VIBRATION MEASUREMENT

Analysing. Monitoring. Intuitive configuration.

Expert Vibro – MORE **FLEXIBILITY**

Expert Vibro is the device of choice for measuring a broad range of vibration types. Following on from the success of the 8 and 16 vibration input models, we are now pleased to offer you models with 4 and 12 channels thereby responding to the needs of many customers for even more flexibility. You can now implement precisely the application you require without any channel overhead.

Expert Vibro makes vibration measurement intelligible. State-of-the-art processor technology enables 4, 8, 12 or 16 synchronous measuring channels with sampling rates of up to 50 kHz per channel, for the smallest of spaces and tailored to your requirements. 24 bit A/D converters guarantee high-level precision.

You have the flexibility to switch between measuring voltages, currents, IEPE or shaft vibration sensors. Integrated comparators and digital inputs allow for flexible triggering. Measurement data is monitored online and, in the event of limit value violations, digital outputs can be switched within msec.

Intelligible **configuration**

Measuring vibrations using Expert Vibro is also possible for inexperienced users. Intuitive configuration ensures quick familiarisation and operation of the system. All relevant characteristic values are determined from time signals and spectra. Spectra are calculated online and stored autonomously together with time signals and characteristic values. Versatile software channels make the Expert Vibro suitable for in-depth analysis and monitoring requirements. A touch screen on the Expert Vibro provides a clear view of important configuration data and measurement data.
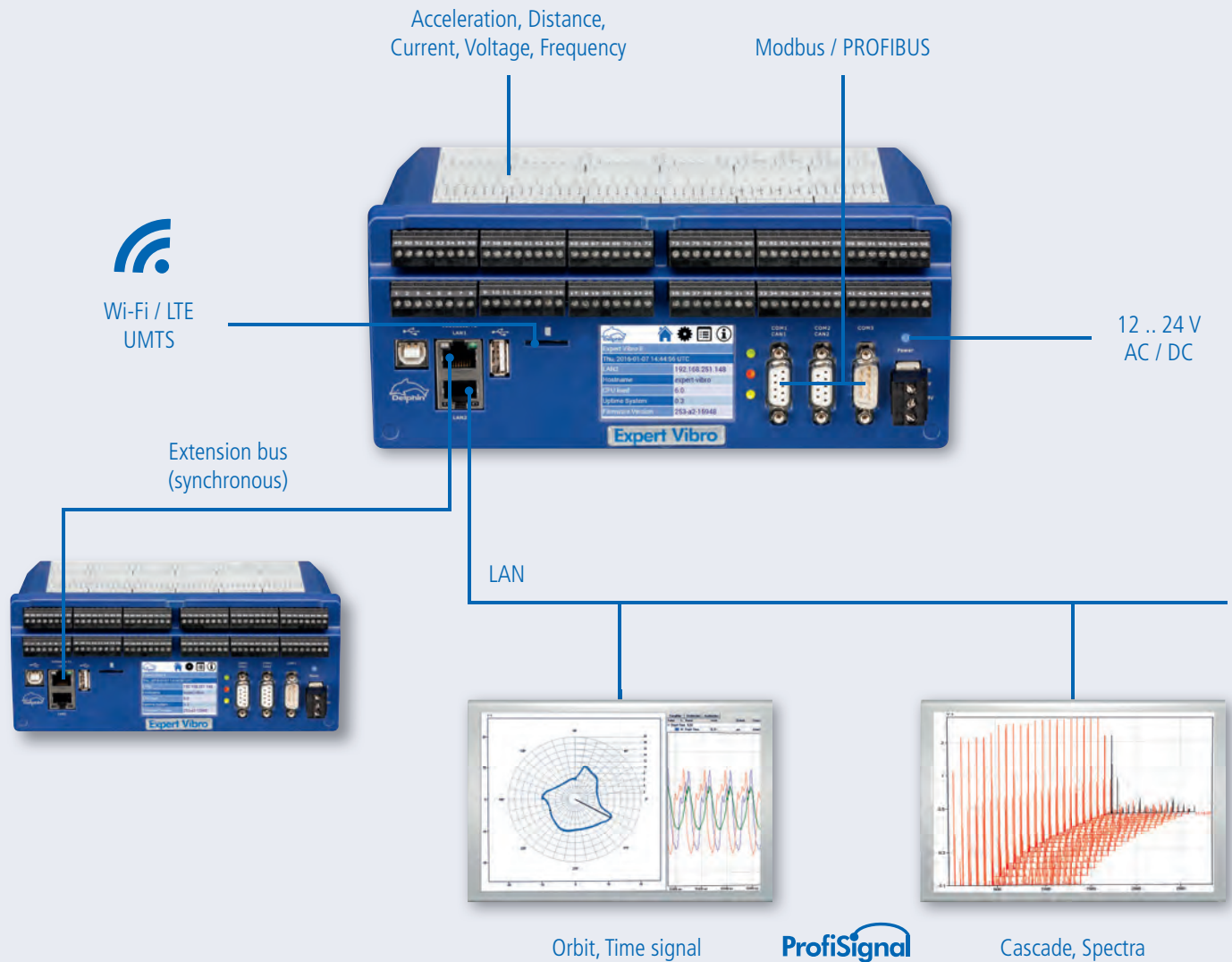
Inputs / Outputs	Type 4	Type 8	Type 12	Type 16
Analog inputs (mV, mA)	4	8	12	16
Analog outputs (mV, mA)	4	4	4	4
Digital / frequency inputs	4	4	4	4
Digital outputs	8	8	8	8

