m+p international

Experts in Vibration

Data Acquisition and Monitoring

m+p Coda

Data Acquisition, Signal Analysis and Condition Monitoring

Photo courtesy of Siemens AG, Germany

YOUR BENEFITS

- **Complete turnkey solution for highest test efficiencies**
- **Mobile and stationary data acquisition and monitoring**
- **Scalable from 2 to more than 2,000 channels to match your test requirements**
- **Ethernet, USB, LXIbus-based acquisition hardware from different manufacturers**
- **Sample rates from 1 Hz to 125 kHz**
- **Online data access from any networked PC**
- **Support of all common types of transducers and sensors**
- **Automatic instrument identification and configuration for fast and easy test set-up**
- **Full-featured alarm monitoring and event handling**
- **Different user interface languages supported**
- **Standalone data acquisition for environments where PCs cannot go**

m+p Coda is a full-featured software platform for data acquisition, signal analysis and monitoring. Complete turnkey operation provides quicker time to test by eliminating costly application programming and long learning curves. The extensive built-in features and tools offer a functionality that was previously available only in custom packages. The intuitive GUI facilitates set-up, operation and analysis, thus leading quickly to precise, repeatable results.

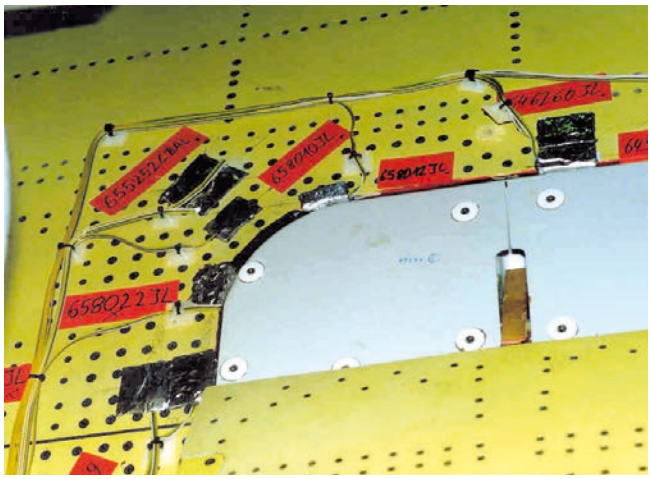
Extensive Application Coverage

Thanks to its modular structure and easy parameterization, m+p Coda is the perfect solution for a wide range of measurement applications in industry and in the laboratory:

- Measurements and data analysis on test stands and test assemblies
- Performance, functional tests and condition monitoring of turbocompressors, gas and steam turbines, jet engines, rocket engines, gearboxes, generators
- Experimental structural testing, multi-axis strain and stress analysis
- Process monitoring in power plants, in refineries, on production lines
- Vibration monitoring during shaker tests
- Standalone data acquisition applications

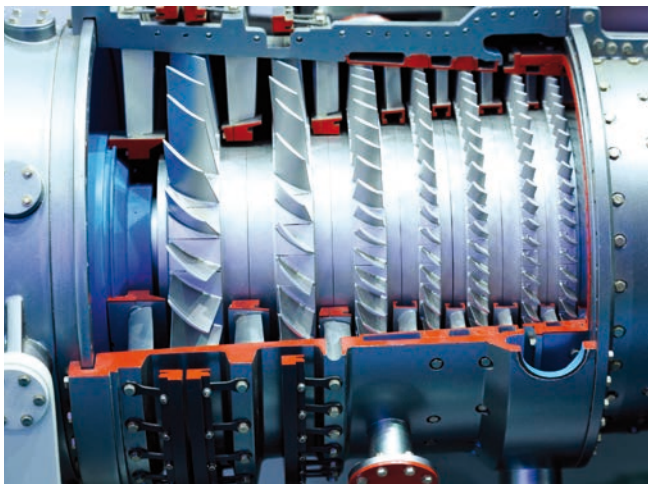
The acquisition system processes virtually every physical quantity, for example: temperature, voltage, stress, strain, pressure, force, acceleration and frequency. Even high-channel count applications using thousands of channels can be configured within a very short time and are handled safely and efficiently.

