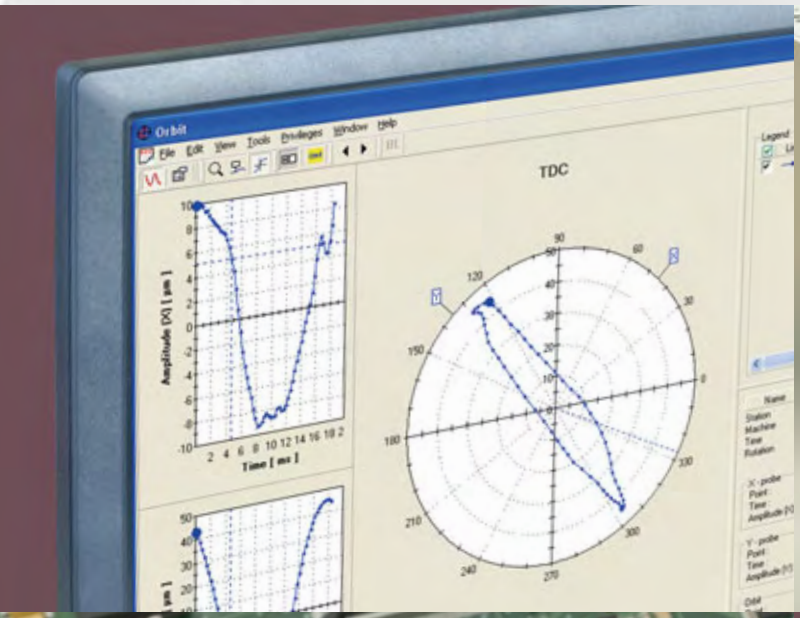
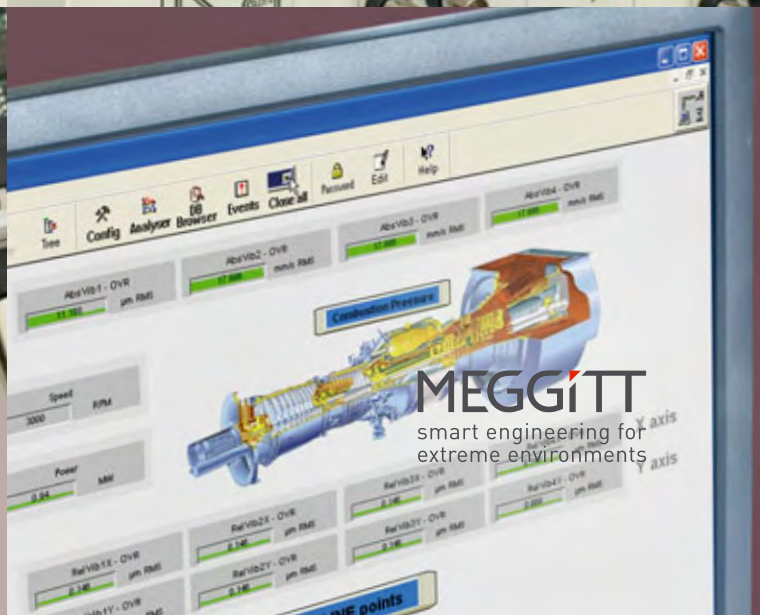
Vibro-Meter

VM600 systems:

Integrated machinery protection, condition and performance monitoring





Why monitor your machinery ?

Monitoring is fundamental to Plant Asset Management. Whether your business is in the power generation, oil and gas or petrochemical industry, understanding the mechanical behaviour of rotating machinery brings you the following benefits:

Safety

Monitoring systems help avoid catastrophic failures and unplanned outages, protecting your personnel and your investment.

Return on assets

The financial return delivered by your physical assets is increased. Monitoring systems help you maximize the overall productivity of your turbomachinery through:

- Higher availability (reduced outages, maintenance optimization)
- Improved machine efficiency
- Lower spare parts inventory and maintenance costs

Emissions and environment

Our performance and emissions monitoring functions help to reduce fuel consumption as well as CO_2 and NO_x emissions, in order to comply with environmental regulations.

VM600 systems overview

Why choose VM600 integrated solution ?

One single expandable platform

Vibro-Meter's VM600 platform truly integrates all protection, condition and performance monitoring functions in a single system. It is easily expandable and does not require additional internal wiring.

One module does all

We are pioneers with our solution based on single modules processing all parameters (vibration, velocity, displacement, dynamic pressure, temperature, etc...) used for protection and condition monitoring.
When you need a new function, it is already included in the module in your system.