EVERYTHING IN **ONE SYSTEM**

Monitoring and online analysis

- Fast limit-value monitoring of time signals
- Monitoring of characteristic values
- Online calculation of measured values
- Spectrum – online – up to 12.800 lines (FFT)
- Diverse characteristic values (phase, frequency and amplitude values)
- Accounting and statistics function
- Integration functions (two-stage)

Expert Vibro – THE MEASUREMENT SPECIALIST

Acceleration, Distance,
Current, Voltage, Frequency

Modbus / PROFIBUS

Wi-Fi / LTE
UMTS

12 .. 24 V
AC / DC

Extension bus
(synchronous)

LAN

Orbit, Time signal

ProfiSignal

Cascade, Spectra

UNIVERSAL. COMPACT. **VERSATILE.**

Fully equipped – compact design

- 4 / 8 / 12 / 16 vibration inputs, individually triggerable
- 4 independent trigger groups (e.g. gear monitoring)
- 50 kHz sampling rate per channel ($\sum$ to 800 kHz) – internal, external data storage possible
- Up to 14 GB data storage
- 4 digital inputs for frequency measurement up to 1 MHz
- 8 digital outputs
- 4 analog outputs for monitoring tasks
- Convenient DIN rail-mounting
- Graphics-capable display for on-site viewing

Versatile applications

- Shaft vibration monitoring and analysis
- Machine and housing vibrations
- Roller bearing monitoring and bearing damage diagnostics
- Spindle monitoring and balancing
- Combustion chamber vibration monitoring
- Drive unit vibration analysis
- Air gap monitoring
- Mobile vibration measurement

Universal sensor connection

- Software-switchable analog inputs
  - Shaft vibration / distance sensors
  - Acceleration sensors
  - Vibration velocity sensors
  - mV / mA signals (pressure etc.)
- Switchable IEPE power supply
- Integrated comparators for KeyPhasor® sensors
- Measuring range up to ± 25 V
- Plug-in screw terminals

Diverse local and decentralized interfaces

- Interfaces to PCs
  - LAN interface
  - USB host for read-out of data memory
- Interfaces to fieldbuses
  - Modbus TCP
  - 2 x PROFIBUS DPV1 slave (redundant)
  - 3 x serial interfaces (Modbus RTU)
  - 2 x CAN interface
  - Optional OPC UA
- Remote monitoring
 - WLAN optional, GSM / UMTS / LTE optional

ProfiSignal – POWERFUL MEASUREMENT SYSTEM

Instant viewing
of measurement data

ProfiSignal provides you with comprehensive measurement software. In combination with the Vibro option, ProfiSignal can be adapted precisely to your vibration measurement needs.