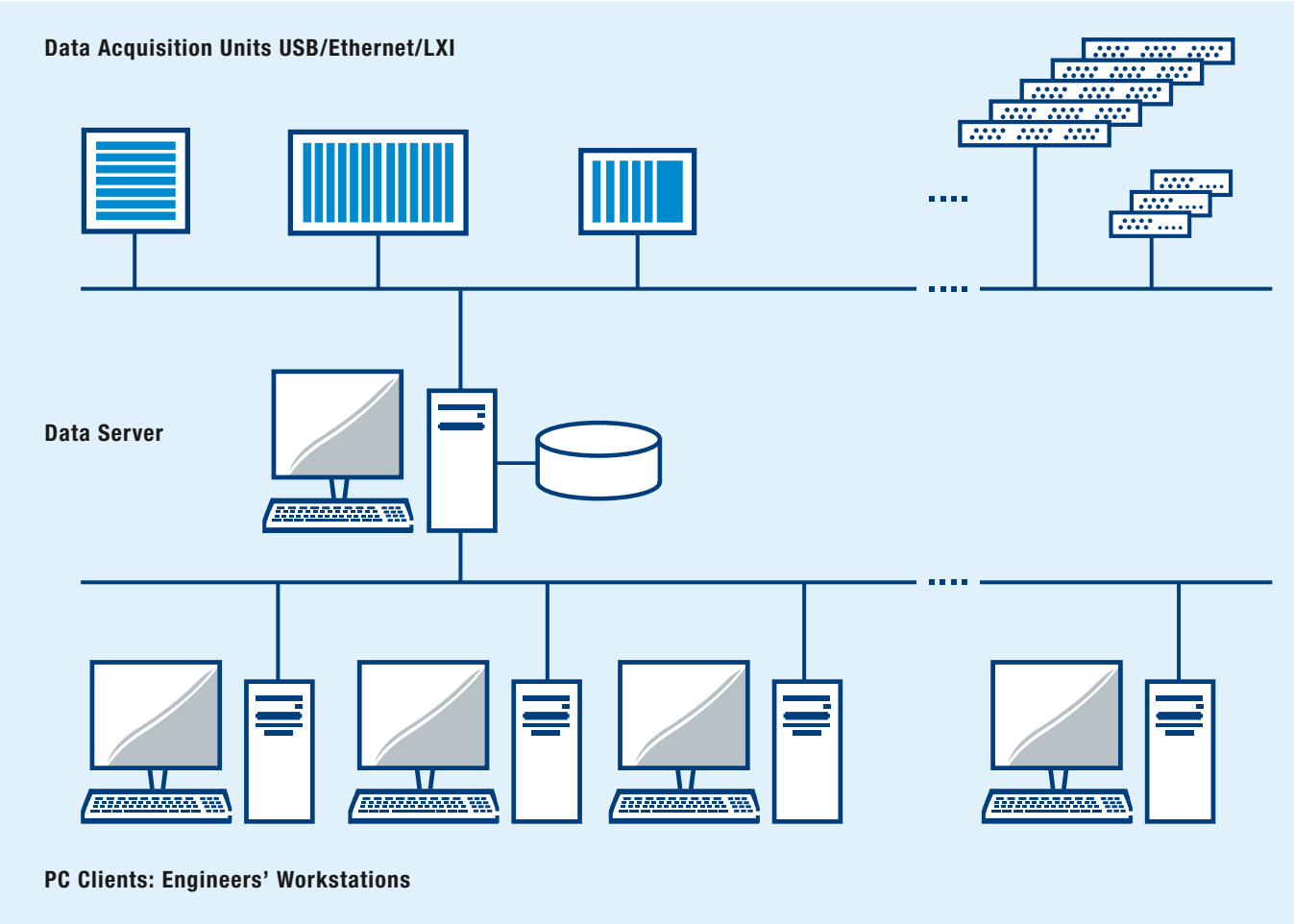
Features include measurements with single- and multi-channel strain gauges, real-time strain and stress calculations, limit checking and communication with the load control system.



Strain measurements on an aircraft

Performance and functional tests of turbines





Instrumentation

m+p Coda supports a range of USB, Ethernet and LXIbus-based instruments from established manufacturers. These instruments are known for their high performance, measurement accuracy and reliability. Users can select their preferred acquisition hardware for any test size. Other or existing acquisition devices can be integrated and communication with subordinate process computers for data transfer is also provided.