High reliability

All modules are independent and separately protected; they allow continuous system operation if one has to be replaced. The VM600 has dual, crossed redundancy between power modules and mains lines, allowing true power supply redundancy.

One source

Request a complete solution from Vibro-Meter! In our Fribourg headquarters (Switzerland), more than 550 employees combine their expertise and commitment to designing and building all parts of your system: Sensors for harsh environments (measuring vibration, dynamic pressure, displacement...), high performance monitoring systems and software. Our sales and support network delivers outstanding service worldwide.

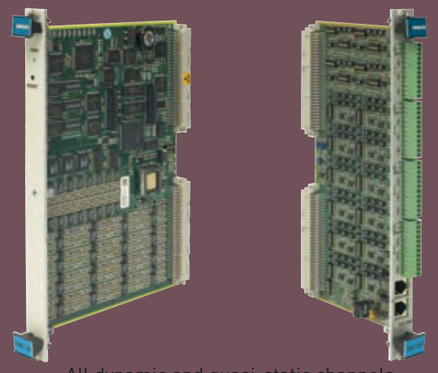
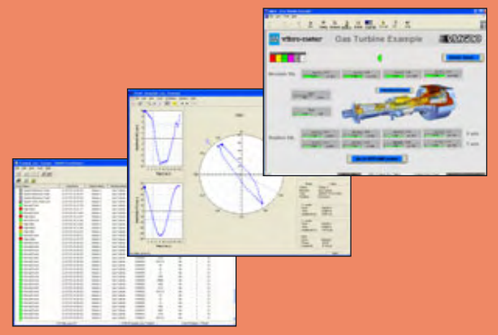
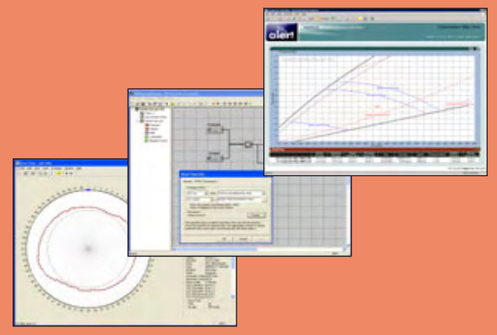
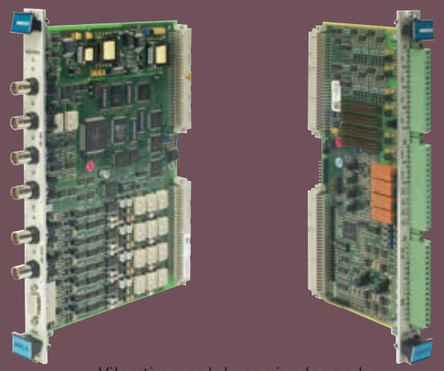
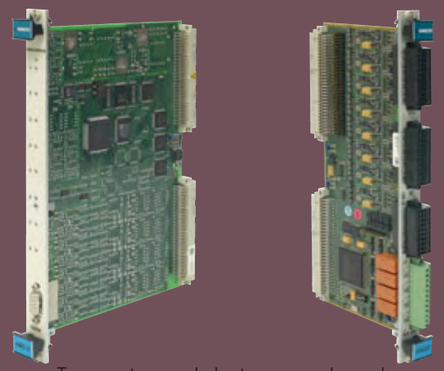
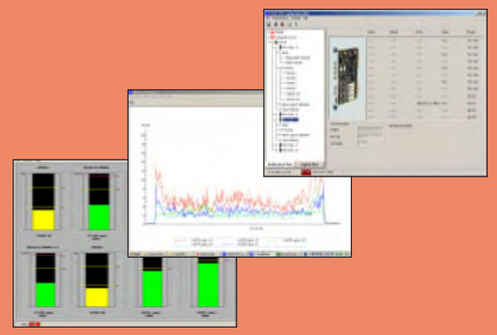
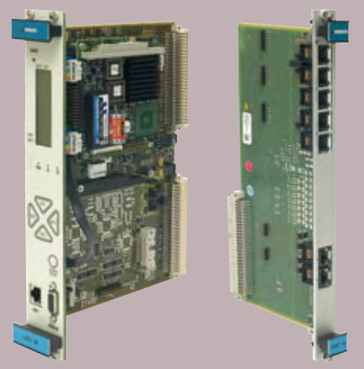
Customer satisfaction and proven expertise

For over 50 years, Vibro-Meter has provided superior quality sensing, protection and condition monitoring systems for critical plant and equipment. We enable clients to reach higher levels of reliability, machine availability and output. Our integrated systems protect and monitor thousands of high capital rotating machines, in numerous industries worldwide:

- Heavy-duty gas turbines
- Industrial and aeroderivative gas turbines
- Steam turbines
- Hydro turbines
- Large generators
- Large pumps, compressor and fans
- Large electric motors

Today, our advanced and highly reliable protection and condition monitoring systems are adopted by most major OEMs. They are certified to international standards, i.e. CE, CSA, API670.

