Leonova® EMERALD

Technical data sheets

SPM®

Leonova Emerald Basic Package

Technical Data Sheets

Package Features include:

- The instrument has been engineered to meet the demands industrial facilities by meeting IP65/NEMA 4X standards, thus offering an extremely rugged and reliable instrument for plant route readings.
- The Emerald offers Easy-to-Understand condition information – the data is displayed as green, yellow, red results that can easily be interpreted by the maintenance personnel.
- Data logging with Condmaster®Ruby software
- ISO 2372 and ISO 10816 vibration monitoring - Overall vibration measurements for determining machine health.
- Speed/RPM and Temperature Measurements
- Stethoscope function
- Replaceable battery packs ensure no issues with battery needing to be charged while readings are being taken
- Notes and Comments are easy and quick to add by using the optional boom headset and microphone for voice recording of them during round readings.
- No annual fees or service agreements. (Recommended annual calibration)
- Instrument and software can have new functions installed at any time. This allows you to expand the functionality of the instrument without having to buy new .

Patents: DE#60304328.3 - US#7,054,761 - US#7,167,814 - US#7,200,519 - US#7,301,616 - US#7,313,484 - US#7,324,919 - US#7,711,519 - US#7,774,166 - DE#60336383.0 - US#7,949,496 - DE#60337804.8 - GB#1474662 - GB#1474663 - DE#60338365.3 - ZA#2011/04946 - SE#0951017-3 - DE#60341502.4 - GB#1474659 - SE#1000631-0 - US#8,762,104 - US#8,812,265 - US#8,810,396 - CN#ZL200980155994.1 - CN#ZL201080019737.8 - KZ#020791 - RU#020791 - AU#2009330744 - RU#021908 - KZ#021908 - US#9,200,980 - US#9,213,671 - CN#ZL201180006321.7 - KZ#022630 - RU#022630 - US#9,279,715 - US#9,304,033 - KZ#024339 - RU#024339 - CN#ZL201380007381.X - AU#2015203801 - AU#2013215672 - RU#201491377 - CN#ZL2012800347548 - US#6,873,931 - DE#602013021988.5 - DK/FI/FR/IT/NL/NO/ES/GB#2810027 - SE#13744257.0 - AU# 2015203361 - RU# 027452 - GB# 2505984 - US# 9,772,219

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Leonova Emerald® – Platform

Leonova Emerald® is a handheld machine condition analyser designed for use in harsh environments. Following functions are always included for unlimited use:

- Data logging with Condmaster®Ruby
- Shock pulse method SPM HDm/HDc and/or SPM LR/HR
- ISO 2372 vibration monitoring
- 1 channel vibration monitoring
- Speed and temperature measurements
- Stethoscope function
- Measuring point identification with CondID® memory tags
- Manual recording and check points

The main Leonova functions are user selected, see TD-375.With synchronous measurement, enveloping, true zoom and up to a 12 800 line spectrum over DC up to 20 kHz, Leonova Emerald® has full vibration analysis capacity. SPM has also incorporated the evaluation tables of the new ISO 10816 standards for broadband measurement of vibration velocity, acceleration and displacement. For single rotor balancing, an easy to use graphical guide calculates balancing weights and their position.

Part numbers

EME400	Leonova Emerald, SPM HDm/HDc
EME403	Leonova Emerald, SPM LR/HR
EME405	Leonova Emerald, SPM HDm/HDc and LR/HR
16573	Optional battery pack
16644	Battery adapter unit
CHA01	Battery charger incl. AC adapter, Euro-plug
CHA02	Battery charger incl. AC adapter, UK-plug
CHA03	Battery charger incl. AC adapter, US-plug
CHA04	Battery charger incl. AC adapter, AU-plug
93484	Car charger cable 12V
CAB94	Communication cable, USB-mini USB
16675	Belt clip, complete
16646	Shoulder strap
CAS25	Carrying case, plastic with foam insert 54x41x21 cm
CAS28	Carrying case, soft with modular insert 37x20x27 cm
81468	Code lock, TSA approved, for CAS25

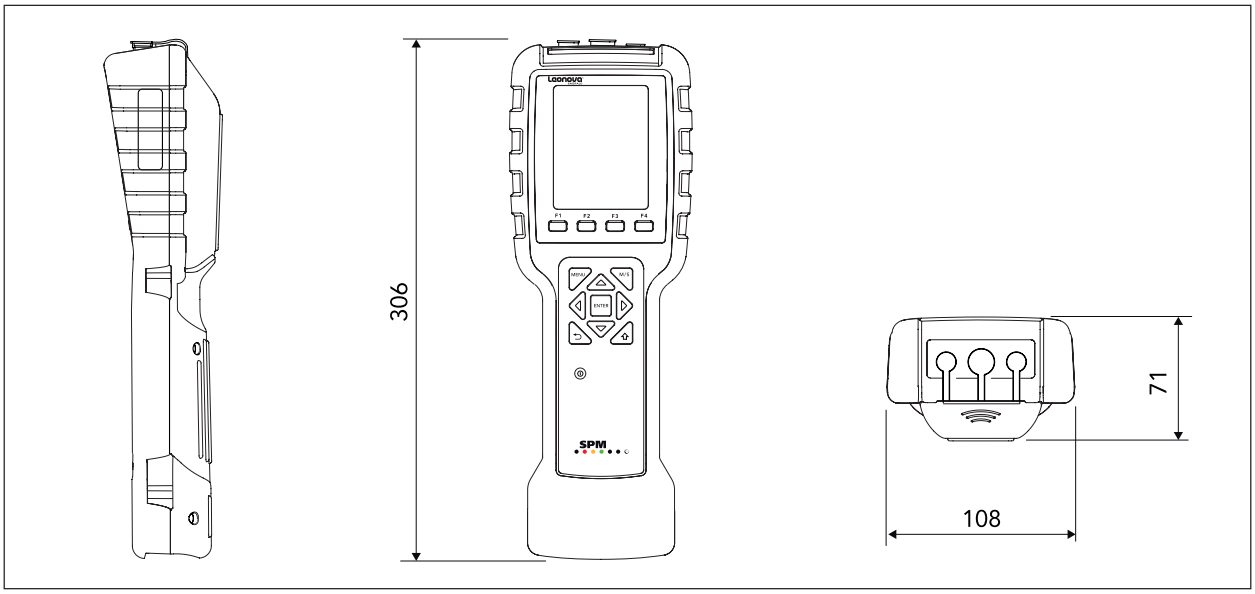
Parts of the Leonova system are specified on the technical data sheets (TD) listed below:

Instrument specifications	TD-373
User selected functions	TD-375
Shock pulse method SPM HD frequency & time domain analysis	TD-435
SPM Shock pulse method dBm/dBc	TD-440
SPM Shock pulse method LR/HR	TD-436
SPM Spectrum®	TD-441
Vibration monitoring ISO 2372	TD-446
Vibration monitoring ISO 10816 with spectrum	TD-442
Recording	TD-444
Vibration Premium	TD-366
HD ENV	TD-512
FFT with symptoms	TD-367
HD Order tracking	TD-439
Vibration Supreme	TD-445
HD ENV	TD-512
EVAM Evaluated Vibration	TD-438
HD Order tracking	TD-439
HD Analysis	TD-515
Vibration Supreme	TD-445
Shock pulse method SPM HD	TD-435
Balancing, single plane	TD-443
Leonova Service Program	TD-437
Transducers and measuring cables	TD-377
Tachometer/Temperature probe	TD-380

Spare parts

16686	Protection foil display
14661	Wrist strap
81469	Silica gel (moisture absorbent) for CAS25
90362	AC adapter, Euro-plug, 100-240 V AC
90380	AC adapter, UK-plug, 100-240 V AC
90379	AC adapter, US-plug, 100-240 V AC
90528	AC adapter, Australia plug, 100-240 V AC
16574	Battery charger
PRO52	Leonova Service Program
71971	Leonova Emerald User guide

