



Brüel & Kjær Vibro



**The Online and Offline Solution
eXtended Monitoring Software **xms****

Optimise profits, lower production costs;

A method that promises accomplishment of these objectives is through machine maintenance

Whoever carries the responsibility for effective production in any industrial plant must ensure optimum use of the machines and plant. Depending on the type of plant, there are three maintenance strategies to choose from to achieve this:

- Operate the machines until breakdown.

This strategy is deployed when machines are redundant and their breakdown does not affect production.

- Regular maintenance that requires a shutdown of the machines.

Wherever regular production stoppages due to the type of manufacturing process are always unavoidable, this time-based maintenance method is used.

- Maintenance of machines when their condition demands it.

This strategy is being used more and more due to the development of powerful systems for condition-diagnosis of machines.

The significant advantages are clear:

- The number of machine stoppages, and therefore also production downtime, is clearly reduced.
- The duration of scheduled and unscheduled machine stoppages is shortened because the required maintenance tasks are often already known and can therefore be planned.
- Spare parts inventory is optimised due to sufficient advance notice to order replacements for damaged parts.

The important technical advantages of condition-oriented maintenance are decisive:

- Lower production losses,
- Lower maintenance costs,
- Reduced expenses for spares parts inventory.

Such an impressive saving potential has been documented in the example of a natural-gas processing plant. ¹⁾

Over 20 instances of early damage in machines important for production were correctly detected and remedied during the survey period of 4 years. Actual repair costs of approx. \$ 126,000 were incurred compared with estimated costs of \$ 3,870,000 if breakdowns had occurred. Without considering the possible costs of consequential production losses, over **\$ 3,600,000 was saved.**

Balance sheets	
AT 31 DECEMBER	
Fixed assets	
Intangible assets	
Tangible fixed assets	
Investments	Subsidiaries
	Others
Current assets	
Stocks	
Debtors	
Cash at bank	
Creditors: due within one year	
Short term borrowing	
Other creditors	
Net current assets	
Total assets less current liabilities	
Creditors: due after one year	
Medium and long term	
Other creditors	
Amounts owed to group	
Provisions for liabilities	
Net assets	
Called up share	
Share premium	
Reserve for	
Capital	
Special	
Profit	
Equity	

¹⁾ 4. Euroform Kongress für Instandhaltungsmanagement Nov. 1999



Often the total costs are almost equal to the costs from lost production due to the unscheduled stoppage of machines important for production.

For example if the unit price of just 2 cents/ kWh is used for power from a 500 MW power station, production losses are in the region of

- \$ 10,000 / hour
- \$ 240,000 / day
- \$ 1,680,000 / week

which can only be partially compensated by taking special measures.

Essential for the tangible prevention of such costs is a continuous knowledge of the machines' condition. This is mainly achieved by an accurate scrutiny of the machine vibrations.

This is the area of application of the professional software package. XMS for Online and Offline applications.

Notes	2006	2005	2004	2003	2002
14	20,327	35,393	304,106	-	-
15	34,988	-	6,874	217,291	-
16	6,574	4,815	310,225	94,522	4,940
	63,889	40,075	310,225	94,522	4,940
17	37,988	27,205	33,219	-	-
18	63,918	53,264	3,664	50,332	5,843
	22,466	14,997	28,225	50,332	18,032
	131,345	105,051	4,889	78,663	20,892
19/21	2,226	2,217	4,889	18,032	20,892
19	69,106	64,832	22,496	78,693	20,932
	69,332	66,619	22,496	78,693	20,932
	63,613	38,779	866	206,931	72,025
	123,885	78,047	311,088	69,199	2,981
20/21	94,548	14,497	99,199	72,025	-
20	294	212	2,994	2,981	-
22	94,812	74,709	92,993	75,116	90
23	3,039	2,660	216,989	220,105	4,728
24	26,042	1,268	4,784	129,291	3,033
25	4,784	4,758	129,293	3,033	-
26	129,993	129,291	-	-	291
27	3,033	291	-	-	34,083
28	1,199	291	-	-	51,762
29	291	-	-	-	220,105
30	-	-	(134,243)	216,989	-
31	-	-	1,268	-	-
32	26,042	1,268	-	-	-

Profit from the first day!

