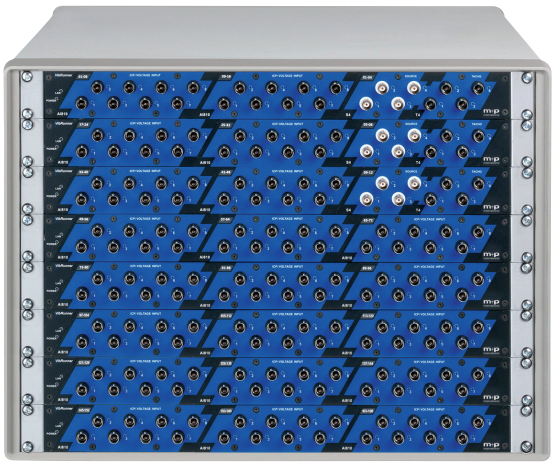
m+p VibRunner

Measurement Hardware Platform for Noise & Vibration Analysis, Vibration Testing and Process Monitoring

m+p VibRunner is m+p international's measurement hardware platform tailored to the specific needs of high-channel count noise & vibration analysis, vibration testing and static and dynamic data measurements such as strain measurements. It is designed for the flexibility of functioning as a desktop instrument or as 19" rack-mount unit. A typical configuration comprises three A/D converter modules for a total of 24 input channels, or alternatively, two A/D converter modules for 16 input channels and one module featuring two or four sources and tachos each. To extend input channel count and functionality, multiple m+p VibRunner front-ends can be synchronized by a daisy-chained master/slave configuration.





m+p VibRunner front-ends mounted into a 19" rack

Based on the latest IC technology m+p VibRunner provides high-precision measurement capability and impressive real-time performance. With 24-bit sigma-delta A/D converters with up to 204.8 kHz sampling rate, m+p VibRunner allows for alias-protected measurements in a frequency range up to 80 kHz and more than 120 dB spurious-free dynamic range.

m+p VibRunner is equipped with a 1 Gbit/s Ethernet interface to the host PC or laptop. The hardware is integrated into its own secure subnet, which is independent of other networks. This guarantees safe and fast communication.

The input channels can be switched between single-ended and full differential mode, thus allowing potential-free measurements such as those required on bridge circuits.

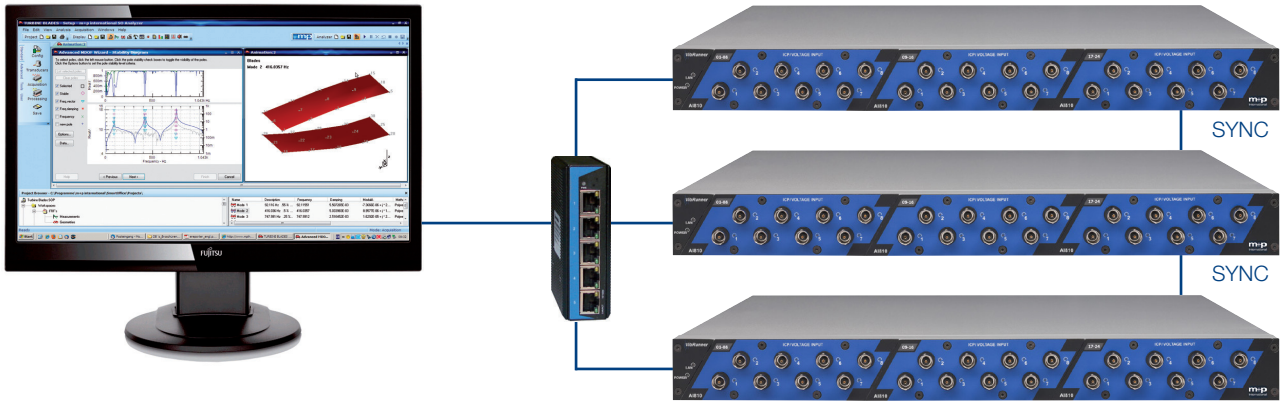
For strain measurements eight programmable channels of strain conditioning and excitation are available in a single module, allowing for remote operation.



