

MEGGITT

Enabling the Extraordinary
To Fly To Power To Live

Why Meggitt Vibro-Meter® machinery monitoring solutions?

 Vibro-Meter®

Expertise and pedigree

60+ years of experience and recognised expertise in sensing and monitoring solutions, especially for harsh environments. Meggitt solutions from the Vibro-Meter® product line are trusted by original equipment manufacturers (OEMs) globally and our products have become standard-fit components on machinery used throughout the Energy industry.

Complete solutions

- **One-stop shopping:** Complete solutions including measurement chains (sensors, cabling, signal conditioners and galvanic separation units), monitoring systems and software from a single supplier.
- **Fully-integrated solutions:** Interfaces for third-party products such as DCS, PLC and/or SCADA systems.
- **Flexibility and support:** Customised solution design including turnkey solutions, services and support.

High performance, quality and reliability

Vibro-Meter® products are renowned for their superior performance and best-in-class quality (“Swiss Made”) offering high MTBF solutions for critical machinery and balance of plant (BOP) equipment in Power Generation, Oil & Gas and other industrial applications.

65+

In 2012, Meggitt Vibro-Meter®
celebrated 60 years
at the forefront of
sensing and monitoring

Vibro-Meter®



A world leader in sensing and monitoring solutions for the Energy industry

- Power Generation and Oil & Gas
- Critical rotating machinery and Balance of Plant (BOP)
- SIL rated and API 670 5th edition compliant products
- Turnkey machinery protection and monitoring solutions.

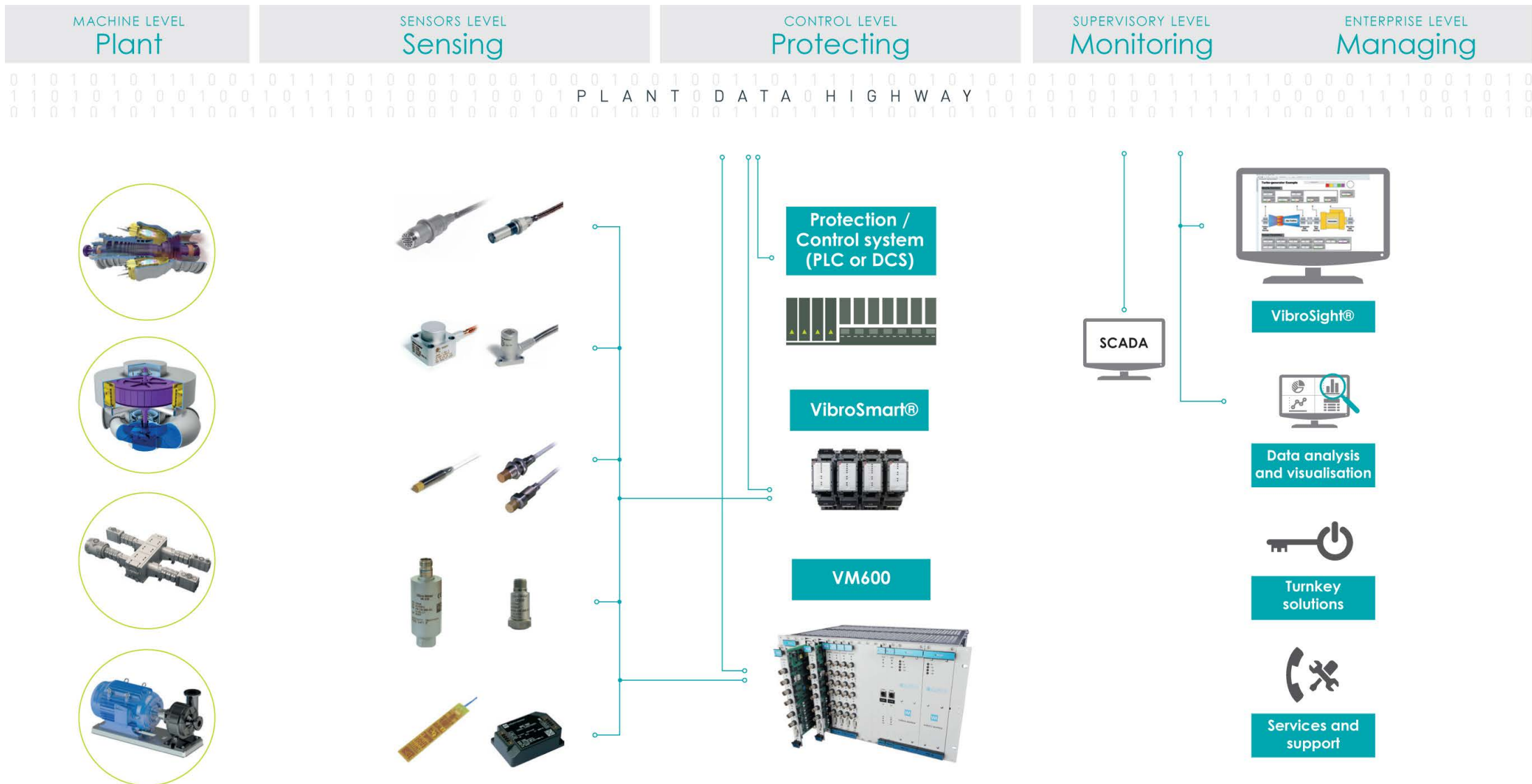
Our mission: Enabling fit machines to power the world

We keep the lights on! Meggitt helps energy and power companies to supply their products to millions of people.

Our solutions enable safer and more efficient operation of critical machinery in power plants and oil & gas company assets. They allow protection and accurate condition monitoring, helping to avoid catastrophic failures and enabling cost-effective predictive maintenance. Our services support customers and end-users through their project life-cycles. Failure is not an option.



