can be an alarm or a change in process data. When an event occurs, based on data from one of the group members, measurement data from all group members are stored.

Client/Server

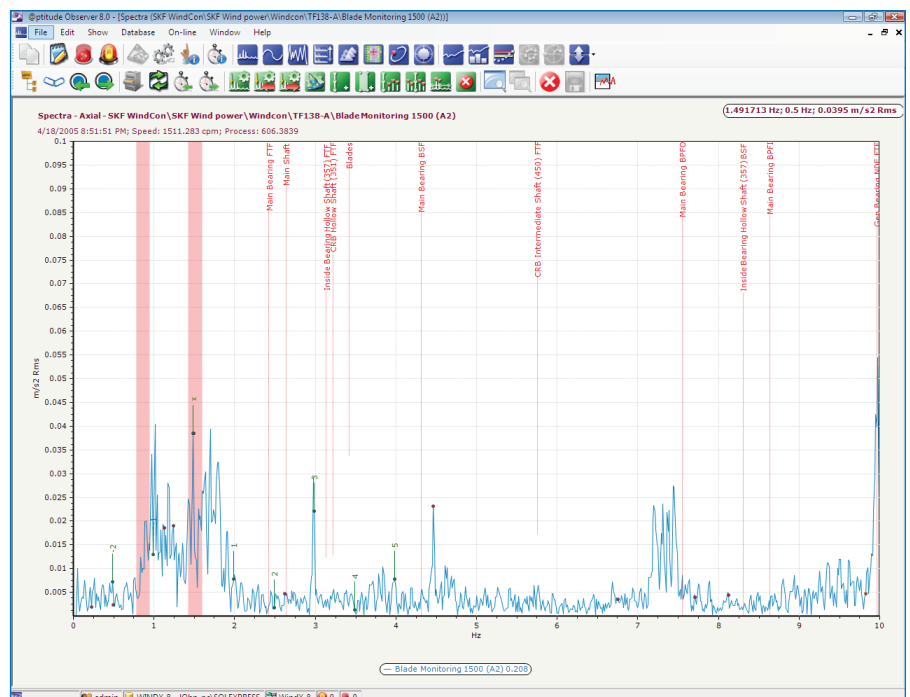
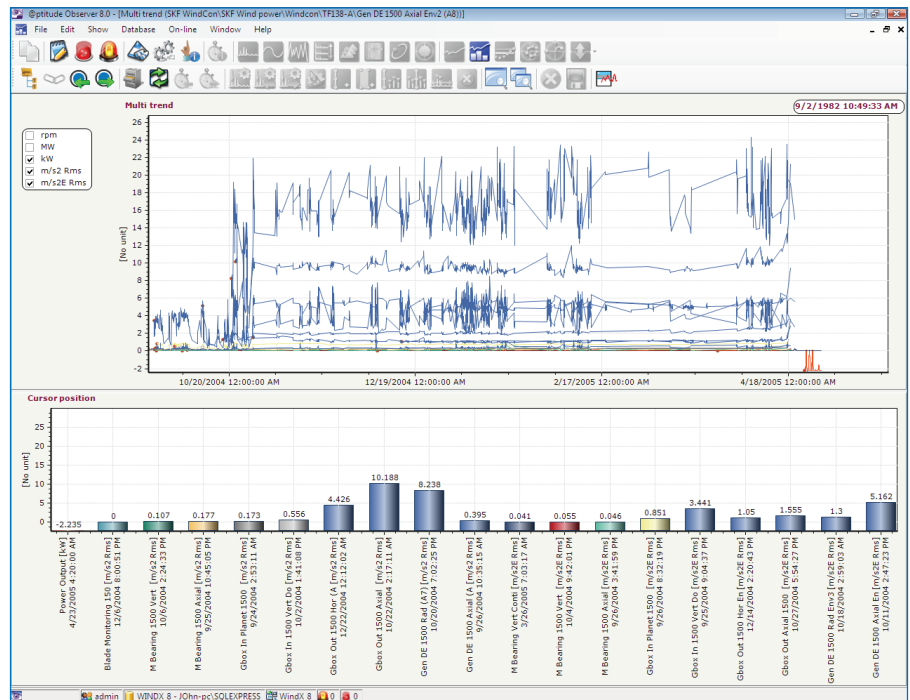
SKF @ptitude Observer is a client/server application fully TCP/IP based, which means that SKF @ptitude Observer Monitor can be connected to Internet through a firewall and easily accessed from a Windows-based computer anywhere having SKF @ptitude Observer installed.