Components of the system

In combination with various data acquisition units the modern modular **xms software package** represents the central system for condition-oriented maintenance. Vibration and process data from the plant's entire machine complement is acquired systematically at regular intervals and "handed over" to the **xms software** program. Depending on the criticality of a machine for production this can be via an on-line system or a portable data-collector.

*1 BBF 0014-EN-11

*2 BBF 0009-EN-14

The Online-connection

With SIMS^{*1} you're relying on the newest generation of intelligent systems for machine protection. Through the modular structure and almost unlimited extendability, any future task can be solved.

- SIMS is a distinctive machine protection system that combines all classic monitoring and machine status signalling functions. Together with XMS the most current information you need is made available at any location world-wide.
- The Sm@rt technology in SIMS permits not only automatic identification of the operating mode, but also on-site signalling of the fault symptoms.
- Combined with XMS you have an overview of all the measurements and information on the screen at a glance.

The Offline-connection

With the functions of VIBROTEST 60^{*2}, a vibration measuring instrument with a modular construction is available that combines the three most important applications in one.

- As a data-collector, VIBROTEST 60 leaves nothing to be desired, with its low weight, enormous storage capacity and flexible handling – especially together with the **xms software package**.
- As a vibration analyzer the 2-channel VIBROTEST 60 sets the standard through the extent of its powerful functions.
- As a balancing instrument for use in field balancing applications, VIBROTEST 60 remains unbeaten because of its unique methods of shortening the balancing procedure.

xms



OFFLINE



ONLINE

Technical use of the XMS software package is directly effectual:

•Machines that require your attention are directly selected from the plant.

- The traffic light system of XMS reliably indicates where machines' limit values have been exceeded.
- With just one click of the mouse on the respective traffic light, e.g. trends and frequency spectra can be displayed for the purpose of evaluation and diagnosis.

•The cause of breakdown at the selected machines is revealed.

- Professional cursor-, Zoom- and Shift-functions streamline the evaluation of the measurement diagram in relation to the cause of the vibration.
- An extended bearing data base allows an overlay of rolling-element bearing damage frequencies on the measured spectrum display.
- Frequency-markers identify machine-specific damage frequencies.
- Cepstra highlight frequency components caused by gear damage.

The implementation phase is given a kick-start for professional data acquisition at common machine types by the pre-defined Machine setups and direct selection of sensors from the sensor database.

Intuitive operation in a familiar Windows environment under the guidance of a tutorial makes it even easier, with the context-sensitive option selection.

A real-world Demo database with actual measured data provides a pattern of support when creating your own database.

With a few mouse-clicks (information zooming) the user navigates quickly and purposefully through the software.

The Navigator is unique – a virtual joystick – and helps the user page through "space and time".



Users of the VIBROEXPERT CM-400 transfer their data to XMS easily, supported by a dynamic data-transfer Assistant.

XMS, the software with many faces

Tastes are different these days. XMS takes this into account. Adapting to your taste and your requirements is easily effected.

XMS grows with the task

The modular structure of XMS is the first step with the view toward your individuality. The necessary modules are combined depending on the application. The XMS specification sheets provide a description of the modules functions and future extensions are carried out in minutes.

XMS, the multi-user software.

Whether you're a single-user or multi-user, with one or a subdivided database, almost every software architecture is catered for with XMS.

Especially interesting case-studies can be archived in their own database.

Accessibility

The accessibility of the users can also be almost arbitrarily arranged according to your own company structure.

Language versions

XMS "speaks" many languages. Whether its the user-interface, Help-functions or operating instructions the right language is your choice.

Colours and composition

All the graphic elements of the screen contents can be changed to suit your own individual recommendations. The colours in the diagrams and the operative elements can be changed to your own taste with a few mouse-clicks.

Your own logo

If you'd like to see your company logo in the user-interface or at the header of reports, be our guest!

Your own Plant in pictures

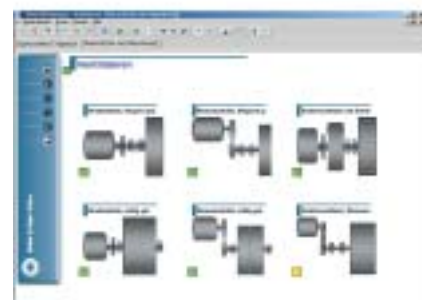
Should your Plant or Machine photos with blended status lamps, measurement Point sketches, drawings of the plant layout or Route sketches be available at a mouse-click? Take your digital camera on "safari" through the plant and Voila!