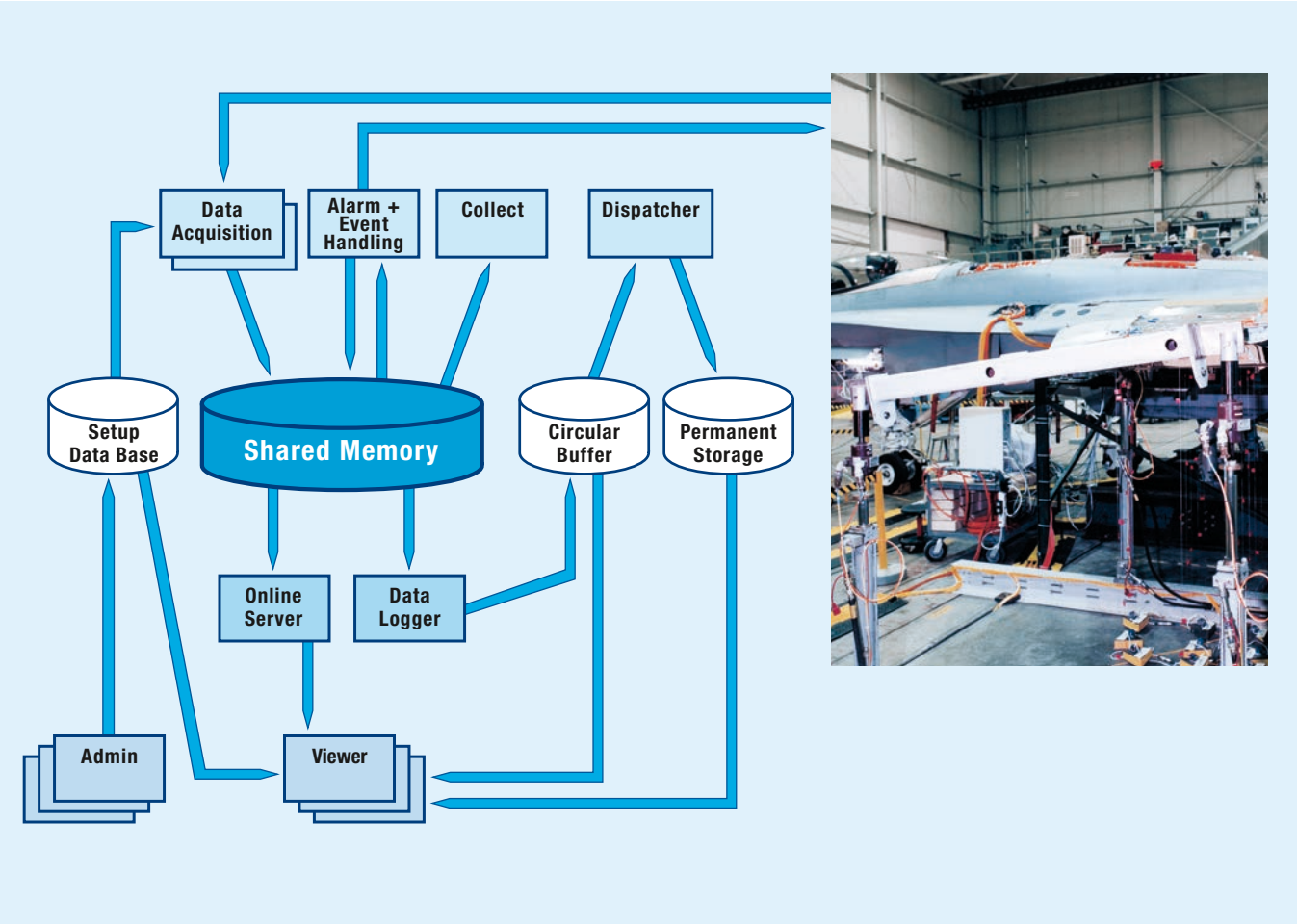
Client/Server System

The client/server architecture allows several test engineers to have concurrent online access to the acquired data for display and analysis operations. The online server approach also ensures reliable data archival and retrieval with integrated error diagnostics to guard against connection and data access issues.

Modular System for any Test Size

The modular architecture makes this package ideal for any test requirement, from tens to thousands of channels. m+p Coda can be expanded at any time to tackle additional tasks and higher channel counts.

> *We found m+p a capable and experienced engineering partner to develop and realize a state-of-the-art measurement system for our turbomachinery test field. They were able to integrate our existing proven and reliable software package for thermodynamic analysis into their Coda solution and to successfully implement our new highly efficient data acquisition and monitoring system.*
>
> Manfred Praus, Manager of the Metrology and Electrical Assembly Department at Siemens AG, Duisburg, Germany



Powerful Data Management

Configuration data are stored in a central SQL database for maximum flexibility and repeatability. m+p Coda stores and processes the acquired data in its uniform data model. Even different sampling rates for data groups or data acquired asynchronously are permitted. As a rule, the measured raw data are always stored to ensure access to the original data at any time.

Automatic Instrument Identification and Channel Configuration

Using a simple mouse-click, m+p Coda is able to identify the connected measurement hardware including across different manufacturers. The hardware will be listed together with some additional information in a table. The user selects the required instruments, whose samples rates can be different, for the subsequent parallel measurements. A channel configuration wizard, with user-definable default values, is also available. Additionally, virtual instruments can be selected for simulation purposes. The m+p Coda functionality is the same for real and virtual instruments.