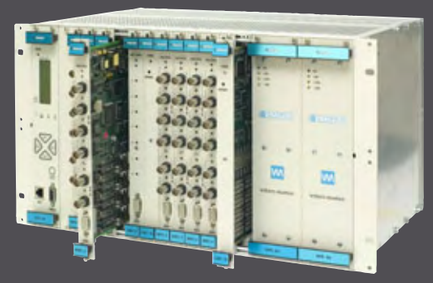
VM600 system architecture

	HARDWARE	APPLICATION	SOFTWARE
CONDITION MONITORING	CMC16 & IOC16T  All dynamic and quasi-static channels	CMS  “Mimic” data display, data analyser, event viewer,	software  rule box, performance, air gap,...
MACHINERY PROTECTION	MPC4 & IOC4T  Vibration and dynamic channels	AMC8 & IOC8T  Temperature and plant process channels	MPS software  Configuration, bar-graph display, trend charts,...
GENERIC	ABE04x  Rack case	RPS6U  Power supply	Optional hardware CPU-M & IOC-N  Network communication and local display RLC16  Relays

VM600 series family

VM600 “System” version

- For continuous on-line protection and condition monitoring of heavy-duty critical rotating machinery
- 19”, 6U standard rack
- Flexible, expandable
- All MPS and CMS functions



VM600 “Slimline” version

- For continuous on-line protection of mid-size rotating machinery
- 19”, 1U compact unit
- Cabinet or panel mount
- 4 protection channels, MPC4 (or AMC8) module included
- All MPS software functions

VM600 “Portable” version

- For quick machinery condition analysis
- Stand-alone and robust
- Easy installation
- Up to 32 dynamic channels, CMC16 module included
- All CMS software functions

VM600 main features

MPC4 & AMC8 modules
Machinery protection

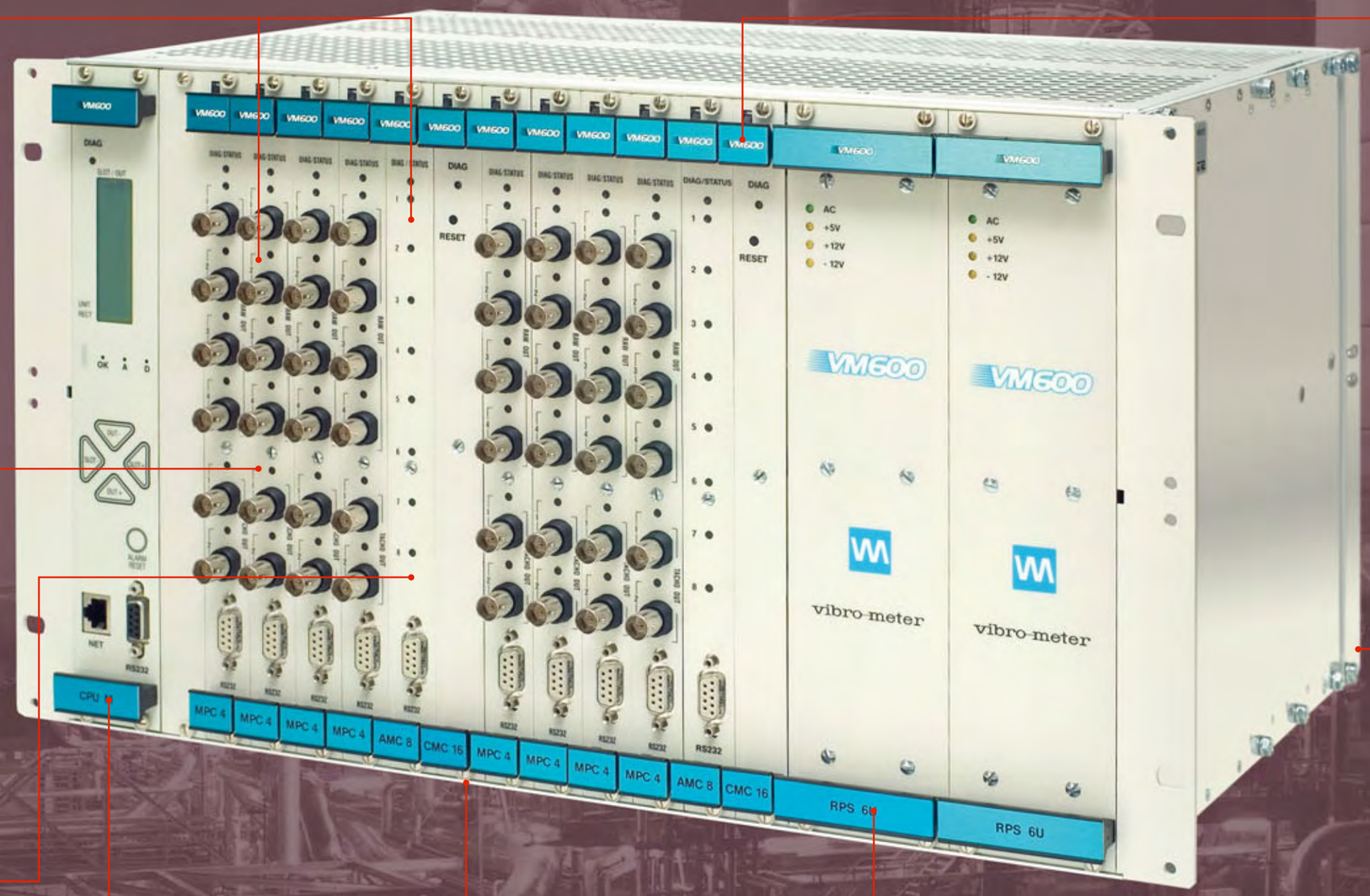
- Real-time measurement and monitoring using state-of-the-art DSP technology
- Fully software configurable via RS-232 or VME
- Programmable and adaptive levels: Alert, Danger and Line Check
- Four 0-10V or 4-20mA outputs
- Four relay outputs, assigned by software to alarm signals
- Front panel LEDs showing monitoring status and alarms