100% predictability from sensors to decisions



100% predictability from sensors to decisions

Safety first with machinery protection

For critical rotating machinery in power plants, regulations dictate that protection systems are used to measure and monitor changes in machinery vibration levels, gas turbine combustion chamber pressure levels and/or machine behaviour. Should a breakdown threaten, our systems are designed to initiate a shutdown within fractions of a second.

Comprehensive condition monitoring solutions

To cut the cost of unscheduled maintenance, unnecessary inspection and troubleshooting, operators must anticipate wear and tear and recognize incipient failure conditions. The Meggitt Vibro-Meter® turnkey condition monitoring solutions includes sensors, conditioners, electronics, data acquisition systems, software and data analytics solutions.

Software to support predictive maintenance programs

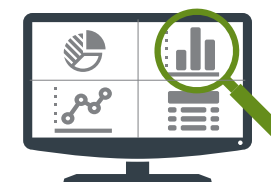
Advanced monitoring and diagnostic functions, enabling informed decisions on all aspects of power plant management.

SAFETY

According to the API 670 standard for machinery protection systems, “the time required to detect and initiate an alarm (alert) or a shutdown (danger) shall not exceed 100 ms”



TURNKEY



SOFTWARE & DATA ANALYTICS

Sensors (measurement chains) for machinery protection and condition monitoring

Absolute vibration

(CAxxx piezoelectric accelerometers, CExxx and PVxxx piezoelectric accelerometers and velocity sensors, CVxxx and VExxx velocity sensors, ...)



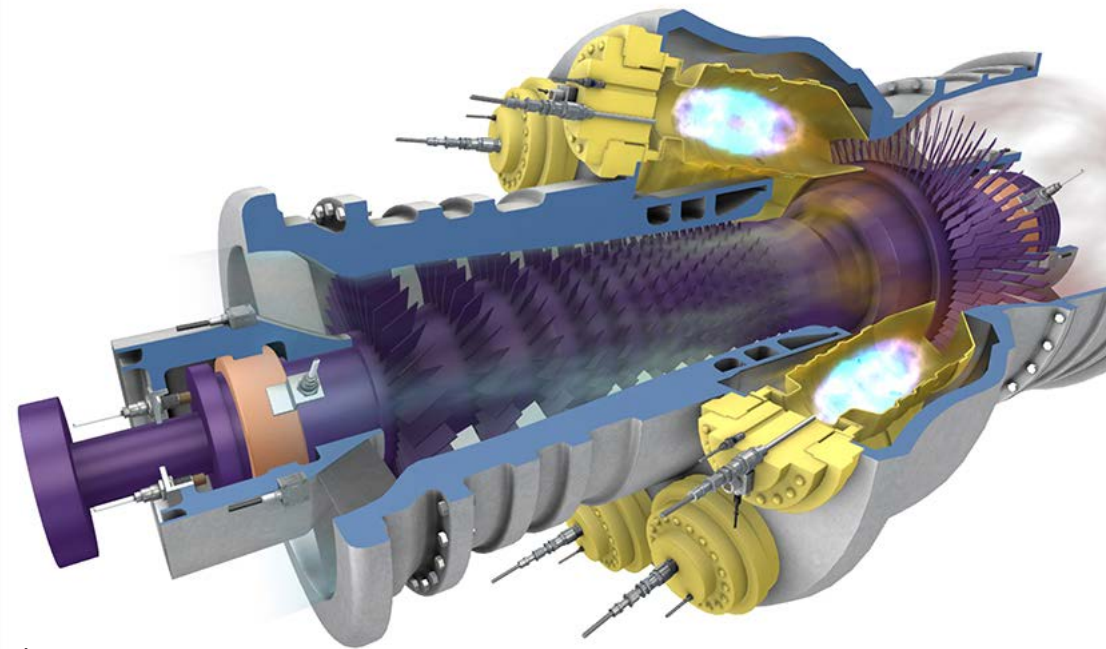
Dynamic pressure

(CPxxx piezoelectric pressure sensors)



Relative vibration

(TQxxx proximity sensors and PAxxx probe mounting adaptors)



High-performance, high-temperature (absolute) vibration measurement solutions

Features and benefits

- High-temperature piezoelectric sensors with external electronics
- Operating temperatures up to 700 °C (1290 °F) for sensors and 85 °C (185 °F) for signal conditioner
- Sensitivities from 10 to 100 pC/g
- Measurement ranges from 0.001 to 500 g (dynamic) and up to 1000 g (overload)
- Frequency responses from 0.5 to 10 000 Hz
- Typical linearity of $\pm 1\%$, transverse sensitivity of $< 5\%$ and sensitivity tolerance of $\pm 5\%$
- Hermetically sealed high-performance metals (such as high nickel alloys) for resistance to heat, humidity and corrosion
- Sensors available with an integral mineral-insulated (MI) cable or as a sensor only, allowing different cable assemblies to be used depending on the application
- Available in Ex versions certified for use in hazardous areas and in standard versions.

Operating temperatures up to 700 °C (1290 °F) enable vibration measurements directly on gas turbines



Highest-quality sensors available today

Hazardous areas

Reliability and SIL safety

IPC707 signal conditioner with diagnostics

SIL 2 ready



Proven success

Every year, more than 10 000 Cxxx measurement chains are installed by OEMs and end users.