24-channel m+p VibRunner equipped with three modules

Key Features

- Desktop or 19” rack mounting, 1U high, 3 slots for modules
- 8 – 24 analog input channels per m+p VibRunner
- Differential and single-ended measurements
- Up to 204.8 kHz simultaneous sampling, multiple gain amplifiers
- Strain measurements
- IEPE sensor conditioning
- TEDS support for automatic front-end and transducer detection
- 2 – 12 source output channels (differential)
- Safety shutdown for source channels
- 2 – 12 tacho inputs
- 8 digital inputs and 8 digital outputs
- DSP powered real-time processing
- Multiple m+p VibRunner synchronization, daisy-chain connection
- Ethernet interface, 1 Gbit/s transfer rate
- Silent operation, temperature-controlled fan



m+p VibRunner configuration

Applications

The m+p VibRunner hardware covers a large range of test and measurement applications from 16 input channels in a desktop instrument to high-channel counts in a 19” rack. It is optimally tuned to support m+p international‘s proven m+p VibControl, m+p Analyzer and m+p Coda software products for vibration testing, dynamic signal analysis and dynamic data measurement.



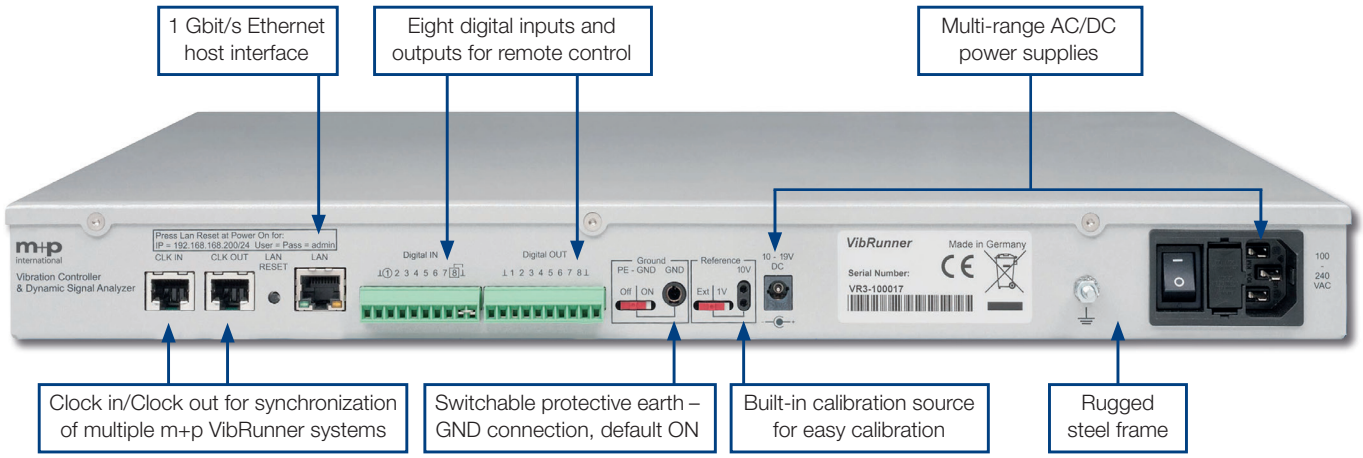
- Vibration testing on electrodynamic and hydraulic shakers
- Multi-axis vibration testing
- Noise & vibration testing
- Structural testing, modal analysis, impact testing
- Stress and fatigue testing
- General purpose bridge measurements
- Test stand engineering
- Process data acquisition and monitoring
- Multi-channel vibration data acquisition including continuous time history recording and data reduction

Basic Unit

The m+p VibRunner basic unit includes the communication and power supply and houses up to three front-mounted functional modules. m+p VibRunner is powered by a 100 – 240 V AC or, alternatively, by a 10 – 19 V DC supply. The low-noise, temperature-controlled fan can be switched off, if required.

