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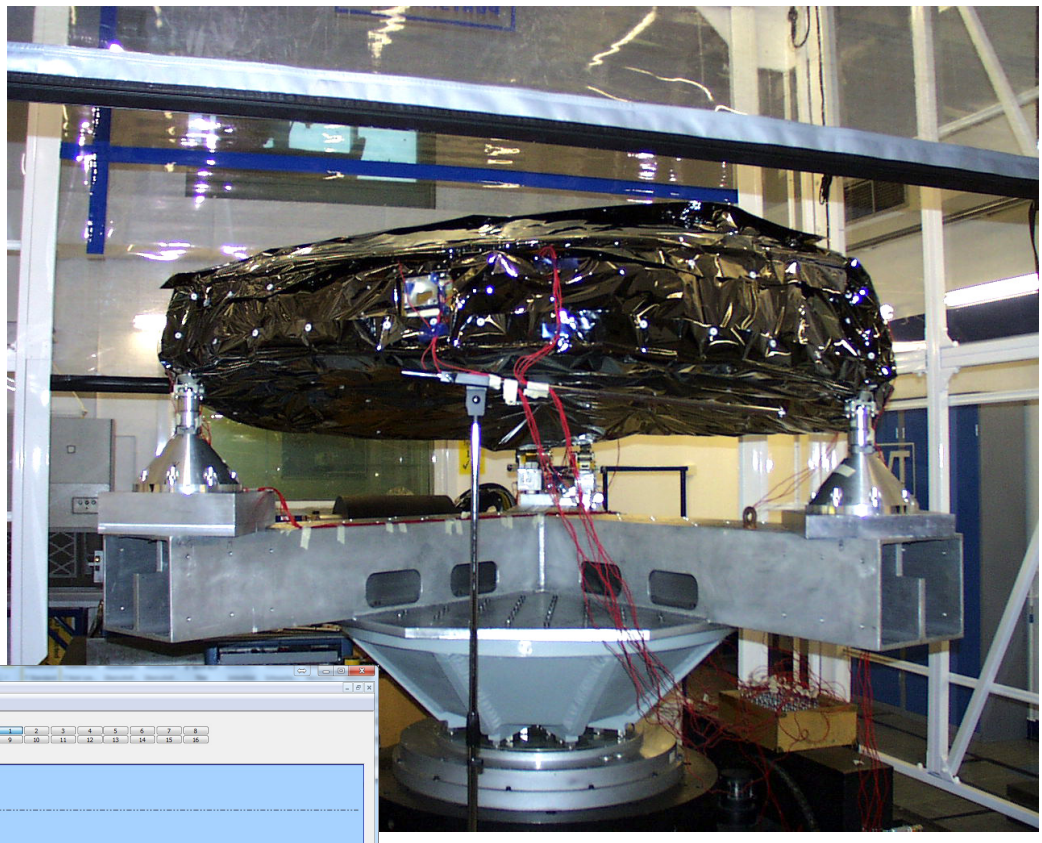
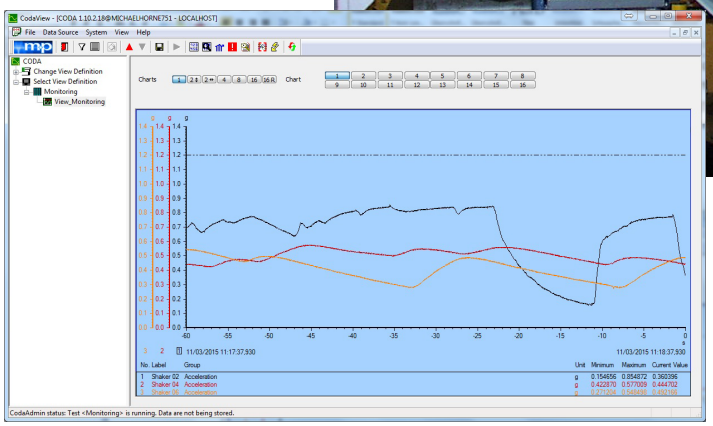
m+p Coda

Vibration Monitoring System

Vibration tests must be safe and reliable and this is especially true for high value specimens in critical aerospace testing applications. Here, m+p Coda offers maximum safety: The monitoring system captures and records data such as acceleration, temperature and strain during vibration tests – irrespective of the vibration control system in use. Each channel can be configured separately for total flexibility.