Set-up: connected measurement hardware is automatically identified

Discover and Select Instruments

Discovered Devices

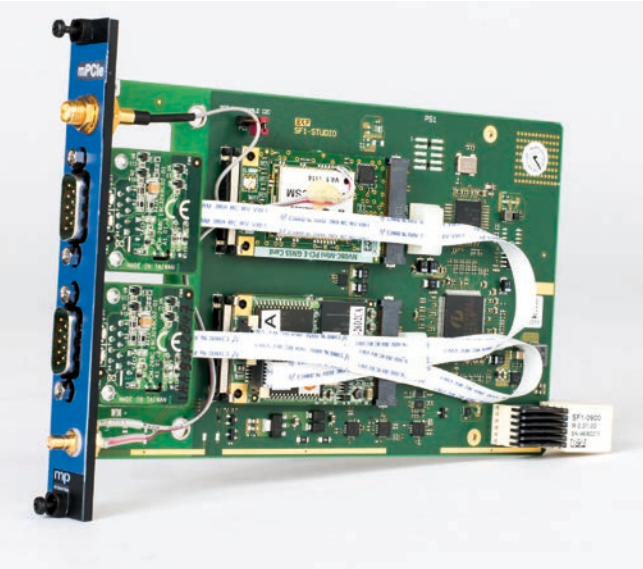
Select		Master/Slave Order	Interface	Model	Manufacturer	Serial Number	IP Address	Vendor/Slot
☐		S0 Slave 1	TCPIP	VibMobile	m+p international	VM08-10012		
☑		S0 Master	TCPIP	VibMobile	m+p international	VM08-10026		
☐		S0 Slave 2	TCPIP	VibMobile	m+p international	VM08-10028		
☑			TCPIP	SIMULATOR	m+p international	1	1	
☑			TCPIP	EX1016A	VTI Instruments Corporation	121002	1.20.0.122	
☑			TCPIP	NI-9213	National Instruments	01B2F3A4	1.20.0.135	1
☑			TCPIP	NI-9215	National Instruments	01B346DF	1.20.0.135	2
☑			TCPIP	NI-9402	National Instruments	01B1BFBA	1.20.0.135	7
☑			TCPIP	EX1629	VXI Technology Inc.	119637	1.20.0.170	
☐			TCPIP	SIMULATOR	m+p international	2	2	
☐			TCPIP	SIMULATOR	m+p international	3	3	
☑			USB	USB-6001	National Instruments	0198C18B		

Standalone Data Acquisition

For standalone acquisition m+p Coda is used with the m+p VibMobile front-end. The application software is installed on the embedded CPU to which monitor, keyboard and mouse are connected. The data will be stored on an onboard SSD disc. You can analyze this data either directly on the monitor or on a remote PC or laptop.

Measurement Functions

m+p Coda supports ¼-, ½-, full-bridge configurations, rosette type sensors, standard thermocouple types (J, K, T, E, S, R, B, N, and user-definable) as well as voltage and current transducers. During the test run the relative zero point (or reference) of all or selected channels can be acquired at any time. A GPS receiver can be connected for time and location information as well as CANbus interfaces.



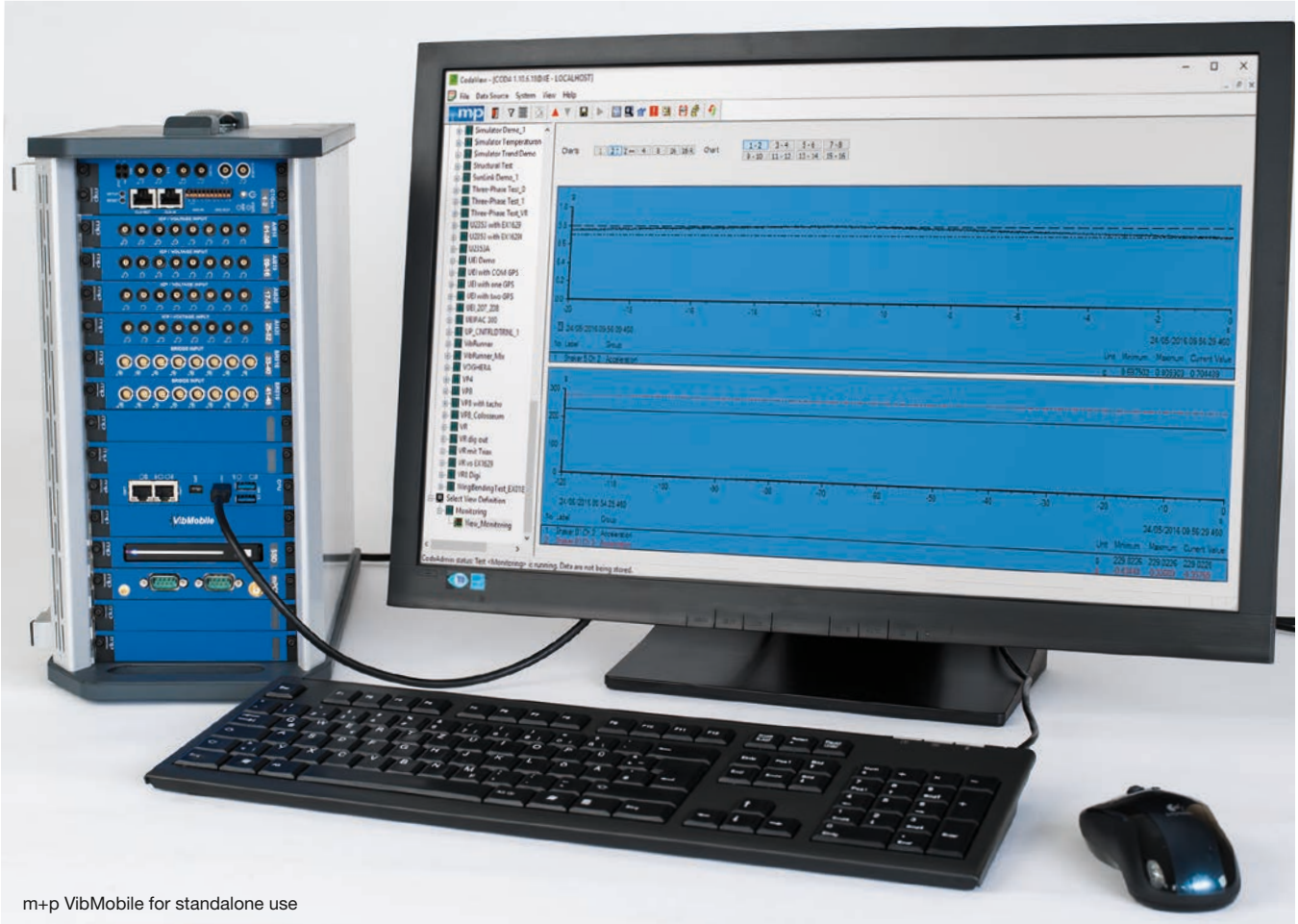
Two-port CANbus and GPS receiver on a single board