The 1 Gbit/s Ethernet interface is used for communication with the host PC or laptop. The interface allows the m+p VibRunner to be placed close to the test specimen and reduces transducer cabling. The m+p VibRunner hardware is integrated into its own separate subnet which guarantees high data transfer rates even when a high number of input channels is utilized.

Eight digital inputs and eight digital outputs support various testing tasks, e.g. combined environmental tests or parallel functional tests of the specimen.



m+p VibRunner rear view

Basic Unit Specifications

General Characteristics	
Mains power supply	100 to 240 V AC
Power consumption	57 W max.
DC input	10 – 19 V, 60 W max.
Fan	Controlled by temperature sensor, can be switched off
Dimensions	Height: 44.45 mm (1U), width: 440 mm (19”), depth: 435 mm
Weight, kg	5.2 (fully equipped)
Housing material	Steel painted, aluminium blend frames
Digital Input/Output	
Number of digital I/Os	16 (8 inputs, 8 outputs), isolated, one input as safety shutdown
Trigger input	1 digital input
Level	TTL (H: > 2.4 V, L: < 0.8 V)
Output current	- 25 to + 10 mA
Connectors, Rear Side	
AC input	C14 connector
DC input	Jack socket
Digital input/output	8/8 Combicon with 2 screw terminals
Host interface	RJ-45, 1000Base-T Ethernet, 1 Gbit/s data transfer rate, connection via Ethernet switch
Clock in/out	2 RJ-45
Calibration source	Measurement jacks
System ground	4 mm banana jack

Switch, Rear Side	
Power on/off	Yes
Indicators, Front Side	
Power on	1 LED, green
Communication	1 LED, green: signal, red: error, off: no signal
Indicator, Rear Side	
Host interface	Link/activity LED in RJ-45

Multiple m+p VibRunner Operation

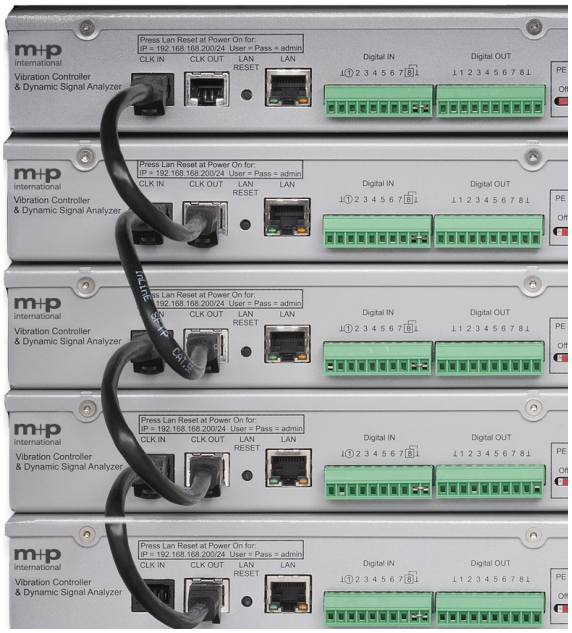


Two m+p VibRunner units operated together



m+p VibRunner units mounted into a 19” rack

For testing campaigns requiring a high number of input channels, multiple m+p VibRunner units are combined to act as one multi-channel system. Data acquisition is synchronized by a daisy chain connection and a master clock. The daisy-chained master/slave configuration means that the m+p VibRunner systems can be placed close to the measuring points and be synchronized over long distances. This minimizes costly transducer cabling and increases measurement quality.



Connection is done using a standard patch cable between the clock out connector of the first m+p VibRunner and the clock in connector of the next m+p VibRunner.