Monitoring of vibration tests

If the set limits are exceeded, defined events will be generated. For example, a digital output can be triggered to switch off the shaker and abort the vibration test or a relay switching a warning lamp will be set. 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.

m+p Coda protects the specimen and shaker reliably, e.g. against misconfiguration or communication loss of the vibration control system. It can also monitor continuously before, during and after a test with the vibration control system on-line or off-line.

To measure accelerations, temperatures and strains, m+p Coda supports the powerful m+p VibRunner acquisition hardware. m+p VibRunner is modular by design: The basic unit is a 19“ mainframe that houses up to three front-mounted functional modules. It can be used as a standalone desktop instrument or equipped with mounting brackets for 19” rack mounting.

The following modules can be configured:

- **8-channel A/D module**, 24-bit resolution, 102.4 kHz maximum sampling rate, sigma-delta A/D converter, ± 10 V input voltage, true differential/single-ended, AC/DC coupling, ICP/TEDS support, BNC connections with LED status information in ICP mode.
- **8-channel bridge module**, 24-bit resolution, 102.4 kHz max. sampling rate, ¼- , ½- or full bridge for 120, 350 or 1.000 Ω strain gauges, 0 to ± 5 V programmable voltage, input voltage for strain gauges ± 100 mV, ± 1 V, input voltage for voltage channels ± 100 mV, ± 1 V, ± 10 V, 8-pin RJ45 or LEMO connectors.
- **8-channel temperature module** for thermocouples types B, E, J, K, N, R, S, T or RTDs, 24-bit resolution, 205 Hz max. sampling rate, TEDS support.

When several m+p VibRunner frontends are operated in parallel, data acquisition over all devices and channels will be exactly synchronized. This is made possible by the use of a daisy-chain connection which feeds the clock from the master frame to all slave devices. This is especially useful for measurements on large objects where the m+p VibRunner frontends can be placed close to the measuring points and be synchronized over longer distances.

Example: 24-channel m+p VibRunner

- 3 slots for functional cards
- 8/8 digital I/O channels (TTL level)
- Ethernet 1 Gbit TCP/IP IEEE802.3 interface
- Clock-in/clock-out port to synchronize several m+p VibRunner frontends

The following two examples illustrate how m+p Coda is used for efficient monitoring of vibration tests.

Example 1: Continuous Monitoring of Multiple Shakers at Different Sites

A European customer in the defence industry utilizes m+p Coda for continuous data acquisition, data processing and real-time monitoring of their shakers. They test missiles or subcomponents on their shakers.