System integrity

An on-line condition monitoring system should always be operating. If something happens that interrupts the monitoring, the system must be able to detect the fault and report it to the operator. If possible the system itself should be able to correct the fault and continue to operate.

Below is a description of the SKF @ptitude Observer system integrity:

- checks all sensor signals and reports on failure
- a watchdog looks after both the SKF MultilogOn-line System IMx/ SKF MasCon units and the SKF @ptitude Observer Monitor and reports, then restarts upon failure
- easy for the operator to disable a sensor upon sensor failure
- system faults are stored in the database and can be accessed by the operator, for example, during system service



Optional modules for SKF @ptitude Observer

Advanced gating for SKF @ptitude Observer

The Advanced gating for SKF @ptitude Observer is a fully integrated plug-in module to the SKF @ptitude Observer software. It checks multiple measurement variables in order to allow when measurement conditions are acceptable. This module checks the range of each variable as well as the maximum variation during the measurement.

Automatic database replication for SKF @ptitude Observer

The Automatic database replication for SKF @ptitude Observer is a piece of software that is replicating the SKF @ptitude Observer database regularly between different database servers. The database servers can be located anywhere and connected by Internet.

Profile for SKF @ptitude Observer

The Profile for SKF @ptitude Observer is a fully integrated plug-in module to the SKF @ptitude Observer software. It measures the profile of a rotor by using any type of vibration sensor and a tacho signal. The tacho signal normally monitors its signal from the same rotor but could also use signals from any shaft mechanically connected to the rotor to be monitored.

Transient module for SKF @ptitude Observer

The Transient module for SKF @ptitude Observer is a fully integrated plug-in module to the SKF @ptitude Observer software. It is a great help in analyzing a great variety of turbine related defects.

Polar plot

The polar plot illustrates vibration phase and amplitude in a polar diagram. Alarms are set as alarm circles for changes in phase or amplitude. The polar plot can display live data, historical data or data captured during run-up/coast-down.

Shaft centerline

Using signals from two perpendicularly mounted transducers, the shaft radial position is shown. The shaft centerline plot can display live data, historical data or data captured during run-up/coast-down.

Transient analysis

Machine run-up or coast-down is automatically detected and a user defined measurement procedure starts. Measurements are taken at defined speed changes and all data is stored in a transient buffer. The data can be viewed in a great variety of displays such as 3D, spectra, time waveform, bode, polar, orbit and shaft centerline.

OPC for SKF @ptitude Observer

SKF @ptitude Observer can be connected to other systems or devices through an OPC server using the OPC standard communication protocol. Data transmission (data publication) of trend data and alarm information, as well as data reception (data subscription) of process data is fully supported.

GPS for SKF @ptitude Observer

The SKF @ptitude Observer GPS is a plug-in for storage of the unit's global position. This information is stored together with trend data to be used in various analysis situations e.g. trains, dump trucks, where the monitored object is moving and when it is of importance to know the position of the vehicle at the time of the measurement.

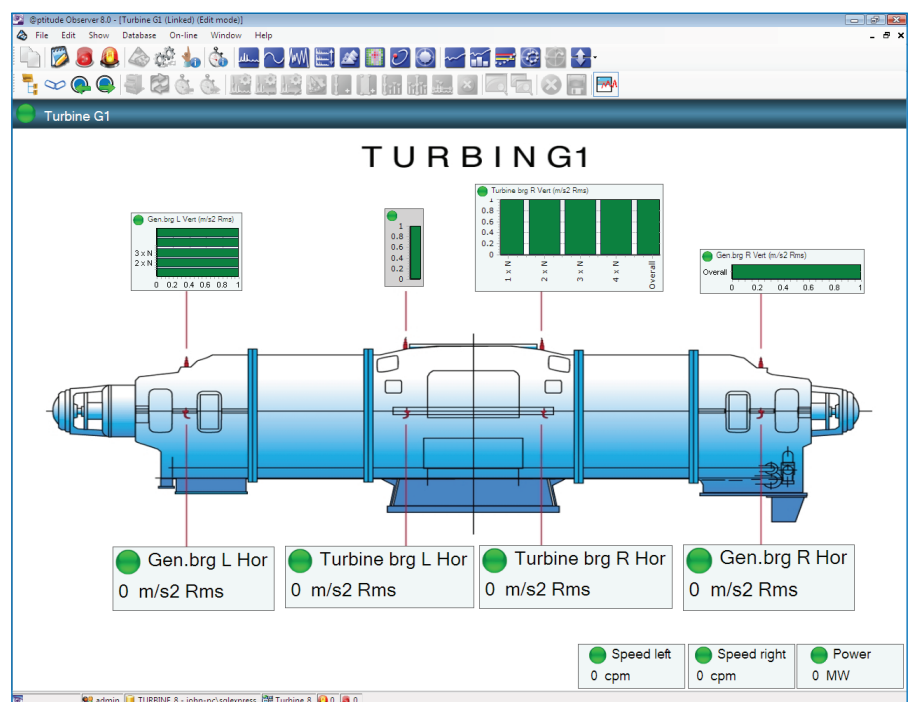
Advanced balancing for SKF @ptitude Observer