CExxx and PVxxx vibration sensor measurement chains

High-performance, high-temperature and general-purpose (absolute) vibration measurement solutions

CExxx measurement chains consist of a CExxx piezoelectric accelerometer with attached or integrated electronics, cabling and optional GSI127 galvanic separation unit. PVxxx measurement chains consist of a PVxxx piezoelectric velocity sensor with integrated electronics, cabling and optional GSI127 galvanic separation unit (or other safety barrier). These solutions have been used for 50+ years in Power Generation, Oil & Gas and other industrial applications, and have become standard-fit components with original equipment manufacturers (OEMs) globally.

Features and benefits

High-temperature piezoelectric sensors with attached electronics:

- Operating temperatures up to 350 °C (660 °F)
- Sensitivities from 5 to 50 $\mu\text{A/g}$, Frequency responses from 2 to 10 000 Hz
- Measurement ranges from 0.001 to 400 g (dynamic) and up to 2000 g (overload)
- Hermetically sealed high-performance metals for resistance to heat, humidity and corrosion

General-purpose piezoelectric sensors with integrated electronics:

- Operating temperatures up to 140 °C (280 °F)
- Sensitivities from 50 to 500 mV/g (CE6xx), 4 mV/mm/s (PV660) or 4 to 20 mA proportional to measurement range, Frequency responses from 2 to 10 000 Hz
- Measurement ranges up to 80 g (CE6xx) and 100 mm/s RMS (PV6xx)
- IP68 “waterproof” protection rating.



API 670 (5th ed.)



CExxx and PVxxx vibration sensor measurement chains (*continued*)

Highest-quality sensors available today

CExxx and PVxxx vibration sensors cover a broad range of applications from high-temperature to general-purpose, using synthetic single-crystal piezoceramics in proven designs. CExxx sensors with attached electronics are designed for the measurement of absolute vibration in more demanding environments such as gas turbines, while CExxx and PVxxx sensors with integrated electronics are suitable for the monitoring of balance of plant (BOP) equipment such as compressors, gearboxes, motors, pumps and fans, as well as large machinery such as hydro turbines.

Hazardous areas

CExxx and PVxxx measurement chains are available in Ex versions certified for use in hazardous areas (potentially explosive atmospheres). Also available in standard versions for use in standard (non-hazardous) areas.

Wide range of sensors

Most CExxx and PVxxx vibration sensors are configurable for environment and sensitivity making it easier to find the perfect sensor for an application. Ex or standard versions are available with voltage outputs ranging from 50 to 500 mV/g, and/or 4 to 20 mA current outputs proportional to 200 to 20 g RMS or 0 to 100 mm/s RMS.

Industry standard vibration sensors and control system solutions

The CE620 and PV660 are industry standard IEPE (integrated electronics piezo electric) sensors providing a dynamic voltage output signal that is suitable for spectral analysis. The CE687, PV685 and PV686 are industry standard 4 to 20 mA loop-powered sensors, also known as “vibration transmitters”, providing a quasi-static output signal that indicates overall vibration. These sensors enable solutions for control system applications (DCS or PLC) where current outputs sensors are more prevalent.



CPxx dynamic pressure sensor measurement chains

High-performance, high-temperature dynamic pressure measurement solutions

CPxxx measurement chains consist of a CPxxx piezoelectric pressure sensor, cabling and IPC70x signal conditioner, and optional GSI127 galvanic separation unit. These solutions have been used for 50+ years in Power Generation, Oil & Gas and other industrial applications, and have become standard-fit components with original equipment manufacturers (OEMs) globally.

Features and benefits

- High-temperature piezoelectric pressure sensors with external electronics
- Operating temperatures up to 700 °C (1290 °F) for sensors and 85 °C (185 °F) for signal conditioner
- Sensitivities from 25 to 750 pC/bar
- Measurement ranges from 0.00005 to 250 bar (dynamic) and up to 350 g (overload)
- Frequency responses from 2 to 15000 Hz
- Typical linearity of $\pm 1\%$, low acceleration sensitivities
- High-performance metals (such as high nickel alloys) for resistance to heat, humidity and corrosion
- Sensors with integral mineral-insulated (MI) cable
- Sensors are Ex certified for use in hazardous areas.

700 °C

Operating temperatures
up to 700 °C (1290 °F)
enable dynamic pressure
measurements directly on
combustion chambers



CPxx dynamic pressure sensor measurement chains (*continued*)

Highest-quality sensors available today

CPxxx dynamic pressure sensors are high-temperature, high-sensitivity devices using synthetic single-crystal piezoceramics in proven designs to ensure security of supply. They are designed for the long-term measurement of pressure pulsations in extreme environments such as gas turbines.

Hazardous areas

CPxxx measurement chains are Ex certified for use in hazardous areas (potentially explosive atmospheres), with Ex certificates available for most countries and regions of the world including Europe (ATEX), North America (cCSAus) and internationally (IECEX).

Reliability and SIL safety

CPxxx measurement chains have been designed for the most demanding applications and are proven to be reliable in extreme environments. They are suitable for use in SIL 1 and SIL 2 safety-related applications in accordance with the IEC 61508 “functional safety” standard.

Wide range of sensors

The IPC707 signal conditioner converts the charge-based signal from piezoelectric sensors into a current or a voltage signal suitable for input to a machinery monitoring system. The IPC707 also supports optional diagnostic circuitry (built-in test equipment (BITE)) that automatically detects and remotely indicates problems with the measurement chain, increasing functional safety.

Proven success

Every year, more than 2000 CPxxx measurement chains are installed by OEMs and end users.

SIL 2 ready



TQ4xx proximity sensor measurement chains

Comprehensive radial vibration, axial position, rotational speed and phase reference (1/REV pulse) measurement solutions

TQ4xx measurement chains, consisting of a TQ4xx proximity sensor, EA40x extension cable and IQS45x signal conditioner, are compliant with the most stringent industry standards and have been used for 50+ years in Power Generation, Oil & Gas and other industrial applications.