Datasheets

If you want datasheets, e.g. of machines or sensors, to be always available, integrate them once and they'll be within reach of your mouse in seconds.

Internet

The most up-to-date technical data on sensors or data acquisition instruments is provided directly by internet link to the home page of Brüel & Kjær Vibro.



The Journal

Historic and current information about Points, Machines, Machine groups, Plants, Routes and other events is contained in the automatically updated Journals.

A daily Journal

Other historical and current information related to Points, Machines, Trains, Plants, Routes and other items are held in an automatic Journal.

Freely-definable views

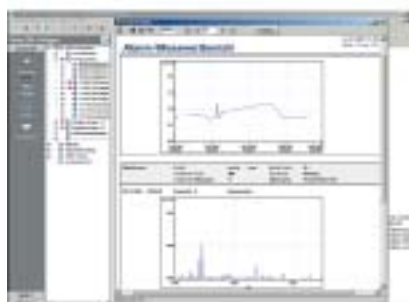
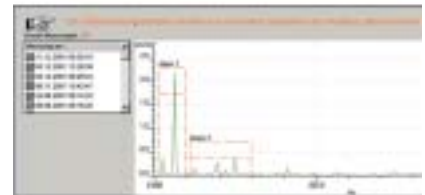
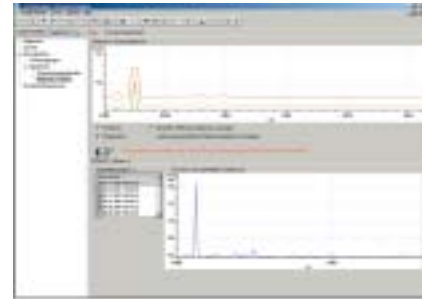
In addition to standard views and the Journal, further views for each Point are freely-definable. Diagrams, sketches, technical datasheets, current information from the Internet, or photos of the machine can be inserted.

Your own report style

The number of report styles provided as standard are just not adequate? Your own logos and company data can be easily integrated into reports made to suit your own style.

Data export

As well as the possibility of printing out reports accessed quickly and easily through the hierarchy, exporting of reports and measured data – in the form of lists or diagrams – in standard Excel, Word, PDF and other formats is simple to carry out.



Effective, fast and powerful with VIBROTEST 60



xMS is the realisation of this catchphrase!

Create your own database

This tiresome task is a pleasure with xMS. Using Drag 'n Drop, built-in objects are combined quickly and easily to form almost any structure. To make it even simpler, the Demo database provides a useful contribution as a database pattern.



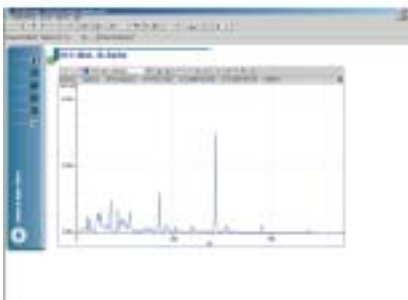
Editing within the database

Changes in the setup of a Point can be simultaneously done for the entire machine group.



Integration of new sensor types

New sensor types are entered into the software and can be immediately assigned to any Point. This prevents errors, e.g. in the entry of sensor output sensitivity.



Creation of Routes

This task is also executed in seconds. Machines are simply clicked and dragged into the Route. Optimisation of the Route sequence is done by sequence-sorting with the mouse.