Data Storage

Powerful storage functions allow for data management and temporary or permanent, preprogrammed or event-controlled data storage for all or selected channel groups.

Channel Grouping

Channels can be sorted into user-definable groups (e. g. sensor types, sub-assemblies of a large structure). Filtering channels according to groups simplifies configuration and subsequent analysis.



m+p VibMobile for standalone use

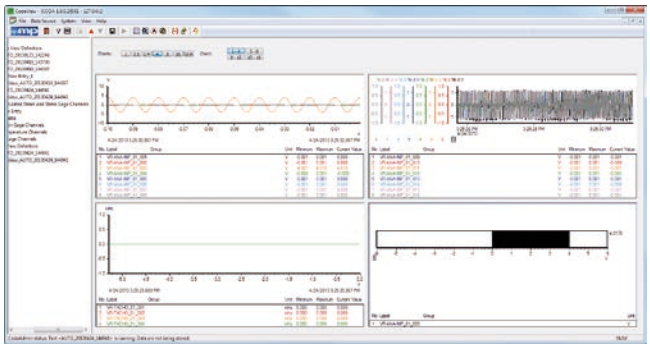
m+p Coda supports performance and functional testing of rocket engines

Real-Time Alarm Monitoring

Full-featured limit checking and alarm monitoring capability for all active channels. Out-of-limit data is displayed in a separate window and logged.

Comprehensive Visualization

As with the online data analysis, the measured values can be graphically displayed in a y/t- or y/x-diagram, as bar chart, tachometer, waterfall, FFT, PSD or digital numbers by a simple mouse-click. m+p Coda allows the user to design individual graphical interfaces.



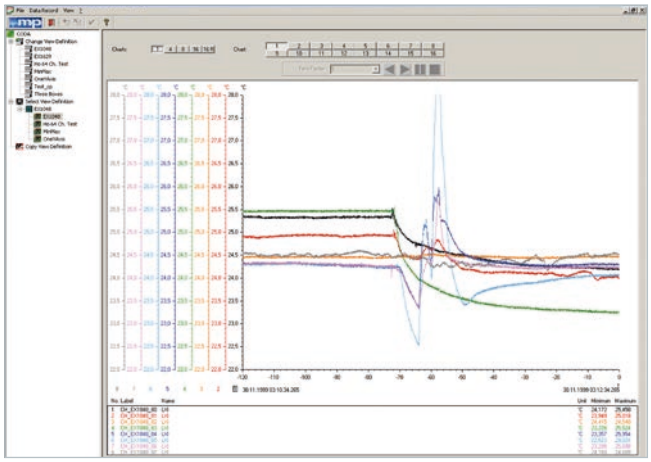
CodaView windows: displaying the channels in a multitude of ways