Leonova Emerald® – Instrument specifications



Technical specifications

Housing:	ABS/PC/TPE, IP65
Dimensions:	306 x 108 x 71 mm
Weight:	860 g
Keypad:	Sealed, snap action
Display:	TFT colour, 240 x 320 pixels, 3.5 inch, adjustable backlight
Main processor:	400 MHz ARM
Memory:	256 MB RAM, 512 MB Flash, SD card 1 GB
Operating system:	Microsoft Windows® CE
DSP processor:	375 MHz floating point
Communication:	USB 2.0
Power supply:	Rechargeable Lithium-Ion battery pack, 5200 mAh or power adapter
Battery power:	For min. 18 hours normal use (20°C)
Operating temperature:	–20 to 55 °C (–4 to 122 °F), non condensing
Charging temperature:	0 to 45 °C (32 to 113 °F)
General features:	Language selection, battery status indication, transducer line test, metric or imperial units
Meas. point identification:	NFC transponder for communi-cation with CondID™ tags, read/ write distance max. 50 mm (2 inch)

Output/input

Headphones/microphone:	3.5 mm stereo plug
Communication:	Mini USB

Temperature measurement

Input:	TTP10 Tachometer/Temp. probe

Stethoscope

Transducer types:	Shock pulse and vibration transducers
Settings:	Filter, volume and gain

Vibration monitoring

Vibration channels:	1
Dynamic range:	< 120 dB, 24 bit A/D converter
Frequency range:	0 (DC) to 20 kHz
Resolution:	Max. 12 800 lines
Vibration transducer input:	< 24 Vpp. Transducer supply of 2,5 mA for IEPE (ICP) type can be set On/Off
Transducer types:	Any transducers (disp., vel. or acc.) with voltage output
Measuring techniqes:	ISO 2372, ISO 10816, HD ENV, FFT with symptoms, EVAM Evaluated Vibration Analysis, balancing

Bearing monitoring

Measuring range:	SPM HD: –30 to 110 dBsv (44000 transducer) dBm/dBc: –9 to 99 dBsv LR/HR: –19 to 99 dBsv
Resolution:	0,2 dB / HD, 1 dB / dBm/dBc and LR/HR
Transducer types:	SPM 40000, 42000, 44000, probe and quick connector transducers, DuoTech

Tachometer input

Measuring range:	1 to 150 000 PPM
Resolution:	1 pulse
Accuracy:	± (1 pulse + 0.01% of reading)
Transducer types:	SPM TTP10, TTL pulses, Keyphasor® and proximity switch NPN/PNP.
Output:	TTL output for stroboscope and 12 VDC

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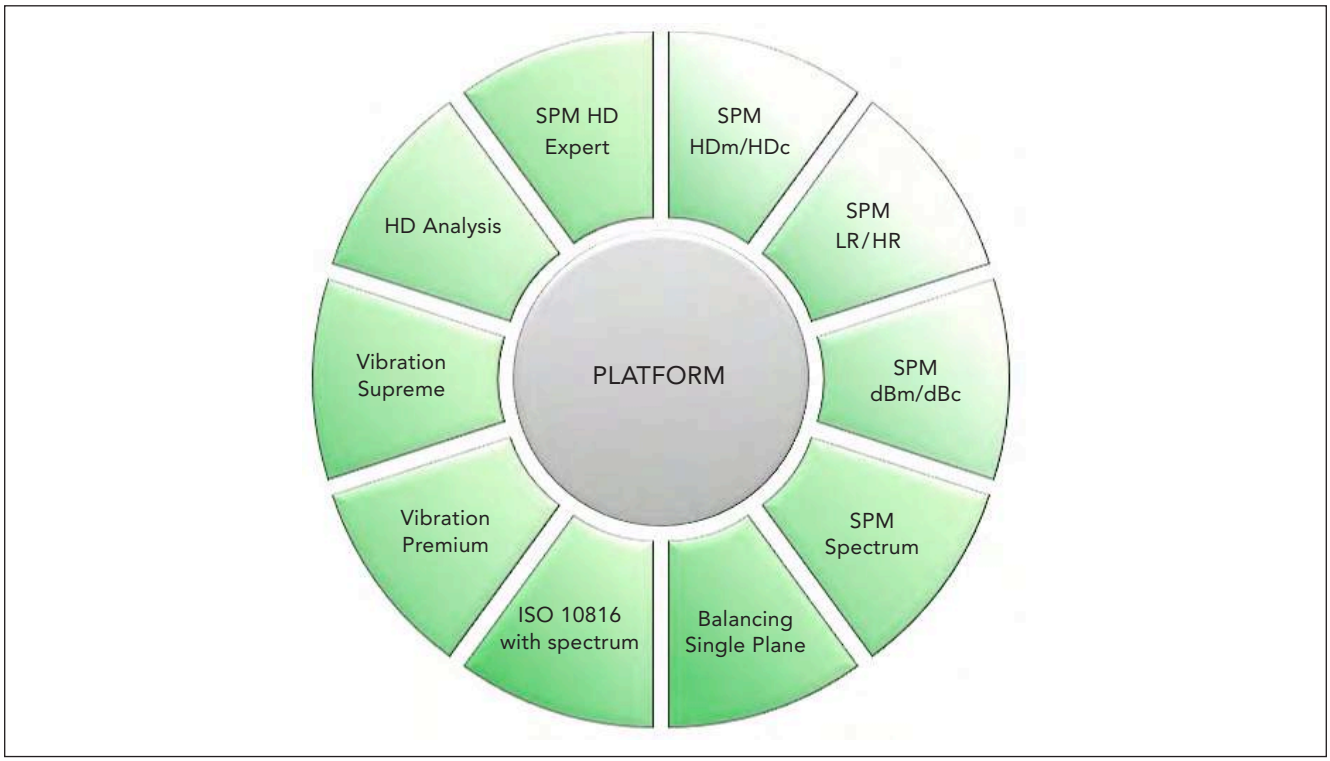
Leonova Emerald® – User selected functions



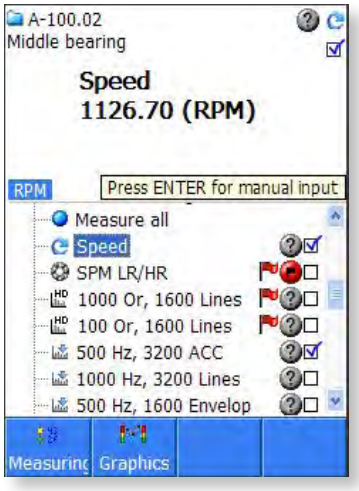
To obtain the optimal performance range and instrument price for their purpose, Leonova users can select any or all of the condition diagnosis and maintenance functions below. Platform functions are always included.

Platform

- SPM HDm/HDc and/or SPM LR/HR
- RMS vibration, ISO 2372
- Speed measurement
- Temperature measurement
- Stethoscope function
- Measuring point identification with CondID® memory tags
- Recording
- Manual recording, free quantity
- Check points, free text
- Recording of vocal comments
- Supports up to 6400 lines, 10 kHz

Optional functions		Module in Ruby
EME195	SPM HD Expert, freq. and domain analysis	MOD195
EME197	Shock pulse method HDm/HDc	(Platform)
EME130	Shock pulse method dBm/dBc	MOD130
EME131	Shock pulse method LR/HR	MOD131
EME132	SPM Spectrum	MOD132
EME133	Vibration ISO 10816 with spectrum	MOD133
EME134	Vibration Premium HD ENV FFT spectrum with symptoms 6400 lines, 10 kHz HD Order tracking Time signal Post trigger	MOD135
EME193	Vibration Supreme HD ENV EVAM evaluated vibration analysis 12800 lines, 20 kHz + all functions in EME134	MOD197
EME140	HD Analysis Vibration Supreme SPM HD Expert	MOD140
EME109	Balancing, single plane	

Leonova Emerald® – Recording function



Recording is an Leonova function included in the platform. It allows the user to measure and record measuring results over longer periods of time, up to 50 hours. The recording function is an analysis tool which can show the interaction of various condition parameters over time.