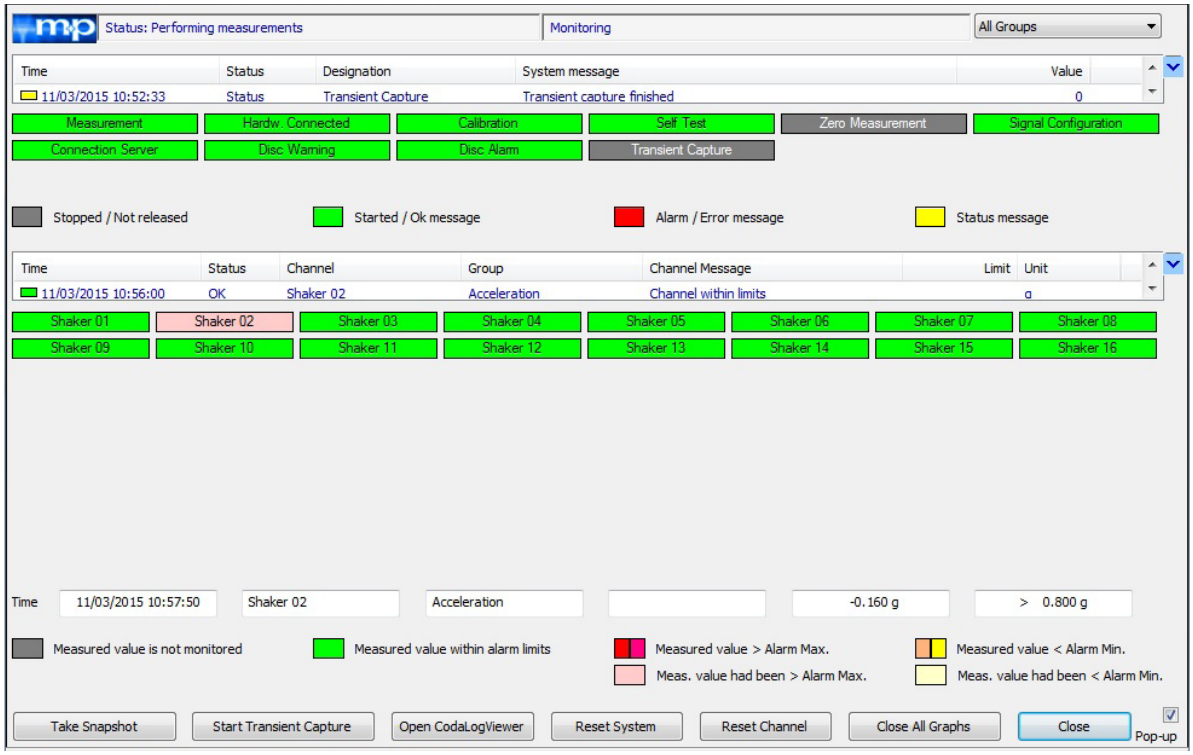
The customer continuously monitors multiple shakers using accelerometers that are mounted to the shakers and the unit under test. The shakers have to be monitored 24 hours per day, 7 days a week. The data acquired from the shakers is stored centrally. If the defined levels are reached, an alarm will be triggered.

The shakers are located in multiple factory buildings. For monitoring purposes, the m+p Coda software is installed on a data acquisition server and m+p VibRunner frontends, one in each building, are connected to this server via Ethernet. The m+p VibRunners have in excess of 20 channels. The channel count can be extended to 48 channels within the existing chassis, if required.

ICP accelerometers are connected to the m+p VibRunner frontends. m+p Coda acquires and stores the data continuously at up to 102.4 kHz. An independent alarm limit can be configured for each accelerometer. The alarm limits can be changed online at any time without stopping the data acquisition.

When the alarm limit is exceeded, a transient capture data block will be generated starting 15 seconds before and ending 20 seconds after the event (time adjustable) and stored separately. Afterwards these transient capture blocks can be selected and analysed in m+p Coda.

The data and alarm limits are visualized on the m+p Coda server and each client PC connected to the server via Ethernet.



m+p Coda: Clearly arranged display of all active channels and out-of-limit data

Example 2: Real-Time Monitoring and Safety Shutdown for Spacecraft Vibration Testing

Specimen protection systems have been used for many years in aerospace vibration testing as an independent fail-safe system to back up the vibration controller. In most cases the number of independent monitors is limited by the specimen protection systems which also only provide the shutdown capability without the ability to capture the alarm event. The m+p Coda system eliminates these limitations while providing the added capability of capturing the alarm event that triggered a test shutdown.

Our customer, a US-American spacecraft manufacturer, was upgrading an out-dated analog system. They chose the m+p Coda system for their multi-channel specimen protection system. The system they configured is a 48-channel system based on the m+p VibRunner acquisition hardware. The m+p Coda software allows the test engineers to set alarm limits for test shutdown on any of the 48 channels, sampled at up to 102.4 kHz. A digital relay system connects the m+p Coda system to the power amplifiers and the vibration control system. A combination of acceleration and strain signals are monitored for specimen protection.

48-channel m+p Coda monitoring system for specimen protection

One of the greatest benefits to m+p Coda is the ability to capture and record the actual measurement signals that triggered the system. The user can set a pre-trigger and post-trigger time in seconds which will be stored. This greatly enhances the troubleshooting methods.

The customer plans to add 48 additional channels in the next phase of their laboratory upgrades. Future expansion plans may include the ability to monitor, acquire and alarm on facility's temperature, pressure, voltage and currents.

By measuring amplifier current, slip table hydraulic pressure and coolant temperatures the electrodynamic shaker will also be monitored.