Advanced Analysis and Reporting

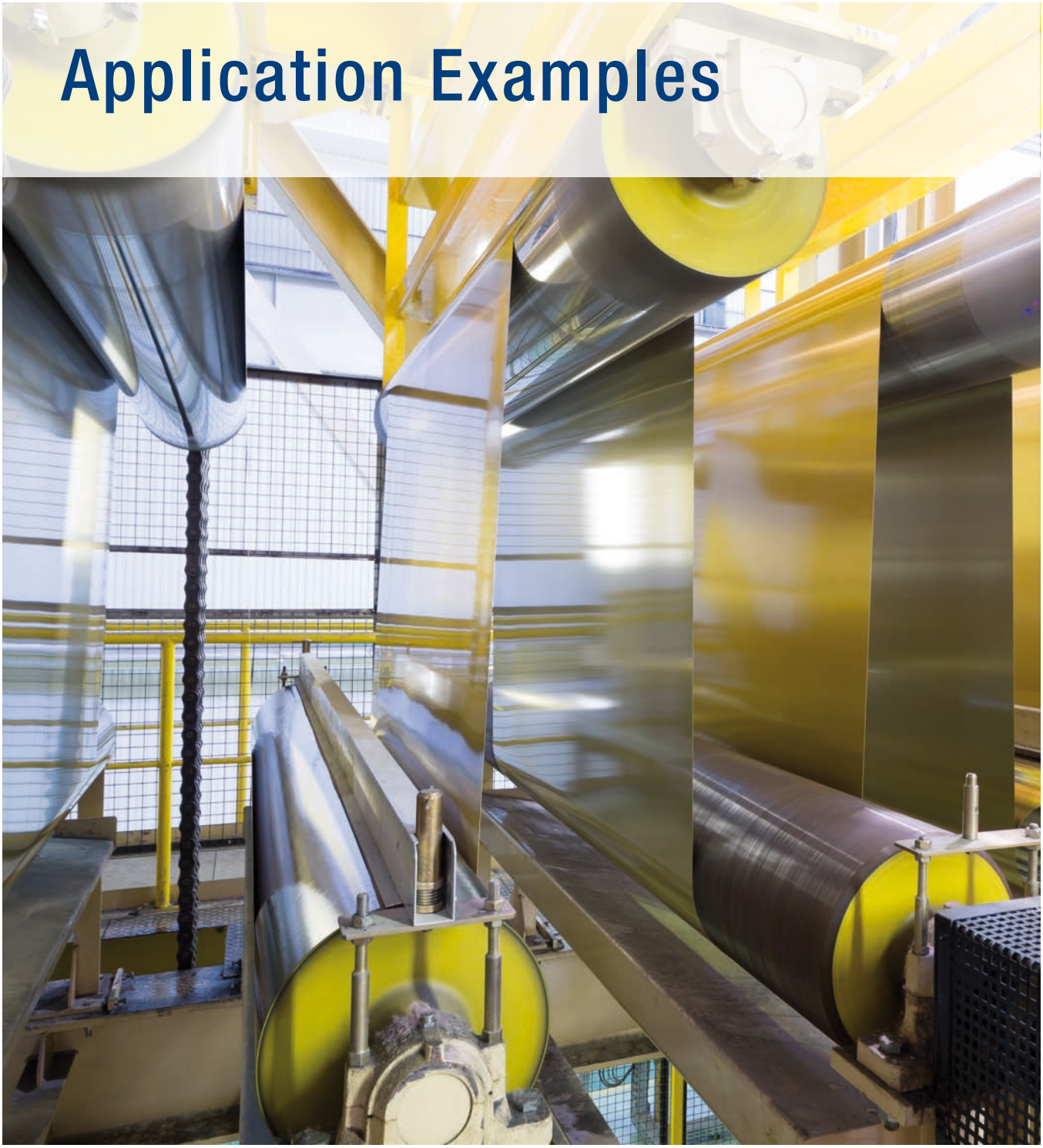
Convenient analysis tools are included for viewing measured data. The ultimate step is using the m+p eReporter software. It provides test engineers with powerful tools for the most demanding analysis and reporting tasks.

Data Export

The formatted data of selected or all channels can be easily exported into Excel, ASCII, MATLAB, m+p Analyzer or other popular analysis packages.



Application Examples



The following examples illustrate some of m+p Coda's typical acquisition and monitoring tasks.

Condition Monitoring

m+p Coda is a versatile monitoring system that captures and records signals coming from sensors such as accelerometers, thermocouples, strain gauges, and pressure transducers.

Limit checking and alarm monitoring is provided for every active channel. The active channels are clearly displayed in a separate window, out-of-limit data can be seen at a

glance. Alarm events are entered into a log file and can be reviewed at any time. You have the option to change the alarm limits online at any time without stopping the data acquisition.

Alarm window: alarm monitoring allowing the user to see the current status at a glance

Monitoring of Piping Systems

The mandatory inspection of piping systems in power plants is challenging because of their length and the severe environmental conditions. The networked monitoring system consists of the m+p Coda acquisition software installed on a standard PC and DAQ instruments which are located directly at the pipes.

m+p Coda supports hundreds of channels to measure and monitor the thermal expansion, temperature, pressure, vibration and weight of the pipes. These measurements are taken by using thermocouples, LVDT (Linear Variable Differential Transformer) sensors, pressure transducers and strain gauge load cells.