When configuring channels and before visualising and analysing measurement data with ProfiSignal, you can pre-process your signals according to your specific needs. A multitude of filter options are available for this purpose. A Bode plot enables you to instantly view the effects of your filter configuration.

After configuration, you can visualise and analyse measurement data using ProfiSignal, without any additional programming effort.
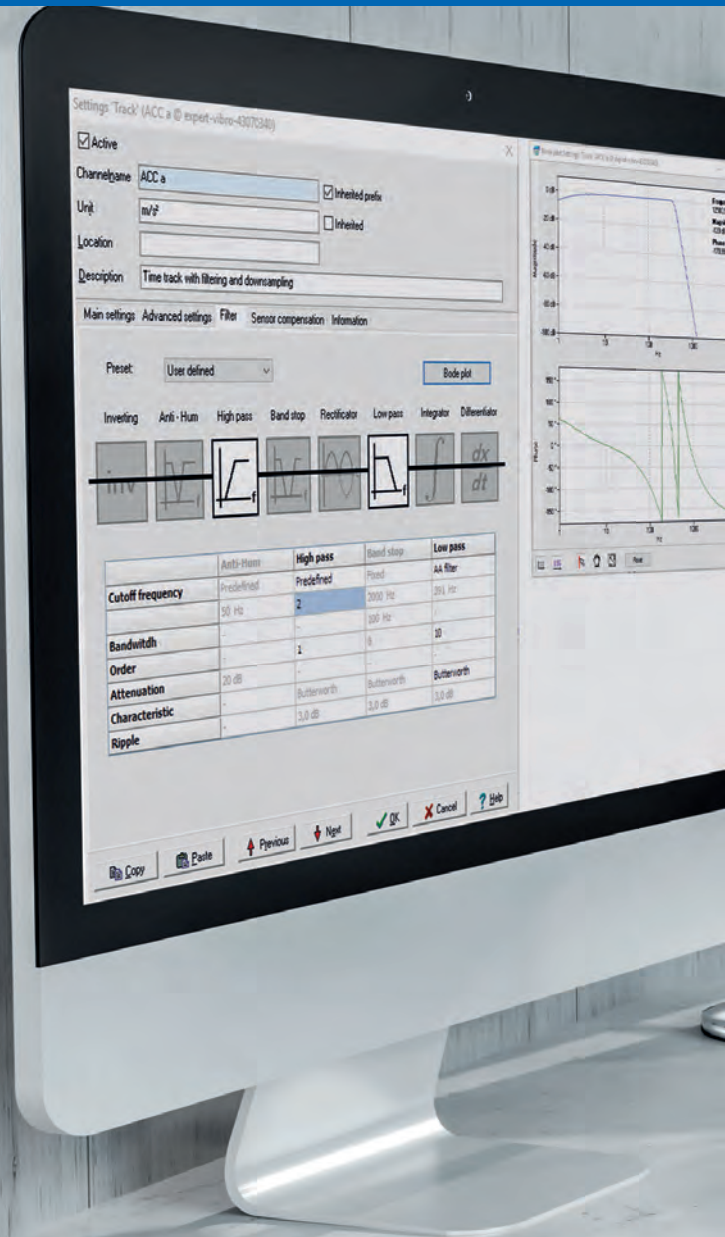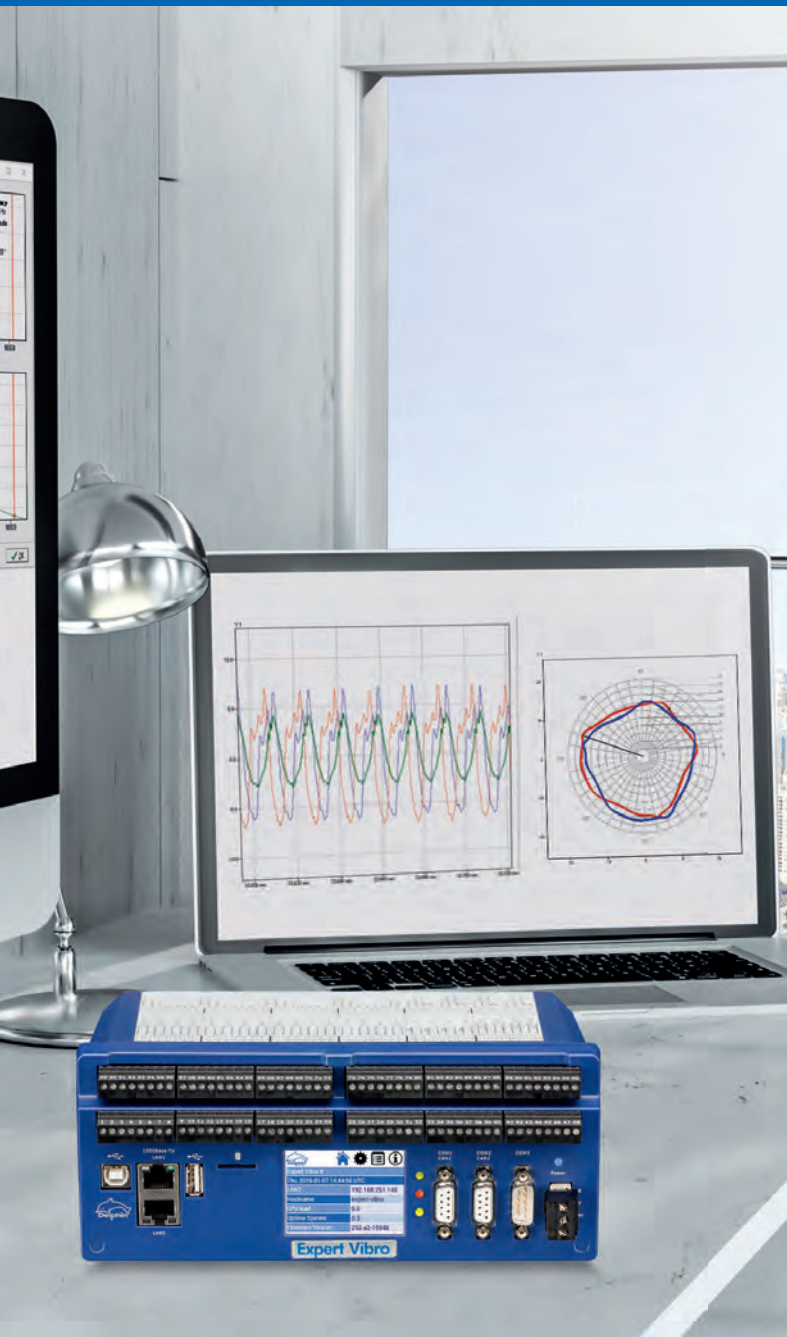
Diagrams of option Vibro

- **Time signal diagram:**
  Visualise and analyse measurement data for a time period.
- **Orbit diagram:**
  View kinetic shaft paths including maximum deflection smax and the angular position / phase for constant-speed machine operation.
- **Shaft centerline diagram:**
  View shaft centerline displacement as a function of speed during system start-up and shutdown.
- **Polar diagram:**
  Displays vibration vectors including amplitude and phase information.