Conclusion: The independent m+p Coda monitoring system provides all relevant signals from the unit under test and the shaker in a very compact format. The signals are recorded and monitored continuously during the vibration test. m+p Coda ensures that alarm events triggered by defective sensors or misconfiguration are avoided or can be used to switch off the shaker immediately.

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listens to customers ...

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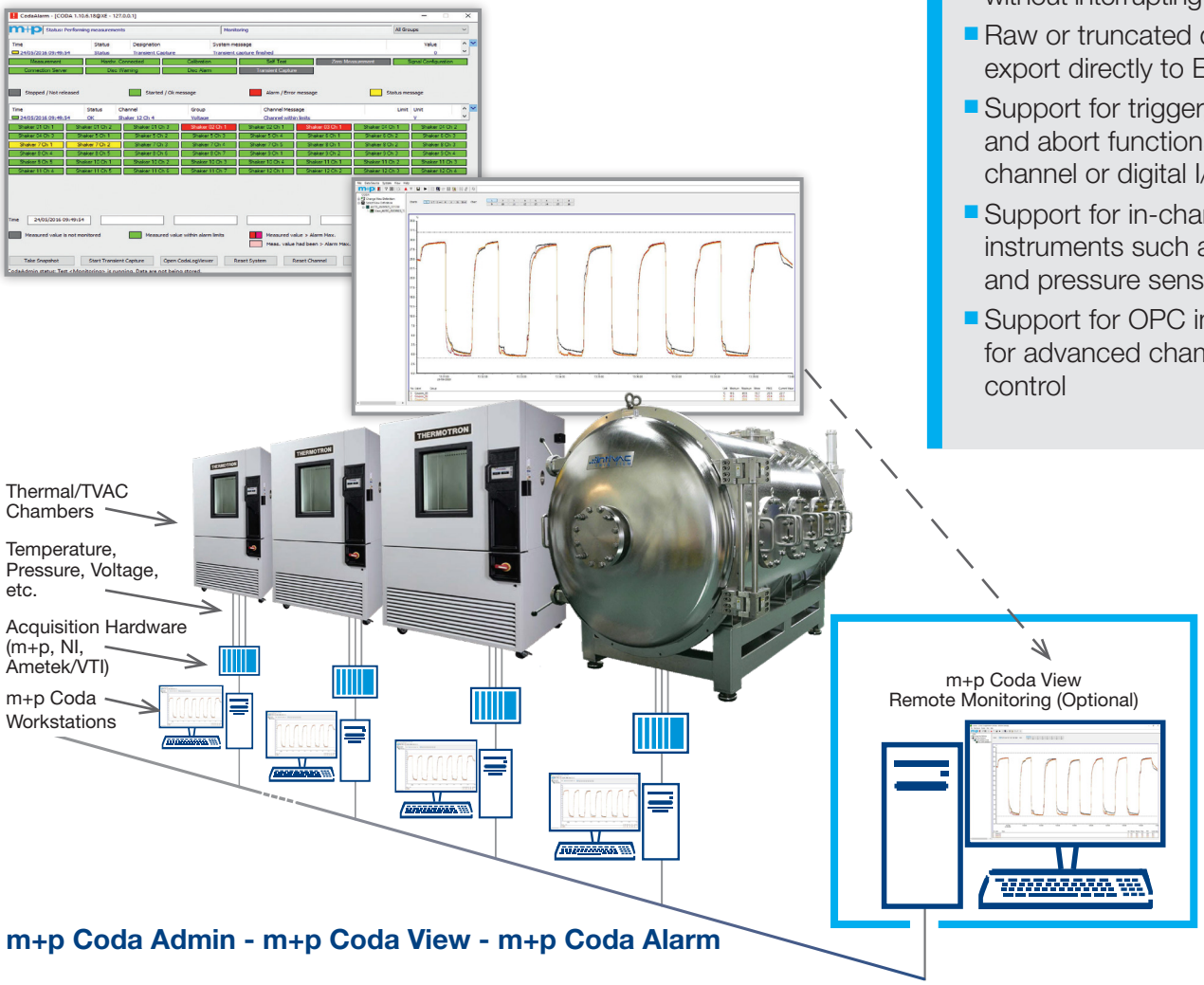
m+p Coda

Thermal Acquisition System

With m+p Coda, m+p international supplies a scalable temperature/voltage acquisition system that requires no advanced training or programming knowledge to operate. From routine bake-out operations to full-scale spaceflight hardware tests, m+p Coda combines accurate and reliable data collection that goes beyond standard temperature loggers with the ease-of-use and scalability you expect from m+p international.