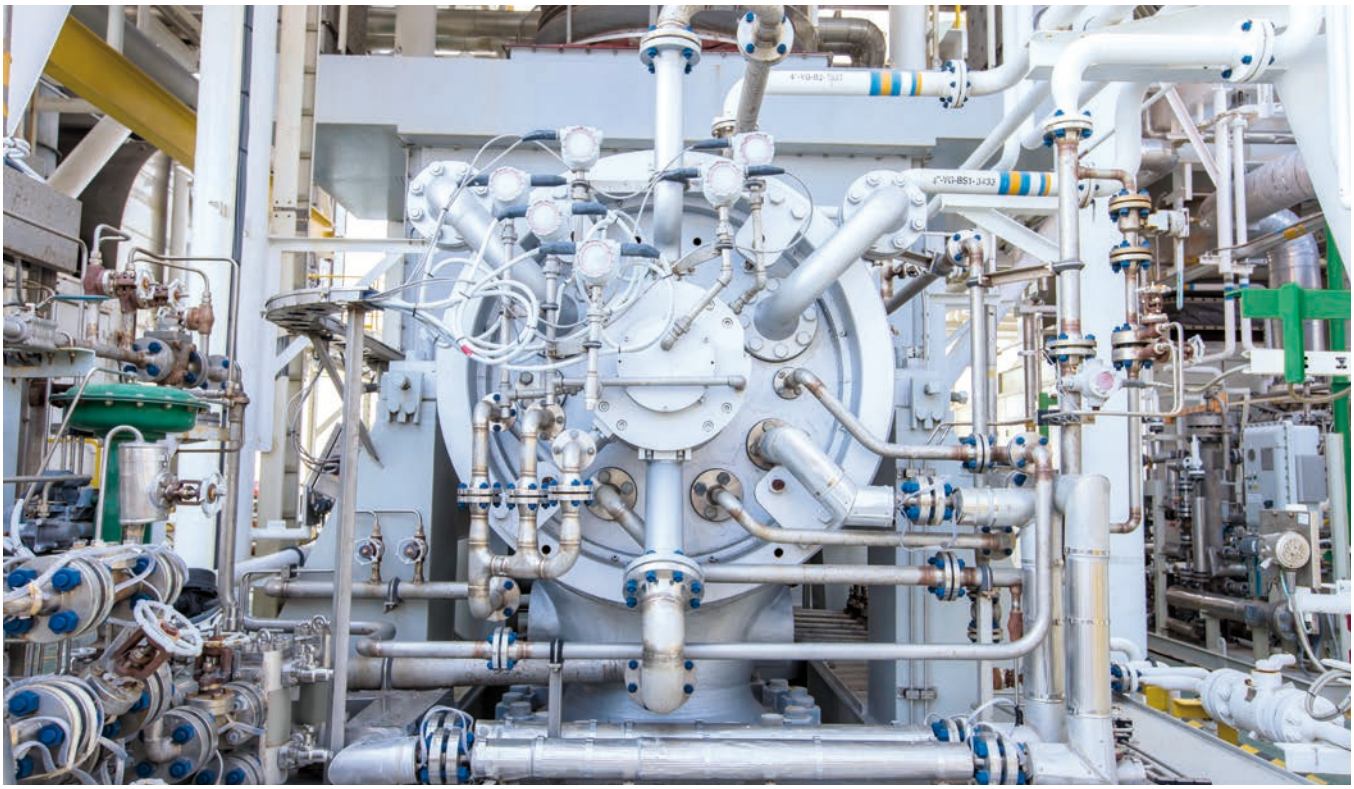
Multi-Channel Monitoring of Turbocompressors

Turbocompressors for the oil, gas and process industries undergo comprehensive testing. m+p Coda is used for continuous data acquisition and real-time monitoring of performance data and thermodynamic parameters. Several compressors can be tested in parallel. To meet different demands, m+p Coda is available as a high-channel count stationary system as well as a rugged mobile system for acquisition and monitoring under original conditions at customers' sites.

Vibration Monitoring during Shaker Test

Vibration tests must be safe and reliable and this is especially true for high value specimens. m+p Coda captures and records signals such as acceleration, temperature and strain during vibration tests, irrespective of the vibration control system in use. It allows you to set alarm limits for test shutdown or a warning on any of the active channels. Specimen and shaker are reliably protected, e.g. against misconfiguration or defective sensors.