Leonova has three channels on three separate connectors, for:

- shock pulse measurement
- speed and temperature measurement
- vibration (one channel).

Simultaneous measurement can be done on up to two channels.

The recording function for a single quantity, e. g. temperature, is accessed and set up from the default file saved under the respective technique window. To record different quantities at the same time, a measuring point file with all the different techniques activated is required.

Under 'Total' in the recording window, the desired number of measurements is input, alternatively the total recording time in minutes.

Under 'Time between measurements' the interval is input in minutes. 0 minutes means 'as fast as possible'.

The measuring sequence is set by opening the list of available measuring techniques with NEW and selecting techniques in any order. A technique can be used more than once in the sequence.

Recording is started with the M/S key and can be terminated with the 'Cancel' key (F4).

Leonova displays the number of measurements taken and powers down when all are recorded. The batch is then saved by the user and can be transferred to Condmaster.

The Recording function is part of the platform, always included for unlimited use.

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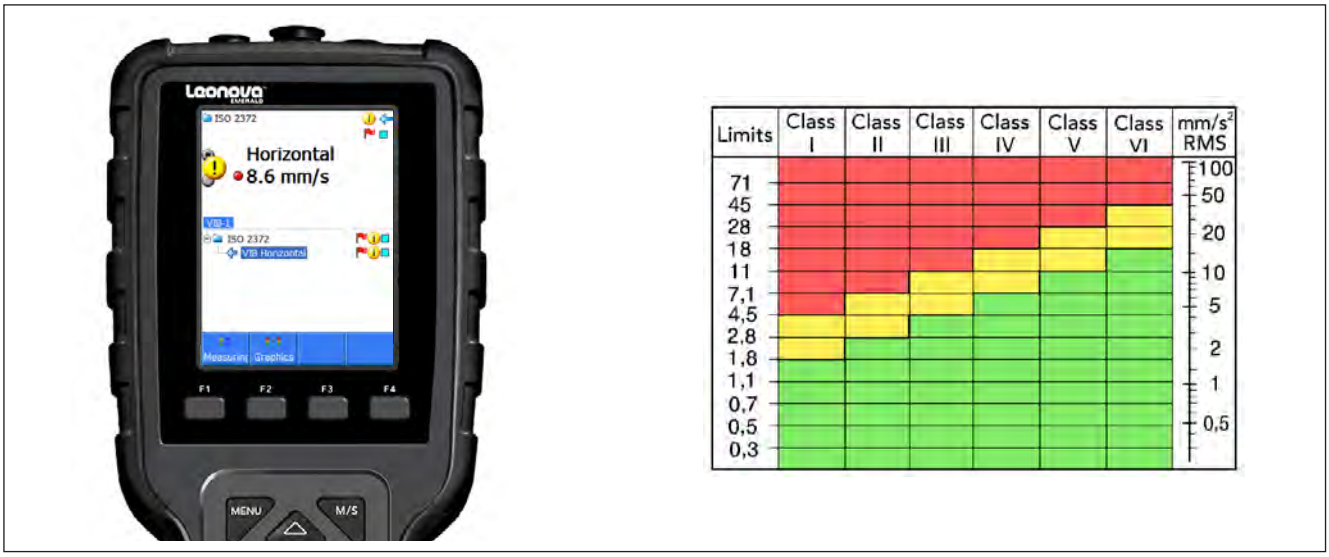
Leonova Emerald® – Vibration ISO 2372



Broadband vibration measurement is the most widely used and cost-efficient method for the diagnosis of general machine condition. There are two ISO recommendations concerning this type of machine condition monitoring; the much used ISO 2372 and the more recent ISO 10816, which is a ongoing replacement of the older standard.

In Leonova, vibration measurement according to ISO 2372 is a platform function, always included for unlimited use.

The features are:

- Machine condition is diagnosed on the basis of broad-band measurements returning an RMS value of vibration velocity in the frequency range of 10 to 1000 Hz. This is called vibration severity.
- Machines are grouped into six vibration classes.
- A table of limit values is presented for each vibration class, differentiating between acceptable vibration (green range), unsatisfactory vibration (yellow range), and vibration that will cause damage unless reduced (red range).
- Measurements are made in three direction (horizontal, vertical, axial). The highest value returned determines machine condition.
- Default limit values for the change from green to yellow and from yellow to red are set automatically when one of the six machine classes is input under the measuring point data.

ISO 10816 is offered as an option, see TD-442.

Technical specifications

Measurement quantities:	Velocity, RMS value in mm/s over 10 to 1000 Hz
Transducer type:	Vibration transducer SLD144 or IEPE* (ICP®) type transducers with voltage output

* Integral Electronic PiezoElectric

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Leonova Emerald® – Vibration ISO 10816 with spectrum

Vibration Velocity RMS		Group 4 Integrated Driver		Group 3 External Driver		Group 2 Motors 160 ≤ H < 315 mm		Group 1 Motors H ≥ 315 mm	
mm/s	inch/s	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible
18	0.71								
11	0.43								
7.1	0.28								
4.5	0.18								
3.5	0.14								
2.8	0.11								
2.3	0.09								
1.4	0.06								
0.71	0.03								

Broadband vibration measurement is the most widely used and cost-efficient method for the diagnosis of general machine condition.

There are two ISO recommendations concerning machine condition monitoring by this type of measurement; the much used ISO 2372 and the more recent ISO 10816, which is an ongoing replacement of the older standard.

With Leonova, ISO 2372 measurement is a platform function, always included for unlimited use.

ISO 10816 is an option with ordering numbers EME 133 (unlimited use).

Features of ISO 10816 are:

- Measurements are made in three directions (horizontal, vertical, axial).
- Machine condition is generally diagnosed on the basis of broadband vibration measurements returning an RMS value. ISO 10816 keeps the lower frequency range flexible between 2 and 10 Hz, depending on the machine type. The upper frequency is 1000 Hz.
- ISO 10816 operates with the term vibration magnitude, which, depending on the machine type, can be an RMS value of vibration velocity, acceleration or displacement. If two or more of these parameters are measured, vibration severity is the one returning the relative highest RMS value. For certain machines, ISO 10816 also recognizes peak-to-peak values as condition criteria.
- The standard consists of several parts, each treating a certain type of machines, with tables of limit values differentiating between acceptable vibration (green range), unsatisfactory vibration (yellow range), and vibration that will cause damage unless reduced (red range).

In Leonova, ISO part, machine group and foundation type are input using a multiple choice guide which displays the various ISO definitions and leads to the limit values.

Exceeding the requirements of the ISO standard, Leonova Emerald also provides a 1600 line spectrum.

Technical specifications

Measurement quantities:	Velocity, acceleration, and displacement
Spectrum unit:	Velocity, mm/s or inch/s
Transducer type:	Vibration transducer SLD144 or IEPE* (ICP®) type transducers with voltage output
Quick mode:	Yes, can be set on/off

* Integral Electronic PiezoElectric

Settings	
Direction:	Horizontal, vertical, axial
Part:	2, 3, 4, 5, 6
Group:	2, 3, 4, 5, 6
Support:	Rigid, Flexible

Part numbers

EME133 Vibration ISO10816 with spectrum, unlimited use

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Leonova Emerald® – Services

The service program Leonova.exe is part of the basic function package for Leonova Emerald. It is used to:

- Print and save balancing reports
- Upgrade a Leonova software package
- Make and reload safety copies of the Leonova files (file extension.lsc)

The operation of the service program is very simple: connect Leonova to the PC, put it in communication mode, then click on the desired service function. Follow the guidance on the screen.