Features and benefits

- Non-contact measurement (based on eddy current principle)
- 2, 4 or 12 mm measurement range:
 - 2 mm range with 8 mV/ μ m or 2.5 μ A/ μ m sensitivity and Ø5.1 mm tip
 - 4 mm range with 8 or 4 mV/ μ m or 2.5 or 1.25 μ A/ μ m sensitivity and Ø8.2 mm tip
 - 12 mm range with 1.33 mV/ μ m or 0.417 μ A/ μ m sensitivity and Ø18 mm tip
- DC to 20 000 Hz frequency response
- -40 to 180 °C (-40 to 56 °F) sensor and -35 to 85 °C (-31 to 185 °F) signal conditioner
- IP68 “waterproof” protection rating and 100 bar pressure rating (sensor tip)
- Standard mount, reverse mount or right-angle mount (90°)
- 1, 5 or 10 m system lengths (sensor integral cable and extension cable)
- Temperature-compensated system with interchangeable (calibrated) system components
- Available in standard versions and in Ex versions certified for use in hazardous areas.

1000 m

A measurement chain using a Vibro-Meter® signal conditioner (IPC70x or IQS45x) with a current output and a GSI127 galvanic separation unit allows signal transmission over up to 1 000 m (> 3 000 ft) – further than any other solution



TQ4xx proximity sensor measurement chains (*continued*)

Interchangeable components

Each TQ4xx measurement chain component – TQ4xx proximity sensor, EA40x extension cable and IQS45x signal conditioner – is individually calibrated during manufacture so that they are interchangeable. This reduces the mean time to repair/restoration (MTTR) and simplifies spare parts inventory management.

Hazardous areas

TQ4xx measurement chains are available in standard versions for use in standard (non-hazardous) areas. They are also available in Ex versions certified for use in hazardous areas (potentially explosive atmospheres), with Ex certificates available for most countries and regions of the world including Europe (ATEX), North America (cCSAus) and internationally (IECEX).

Reliability and SIL safety

TQ4xx measurement chains have been designed for the most demanding applications and are extremely reliable. They are suitable for use in SIL 1 and SIL 2 safety-related applications in accordance with the IEC 61508 “functional safety” standard.

API 670 machinery protection systems standard (5th ed.)

While many companies claim 100% compliance to the API 670 machinery protection systems standard, we are pleased to confirm that our TQ4xx measurement chains (and monitoring systems) are the most API 670 (5th ed.) compliant solutions on the market.

Proven success

Every year, more than 10 000 TQ4xx measurement chains are installed by OEMs and end users.



Machinery protection and condition monitoring systems

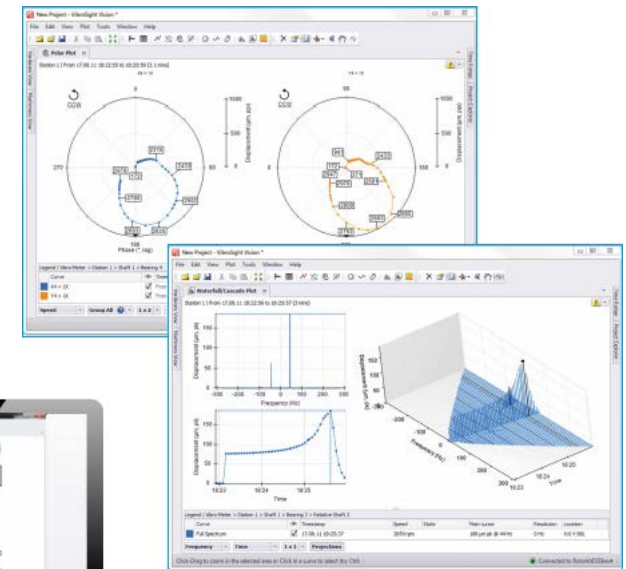
VM600 rack-based systems



VibroSmart® distributed monitoring system



VibroSight® software and solutions



VM600 rack-based systems – centralised intelligence

Machinery protection, condition and/or combustion monitoring for gas, steam and hydro turbines and other critical machinery. Suitable where rotating plant is concentrated in one area, requiring centralised monitoring with higher channel counts.

For complex installations

The high channel density of VM600 rack-based systems addresses complex installations. Dynamic inputs from proximity probes, accelerometers, velocity, dynamic pressure and ice detection sensors are fed into standard 19-inch, 6U racks.

Accessible

VM600 is designed for plants where measurement data from all the machines is accessed in a safe, central area, with personnel obtaining waveforms by physically connecting to raw signals.