Multi-channel monitoring of compressors and piping



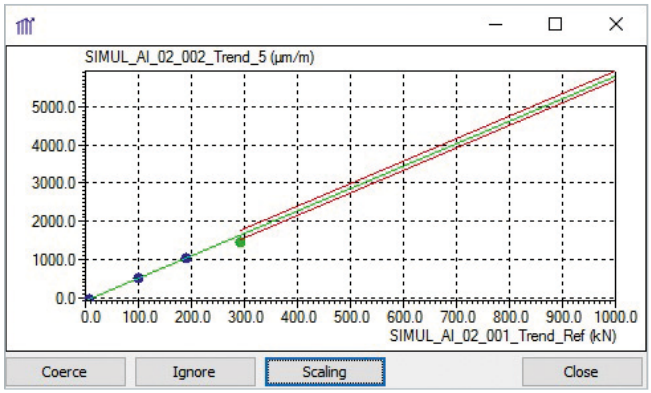
Experimental structural testing in the aerospace industry

Strain Measurements and Experimental Stress Analysis

Experimental structural testing using strain gauges is necessary in a wide range of applications from airframes and sub-assemblies down to individual components such as turbine blades, satellites, wind turbines and many others. These tests enable the engineers to compare the acquired data with the predicted results from the design calculations.

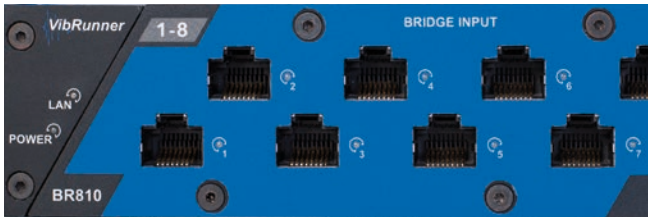
Its modular design and easy parameterization make m+p Coda ideally suited for experimental structural testing and multi-axis strain and stress analysis. Features include measurements with single- and multi-channel strain gauges, real-time strain and stress calculations, limit checking and communication with the load control system. m+p Coda provides limit checking and alarm monitoring on every channel.

m+p Coda supports ¼, ½, full-bridge configurations and rosette type sensors, also thermocouples and RTDs for temperature compensation are supported. An optional linear trend of strain gauge signals allows tracking with respect to the reference channel (e.g. force).



Linear trend tracking of strain gauge signals

m+p Coda supports the 8-channel bridge module VRBR810



Thermo-Man® mannequin equipped with 122 heat sensors

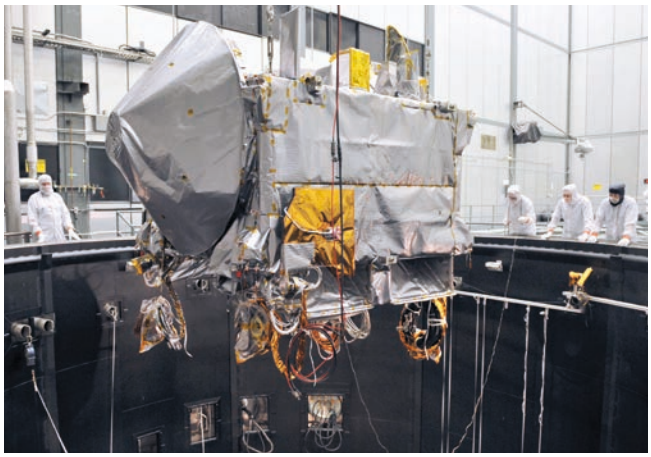
Thermo-Man® in action

Temperature Measurements

Temperature is one of the most common types of measured quantities. With m+p Coda, you can measure temperature in various environments and for various test requirements. It also addresses demanding distributed measurement applications over large distances. m+p Coda accepts all standard thermocouple types and RTDs. Open channels are marked by the software.

Applications include:

- Climatic chamber testing
- HALT/HASS testing
- Temperature acquisition in turbine test cells for jet engines
- Vibration testing of exhaust systems with hot gas
- Temperature measurements of solar modules
- Testing of heat protective clothing



Testing in a thermal vacuum chamber

> *Your folks have done a great job converting our software requirements specification into an efficient GUI that addresses our specific needs. We look forward to continue working with m+p as we further refine the Thermo-Man® software package.*
>
> Roger Parry, Principle Investigator at DuPont Protection Technologies, Richmond, Virginia/USA

m+p international

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Founded in Hannover, Germany in 1980, m+p international develops and manufactures test and measurement systems for vibration testing, dynamic signal analysis, multi-channel data acquisition and monitoring and test stand engineering. Our product reputation and broad experience coupled with valuable user feedback have led to significant market share in numerous key industries worldwide.

The company has its headquarters in Hannover, Germany with sales/marketing subsidiaries in New Jersey (USA), England, France and China, along with representatives and agents in many countries.

Learn more on the full range of m+p international products and services and their applications. Select the m+p literature library on our website and download the desired product literature.

m+p VibControl, m+p Analyzer, m+p Coda, m+p VibPilot, m+p VibRunner, m+p VibMobile, m+p HFDST-3000-E and m+p ACON are products of m+p international.

Specifications subject to change without notice.

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