MPC4 module
Protection of vibration & dynamic channels

- Four dynamic channels (e.g. vibration, pressure, etc.) and two tachometers
- Digital broad-band and tracking filters
- Front panel BNC connectors for easy analysis of raw signals
- Power supply for ICP accelerometers, proximity systems, and other front-ends

AMC8 module
Protection of temperature & plant process channels

- Eight channels with software-selectable functions: Thermocouple (TC), Resistance Temperature Detector (RTD), current and voltage inputs
- Analog signal inputs: 0-25mA and 0-30V, on all channels
- Cold Junction Compensation (CJC) sensor processing on two selectable channels
- User-defined polynomial coefficients for non-linear compensation



CPU-M module
Network communications

- Accessibility through Ethernet and serial ports
- Manages configuration of all modules with external PC

Micro Display

- Front-panel LCD bar-graphs and LEDs
- Levels and status display

ABE04x rack 19” standard
Backplane, no internal wiring

- Standard for cabinet installation
- VME backplane replaces internal wiring
- EMC compliant design, immune to EMI. CE and CSA certified. Separate circuits with 2.1kV insulation (compliant IEC/CEI 60255-5)

RPS6U module
Redundant power supply

- Highly reliable: true redundancy (dual, crossed between power modules and mains lines)
- AC or DC power input in one module
- Power status relays

CMC16 module
Condition monitoring

- All dynamic and quasi-static parameters (acceleration, velocity, displacement, dynamic pressure, temperature,...)
- Sixteen simultaneous dynamic channels (incl. up to four tachometers)
- Ten configurable outputs per channel
- Six configurable alarms per processed output
- Adaptive Alert and Alarm levels
- Multiple machine monitoring
- High-resolution on-board FFT processing (3200 lines)
- Digital broad band & tracking filters
- Synchronous and asynchronous sampling
- DSP-programmable data acquisition (time, event,...)
- Auto run-up & coast-down detection
- “On alarm” or “on exception” - based logging
- On-board buffer storage
- Ethernet communication

RLC16 module
Relay outputs on the rear of rack

With flexible comprehensive Boolean voting logic combinations

All modules
Hot-swappable

To make maintenance easier there is no need to turn off rack power when adding/removing an MPC4, AMC8 or CMC16 module.

CMS software

Condition-based maintenance is a predictive methodology that is used to improve your machinery's safety, availability and efficiency.

Vibro-Meter's CMS (Condition Monitoring System) software is dedicated to the support of operators and engineers, enabling them to rapidly identify a problem, evaluate a situation and determine appropriate actions to take.

CMS software has a truly modular architecture that comprises of several **Monitoring Modules**. It runs under Windows, uses an SQL database and can be remotely accessed through the web.