Synchronization of five m+p VibRunner front-ends

Multiple m+p VibRunner Operation Specifications

Synchronization	
Clock out	Master clock and synchronization pulse output
Clock in	Master clock and synchronization pulse input
Master/slave	Configured in software
Connection cable	Patch cable

Analog-to-Digital Converter Module VRAI810 (102.4 kHz)



8-channel A/D converter VRAI810 (102.4 kHz)

Analog input circuits have advanced sigma-delta converters which offer advantages such as simultaneous sampling by independent A/D converters on each input, reduced noise and improved accuracy due to 64 times over-sampling on each input. Both analog and digital filtering are used for full anti-aliasing protection and they provide excellent low-level signal-to-noise performance and differential linearity.

Signal conditioning for the analog input channels provides source capabilities for IEPE sensors including cable break indicators as well as an interface for accessing standardised Transducer Electronic Data Sheets (TEDS). TEDS support is a time-saving tool to automatically enter information stored in the transducer, e.g. sensitivity, calibration and serial number.

The input channels can be switched between single-ended and full differential mode for potential-free measurements.

Each A/D converter module has two 300 MHz floating point dynamic signal processors: one DSP for addressing the converters, offset correction and downsampling and the other one for signal processing and TEDS support.

Analog-to-Digital Converter Module VRAI810 Specifications

Analog Input	
Number of analog input channels	8
Channel type	Full differential or single-ended, switchable
Analog-to-digital converter type	Sigma-delta
Resolution	24 bits
Sampling rate per channel	Typically 65.536 and 102.4 kHz, programmable
Input voltage range	± 10 V
Overload protection	40 V max.
Input impedance	≥ 1 MΩ, capitance: 45 pF
Coupling	AC/DC, switchable per channel
AC coupling 3 dB corner frequency	0.34 Hz
Signal-to-noise ratio	≥ 105 dB (for short-circuited input)
Amplitude accuracy	± 0.06 dB (at 1 kHz)
Amplitude flatness	± 0.015 dB (DC to 40 kHz, relative to 1 kHz)
Spurious-free dynamic range	120 dB (typical 125 dB)
Cross-channel phase match	< 0.1 deg (at 1 kHz)
Channel crosstalk	≤ - 100 dB (at 1 kHz)

Frequency response	DC coupled: 0 Hz to 0.4 * fs - 0.1 dB AC coupled: 3 Hz to 0.4 * fs - 0.1 dB
Total harmonic distortion	- 95 dB (typical)
Alias protection	≥ 100 dB
DC offset	≤ 1.5 mV calibrated
IEPE power supply	4 mA, 24 V, switchable per channel
TEDS support	Yes, according to IEEE P1451.4, switchable per channel
Dynamic Signal Processors	
Number of DSPs	2, 300 MHz floating point
DSP 1	Addressing the converters, offset correction, downsampling
DSP 2	Signal processing, TEDS
Connectors, Front Side	
Analog input channels	8 BNC
Indicators, Front Side	
Input signal conditioning per channel	8 LEDs, green: IEPE operation red: IEPE error off: IEPE off

Analog-to Digital-Converter Module VRAI820 (204.8 kHz)



8-channel A/D converter VRAI820 (204.8 kHz)

The Analog-to-Digital Converter Module VRAI820 is the more powerful version of the VRAI810 module and includes a maximum 204.8 kHz sampling rate, configurable input architecture and gain as well as multiple clocking and trigger options. The VRAI820 is a useful tool for a range of special applications including ultrasonic measurements in sonar, automotive crash testing as well as in other high frequency event analysis such as explosive shock. With a full 24-bit precision at the 204.8 kHz sampling rate the VRAI820 ensures precise signal data is captured for both online and post-processing requirements.

The switchable input voltage ranges provide improved sensitivity for very low level vibration signals and microphone measurements as well as a higher range to handle higher outputs from sources such as tacho sensors. Six input ranges are available: ± 100 mV, 316 mV, 1 V, 3.16 V, 10 V and 20 V.