Different portrayals
of spectra

In addition to a basic spectrum portrayal based on FFT analysis, you also get the following visualisation options:
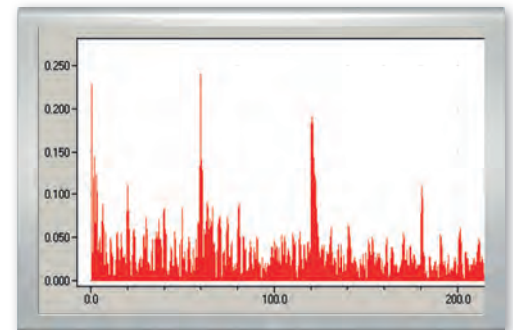
Envelope spectrum:
Provides information on current machine condition at early stages of emerging damage and aids filtering of condition-relevant frequencies.

Cascade spectrum:
Enables the analysis of system behaviour during start-up and shutdown.

Order analysis:
Normalises and displays frequencies according to the order of harmonic oscillations.

Spectrogram:
Portrays a spectrum's temporal progression. The colour display facilitates quantitative evaluation and enables simple tracking of changes in frequency or amplitude.

Bode plot:
Used to visualise the frequency response of your vibrating system during start-up and shutdown. This enables you to determine amplitude-phase characteristics.

VIBRATION MONITORING AND

As a plant operator, you want high levels of availability and efficiency. Operating conditions need to be optimised and downtimes prevented while service and maintenance intervals need to be performed according to machine status or maintenance schedule.

Vibration monitoring and online analysis are therefore indispensable for your plant. Modern technology combined with a wide range of interfaces make this system not only applicable to new but also existing infrastructures.

Rotating plant.
Machines.
Components.

A practical example demonstrates how Expert Vibro devices are being used in hydroelectric power plants in dams, reservoirs and rivers.

Vibrations on Kaplan and Francis turbines are being monitored using Expert Vibro devices that then transmit characteristic values via redundant PROFIBUS interfaces to control systems. With an Expert Vibro device, up to 16 vibration sensors can be synchronously measured, analysed and monitored. Static shaft positioning and dynamic shaft vibrations of journal-bearing shafts can be determined with reference to bearing casings. Radial shaft positioning and rotational speeds are also acquired via a reference mark (KeyPhasor®) on the shaft. Phase information can be computed from the shaft position. From the measured time signal, the Expert Vibro device can directly compute a frequency / amplitude / phase spectrum as well as characteristic values such as smax or peak-peak. The data can then be independently recorded or transmitted via Ethernet or PROFIBUS-DP to DCS systems or PCs.

Using ProfiSignal's Vibro software option, measurement data can be portrayed and evaluated in orbit, polar, bode, shaft centerline and FFT diagrams or spectrograms.

SERVICE LIFE TEST STAND

Securing
competitiveness

Service life testing is used to test products for long-term operation under realistic conditions and to certify service lives. It aids in the development of your products and thus directly contributes to securing your competitiveness.

The special benefits you gain include simultaneous acquisition and monitoring of all relevant vibration and process data for the product under test, as well as highly dependable and available measurement data.

A practical example demonstrates how one of the world's leading manufacturers of ball, roller and journal bearings uses our systems for service life test stand.

For numerous service life testing systems, Expert Vibro devices are being used in combination with Profi Message slaves and the ProfiSignal Klicks software as instrumentation and control technology.

All vibration data is securely recorded together with process data such as temperatures, pressures, flow rates, speeds, etc. and monitored independently by the system. Various characteristic values and FFT spectra are portrayed online during the test process, analysed instantly and forwarded to a centralised SQL database. Stand-alone operation by the Expert Vibro, with its internal control and regulating functions, guarantees independent operation of each individual test stand. A frequency inverter and other peripherals are also controlled directly by the Expert Vibro device.

The ProfiSignal Klicks software was used to create the test procedure. All measurement data and test sample statuses remain clearly visible to the operator via a range of diagrams. A central database, storing all relevant test sample data, guarantees full traceability for each individually tested bearing. Testing can then be performed very flexibly and for example, paused and continued without any problem.