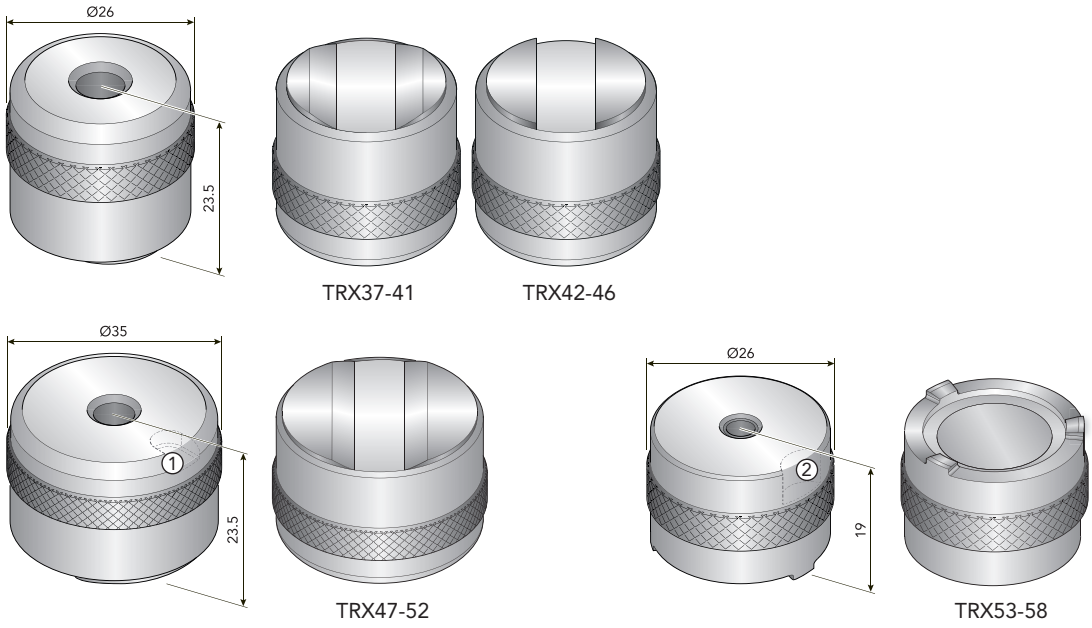
For example, a safety copy of the Leonova file can be sent to SPM Instrument for technical advice. Upon reload, you choose which part of your safety copy should be reloaded.

The file 'Leonova.txt' can contain Leonova functions that are new for the instrument. It is coded to fit the individual instrument and ordered via the local SPM Instrument distributor.

Part numbers

PRO52 Leonova Service Program

Magnetic mounting bases



1. Notched only for TRX52
2. Notched only for TRX58

Two-rail, 25 mm diameter, 13 kg (29 lbs) pull strength
The two rail type magnetic mounting bases are usually utilized on curved surfaces, such as motor and compressor housings, although they are also suitable for flat surfaces.

TRX37	Magnetic mounting base, M6
TRX38	Magnetic mounting base, M8
TRX39	Magnetic mounting base, M10
TRX40	Magnetic mounting base, UNF 1/4
TRX41	Magnetic mounting base, UNC 5/16

Flat, 25 mm diameter, 13 kg (29 lbs) pull strength
The flat magnetic mounting bases are optimal for smooth, flat surfaces.

TRX42	Magnetic mounting base, M6
TRX43	Magnetic mounting base, M8
TRX44	Magnetic mounting base, M10
TRX45	Magnetic mounting base, UNF 1/4
TRX46	Magnetic mounting base, UNC 5/16

Two-rail, 35 mm diameter, 25 kg (55 lbs) pull strength
The two rail type magnetic mounting bases are usually utilized on curved surfaces, such as motor and compressor housings, although they are also suitable for flat surfaces. A large diameter enables magnetic mounting on two heat sinks for an electric motor, for example.

TRX47	Magnetic mounting base, M6
TRX48	Magnetic mounting base, M8
TRX49	Magnetic mounting base, M10
TRX50	Magnetic mounting base, UNF 1/4
TRX51	Magnetic mounting base, UNC 5/16
TRX52	Magnetic mounting base for triaxial transducers, UNF 10-32

Three-rail, 25 mm diameter, 10 kg (22 lbs) pull strength
The three rail type magnetic mounting base are usually utilized on curved or uneven surfaces.

TRX53	Magnetic mounting base, M6
TRX54	Magnetic mounting base, M8
TRX55	Magnetic mounting base, M10
TRX56	Magnetic mounting base, UNF 1/4
TRX57	Magnetic mounting base, UNC 5/16
TRX58	Magnetic mounting base for triaxial transducers, UNF 10-32

Technical specifications

Material:	stainless steel
Temperature:	up to 100 °C
Grip:	knurled edge

Options

16065	Mounting disc for 26 mm diameter magnetic mounting base (TRX37-46 and TRX53-58)
18033	Mounting disc for 35 mm diameter magnetic mounting base (TRX47-52)

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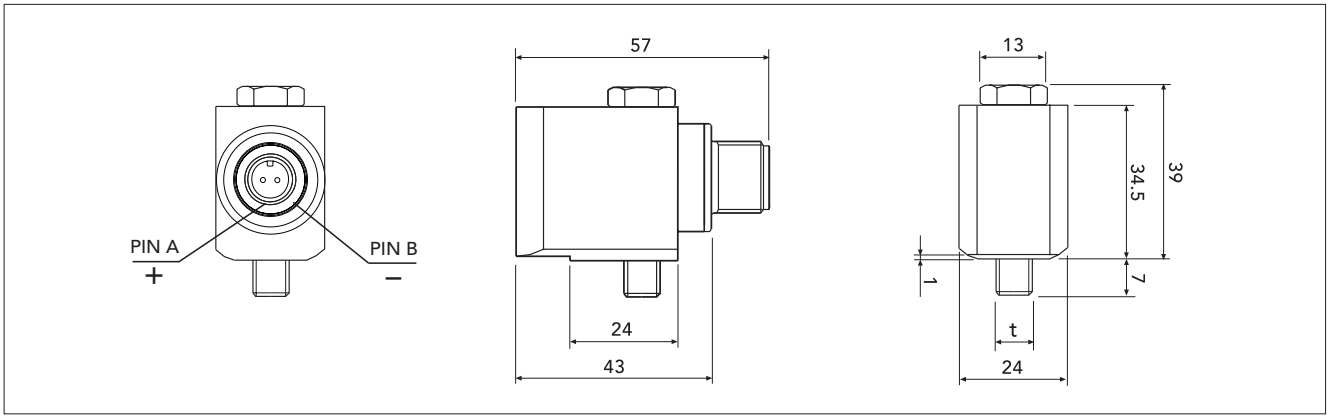
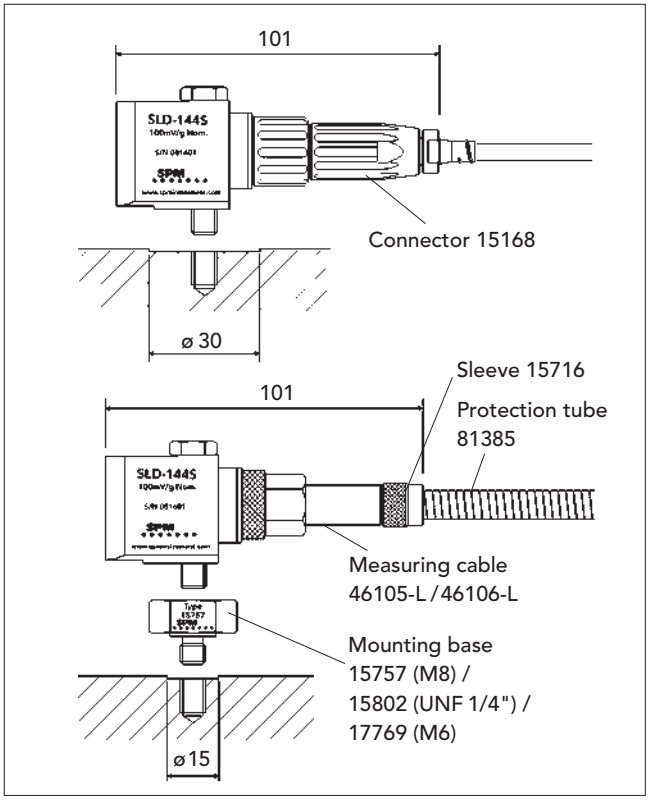
Vibration Transducers SLD144S with Side Entry



The vibration transducer SLD144S is a piezo-electric accelerometer of compression type with side entry and built-in electronics, designed for vibration monitoring of industrial machinery. The electrical signal is isolated from the transducer housing.