Another important feature of the VRAI820 module is the analog filter selection. The standard configuration consists of a 0.3 Hz and a 10 Hz AC filter. Optionally, a 0.05 Hz AC filter can be purchased which replaces the 10 Hz filter.

Analog-to-Digital Converter Module VRAI820 Specifications

Analog Input	
Number of analog input channels	8
Channel type	Full differential or single-ended, switchable
Analog-to-digital converter type	Sigma-delta
Resolution	24 bits
Sampling rate per channel	204.8, 102.4, 81.920, 65.536, 51.2 and 32.768 kHz programmable, additional downsampling in DSP
Input voltage range	± 100 mV, 316 mV, 1 V, 3.16 V, 10 V, 20 V peak full scale
Overload protection	40 V max.
Input impedance	> 1 MΩ (100 kΩ in 20 V range), capacitance: 20 pF
Coupling	AC/DC switchable per channel
AC coupling	0.3 Hz, 10 Hz (switchable) Optional: 0.05 Hz replacing 10 Hz
Signal-to-noise ratio	At 102.4 kHz sampling: > 105 dB in 1 V, 3.16 V, 10 V, 20 V ranges > 92 dB in 100 mV range > 96 dB in 316 mV range
Amplitude accuracy	± 0.06 dB (at 1 kHz)
Amplitude flatness	± 0.015 dB (DC to 80 kHz, relative to 1 kHz)
Spurious-free dynamic range	120 dB (typically 130 dB)
Cross-channel phase match	< 0.1 deg (at 1 kHz)
Channel crosstalk	< - 100 dB (at 1 kHz)
Frequency response	DC coupled: 0 Hz to 0.4 * fs: 0.1 dB calibrated AC coupled: 10 Hz: 70 Hz to 0.4 * fs - 0.1 dB 0.3 Hz: 2 Hz to 0.4 * fs - 0.1 dB 0.05 Hz: 0.35 Hz to 0.4 * fs - 0.1 dB
Total harmonic distortion	At 102.4 kHz sampling: < 100 dB
Alias protection	> 100 dB
DC offset	< 1.5 mV calibrated
IEPE power supply	4 mA, 24 V, switchable per channel
TEDS support	Yes, according to IEEE P1451.4, switchable per channel
Dynamic Signal Processors	
Number of DSPs	2, 456 MHz floating point
DSP 1	Addressing the converters, offset correction, downsampling
DSP 2	Signal processing, TEDS
Connectors, Front Side	
Analog input channels	8 BNC
Indicators, Front Side	
Input signal conditioning per channel	8 LEDs, green: IEPE operation red: IEPE error off: IEPE off

Digital-to-Analog Converter/Tacho Input Module VRT2S2/VRT4S4



4-channel analog output/4-channel tacho input

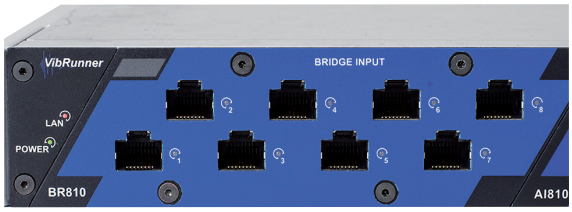
This module provides analog outputs for vibration testing or modal analysis applications requiring drive signals for the shakers and tacho inputs for rotating machinery testing. Two versions are available: one with 4-channel analog output and 4-channel tacho input and the other one with 2-channel analog output and 2-channel tacho input.

The analog outputs include a hardware shutdown circuitry which ramps down the source signals in a controlled manner in case of emergency, for example at power failure or when the connection to the host PC is lost. The tacho inputs with 32-bit high-speed up/down counters are used to measure synchronous signals on rotating machines.