Route management

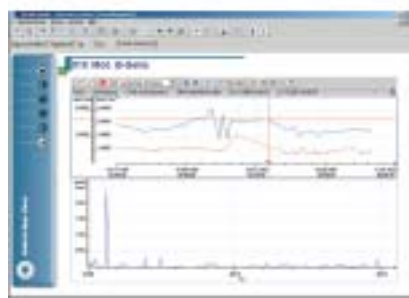
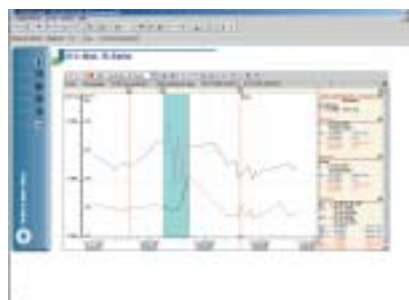
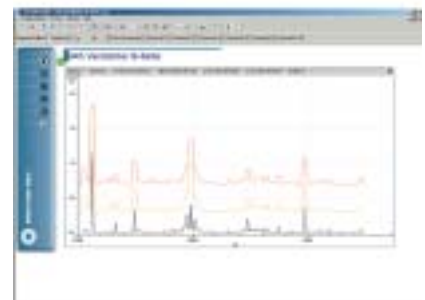
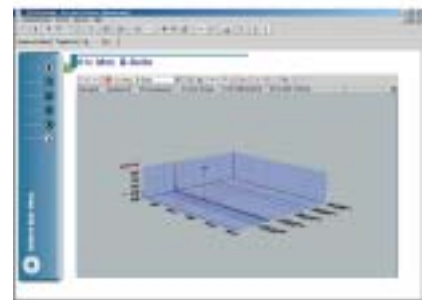
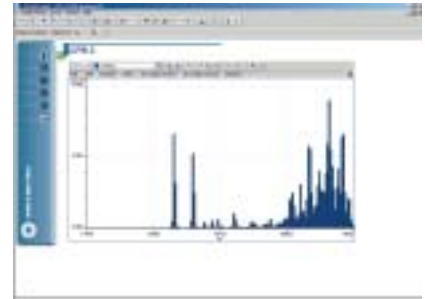
The most varied Routes can be created to exactly suit your requirements. Only regular data measurement of machine condition results in the desired success. To guarantee that even with an overview you don't miss anything, a Route calendar is integrated that automatically reminds you of due Routes.

The true strength of xMS lies in the multiple choices of viewing the data for professional analysis.

A selection of standard diagram displays and components:

- Trends, e.g. of vibration values in correlation with operating or process values, or spectra and cepstra functions, identify changes in the machine condition at an early stage. This gives you ample time for planning the appropriate maintenance measures without an unscheduled shutdown.
- Overall vibration or process values as a function of time show the development towards a breakdown.
- Vibration amplitude and phase as functions of machine speed are used for recordings and for detection of changes in the machines' resonance.
- Frequency spectra, either single or multiple in a cascade diagram display, allow investigation into changes in machine condition.
- The amplitude trend in selected frequency bands can be displayed in the form of Single Frequency Trends (SFT). Using one or more actual measured spectra, associated alarm and reference spectra can be derived and calculated. In this way not only can defined frequency bands be monitored, but also the entire frequency spectrum. Alarming on spectrum changes is now a reality!
- Cepstra reliably verify damage to the teeth in gearboxes.
- The truly unique Constant Percentage Bandwidth (CPB) spectra allow fast and objective damage mechanism monitoring.

- Freely-rotating, 3-D cascade displays of spectra or envelope curves such as "Bearing Condition Signature" (BCS) or "Selective Envelope Detection" (SED) simplify evaluation of specific damage development.
- Where the 3-D cascade display is not clear due to the amount of data, the Contour Plot demonstrates its strength. Here the amplitudes are displayed in colours.
- The arbitrary combination of diagrams in views that can be stored increases the value for the diagnostic technician.
- Of course in all the diagrams powerful "measurement tools" such as Cursor styles, Zooming, Shifting and scaling functions are available.

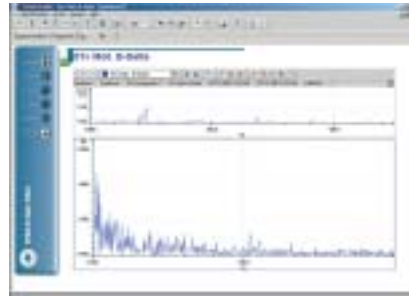


Precise Diagnosis through Offline Data-collection and

Modern machines are increasingly operated closer to the physical limits of their construction. It is therefore more important to prevent vibrations arising from wear in the machine.