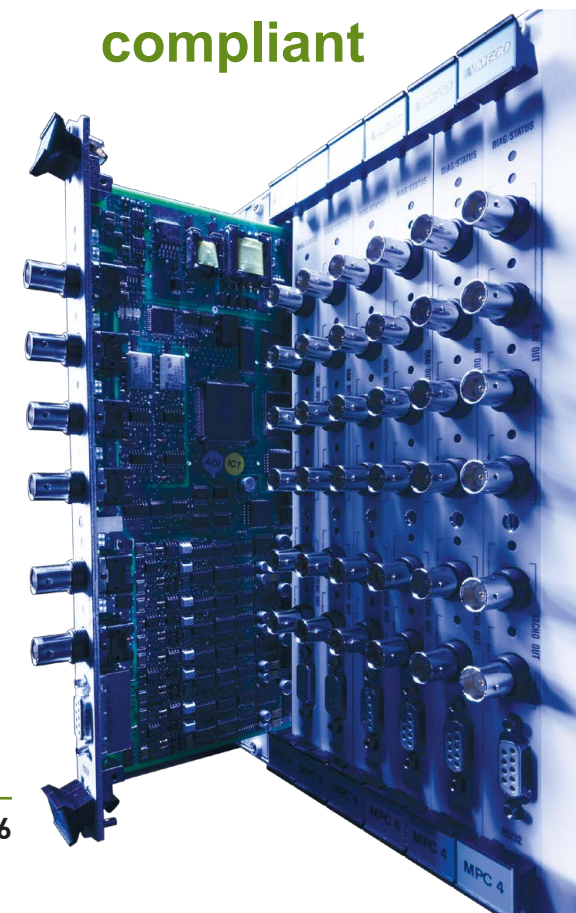
For reactive or proactive management

Whether you want to fit and forget a reliable vibration protection system, or you require advanced combustion dynamics analyses to ensure safe and optimal fuel mixtures, the VM600 covers basic to highly sophisticated analysis.

VM600 system segregation

The VM600 system uses one type of card for machinery protection and another for condition monitoring in order to separate these functions, thereby ensuring API 670 compliance, improving cyber security and reducing costs.

**API 670
compliant**



VM600 rack-based systems (continued)

ABE04x
VM600 19" system rack with a height of 6U suitable for up to 12 monitoring card pairs

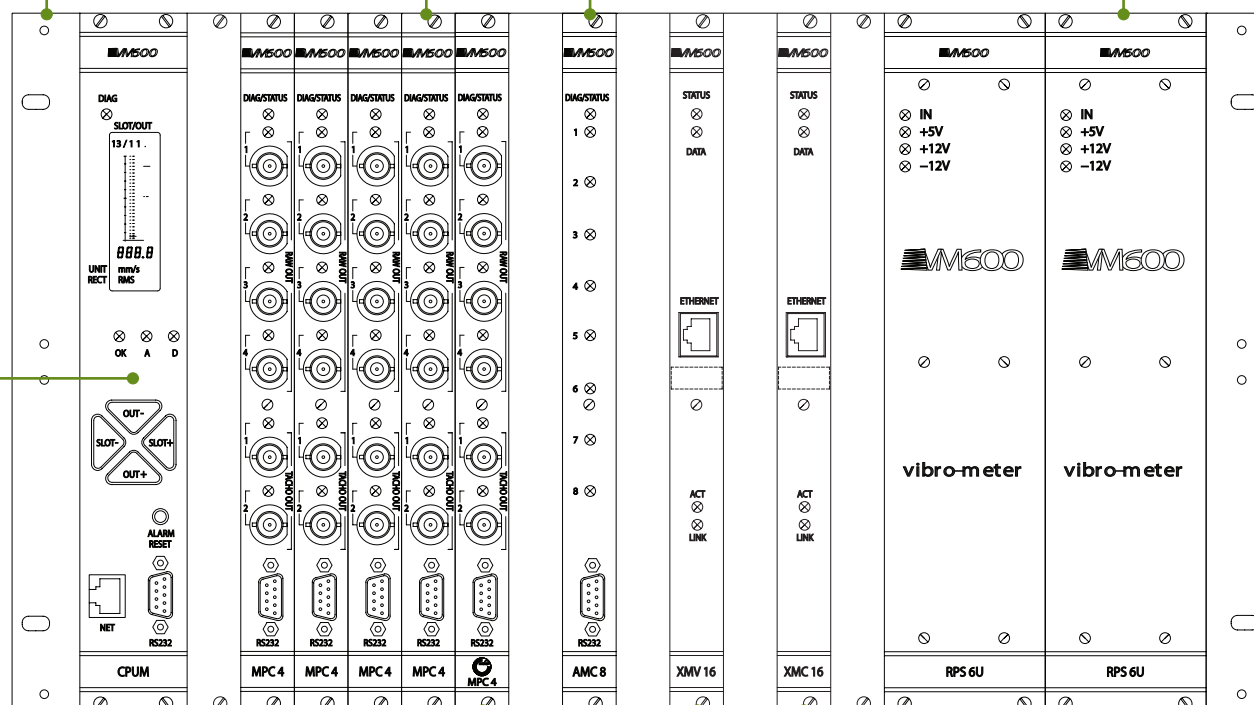
MPC4/IOCT4
Machinery protection card pair with 4 dynamic channels and 2 tacho channels

AMC8/IOC8T
Analog monitoring card pair with 8 channels

RPS6U
VM600 19" system rack power supply.
Note: Two power supplies can be used for redundancy.

Rack channel-density:
Up to 48 dynamic channels of protection (MPC4), 192 dynamic channels of monitoring (XMx16), or any combination thereof, per rack

CPUx/IOCx
"Rack controller" and communications interface card pairs:
CPUM/IOCN,
CPUR/IOCR or
CPUR2/IOCR2



• RLC16
Relay card with 16 relays

• IRC4
Intelligent relay card with 8 relays

Note: Input/output, RLC16 and IRC4 cards are not shown (rear of rack)

• VM600 MPSx software
Used to configure and operate VM600 machinery protection systems

• VibroSight® software
Used to configure and operate VM600 condition monitoring systems

MPC4SIL/IOCT4
SIL safety version of machinery protection card pair

• XMV16/XIO16T
Condition monitoring card pair for vibration with 16 dynamic channels and 4 tacho channels

• XMC16/XIO16T
Condition monitoring card pair for combustion with 16 dynamic channels and 4 tacho channels

VibroSmart® distributed monitoring system – distributed intelligence

For plants where a distributed architecture makes sense, often involving balance of plant (BOP) machinery with lower channel counts dispersed over large areas where the cost of sensor wiring must be contained.