Digital-to-Analog Converter/Tacho Input Module VRT2S2/VRT4S4 Specifications

Tacho Input	
Number of channels	2 or 4
Channel type	Differential or single-ended
Coupling	DC
Trigger threshold	- 10 V to + 10 V, programmable
Hysteresis	0 to 1 V, programmable
Input voltage	± 10 V
Overload protection	40 V max.
Counter	32-bit resolution, 24 MHz (max.)
Analog Output	
Number of channels	2 or 4
Channel type	Differential
Coupling	DC
Resolution	24 bits
Sampling rate	Synchronized with analog inputs, 102.4 kHz max.
Output voltage range	± 10 V, max. 10 mA
Output impedance	50 Ω
Signal-to-noise ratio	≥ 100 dB
DC offset	≤ 5 mV calibrated
Calibration	Offset
Frequency range	0 to 40 kHz (- 3 dB)
Signal shutdown	Yes
Dynamic Signal Processors	
Number of DSPs	2, 300 MHz floating point
DSP 1	Tacho inputs, D/A converter
DSP 2	Signal processing
Connectors, Front Side	
Tacho input channels	2 or 4 BNC
Analog output channels	2 or 4 BNC
Indicators, Front Side	
Tacho input channels	2 or 4 LEDs, on: trigger
Analog output channels	2 or 4 LEDs, on: signal output

Bridge Module VRBR810/VRBR810L



Bridge module

The m+p VibRunner bridge module simplifies experimental stress analysis and fatigue testing of mechanical structures. Optimally designed for both desktop and rack-mounted use, a single module enables connection of 8 strain gauges in full-, half-, or quarter-bridge configurations. The built-in bridge excitation and completion is individually programmable for each channel, thus making time-consuming hardware re-configuration of different gauge types unnecessary.

Typical applications include both static and dynamic strain measurements, load tests, fatigue tests for durability analyses, structural testing in aerospace, material testing and residual stress analysis.

Two versions are available: one with RJ-45 connectors and the other one with 9 pin LEMO 0B connectors. These robust and reliable connectors have proved ideal for flexible strain measurement configurations. All channels support TEDS to ensure fast, convenient and secure transfer of your transducer details to the m+p VibRunner bridge module.

The Ethernet interface allows for remote operation and integration of the m+p VibRunner system close to the measurement point to obtain the shortest possible sensor wire lengths and hence the best low noise performance.



Thermocouple amplifiers for RJ-45 and LEMO connectors

One input channel can be used for temperature measurements. The bridge module allows connection of a thermocouple amplifier type J or K with internal cold junction compensation. The amplifier produces a high level (5 mV/°C) output directly from a thermocouple signal.

Bridge Module VRBR810/VRBR810L Specifications

Analog Input	
Number of analog inputs	8 resistive bridge transducers
Resistor values	120, 350, 1000 Ω
Connector	8-pin RJ-45 or 9-pin LEMO 0B
Voltage mode	32 or 16 differential inputs, ± 10 V
Resolution	24 bits
Sampling rate per channel	max. 102.4 kHz, programmable
Bridge excitation	DC, symmetrical, 0 to ± 6 V, programmable for each channel, 12-bit resolution short-circuit protected, max. current 42 mA
Bridge completion	Half-bridge: programmable for each channel, 0.05 % Quarter-bridge: programmable for each channel 120, 350, 1000 Ω, 0.1 %
Shunt calibration	Built-in
Input voltage range	Signal inputs: ± 100 mV, ± 1 V, ± 10 V, programmable for each channel Sense inputs: ±10 V
Noise	100 mV range: SNR = 90 dB at 102.4 kHz sampling, input terminated with 120 Ω = 1.4 µV RMS/V at ± 1.25 V bridge supply 0.7 µV RMS/V at ± 2.5 V bridge supply 0.35 µV RMS/V at ± 5 V bridge supply 1 V range: SNR = 98 dB at 102.4 kHz sampling, input terminated with 50 Ω 10 V range: SNR = 104 dB at 102.4 kHz sampling, input terminated with 50 Ω Additional downsampling in DSP will improve SNR by 3 dB for each downsampling step
Total harmonic distortion	< - 90 dB