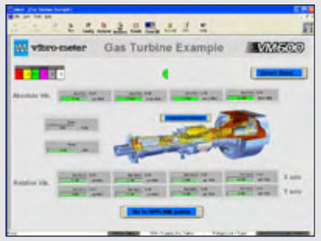
For further applications, CMS software provides a suite of standard **Communication Interfaces**, enabling data transfer to/from any third-party system. Users benefit from the full flexibility and scalability of the CMS system, because it enables the correlation of vibration data with other process parameters.

Communication interfaces

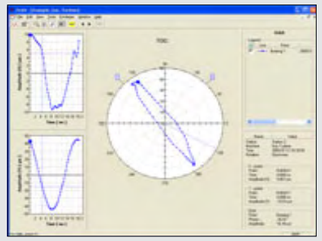
- **VMCom** - For VM600 communication
- **ODBC** - Interface with databases
- **DDE (Dynamic Data Exchange)** - Interface with software applications
- **MODBUS** - Serial & Ethernet interface
- **OPC (Open Connectivity)** - Interface with software applications

Monitoring Modules

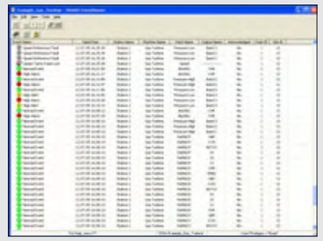
- **Administrator** - Access to all CMS modules
- **Configuration Editor** - Hardware parameters definition
- **Mimic** - Machine and data display
- **Data Analyser** - Data handling & display
- **Event Viewer** - Recorded events, limit values reached
- **Rule Box** - Execute actions according to machine conditions
- **Air Gap** - Hydro generator's air gap monitoring
- **Alert Performance** - Operation optimization, fleet management, emissions monitoring



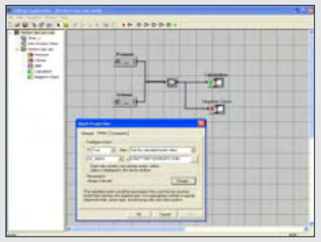
Mimic



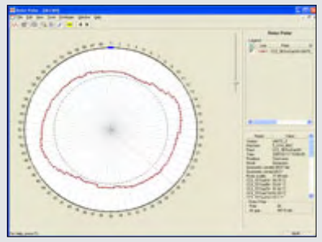
Data analyser - Orbit



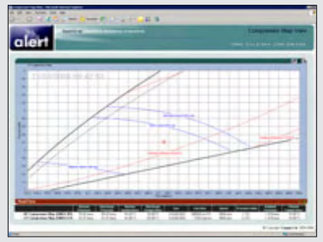
Event viewer



Rule box



Air Gap – Rotor shape



Alert Performance – Compressor map

MPS software

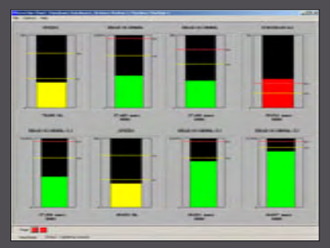
Machinery protection is an absolute must, as the failure of high capital machinery results in critical safety issues and significant financial losses. The VM600 provides on-line protection of vibration, speed, displacement, temperature, dynamic pressure in GT combustors and many other machine parameters.

MPS (Machinery Protection System) software has an easy-to-use graphical user interface for the protection of critical rotating machinery. It allows stand-alone hardware configuration and data display through a serial connection to the VM600.

MPS1 & MPS2 softwares are used for the VM600 configuration (installed modules) and the programming of functions.

Additionally, the MPS2 tool allows real-time values (bar graphs and strip charts), trend charts and long-term (data average) charts to be displayed.

Configuration tool



Real-time bar graph

Trend chart

Measurement capabilities

All rotating machines

- Absolute vibration (1)
- Relative shaft vibration (x,y) (2)
- Absolute shaft vibration (1) + (2)
- Shaft position, displacement (3)
- Displacement (valves, gates, cylinders)
- Static (oil) pressure (4)
- Temperature (5)
- Speed (6)

Steam turbines

- Shaft eccentricity (x,y)
- Absolute expansion
- Differential expansion
- Casing expansion