The Advanced balancing for SKF @ptitude Observer is a plug-in for on-line applications in order to make a full dynamic rotor balancing operation. The data input comes from SKF Multilog On-line System IMx, SKF MasCon48, SKF MasCon16 and the balancing operation is done step-by-step. Dynamic rotor balancing can be performed from 1 up to 15 planes in one session and if needed the number of correction planes can be reduced using balancing plane elimination.

The data quality used by the balancing software is continuously checked and displayed to the operator. It is easy to go back and replace a bad measurement. The result from a balancing operation, including the Influence coefficient matrix, is stored in the SKF @ptitude Observer database. If a rotor needs rebalancing, stored balancing data can be recalled in order to minimize the stops to only one.

WebCon

The SKF @ptitude Observer database fully supports WebCon providing data and alarm information to the WebCon web server which can be accessed by any PC using Internet Explorer.



SKF @ptitude Observer features and capabilities

Alarms

- Alarm window
 - Quickly find and identify all points in alarm within the hierarchy, process view or system view
- Alarm detail
 - Provides a summary of type of alarm and status
- Trend alarms
 - Trend alarms frequency can be fixed or speed following with a selectable number of harmonics
 - The trend alarm level can be speed or process data dependent following a user defined graph
 - Unlimited number of alarms can be configured in the system
 - Alarms based on data from multiple measurement points
 - Run-up/coast-down alarming using speed dependent alarm levels
 - Vector alarms using circular alarm levels
 - Alarm hysteresis
 - Exponential filtering
 - Activation of user selectable on-line device relay for each alarm level violation
 - Activation of user selectable SKF @ptitude Observer Monitor device relay for each alarm level violation
 - User defined vibration unit selection (acceleration, velocity or displacement)
 - Data storage selection (maximum, minimum or instant)
 - Alarm blocking (on/off)
 - Alarm groups
- Four overall alarm levels per measurement point
 - Danger high, alert high, alert low, danger low
 - Adaptive alarming whereas the trend alarm level can be speed or process data dependent following a user defined graph
 - Enhanced event log capabilities
- Machine diagnostics
 - Alarms based on rules created to detect a particular machine fault
 - Standard rules as well as user defined rules available
 - Clear text message on machine fault

- Active range
 - Speed range setting and/or process data range setting
 - Setting for maximum allowed speed and/or process data variation during measurement
 - Advanced data gating

Communication

- Automatic e-mail or SMS generation upon alarm
- Data transfer with SKF Multilog IMx and SKF MasCon. For other devices contact your local SKF Representative.
- TCP/IP
- RS232 or USB
- OPC – subscription as well as publication
- Modbus

Machine parts

- Graphical tool for machine library creation
- Automatic defect frequency calculation
- Automatic calculation of all shaft speeds
- Seamless connection to machine diagnostics
- Standard library
- Machine template

Data display

All displays can be used in live mode for transient as well as for steady-state analysis

- True orbit
- Filtered orbit
- Shaft centerline
- Polar (including circular alarm levels)
- Bode
- Profile
- Topology
- 3D plot
- Overall trend displays
- Process (Temperature, pressure, speed, etc.)
- Digital images
- Spectrum displays
- Single point, multiple point displays
- Triaxial point
- Time waveform
- Phase displays
- History plot
- Multi-channel display

- Process overview
 - Live update
 - Amplitude/phase
 - Speed
 - Links to other process views
 - Live bars
- Graph overlays
- Spectrum
 - Machine part defect frequency
 - Single, harmonic, sideband, peak, band cursors
 - Running speed
 - Spectral band alarm
 - Overall alarms
 - DiagX
- Display tools
 - Notes with image attachment and priority setting capability
 - Percent of alarm level setting
 - Auto scaling
 - Cursor micro-manipulation
 - Auto-linking of displays and active hierarchy
 - Linear or log scaling
 - Grid
 - Orders, frequency scaling
 - Amplitude threshold %
 - Waterfall slant angle setting in all directions
 - Date range setting
 - User selectable color settings
 - Waterfall spacing (time/date, speed or process data)
 - Spectrum data post processing (integration/differentiation)
 - Zero Padding
 - Inverse FFT
 - Baseline spectrum storage
 - Run-out compensation
 - User-individual display settings