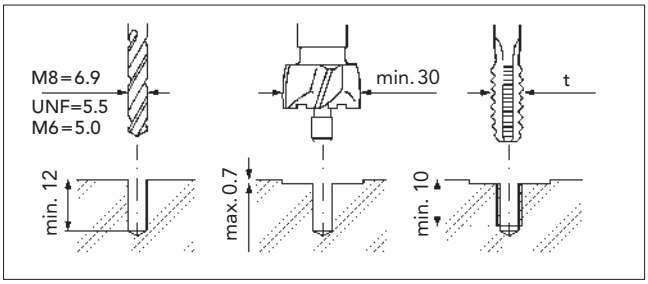
The transducer is mounted against a smooth, flat surface min. 30 mm in diameter (min. 16 mm is required when using mounting base SPM 15757, 15802 or 17769). The transducer has a captured bolt for mounting and is connected via a twisted pair cable with 2 pin connector. In moist environment, use the sealed connector with integrated measuring cable SPM 46105-L/46106-L together with cable protection tube SPM 81385.



Technical Data

Nominal sensitivity, main axis:	10 mV/m/s² * =100 mV/g
Transverse sensitivity:	max. 10%
Base strain sensitivity:	0.01 m/s²/μ strain typical
Linear frequency range:	2 Hz to 10 kHz (±1 dB)
Max. peak acceleration:	600 m/s² = 60 g
Settling time:	3 sec
Bias point:	10 to 13 V (typical 12V)
Temperature range:	–40° to +125° C (–40° to 257° F)
Power requirements:	24 V, 2 to 5 mA
Isolation:	case isolated, > 10 Mohm
Casing:	stainless acid proof steel Sandvik 1802, EN:1.4523
Sealing:	IP66/67
Thread (t):	M6x1.0, M8x1.25 or UNF 1/4"-28
Torque limit:	10 Nm (7.4 lbf·ft)
Weight:	200 grams (7 oz)
Connection:	2 pin connector, MIL-C-5015 style
Cable length:	max. 100 m (328 ft) (cable capacitance 210 pF/m)

* Individual value given on the calibration chart.



Mounting tools

81393 Holder for counterbore
81394 Pilot for M6 and UNF 1/4"-28
81395 Pilot for M8
81396 Counterbore, diameter 30 mm

ARTICLE NO: SLD144S | X | - | XXX
A B C

A. Part number SLD144S
B. Option Other connector than 2 pin MIL-C-5015
C. Thread (t) M6, M8 or UNF

SERIAL NO: XX | XX | XXX
Year | Week | Number

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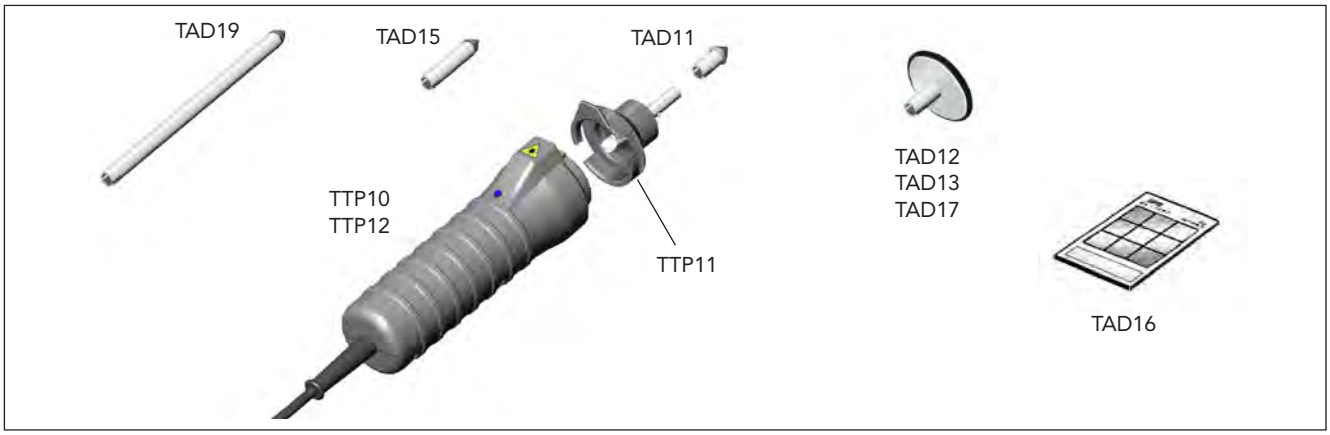
ISO 9001 certified. TD-508 B

Tachometer and Temperature Probe TTP10 / TTP12



The Tachometer and Temperature Probe TTP10/12 is used together with Leonova Diamond® and Emerald® instruments for optical or contact measurement of the rate of rotation and for contact measurement of peripheral speed. It also has a built-in temperature sensor.

Optical measurement of the rate of rotation
A laser light beam is directed against a reflecting tape on the rotating object, from a distance of 30-2000 mm and from an angle of 5-75°.

Contact measurement of rpm
The contact adapter TTP11 with a rubber tipped contact center, TAD-11/15/19, is attached onto the probe and then held against the center of a shaft end or a wheel.

Contact measurement of peripheral speed
The contact adapter TTP11 with contact wheel is held against the circumference of a shaft, a belt, etc. The speed is read out in units, depending on which contact wheel is used: TAD-12/13/17.

Temperature measurement

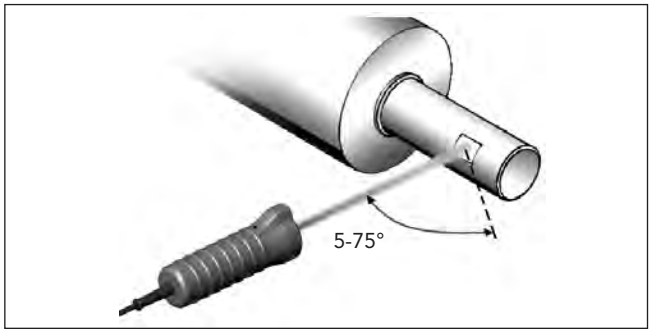
The Tachometer and Temperature Probe TTP10/12 is also used together with Leonova Diamond/Emerald for temperature measurements with a thermopile element in the range –20 to +300 °C.

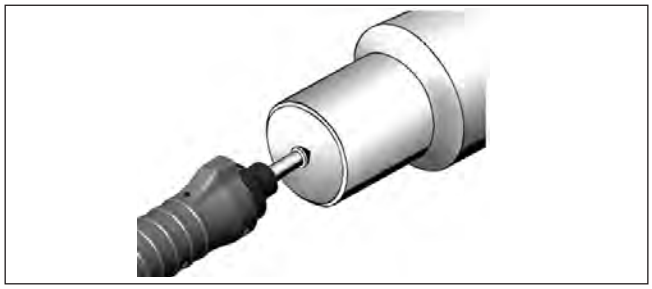
Part numbers

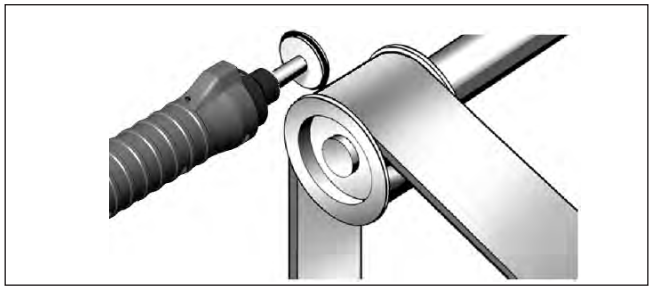
TTP10	Tachometer and Temperature Probe, incl. TTP11 and cable, spiral 1–2 m
TTP12	Tachometer and Temperature Probe, incl. TTP11 and cable, straight 5 m
TAD11	Contact center, rpm, short, 30 mm
TAD15	Contact center, rpm, long, 60 mm
TAD19	Contact center, rpm, extra long, 170 mm
TAD12	Contact wheel m/min.
TAD13	Contact wheel yd./min
TAD17	Contact wheel ft./min
TAD16	Reflecting tape for thin shafts, 5 sheets
TTP11	Contact adapter (spare part)
CAB100	Cable, spiral (spare part for TTP10)