- Unbalance,
- Alignment errors,
- Belt flutter,
- Rolling-element bearing damage,
- Gear-tooth damage,
- Operating in the resonance region,
- Beats,
- Looseness,
- Cracks,
- and others

are typical root causes of breakdowns. With xms these are inerrantly identified at an early stage.



xms offers decisive diagnosis assistance here

• Frequency-marker

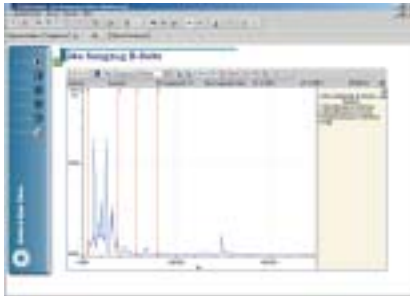
Using the geometric data of the bearing or machine elements and the operational data of the Machine or Train, xms calculates typical damage frequencies and stores them for the associated Points.

These damage frequencies are overlaid as lines on the spectrum being analysed. A comparison of the displayed frequency components with the theoretically calculated damage frequencies clearly verifies whether the component is indeed the cause of the disturbance.

Date	Time	Measurement value	Speed	Alarm
14.12.2012	12:17:40	1.41	1000	
14.12.2012	12:18:00	1.36	1000	
14.12.2012	12:18:20	1.32	1000	
14.12.2012	12:18:40	1.28	1000	
14.12.2012	12:19:00	1.24	1000	
14.12.2012	12:19:20	1.20	1000	
14.12.2012	12:19:40	1.16	1000	

Date	Time	Measurement value	Speed	Alarm
14.12.2012	12:19:40	1.12	1000	
14.12.2012	12:20:00	1.08	1000	
14.12.2012	12:20:20	1.04	1000	
14.12.2012	12:20:40	1.00	1000	
14.12.2012	12:21:00	0.96	1000	
14.12.2012	12:21:20	0.92	1000	
14.12.2012	12:21:40	0.88	1000	

Analysis




Four methods of detecting damaged bearings

Together with VIBROTEST 60, XMS offers a number of methods for detecting damaged rolling-element bearings.

Bearing Condition Unit analysis method

- An evaluation of the trend of shock impulses from the bearing is carried out using BCU values, where the resonance of the sensor is used as an amplifier.



BCU	BCU	BCU	BCU	BCU	BCU
100	1000	10000	100000	1000000	10000000
200	2000	20000	200000	2000000	20000000
300	3000	30000	300000	3000000	30000000
400	4000	40000	400000	4000000	40000000
500	5000	50000	500000	5000000	50000000
600	6000	60000	600000	6000000	60000000
700	7000	70000	700000	7000000	70000000
800	8000	80000	800000	8000000	80000000
900	9000	90000	900000	9000000	90000000
1000	10000	100000	1000000	10000000	100000000

- In the case of slow-rotating machines the same method is used, however here the machine structural resonance is used for signal amplification.

Selective analysis method

- The bearing damage frequencies are often directly identifiable in the spectrum. Here the bearing damage frequencies derived from the bearing library and the overlaid theoretical lines provide tangible support.
- Rolling-element bearing damage frequencies are identified using an envelope analysis curve (BCS or SED), where undesirable frequency components are suppressed.



The damage frequency factors of the inner-race, outer-race, rolling-element and cage for thousands of bearings from different manufacturers are available in XMS. The damage frequencies derived from these factors can be overlaid as lines on the measured spectra or envelope curves and compared with the displayed components.

Factors for special bearing types can be manually entered into the library and are then always available for diagnosis.

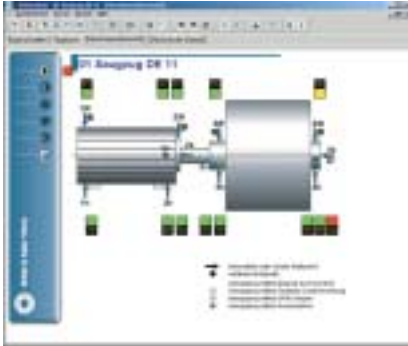
Getting it on paper

The days of drawn out report creation are over. The standard reports delivered with XMS permit fast and effective report processing. Of course all diagrams can be processed further in a simple way using commercially-available word-processing programs.



Setup Report		Measurement Point	04.01.2015 14:28:01
Machine: ...			
Measurement type: ...			
Measurement data: ...			
Measurement results: ...			