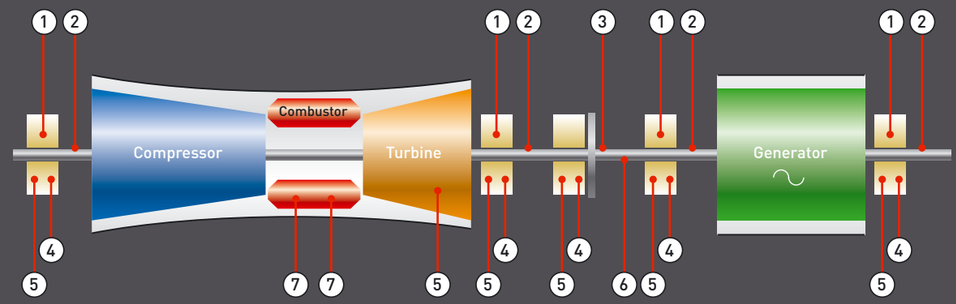
Gas turbines

- Dynamic (combustor) pressure (7)

Hydro turbines

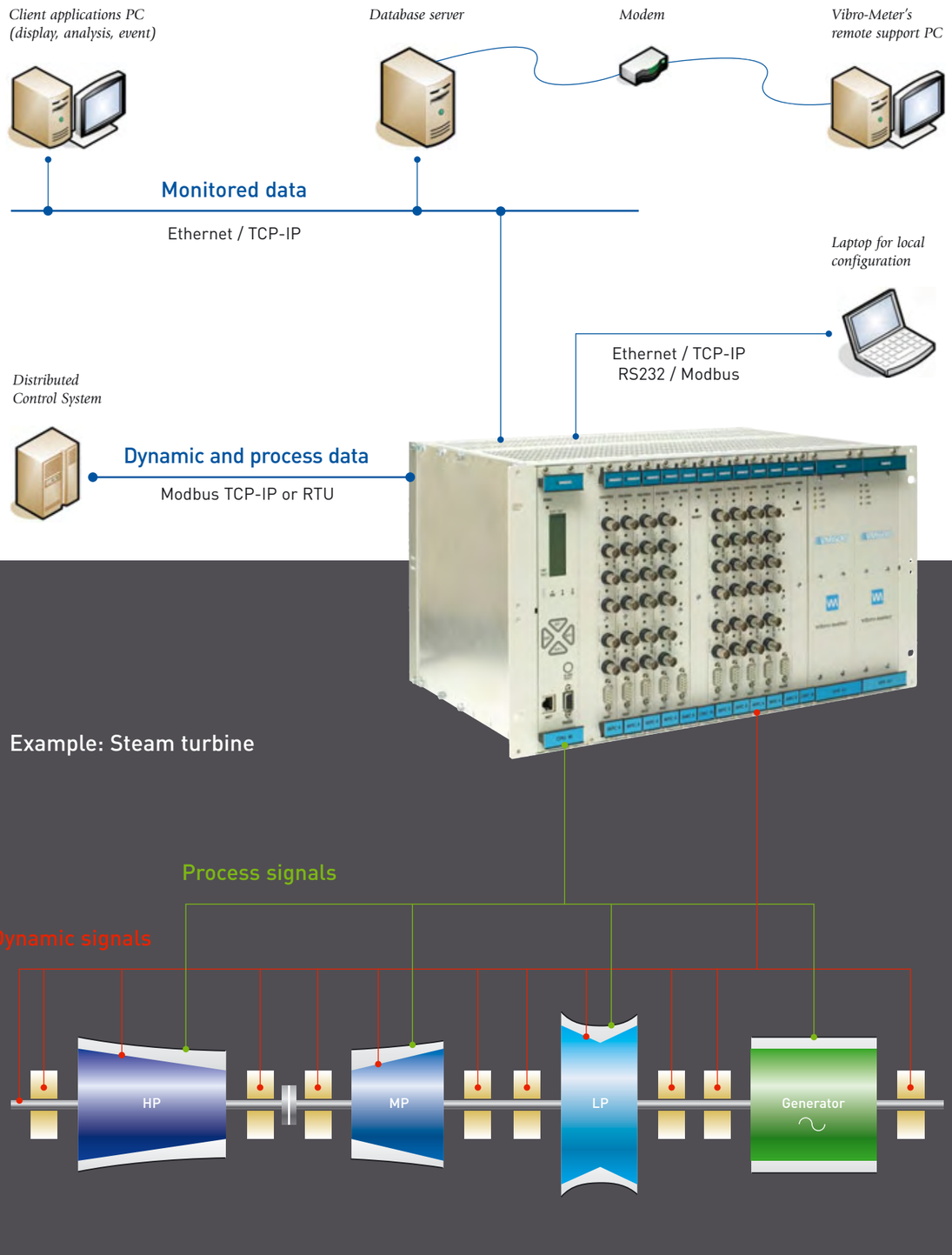
- Airgap

Example: Gas turbine



VM600 Networking

VM600 can be operated as a stand-alone unit configured from a laptop PC or can be networked and integrated with other control and information systems using “industry standard” protocols. Configuration and display can be provided by an “applications PC” running Windows operating system.