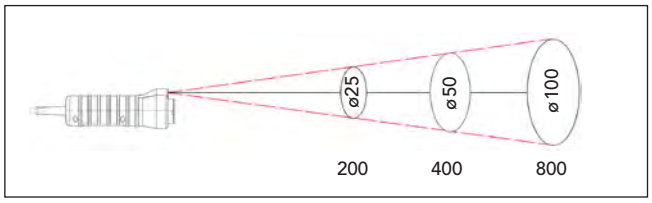
Technical specifications

Measuring range, rpm	max. 100 000 (pulses) optical
Measuring distance, rpm	30 to 2000 mm
Indicator, rpm	blue LED
Measuring range, temp.	–20 to +300 °C







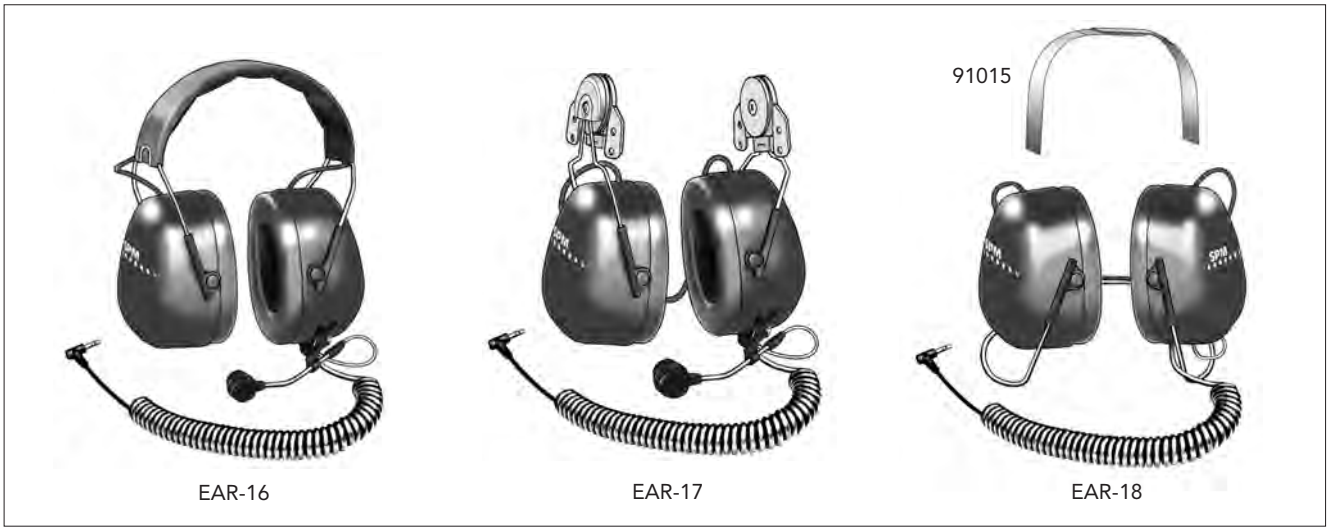


Measuring accuracy, temp.	± 2,5° C*
Dimensions	137 x 50 mm, 179 x 50 mm incl. TTP11
Operating temperature	0 to + 40 °C
Weight	160 g (TTP10), 300 g (TTP12)
D:S	8:1

* If RF emission is present at 625MHz to 655MHz, the accuracy is possibly reduced to ±2.5°C – 10% of full scale

Technical data are subject to change without notice.
ISO 9001 certified. TD-380 B Rev.0

Headset with microphone



EAR16/17/18 are specially selected headsets for Leonova Diamond/Emerald, providing excellent sound reproduction even in noisy environments. The headphones are equipped with microphone for voice recording of comments to the measuring points.

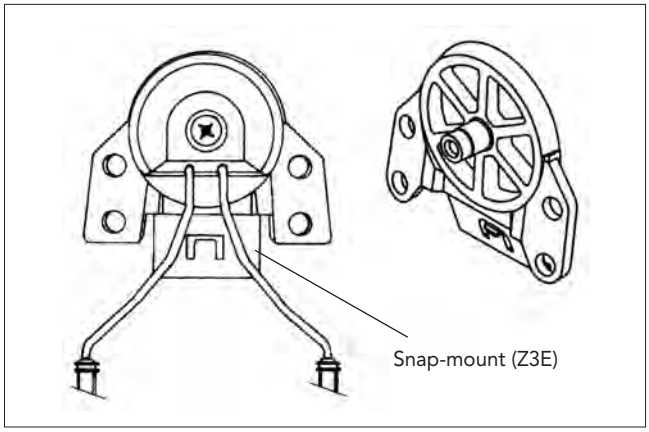
- Individually sprung headband wires of stainless sprung steel provide an even distribution of pressure around the ears. Steel headband wires retain their resilience better than plastic through a wide temperature range.
- Low, two-point fasteners and easy height adjustment with no protruding parts.
- Soft, wide foam and fluid-filled sealing rings with built-in pressure-equalizing channels provide low pressure, effective sealing and ideal comfort.
- Connection cord, 0.75 to 1.4 m, of soft spiral polyurethane with a 3.5 mm stereo plug.

The headsets are tested and approved in accordance with PPE directive 89/686/EEC and EMC directive 89/336/EEC to meet the demands for CE labelling.

Headset with headband, EAR16
EAR16 is a headset with two parallel connected earphones and a microphone. It has a collapsible headband for convenient storage when you are not using the headset.

Headset, EAR18
EAR18 is a headset with two parallel connected earphones and a microphone. It has a neckband for use with or without helmet. A soft headband with velcro is optional.

Headset for helmet, EAR17
The headset with microphone EAR17 is a headset with two parallel connected earphones and a microphone. The headset fits most safety helmets available in the market today. The headphones have standard snap-mounts (Z3E) and are adapted to a specific helmet by simple manipulation.



To mount the headphone, snap the helmet attachment into the slot on the helmet. Note! The cups can be set in three positions: working position, ventilation position and parking position. When in use, the cups must be placed in working position. Press the wires inward until you hear a click on both sides. Make sure that the cup and the headband wire in working position are not pressing on the helmet lining or the edge of your hard hat so that leakage can occur. Parking position should not be used if the cups are damp inside after an intense period of use.

Part numbers

EAR16	Headset with headband
EAR17	Headset with helmet brackets
EAR18	Headset with neckband
EAS11	Hygiene set (consists of two sets of attenuating cushions and snap-in sealing rings.)
91015	Headband with velcro for EAR18

This option is not included in the Basic package but is available as an add on to the basic platform.