Database

- Microsoft SQL Server 2000, 2005 and 2008
- ODBC, SQL, and TCP/IP protocol compliant database opens the database content
- User friendly database management
 - Back-up scheduling
 - Database upgrade

SKF @ptitude Observer features and capabilities (continued)

- Full support in Local Area Network (LAN), Wide Area Network (WAN), and Thin-client (Terminal) environments
- Unlimited number of:
 - Hierarchies
 - Hierarchy levels
 - Work spaces
 - Collection points
 - Measurements
- Smart Data Storage
 - Data storage based on time, speed variation, process data variation, alarm status and trend variation
 - Capability of data reduction due to aging
- Database supports
 - XML data importing and exporting
 - Binary importing and exporting
 - Data export to Image file, Text, XML, HTML, Microsoft Excel
- Database libraries
 - Bearing library
 - Machine template library
 - Multi-folder image library

General

- Multiple languages available
- Windows-based functionality
 - True multi-processing operating environment allowing simultaneous background and foreground processing
 - Complete right click functionality (drop down menus)
 - Drag and drop
 - Cut/Copy/Paste
 - Complete integration of third party applications
- User preferences allow customization
- Context sensitive help
- Complete user manual on installation CD-ROM
- Product Support Plans (PSP) available

Measurements

The following measurements can be entered manually or automatically

- Acceleration
- Amps
- Displacement
- English or metric units
- Enveloped acceleration

- Flow (GPM, LPM)
- High Frequency Detection (HFD) and Digital High Frequency Detection (DHFD)
- Inspection points (user definable)
- Multi-channel
- Operating hours
- Operating time (elapsed and cumulative)
- Peak, Peak-to-peak, True peak, True peak-to-peak and RMS
- Pressure (PSI and bars)
- RPM
- SKF Acceleration Enveloping (gE)
- Speed
- Temperature (°C and °F)
- Triax
- User-specific units
- Velocity
- Volts (AC or DC)
- Torsion
- Time difference
- Simultaneous speed, process and digital storage together with vibration, speed or process measurement
- Derived point – user definable mathematical formula to calculate a derived value from data collected on multiple points across all type of devices.

Transient analysis

- Run-up/coast-down measurements
- Run-up/coast-down measurement point groups
- Vector, polar, shaft centerline, orbit, profile
- Adaptive alarming
- Run-out compensation
- Live data display update for multiple graphs

Reports

- Preserved reports – enables you to maintain a history of reports
- Shared reports – allows you to share and pre-configure reports for selected users
- Send reports to screen, PDF file, Word document, RTF, open Office or printer
- Report file can be posted to internet, intranet or e-mailed
- Customizable report content
- Data plots, supplemental information, and digital images can be included in reports

- Report types
 - Last measurement
 - Exception
 - Collection status
 - History
 - Inspection
 - Work notification
 - Blank (user defined)
- Report templates allow quick and easy report configuration for use and reuse

Security

- Fully configurable user rights that allow you to read, view and have full access
- Pre-configured user roles (analyst, super user, operator)
- Password encryption for database login

Monitoring system supervision

- BIAS range setting and alarm upon failure
- Measurement range setting and alarm upon failure
- SKF @ptitude Observer Monitor supervision
- On-line device supervision (automatic hardware reset)
- System supervision alarm distribution using e-mail and SMS
- On-line device and SKF @ptitude Observer Monitor device restart upon failure
- Automatic remote firmware upgrade of all on-line devices (SKF MasCon, SKF Multilog On-line System IMx)
- System event recording for all parameter modifications including date/time and user information

Templates and wizards

- Machine parts creation wizard
- Multiple point update wizard
- Statistical alarm wizards use historical data to help refine machine diagnostic alarms
- Hierarchy template wizard allows for rapid hierarchy creation and machine templates for reuse
- Report template allows for the custom configuration of reports and report templates for reuse
- Machine expert wizard

Hardware requirements

Stand alone configuration

- Running SKF @ptitude Observer
- Running Microsoft SQL Server database management system
- Storing data

Configuration	Minimum requirements	Recommended requirements
Operating system	Windows 2000 with Service Pack 4, Windows XP Professional with Service Pack 2, Windows 2003 Server with Service Pack 1 OR Windows Vista	Windows 2000 with Service Pack 4, Windows XP Professional with Service Pack 2, Windows 2003 Server with Service Pack 1 OR Windows Vista
Processor (Note 1)	Pentium IV, 1.0 GHz	Pentium IV, 2.4 GHz or better
RAM	1.0 GB	2.0 GB or more
Disk space available for stand-alone computer (Note 2)	1.2 GB	1.2 GB or more
DVD drive	One (1) required	One (1) required
Video display	800 x 600	1024 x 768 or larger