Modular and scalable

VibroSmart® distributed monitoring systems offer the same rock-solid safety assurance as our centralised VM600 solutions but priced by channel, so more assets can be monitored for less capital investment.

Versatile

VibroSmart's structure is highly flexible and supports all sensor types to deliver API-standard machinery monitoring functions. What's more, when combined with the VibroSight® software, it enables detailed insights into machinery health.

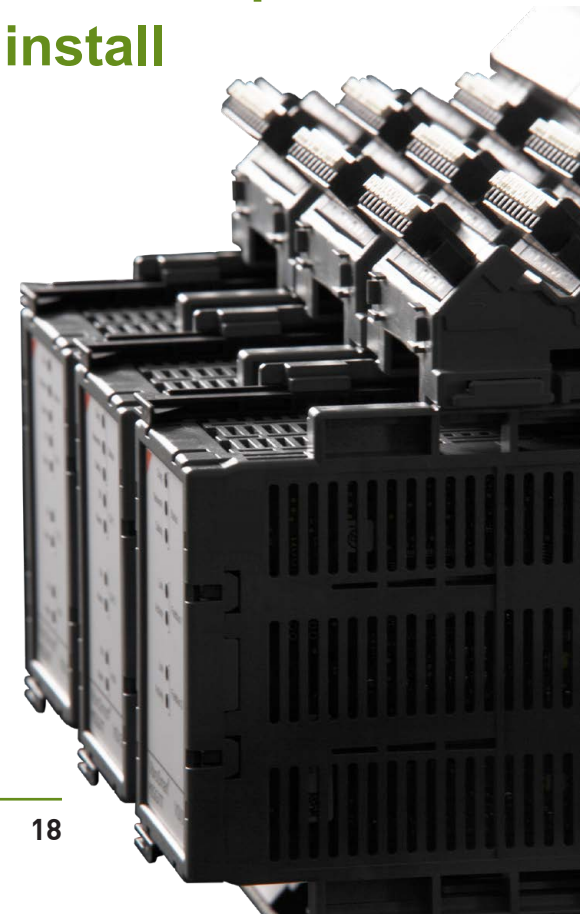
Low-cost installation

Due to its distributed design, our Ethernet-enabled system costs up to 30% less to install.

Smart engineering for extreme environments

In common with all Meggitt products, VibroSmart® is designed and certified to work in extremes — harsh industrial environments characterized by potentially explosive atmospheres, high temperatures and high mechanical stress.

**30% less expensive
to install**



VibroSmart® distributed monitoring system (*continued*)

• VSV301/VSB300

Monitoring module and terminal base with 2 dynamic channels and 1 auxiliary channel (tachometer or DC input)

System channel-counts:

2 to 256 dynamic channels of machinery protection and/or condition monitoring per VibroSmart® system (up to 128 x VSV30x modules)

• VibroSight® software

Used to configure and operate VibroSmart® distributed monitoring systems

• Accessories

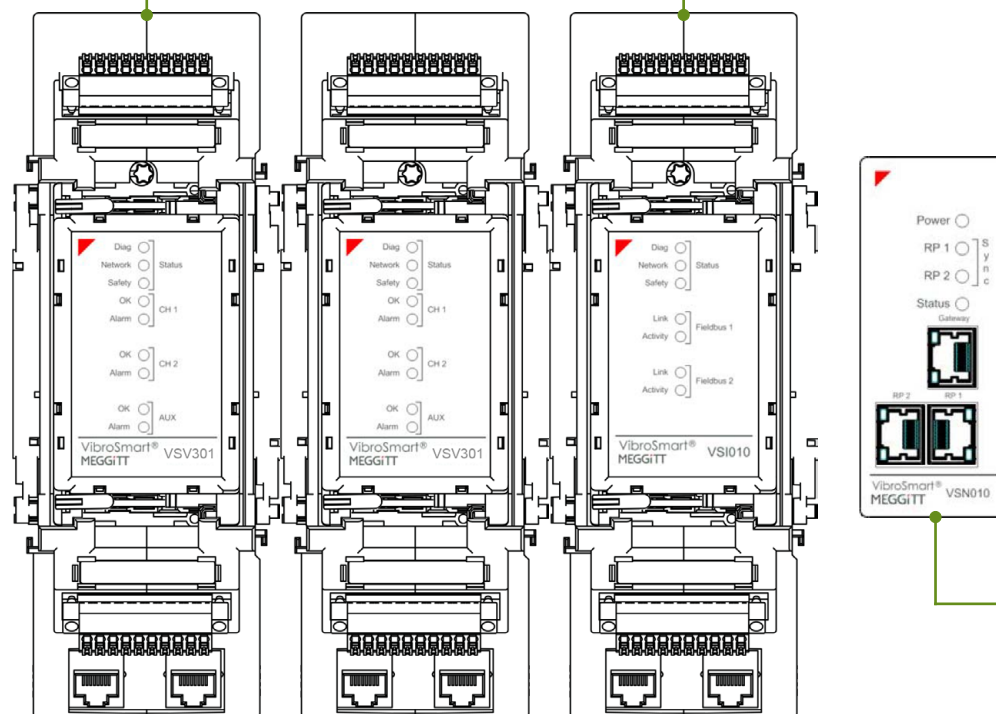
APFxxx power supplies, VSA00x cable assemblies and BNC patch panels, VSA301 buffered output amplifier, and more ...