Key Features

- Supports from eight to thousands of channels for all environmental sensors
- Supports several hardware types simultaneously, at various sample rates (up to 204.8 kSa/s)
- Easy setup and operation
- User configurable plots
- Real-time thermal balance, trends, and alarm alerts
- Data can be viewed online, offline, and remotely via secure network connection without interrupting acquisition
- Raw or truncated data export directly to Excel
- Support for trigger, alarm and abort functions via channel or digital I/O (TTL)
- Support for in-chamber instruments such as TQCM and pressure sensors
- Support for OPC interface for advanced chamber control



m+p Coda Admin - m+p Coda View - m+p Coda Alarm

m+p Coda Admin allows test engineers the ability to create dynamic test definitions, average and group datasets by location, and restrict access to protected test setups without any programming knowledge or advanced training. Once tests are operational, m+p Coda View gives technicians a powerful suite of display options that simply aren‘t possible with standard programmable laboratory software. m+p Coda Alarm provides advanced monitoring operations on any and all channels. With programmable alarm & stability events as well as remote notifications, m+p Coda Alarm keeps you in the loop even if you aren‘t in the lab.

m+p Coda is …

… scalable

Support for many different hardware platforms such as m+p VibRunner, m+p VibPilot, m+p VibMobile, Ametek VTI EX-XXXX, NI and CAN over USB or Ethernet. Disparate hardware platforms may be operated simultaneously and at differing sample rates. This open architecture allows for easily adopted and integrated third-party hardware.

… safe

Due to the network-based server-client architecture m+p Coda is the ideal solution for centralized fail-safe data acquisition, independently monitoring processes widely spread around a plant or laboratory.

… reliable

All data is kept in a circular buffer allowing for continuous data storage as well as triggered storage before, during and after an alarm/abort condition. Data from all channels is available for documentation and post-processing and can be viewed and exported, without interrupting a test, on the host machine or remotely.

… versatile

Support for many different sensor types: temperature, pressure, acceleration, displacement, DC values, strain, force, current, gas flow and electrostatic radiation. Sensor types can be mixed by combining different hardware platforms, allowing you to select the ideal signal conditioner for each of your sensors. The powerful SQL database supports this mixing of signals as well as data grouping, which allows the user to filter by equipment location, sensor type or connected hardware. Grouping makes data management of a large number of mixed signals not only attainable, but easy.

m+p international

Founded in Hannover, Germany in 1980, m+p international develops and manufactures test and measurement systems for vibration control, dynamic signal analysis, data acquisition, process 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‘s headquarters is located in Hannover, Germany with sales/marketing subsidiaries in New Jersey (USA), England, France and China, along with representatives and agents in many countries.