Crosstalk	< - 100 dB at 1 kHz between channels
Phase error	< 1° at 1 kHz between channels
Input protection	max. ± 25 V
CMRR	DC to 60 Hz, > 85 dB
Calibration	Offset and gain Internal programmable shunt calibration for each channel, 55 kΩ 0.05 %
TEDS support	8 channels, class 2
Filter	Per channel programmable digital filter: 4th order low-pass, or 4th order high-pass, or 2nd order bandpass low-pass 1 Hz to 100 Hz, high-pass 10 Hz to 10 kHz (max. 0.25 * fs)
Dynamic Signal Processors	
Number of DSPs	2, 300 MHz floating point, 64 Mbytes SDRAM, 8 Mbytes non-volatile flash memory
Connectors, Front Side	
Analog input channels	8 RJ-45 or 8 LEMO 0B 9 pin
Dimensions	
Size	220 x 100 mm (w x d)
Thermocouple Amplifier	
Types	J, K
Number of channels	1
Connectors	RJ-45 or 9 pin LEMO 0B, mini-TC
Output	5 mV/°C
Cold junction compensation	Yes
Initial accuracy	1 °C
Ambient temperature rejection	0.025 °C/°C
Ambient temperature range	0-50 °C or 25-100 °C

Environmental and Safety Specifications

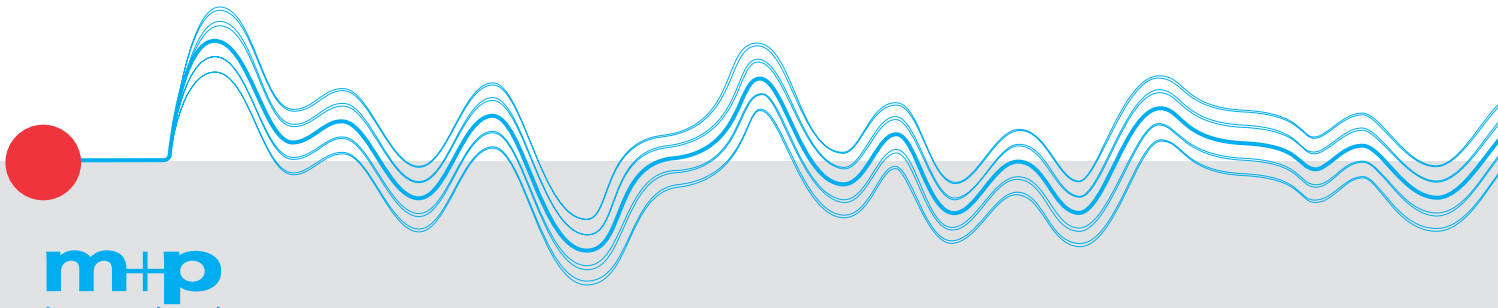
Environment	
Operating temperature	- 20° C to + 50° C
Storage temperature	- 25° C to + 70° C
Humidity	0 to 95% rel. humidity, non-condensing
Standards	
EMC compliance	Certified with DIN EN 55011, DIN EN 61000-4 (-2, -3, -4, -5, -6, -11), FCC Part 15 B, ICES-003: Issue 4 Contact discharge: 4 kV Air discharge: 8 kV

Warranty, Calibration, Upgrade and Repair Services

Warranty	
	12 months, optional 24 or 36 months
Calibration	
	m+p VibRunner hardware is calibrated before delivery and delivered with calibration certificate; factory re-calibration (return to m+p) and on-site calibration is provided
Upgrade	
	To add one or more modules, return the complete m+p VibRunner system to m+p
Repair	
	Return the complete m+p VibRunner system to m+p repair service; 24 hours back-to-operate guarantee (option)

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