• VSI010/VSB010

Communications interface module and terminal base with 2 fieldbuses (with VSF00x fieldbus communications adaptors)

• VSN010

Real-time Ethernet switch enables cost-effective redundant networks (HSR ring topology) of VibroSmart® modules



VibroSight® software – visualised intelligence

VibroSight® is the latest generation software from Meggitt for the effective monitoring of all rotating machinery. It is designed for the configuration, operation and management of monitoring system hardware such as VM600 rack-based systems and VibroSmart® distributed monitoring systems and offers a single comprehensive machinery condition monitoring platform at plant and/or enterprise levels.

The VibroSight® software uses a client-server architecture and VibroSight® historical data repositories in order to stream live data or display historical data recorded over months in just fractions of a second. And unlike some competitor's products, VibroSight® has an active development team so there are regular new releases bringing new features and functionality.

Features and benefits

- Highly-integrated software suite with a user-friendly interface for a system that is easy and straightforward to understand and to use.
- Seamless and open access to data.
- Unrivalled capabilities to manage and display very large quantities of data.
- Highly configurable monitoring system for various custom monitoring approaches.
- Data-integrity maintained and guaranteed in all operational situations (no risk of data loss).
- Integrated data management tools enabling simple and efficient data analysis as well as data backup and purging.
- Designed for remote data access and data transfer in the most stringent cyber-secure environments.
- A single software platform and data repository enabling enterprise-wide machinery condition monitoring and data analytics applications, ideally suited for machine diagnostics and predictive maintenance planning.



VibroSight® software – data display and analysis

In VibroSight® Vision, an extensive catalogue of plots is available to support the display, visualisation and analysis of measurement data for vibration and other applications. In order to display your data in the way that you want, VibroSight® Vision projects and plots are fully customisable for arrangement and layout of windows, unit preferences (metric, imperial or custom) and conventions such as default angle and plot organisation.

Plot catalogue

Whenever a plot is updated in VibroSight® Vision, the available measurement data is automatically and rapidly processed in order to optimally select the data points required to accurately display the data in plots such as:

- **Basic plots** – Trend, Table, Bar Chart, Spider, Waveform, Long Waveform, Polar Waveform, Spectrum
- **Composed plots** – Bode, Polar, Acceptance region, Orbit, Shaft Centerline, Correlation
- **3D plots** – Corbit (cascaded orbit), Waterfall/Cascade, Spectrogram.

Cursors and zooming

Data navigation tools such as cursors and zooming are optimised to facilitate the interpretation of the data.

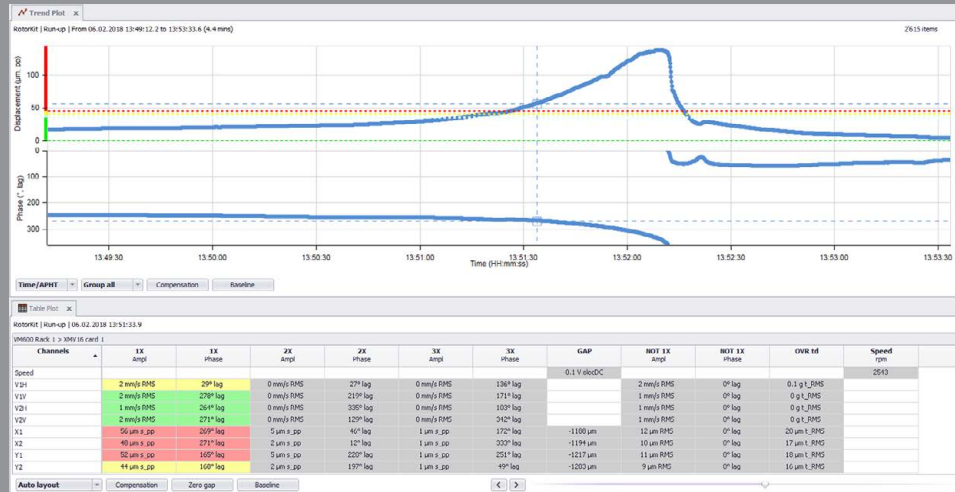
Main and delta cursors support the analysis of data in a single plot. The main cursor can be synchronised across multiple different plots in order to make it easier to find and analyse all of the measurement data corresponding to a particular event or time period. Similarly, zooming supports the analysis of data in more detail in a single plot, and zooming can also be synchronised across multiple different plots.

Data export

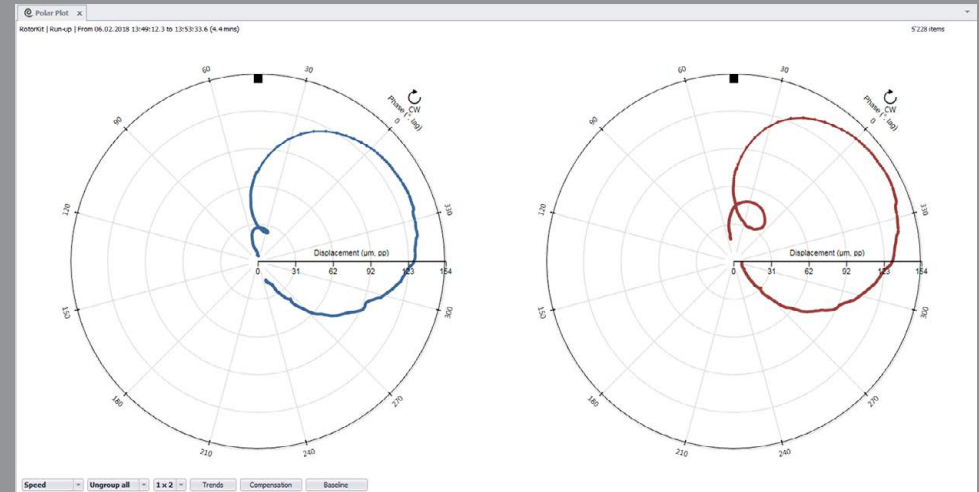
The measurement data displayed in a VibroSight® Vision plot can be quickly and easily exported as an image or as data to help information sharing and the writing of condition monitoring reports.