Our expertise

Engineering

Vibro-Meter has a core team of skilled design engineers with vast experience in designing complex electronics for high precision measurement applications. High quality analogue signal acquisition circuitry is integrated with data handling, digital signal processing and communication circuitry.

We also have a complete in-house capability to test and qualify state-of-the-art monitoring systems. We are able to simulate complete machinery applications in our labs, to meet the latest industry requirements.

To guarantee the uniqueness of our technology and know-how, we continuously invest in training, technical innovation and first class simulation and design software. To support our continuous innovative effort, we have ongoing collaborations with several renowned universities and industrial partners.

Manufacturing

Since the 80’s Vibro-Meter has had a Production Planning System, enabling high quality and productivity objectives to be achieved.

Our large and modern manufacturing facility in Fribourg (Switzerland) is designed to ensure the highest quality standards and organized to efficiently produce large scale orders as well as small batches.

Skilled and experienced production staff can manufacture a series of products adapted to fulfil the special requirements of our customers.

Qualification & quality insurance

The quality and reliability of Vibro-Meter’s products has been widely recognized since our entry into the aviation sector in the 70’s. This is when our Quality System was put in place. Our latest BS EN ISO9001:2000 certification was awarded in April 2007.

Our continuous improvement culture applies to everything we undertake. All employees strive to consistently develop, maintain and improve our quality management system at every opportunity. Customers are the focus of everything we do.

Certification Awarded to

VIBRO-METER S.A.
RTE DE MONCOR 4
CH-1701 FRIBOURG
SWITZERLAND

Bureau Veritas certify that the management system of the above organisation has been assessed and found to be in accordance with the requirements of the standards detailed below.

STANDARD

BS EN ISO 9001:2000

SCOPE OF SUPPLY

DEVELOPMENT, MANUFACTURING, SALES AND SUPPORT OF EQUIPMENT AND DEVICES FOR THE MEASUREMENT OF VARIOUS PHYSICAL PARAMETERS.

Original approval date: 28 APRIL 2004

Subject to the continual satisfactory operation of the organisation's management system, this certificate is valid until:

28 APRIL 2010

To check this certificate validity please call 0207 661 0739

Further clarifications regarding the scope of this certificate and the applicability of the management system requirements may be obtained by consulting the organization

Vibro-Meter

Vic Bowen

Certificate number: 32489

Date issued: 13 APRIL 2007

Case studies

Heavy duty gas turbine: “Irsching 4” combined cycle power plant (Germany)
On-line diagnostics and remote balancing (VM600 system, with CP, CA and TQ sensors)

Siemens uses Vibro-Meter’s VM600 to protect and remotely monitor the world’s most powerful gas turbine (GT).

“Irsching 4” near Ingolstadt (Germany) is the test power plant for the new SGT5-8000H, which is the world’s most powerful GT with a 340MW simple cycle power output. The GT was first fired in December 2007. After an 18-month trial operation period, it will be expanded to become a 530 MW combined cycle power plant (CCPP) and will be handed-over by Siemens to E.ON for commercial operation in 2011.

This technologically leading CCPP will achieve an efficiency of 60%, which is a new world record. As a result, it will emit approximately 40000 tons of CO_2 per year less than comparable existing plants.

Monitoring vibrations and GT’s combustion is a proven way to contribute to reliable GT operation, with the target of reaching the highest possible efficiency and lower emissions. Siemens has chosen Vibro-Meter to provide the monitoring system for the SGT5-8000H.

Our integrated solution includes dynamic pressure sensors (CP), as well as relative and absolute vibration sensors (CA and TQ) and a VM600 protection & condition monitoring system.

All data collected by the VM600 are continuously transferred to Siemens’ Intranet, interfaced with their Win_TS system (a global networked plant diagnostic platform). With these tools, experts working in Siemens’ Diagnostic Centres (Erlangen and Orlando) and Research-and-Engineering Centres (Erlangen, Berlin, Muelheim, Orlando and others) can for example remotely calculate balancing for turbines located in plants all over the world. Using this information, staff on-site can balance a turbine without the need for an on-site visit by experts, saving time and cost.

Vibro-Meter is proud to contribute to Siemens’ leading-edge technology and their outstanding support to customers.