CE

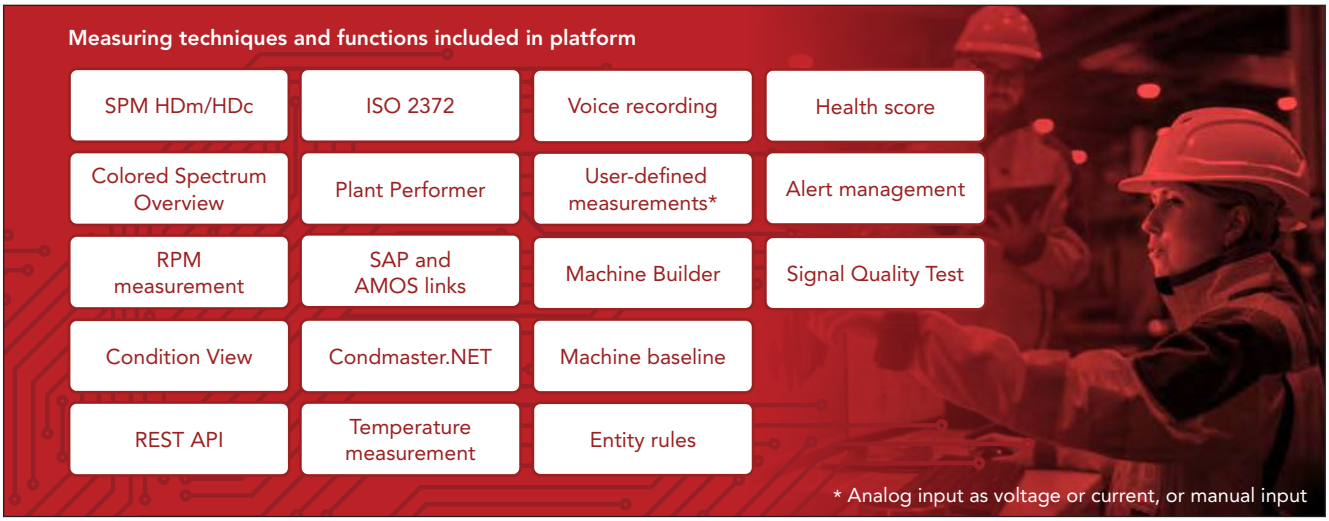
SPM

Condmaster® RUBY

Technical Data sheets

SPM®

Condmaster® Ruby – Platform



Condmaster Ruby is a comprehensive condition monitoring and predictive maintenance program. Module built, it can be tailored to your selected hardware.

Condmaster Ruby communicates with all SPM handheld data logging instruments and Ethernet-compatible online systems for continuous condition monitoring. The software works under Windows 8 or later and uses SQL Server 2016 or later (SQL Server 2019 Express Edition is included in the installation media, managing up to 10 GB of data).

The measuring techniques included in the platform are:

- Shock pulse technology SPM HDm/HDc. The scalar decibel value HDm represents the highest shock pulses found during the measuring cycle, and is the primary value for determining the severity of bearing damage, and also to trigger alerts. HDc, also a scalar dB value, is useful to determine lubrication conditions.
- ISO2372 vibration measurement.
- Two user-defined measurements, with a special input window for temperature (data input as analog voltage or current, or manual).
- RPM measurement.
- Temperature measurement.

The basic program functions are:

- Checkpoint (free text describing maintenance activity). It also has a runtime counter for machine operating hours.
- Contact-free identification tags, CondID®, can be loaded with basic data and the latest measuring results.
- Measuring point definition, using a customer-defined numbering system and including input data for all active measuring techniques.
- Graphical overview, showing measuring point location as a hierarchical structure and/or with pictures, from plants down to machines or measuring point level.
- Measuring rounds and communication with portable measuring devices (data logging, time planning).
- Alert messages and lists, statistics, and reports.
- REST API, a web-based service enabling other resources, systems, or devices to access Condmaster data for further processing or analysis.
- The stand-alone features Health score, Alerts, Machine Builder, Signal Quality Test, Machine baseline, and Entity rules form the Decision Support System (TD-612).
- Condmaster.NET, a web application and downloadable mobile app that provides easy access to measurement data through a user-friendly interface.
- Condition View combines multiple graphs in one window.
- SAP and AMOS links send alert messages to the receiving software and accept a work order number in return.
- Plant Performer compiles and visualizes statistics relating to technical and economic KPIs for display, evaluation, and printing in Condmaster.NET.
- Colored Spectrum Overview shows large numbers of spectrums over a longer period and provides a good overall picture of machine condition development.
- Voice recording of comments linked to measuring points.
- Display of all measuring results as graphics and lists.

Further modules can be added as needed, see TD-584.

Minimum system requirements for Condmaster Ruby:

- Windows 8 or later (Windows 8, 64-bit or later if SQL Server 2016 is installed on the same computer)
- 1 GHz 32-bit (x86) or 64-bit (x64) processor
- 1 GB RAM (32-bit) or 2 GB RAM (64-bit)
- 15 GB free disc space
- Microsoft SQL Server 2016 or later

NOTE: Microsoft SQL Server 2016 requires Windows 8 (64-bit) or later with at least 1.4 GHz CPU. Condmaster Entity Server (CES) requires 64-bit Windows. LinX (handling online systems) and CES require higher data performance.

For recommended system requirements, see *Condmaster Ruby Installation and system administration* manual, 72260.

Part numbers

PRO400	Condmaster Ruby, Platform, CD
PRO400-USB	Condmaster Ruby, Platform, USB

Condmaster® Ruby – Modules

Measuring techniques and functions included in platform

SPM HDm/HDc	ISO 2372	Voice recording	Health score	Colored Spectrum Overview	Plant Performer
User-defined measurements*	Alert management	RPM measurement	SAP and AMOS links	Machine Builder	Signal Quality Test
Condition View	Condmaster.NET	Baseline	REST API	Temperature measurement	Entity rules

Additional measuring techniques and functions ordered separately

dBm/dBc	LR/HR and Lubmaster	SPM Spectrum	SPM HD Expert	ISO 10816	Virtual Online Unit
FFT with symptoms	EVAM incl. Condition Manager	HD Analysis	Online	Run up/Coast down Bump test, FRF	High resolution and frequency
Orbit analysis, Shaft Centerline Plot	LR/HR HD and Lubmaster	HD ENV	ISO 20283-5	Rule-Based Evaluation, RBE	Multi-channel measurement

* Analog input as voltage or current, or manual input

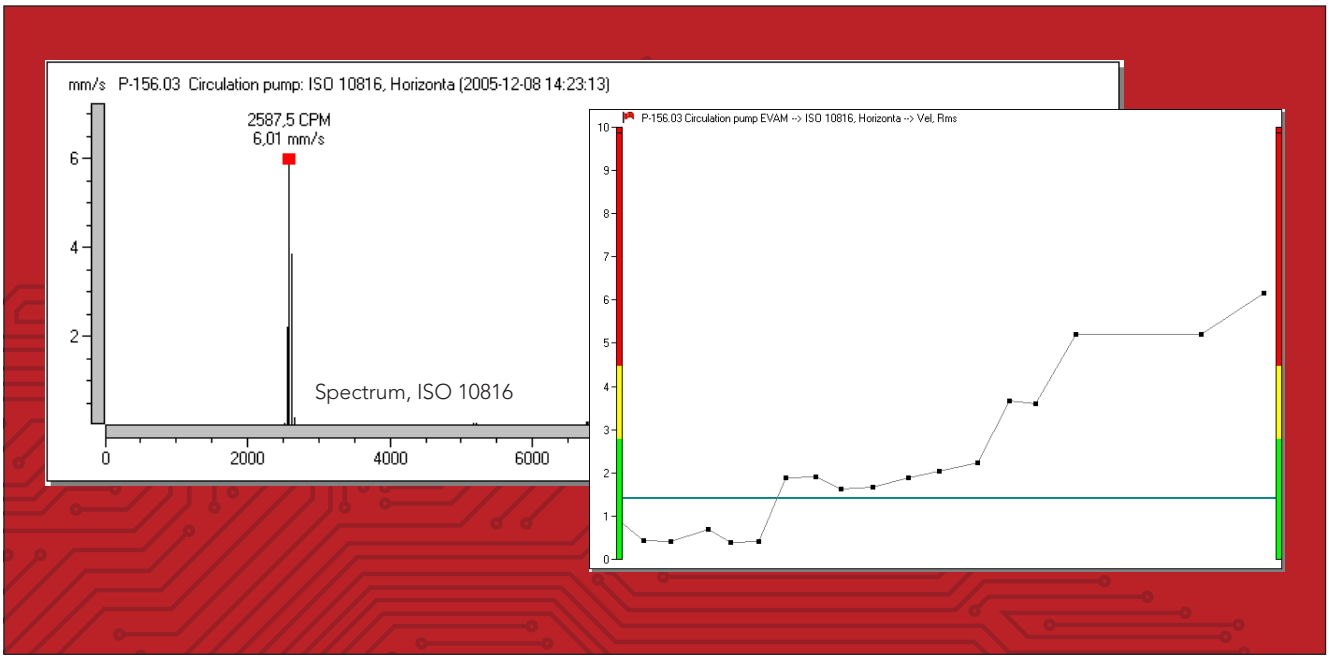
Condmaster Ruby is modular and its functionality can be tailored to specific requirements and personal preference. Modules can be ordered at any time as update files.