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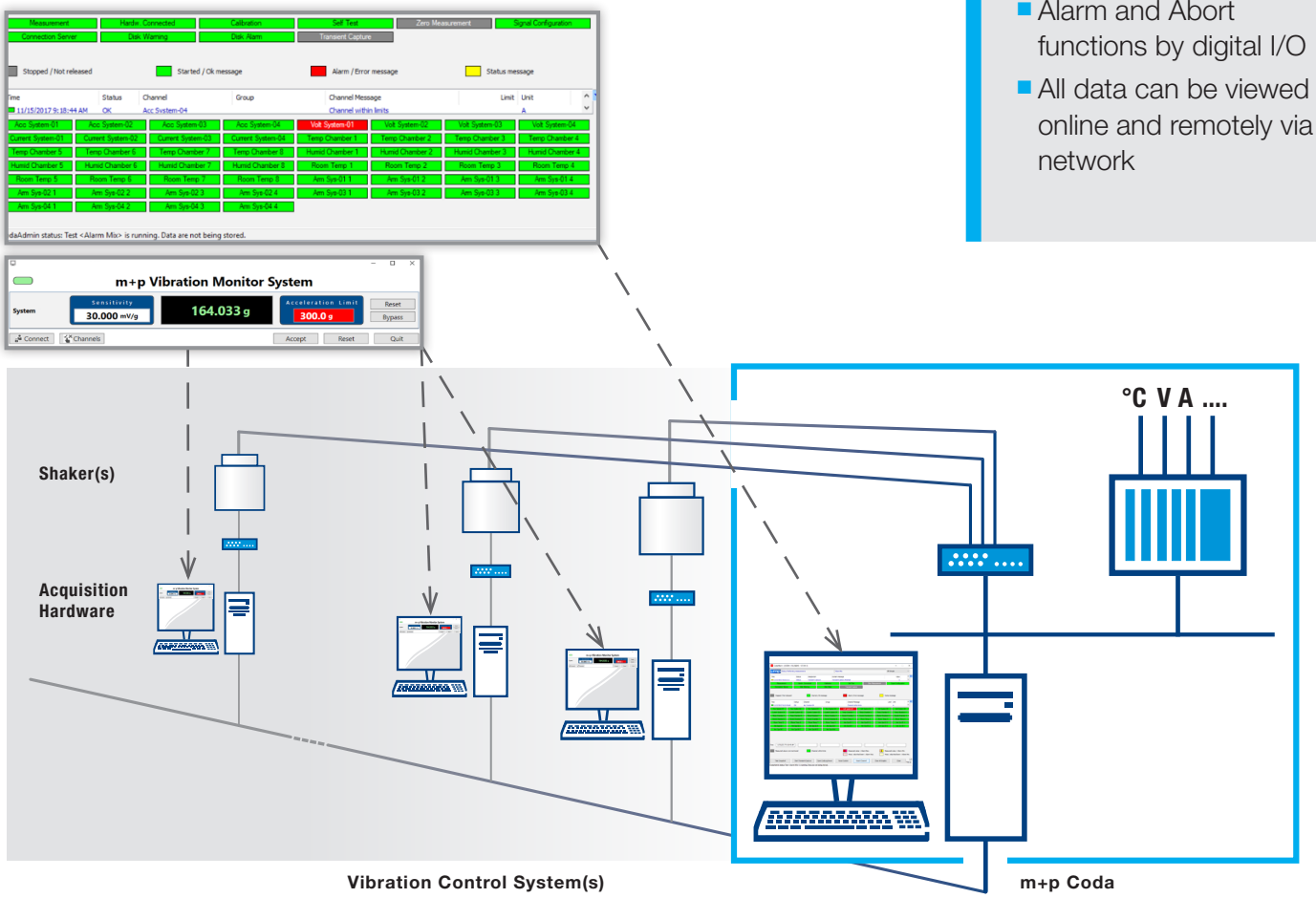
Vibration Monitoring System

With m+p Coda, m+p international supplies a digital monitoring system which ensures full protection of your high-value test items and shakers regardless of the controller manufacturer. In critical vibration testing applications, there is a need to monitor signals that are independent from feedback measured for control purposes. m+p Coda is such an independent specimen protection system which guarantees a safe testing environment without influencing the vibration control task and system performance.

Key Features

- Centralized data acquisition server
- Applicable to any vibration control system
- Extendable to multiple shakers and sensors
- Support of many hardware platforms and signal types
- Sampling rates up to 204.8 kHz
- Alarm and Abort functions by digital I/O
- All data can be viewed online and remotely via network



Exemplary setup

A self-contained server runs m+p Coda service (Fig. 1 right). Data acquisition hardware is installed to acquire e.g. ambient data at a slow rate as well as high sampled vibration data from different shaker test stands. All acquired data is stored on a common time base on the m+p Coda server, allowing operators to review this data in real-time. During runtime all data is constantly monitored for prescribed alarm and abort limits providing an additional safety layer by triggerable events e.g. a shaker shutdown. Due to m+p Coda network-based server-client architecture, any subset of data can be streamed from the server to a client. This allows for a compact vibration monitor on the client PC informing operators about the status of individual test stands. Data acquisition is independent of the test stands DAQ system, thus providing crucial information on the test specimen before, during and after the test.

m+p Coda is …

… scalable

Support of many different hardware platforms such as m+p VibRunner, m+p VibMobile, m+p VibPilot, VTI EX xxxx, NI hardware, CAN, USB, Ethernet. The open architecture allows to easily adopt and integrate any third-party hardware.

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