SPINDLE TEST STAND

A spindle test stand is used to check spindle-driven machine tools in production for unacceptable levels of vibration and imbalance.

This is vital in the production of components requiring a very high level of dimensional precision. Unacceptably high vibrations and imbalances in spindle systems also mean significantly higher loads on bearings and thus lead to higher levels of wear and machine downtimes. A spindle test stand therefore helps to ensure high standards of quality for manufactured goods and increases levels of machine availability.

Identifying loads and imbalances and **raising quality**

A practical example demonstrates how a worldwide leading manufacturer of common-rail injectors and jets uses our systems in production.

By using Expert Vibro devices, vibrations and speeds as well as spindle and bearing temperatures are constantly recorded and monitored during production. This gives the customer a condition monitoring system for machine tools.

All data is monitored using internal limit values. Subsequent spindle balancing is based on determining phase angles and associated imbalances which are calculated online using the ProfiSignal software and the Expert Vibro device's internal analysis-channels.

If a limit value is exceeded during production, the operator is immediately prompted to balance the spindle. The balancing process is then carried out using the measurement data and instantly evaluated using the ProfiSignal application. In this way, the customer's requirements for high quality manufactured products and machine availability are being fulfilled.

Expert Vibro MOBILE

Highlights of the vibration measuring case

- Mobile with high-resolution data acquisition
- Synchronous measurement of analog signals
- Universal vibration inputs with sampling rates up to 50kHz / channel
- Calculation of characteristic values directly in the device
- Measurement of process and vibration values in one system
- System tailored to your measurement needs

Diverse applications

- Measuring vibrations and process values
- Mobile acceptance control
- Monitoring pressure vibrations
- Measuring and analysing machine vibrations
- Shaft vibration analysis and diagnosis
- Measuring electrical vibration variables with combined power measurements
- Mobile bearing monitoring
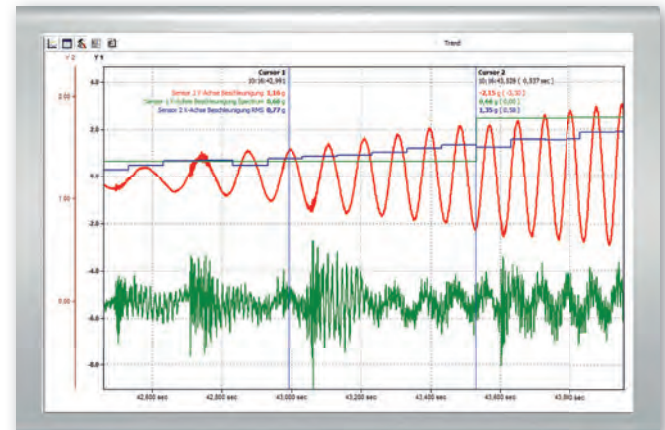
SECURE MONITORING

Compact design for mobile use

The vibration measuring case from Delphin has been specially developed for measurement requirements in the field of vibration technology. Its compact design makes it highly suited to mobile use while providing all the functions needed for analysis as well as all those expected in a stationary measurement system.

Depending on the model being used, mechanical and electrical vibration analyses can be carried out directly. A PC connection is unnecessary for measuring because the integrated data logger operates fully independently and calculates FFTs, characteristic values and RMS values directly within the device. The internal device memory securely stores your measurement data.

The measuring case can be individually adapted to your measurement needs and is therefore a flexible and powerful companion whether for run-out analysis, acceptance control, error and fault diagnostics or mobile vibration monitoring. High-resolution measurement data and fully synchronous analog inputs provide meaningful measurement information. Internal signal conditioning simplifies working procedures and saves on the need for expensive measurement transducers or any other additional equipment. Galvanic isolation and differential inputs prevent interference from process signals or earth loops.

The user-friendly ProfiSignal software and option Vibro provide you with tools tailored to vibration analysis. You will appreciate the easy operation and diagram types especially designed for vibration measurement. Measurement and analysis is the priority rather than time-consuming training in a new measuring technique.