Get an overview with Online process visualization



Your start in the online world with SIMS

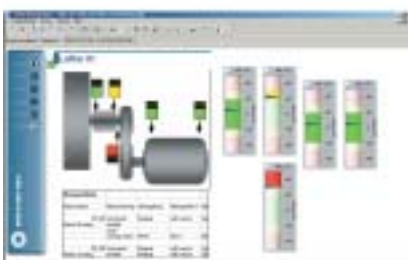
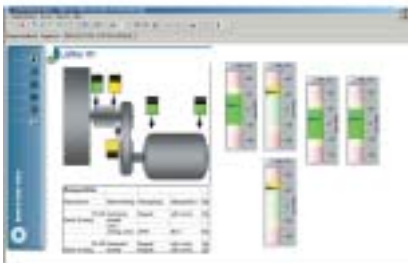
In addition to analysis and diagnosis using the offline VIBROTEST 60 instrument, now with the SIMS family the world of dynamic online measurement and monitoring is available to you.

In almost every case, a production increase in an enterprise means increased demands on the machinery and equipment. This results in a growing number of customers that wish to have their machines firmly within their grasp.

Whoever decides on SIMS for a measurement and monitoring systems also wants to see what it can do. For this task, a well-prepared visualization of the measured data is indispensable.

XMS sets the standard for this requirement with the Process Visualization module. In addition to the extensive and powerful functions of the PV, through pre-configuration of the SIMS OPC-server necessary for communication, an extremely simple and fast setup of the connection required for visualization is realized.

You can find more information about OPC technology on page 14.



Process visualization

In contrast to offline data collection, with online monitoring the vibration and machine condition data is always current and permanently available.

With process visualization you have available an operational tool that is powerful and simple to operate that provides you with a continuous machine condition overview.

The process visualization module adapts to the desires of the user and offers a variety of configurable display types. These PV components can be used in the typical XMS Views in any combination.

The right display for every measurement type

All components can display a violation of two definable alarm limits using traffic-light lamps in a bi-directional format. Thus up to four alarm limits can be monitored. The PV components can be configured as

- An indicator with circular or segment display,
- Column display,
- Bargraph display,
- Multi-channel trend display or,
- Digital display.

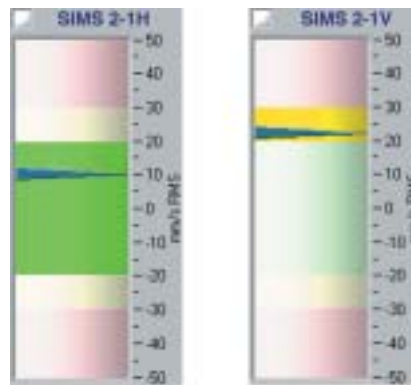
Naturally the components can be individually set up as you like according to

- Measurement type,
- Unit,
- Signal detection type,
- Title and
- Scaling.

The system overview

In many cases the **xms software package** is utilized as the management system for online and offline monitoring.

To avoid that your online measured data is not available during a time when you are working with other data in the xms, a System View can be defined within the Process Visualization module. This view is always "on top" meaning that it is always available and visible in a separate window on the screen independent of other xms windows.



XMS – offers you technology at its latest

OPC client/server technology is in place for the data transfer between xms and the various online monitoring systems.

OPC (OLE for process control) is a standard technology for automated data exchange between measuring instruments and PC software.

Features of OPC

OPC is THE standard software interface in the automation technology and is based on DCOM, a Microsoft® technology for integration of distributed, object-oriented applications.

OPC supports an all-systems access operation between applications, as well as Plug and Play. This means a number of programs from different manufacturers use a common communication platform without the interfaces needing to be especially adapted.

The program is simple to install and can be used immediately.

The OPC specification determines the type of information exchange used for various applications in automation technology, such as access to real-time data, alarm information and historic data.