VibroSight® is fast
because it uses data
repositories consisting of a
specialised and proprietary
system of files designed
and highly optimised for
the high-speed storage and
retrieval of data

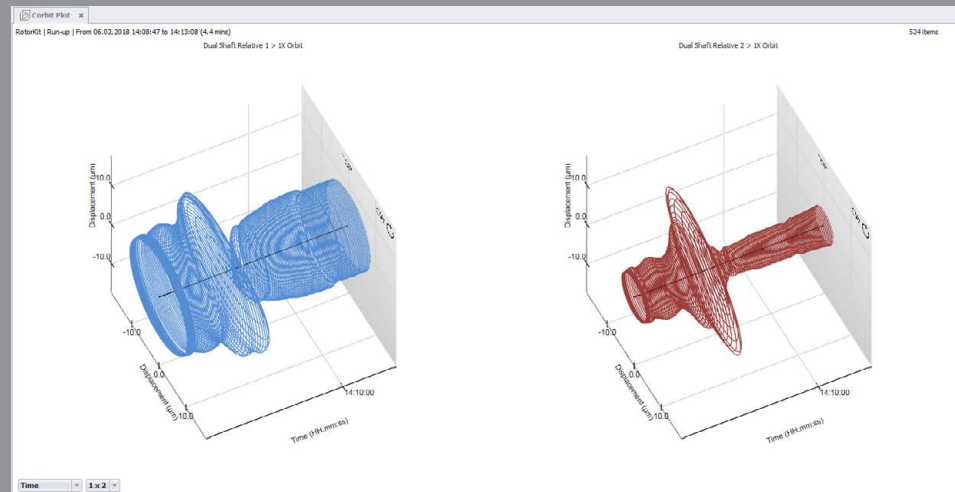
VibroSight® software – example VibroSight® Vision plots



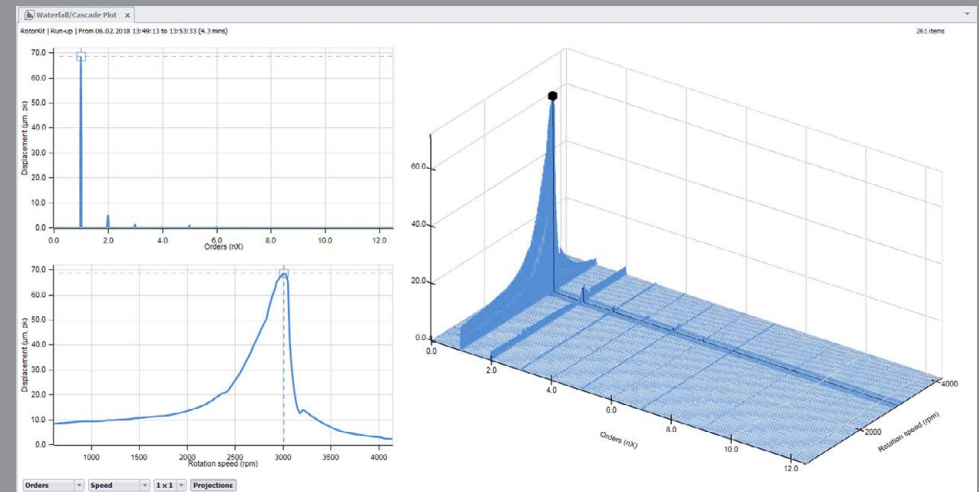
Trend plot (top) and Table plot (bottom)



Polar plot



Corbit (cascaded orbit) plot



Waterfall/Cascade plot

VibroSight® software – integrated data management

VibroSight®/XMV16 systems are highly configurable and can be used to capture as much (or as little) data as your condition-based maintenance programme requires. So even though VibroSight® and its data repositories have been specifically designed to guarantee high-performance with ultra-fast data retrieval and display, and the cost of data storage keeps falling, having a workable data management strategy remains as important as ever in order to protect your valuable data.

Just as “great power comes with great responsibility”, lots of data requires a data management strategy

Good data management improves overall system performance and operational efficiency, and helps ensure quick recovery with minimal data loss due to various random events such as human error, hardware failure or cyber-security attacks (malware). This is why VibroSight® integrates support for data management that simplifies the configuration and execution of standard data repository copy, purge and backup operations:

- **Offline data storage** – typically used for regular copies of the most recent data in the data repository used by the VibroSight® Server, in order to send data to other systems or for offline data analysis.
- **Data purge** – typically used for regular purges of the data repository used by the VibroSight® Server (after the data has been copied to offline data storage).
- **Data repository backup** – used for regular (daily) backups of the data repository used by the VibroSight® Server, essential for data recovery in the unlikely event of catastrophic hard disk drive failure.

These data management operations are configured in VibroSight® Configurator and then automatically scheduled and run by the VibroSight® Server as a series of smaller ‘incremental’ operations that provide the required data management without reducing the overall system performance. VibroSight® Server also reports the status of the data management so you can be confident that your data will be there when you need it.

So what are you waiting for?

Higher performance, quality and reliability are all waiting for you.

To learn more about how Meggitt Vibro-Meter® machinery monitoring solutions can help optimise the operation of your machinery, simply speak to your local contact today.

Alternatively, visit our website at:

www.meggittsensing.com/energy

Browse technical information 24/7 and find the right product for your application.