Expert Vibro – TECHNICAL SPECIFICATIONS

Inputs / Outputs	
Analog inputs	4, 8, 12 or 16
Sampling rate, adjustable per channel	20 Hz .. 50 kHz
Usable signal range	DC .. 20 kHz
Voltage / current measurement ranges	± 25 V / 0 .. 20 mA / 4 .. 20 mA / free
Signal conditioning, switchable from software	None, AC coupling, IEPE
Resolution / input impedance	24 bit / 4 MΩ
Dielectric withstand voltage	± 100 VDC
Galvanic isolation: channel to channel / channel to system	± 400 VDC
Measurement accuracy	0.5 mV + 0.008 % of measured value
Digital inputs	4
Input signals	low: 0 .. 1 V / high: 5 .. 100 VDC@3.5 mA
Galvanic isolation: channel to other channel types / channel to system / PE	± 400 VDC
Max. input frequency / min. pulse width	1 MHz / 500 ns
Analog outputs	4
Resolution	16 bit
Output ranges	0 .. 10 V / ± 10 V / 0 .. 20 mA / 4 .. 20 mA / ± 20 mA
Galvanic isolation: channel to other channel types / channel to system / PE	± 400 VDC
Min. load / max. burden	650 Ω
Digital outputs	8
Max. switching voltage / current	50 V / 2.5 A for 2 sec., 1 A for continuous current
Galvanic isolation: channel to other channel types / channel to system / PE	± 400 VDC
PWM basic frequency / duty cycle	5 Hz .. 10 kHz / 1:1000
Data storage	
Internal / external	2 .. 14 GB (approx. 30 million measurement values per GB) / USB, NFS, CIFS, (S)FTP
Signal processing functions: high pass / low pass / bandpass filters	
Cut-off frequency / filter order / filter characteristics	5 Hz .. 20 kHz / 2, 4, 6, 8, 10 / incl. Butterworth

Integrator / Differentiator	
Single or double integrator / differentiator	
FFT	
Number of lines / window functions / averaging	100 .. 12.800 lines / von Hann, Hanning, Flat-Top / 2 .. 32 fold
FFT types	Narrow band / wide band, envelope / demodulation, amplitude / phase spectra
Characteristic values from time signal	
Characteristic values	Max. / min. value, peak-to-peak value, arith. average, TRMS, max vect. sum, local min. / max. values
Characteristic values from frequency spectrum	
Characteristic values	Amplitude, frequency and phase of main vibration and any harmonic, sum value, quadratic mean (in any frequency bands), residual value
Characteristic values on digital input	
Frequency	0.2 Hz .. 1 MHz
Counter	64 Bit, UP-Down counter, quadrant decoder
Interfaces	
Mechanical type COM 1 / COM 2	RS485, 9-pole Sub-D-plugs, DIN EN ISO 19245-1
Mechanical type COM 3	RS232, 9-pole Sub-D plugs
LAN	1 x 1000Base-TX
WLAN / WWAN (optional)	802.11b/g/n / GPRS, UMTS, LTE mx. 100 Mbit/s
USB	Device 2.0 / Host 2.0 / low / high / full
PROFIBUS	2 x PROFIBUS DPV1 / Slave max. 12 Mbit, also redundant complying to PN0 2.212 V1.2
CAN / RS 232/485	2 x CAN 2.0 / Modbus RTU, SCPI, ASCII
TCP/IP	Modbus TCP, OPC UA
General technical information	
Dimensions / Weight	W 210 x H 80 x D 125 mm / 750 g
Mounting	Rail mounting DIN EN 60715 or screw fixing
Signal connectivity	Plug-in screw terminals, 96 terminals in 2 rows, max. 1.5 mm²
Temperature range	-20 .. 50° C
Supply voltage	12 .. 24 VDC / ± 10%
Power consumption	max. 20 W

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