Get started right away with SIMS compact monitor

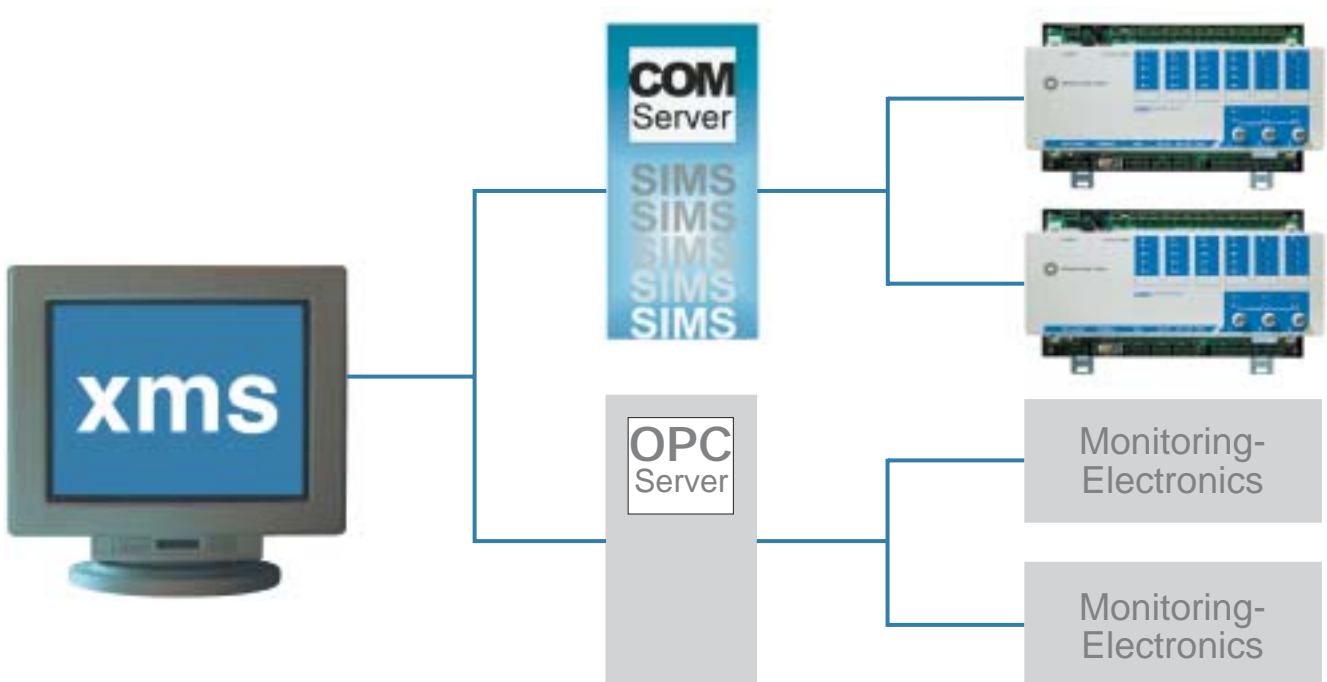
For the integration of xms and SIMS, a qualified solution – a special tailored OPC server (SIMS COM-server) and the XMS as OPC client – has been developed, allowing fast and simple system configuration.

With SIMS compact monitor you have the preferred solution

In addition to being the preferred solution, the total concept takes care of data transfer from foreign instruments through an own OPC server. This innovative data transfer through the OPC client/server technology makes it independent of the hardware. Even when you do not use SIMS, the XMS program is available as a competent management system.

The quality of at-a-glance online visualization

All display components of the XMS process visualization are in addition equipped with a status box. This informs you of the connection quality to the OPC server by way of colour allocations.



OLE linking

Also in the case of linking data from your other enterprise areas, XMS shows the way with the latest state of technology. OLE (an abbreviation for Object Linking and Embedding) offers the possibility to link XMS to other programs or applications. For example it is possible to make information about the entire plant available in table formats, save this with the associated Excel application in a View, start this whenever required and process the data as normal.

DEMO mode

When the users need to be convinced of the advantages of XMS for their area of responsibility before the purchase of the **xms package**, the Demo mode offers all the possibilities.

If you have a PC with a Windows operating system (NT 4,0 2000, or xp) an immediate test start is no problem.

Visual monitoring or inspection?

Should a suspect machine be visually monitored? A webcam that can be integrated makes this possible even if there's no one there.

Info-pool

Various diagrams, datasheets, photos, sketches, Internet-links and others can be combined in an info-pool and be stored for selected measurement Points. They can be available with the most up-to-date content at a mouse-click.



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