“Irsching 4” CCPP near Ingolstadt

VM600 data are used for turbine monitoring (copyright Siemens AG)

Hydro turbine-generator: “Shipshaw” Hydro Power Plant (Canada)
Remote condition monitoring (VM600 system, with LS and CA sensors)

Shipshaw Hydro Power Plant (HPP) is owned by the largest independent producer of hydroelectricity in Quebec, Rio Tinto Alcan. At the time of construction, the power plant was the most powerful in the world, with an output of 896 MW from 12 generators.

Condition monitoring of hydroelectric generators is critically important to increase efficiency, plan preventive maintenance and detect wearing of critical parts.

In Shipshaw HPP, the main control centre is 60 km away from the plant. The customer’s goal is to ensure permanent remote monitoring and analysis by their experts. This reduces on-site human presence and thus lowers maintenance costs. High speed network access via optical fibre is established between the control centre and Vibro-Meters’ VM600 systems in the plant. Twelve VM600 Systems provide condition monitoring of vibration and other dynamic measurements (e.g. relative vibration, axial position, rotating speed, dynamic pressure and generator’s air gap). Temperatures and plant process signals are also monitored (e.g. active power, oil bearings temp., stators temp., ambient temp., oil levels, water flow, as well as other flows and plant data). Furthermore, Vibro-Meter provides air gap measuring systems for the generator and vibration measurement chains to monitor bearing vibration in both generators and turbines.

Shipshaw HPP (courtesy of Alcan Canada)

Heavy duty gas turbine: “Nhon Trach” combined cycle power plant (Vietnam)
Protection and condition monitoring (VM600 system, with CP, CA and TQ sensors)

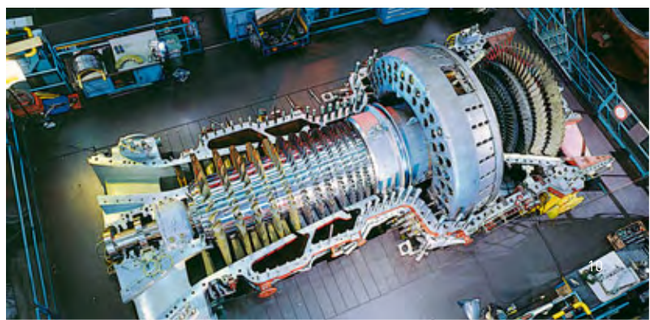
Alstom uses Vibro-Meter’s VM600 for the first time to protect and monitor a GT13E2 for a large CCPP in Vietnam.

The Nhon Trach CCPP project will be carried out in two phases, with the GT operating first in simple cycle to support the high energy demand during the dry season in 2008. In the second phase, further equipment will be added for a full combined cycle operation. Once fully operational, the 460MW CCPP will be capable of supplying 2.5 billion KWh annually to the national grid.

With more than one hundred GT13E2s in operation and millions of fired hours to its credit, Alstom’s 180MW gas turbine has already built an impressive track record of reliability and performance. The VM600 monitoring system and high sensitivity piezoelectric accelerometers supplied by Vibro-Meter alerts the operator in case of abnormal bearing vibrations, allowing early maintenance planning.

A challenge with heavy duty GTs is to combine the highest possible efficiency with extremely low NOx emissions. Vibro-Meter’s dynamic pressure sensors allow Alstom to control combustion parameters such as fuel injection.This leads to very low emissions, reduced fuel consumption and long intervals between major inspections.

Vibro-Meter is proud to contribute to Alstom’s success in providing customers using their GT13E2 with high efficiency, operational flexibility and longer inspection intervals, leading to lower maintenance costs.



Alstom's GT13E2 heavy duty gas turbine

Since its foundation in 1952, Vibro-Meter in Fribourg (Switzerland) has been supplying reliable, high quality instrumentation for aviation and industrial customers worldwide. Vibro-Meter has been part of the Meggitt group since 1998. With its headquarters in the United Kingdom, Meggitt PLC is an international group of companies specialising in aerospace equipment, high performance sensing systems and defence.

Vibro-Meter's quality policy is fundamental to its success. The excellent reputation of our company is built on our dedication to fulfil our customers' needs, our continuous investment in technical innovation and the skills and experience of our staff.

We develop and supply engine monitoring units for new airliners produced by all leading aircraft manufacturers. For more than 30 years, our aerospace division has been the leading supplier of vibration and pressure monitoring systems for aircraft engines.

The power generation industry widely uses the complete monitoring solutions for turbomachinery offered by our industrial and marine division. Our integrated systems are adopted by major manufacturers of gas turbines, steam turbines and water turbines.

Our international network of subsidiaries and distributors delivers outstanding support worldwide, for both our aerospace and power industry customers.

Vibro-Meter

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smart engineering for
extreme environments