Network configuration – Server

- Running Microsoft SQL Server database management system
- Storing data

Configuration	Minimum requirements	Recommended requirements
Operating system	Windows 2003 Server with Service Pack 1, Windows 2000 with Service Pack 4 OR Windows Vista	Windows 2003 Server with Service Pack 1, Windows 2000 with Service Pack 4 OR Windows Vista
Processor (Note 1)	Pentium IV, 2.0 GHz	Pentium IV, 3.2 GHz or better
RAM	1.0 GB	2.0 GB or more
Disk space available (Note 2)	1.2 GB	1.2 GB or more
Microsoft SQL Server	SQL Server 2000, 2005 and 2008	SQL Server 2000, 2005 and 2008

Network configuration – Network Client

- Running SKF @ptitude Observer
- Running database client software

Configuration	Minimum requirements	Recommended requirements
Operating system	Windows 2000 with Service Pack 3+ OR Windows XP Professional with Service Pack 2	Windows 2000 with Service Pack 3+ OR Windows XP Professional with Service Pack 2
Processor (Note 1)	Pentium IV, 1.0 GHz	Pentium IV, 2.4 GHz or better
RAM	1.0 GB	2.0 GB or more
Disk space available for each network client (Note 2)	500 MB	1.0 GB or more
DVD drive	One (1) required	One (1) required
Video display	800 x 600	1024 x 768 or larger
Microsoft SQL Server	SQL Server 2000, 2005 and 2008	SQL Server 2000, 2005 and 2008

Note 1: These requirements apply to SKF @ptitude Observer complete with database management system. Other applications running simultaneously may degrade performance.

Note 2: These requirements ONLY apply to SKF @ptitude Observer complete with database management system. Additional storage disk space is required for data.

Notice: If running other versions of Microsoft SQL Server, or other database management system are expected to run in the same PC environment, please contact your local SKF Representative to inquire about compatibility.

Ordering information

SKF @ptitude Observer

- **CMSW 7500-SC** SKF @ptitude Observer, single client
- **CMSW 7500-MCB** SKF @ptitude Observer, multi client base, five (5) clients
- **CMSW 7500-BCX** SKF @ptitude Observer, base client extension, one (1) client
- **CMSW 7500-AC** SKF @ptitude Observer, additional client for existing installation, one (1) client
- **CMSW 7500-SIP** SKF @ptitude Observer, site license privilege
- **CMSW 7500-SC/MCB** SKF @ptitude Observer, single client to multi client base upgrade

Modules for SKF @ptitude Observer

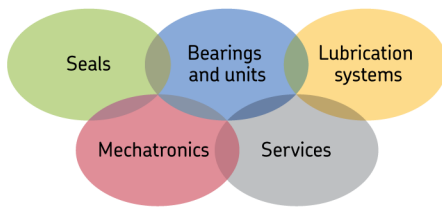
- **CMSW 7501** Advanced gating for SKF @ptitude Observer
- **CMSW 7503** Automatic database replication for SKF @ptitude Observer
- **CMSW 7601** Profile for SKF @ptitude Observer
- **CMSW 7603** GPS for SKF @ptitude Observer
- **CMSW 7605** Transient module for SKF @ptitude Observer
- **CMSW 7606** OPC for SKF @ptitude Observer
- **CMSW 7607** Advanced balancing for SKF @ptitude Observer

Product Support Plans (PSP)

A range of Product Support Plans are available to protect your investment. Contact your local SKF Reliability Systems Sales Representative for additional information.

Installation and training

Installation and training available through your local SKF Supplier or Representative.



The Power of Knowledge Engineering

Drawing on five areas of competence and application-specific expertise amassed over 100 years, SKF brings innovative solutions to OEMs and production facilities in every major industry worldwide. These five competence areas include bearings and units, seals, lubrication systems, mechatronics (combining mechanics and electronics into intelligent systems), and a wide range of services, from 3-D computer modelling to advanced condition monitoring and reliability and asset management systems. A global presence provides SKF customers uniform quality standards and worldwide product availability.

For additional information on SKF Reliability Systems products, contact:

SKF Reliability Systems

SKF Condition Monitoring Center – Luleå

Aurorum 30, S-977 75 • Luleå, Sweden

Telephone: +46 (0) 920 758 00 • FAX: +46 (0) 920 134 40

Web Site: www.skf.com/cm

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