For further information on the Condmaster Ruby platform and the measuring techniques and functions included in the platform, see technical datasheet TD-583.

TD sheet	Module	Part numbers	Tester T30	Analyzer A30	Leonova Infinity	Leonova Emerald	Leonova Diamond	Intellinova Standard	Intellinova Compact	Intellinova Parallel EN	Airius
TD-583	Platform	PRO400	●	●	●	●	●	●	●	●	●
TD-585	dBm/dBc	MOD130	●		●	●	●	●			
TD-586	LR/HR and Lubmaster	MOD131		●	●	●	●	●			
TD-587	SPM Spectrum	MOD132			●	●	●	●			
TD-588	SPM HD Expert	MOD195				●	●	●	●	●	
TD-589	Vibration ISO 10816	MOD133			●	●	●	●	●	●	●
TD-590	FFT with symptoms	MOD134	●*	●**	●	●	●	●	●	●	●
TD-591	EVAM incl. Condition Manager	MOD135	●*	●**	●	●	●	●	●	●	●
TD-592	Multi-channel measurements *****	MOD192					●			●	●
TD-593	Run up/Coast down, Bump test, FRF	MOD137			●		●	●***	●***		
TD-594	Orbit analysis, Shaft Centerline Plot	MOD138			●****		●	●****		● ****	
TD-595	High resolution and frequency *****	MOD194					●			●	
TD-596	Rule-Based Evaluation, RBE	MOD181	●	●	●	●	●	●	●	●	●
TD-599	Online	MOD187						●	●	●	●
TD-603	Vibration Expert	MOD193					●				
TD-604	Vibration Supreme	MOD197				●					
TD-606	LR/HR HD and Lubmaster	MOD131+MOD195				●	●	●	●	●	
TD-607	Vibration ISO 20283-5	MOD198					●				
TD-608	HD ENV	MOD199				●	●	●	●	●	
TD-609	HD Analysis	MOD140				●	●	●	●	●	
TD-610	Virtual Online Unit ******	MOD200									

* T30-3 ** A30-3
*** Run up/Coast down only **** Orbit analysis only ***** The number of measuring channels as well as the maximum resolution and frequency range depends on the measuring equipment. ****** Virtual Online Unit is used to import values from various systems or units, see TD-610.

Condmaster® Ruby – Vibration ISO standard 10816



Broadband vibration measurement is the most widely used and cost-efficient method for the diagnosis of general machine condition.

There are two ISO recommendations concerning machine condition monitoring by this type of measurement: the much used ISO 2372 and the more recent ISO 10816, which is a replacement of the older standard.

ISO 2372 measurement is always included in the Condmaster Ruby platform (TD-583), while ISO 10816 can be ordered as a module (TD-584) through part number MOD133.

Features of ISO 10816 are:

- Measurements are made in three direction (horizontal, vertical, axial).
- Machine condition is generally diagnosed on the basis of broadband vibration measurements returning an RMS value. ISO 10816 keeps the lower frequency range flexible between 2 and 10 Hz, depending on the machine type. The upper frequency is 1000 Hz.
- ISO 10816 operates with the term vibration magnitude, which, depending on the machine type, can be an RMS value of vibration velocity, acceleration or displacement. If two or more of these parameters are measured, vibration severity is the one returning the relative highest RMS value. For certain machines, ISO 10816 also recognises peak-to-peak values as condition criteria.
- The standard consists of several parts, each treating a certain type of machines, with tables of limit values differentiating between acceptable vibration (green range), unsatisfactory vibration (yellow range), and vibration that will cause damage unless reduced (red range).

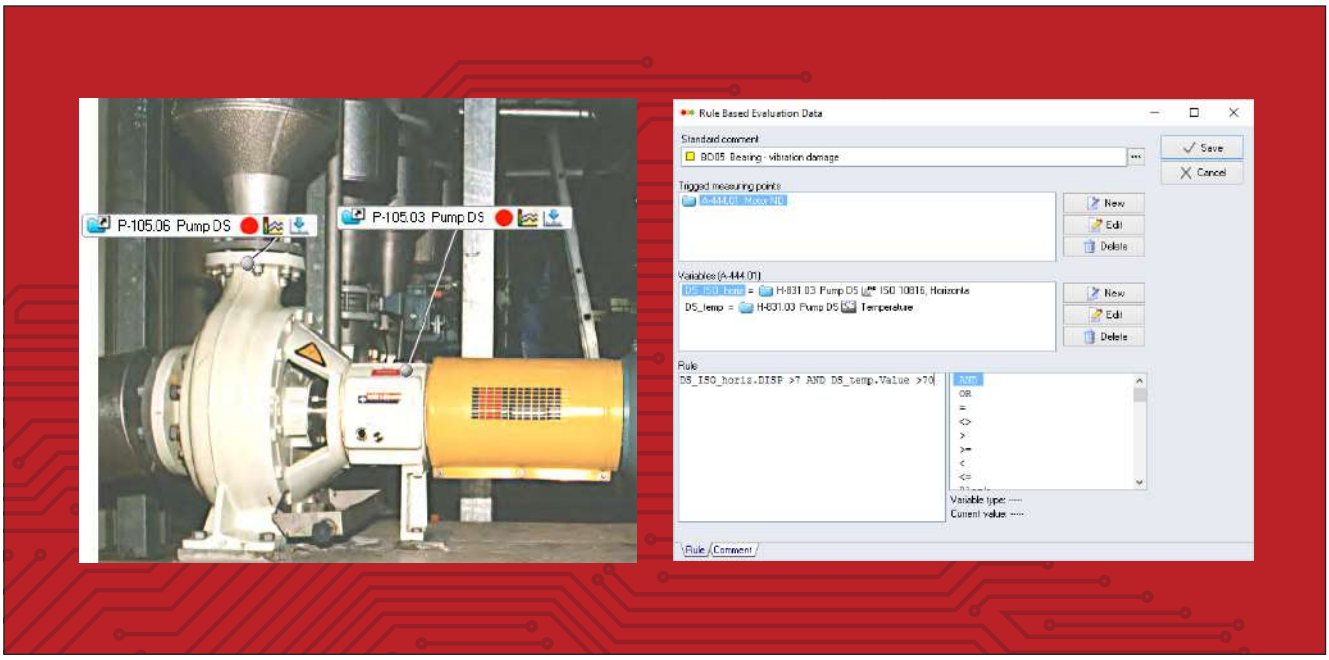
In Condmaster Ruby, ISO part, machine group and foundation type are entered using a multiple-choice guide that displays the various ISO definitions and leads to the limit values.

Exceeding the requirements of the ISO standard, Condmaster Ruby also provides a 1600 line spectrum.

Part numbers
MOD133 VIB ISO 10816 and spectrum

SPM

Condmaster® Ruby – Rule-Based Evaluation, RBE



Rule-Based Evaluation (RBE) is a module in Condmaster Ruby. The purpose of RBE is to give the user guidance on what to do when certain alert conditions are met. RBE is an excellent tool in Product Integrated Maintenance (PIM).

RBE items concist of standard comments and user-defined texts to set up alert parameters for triggered measuring points. Pictures can be attached to illustrate.

Each RBE item consists of a standard comment, one or more trigged measuring points, one or more variables and a rule that specifies under what conditions the alert should be triggered. Measuring points can be added and deleted as required. When the conditions of a specific alert are met, the alert is triggered, suggesting appropriate measures.

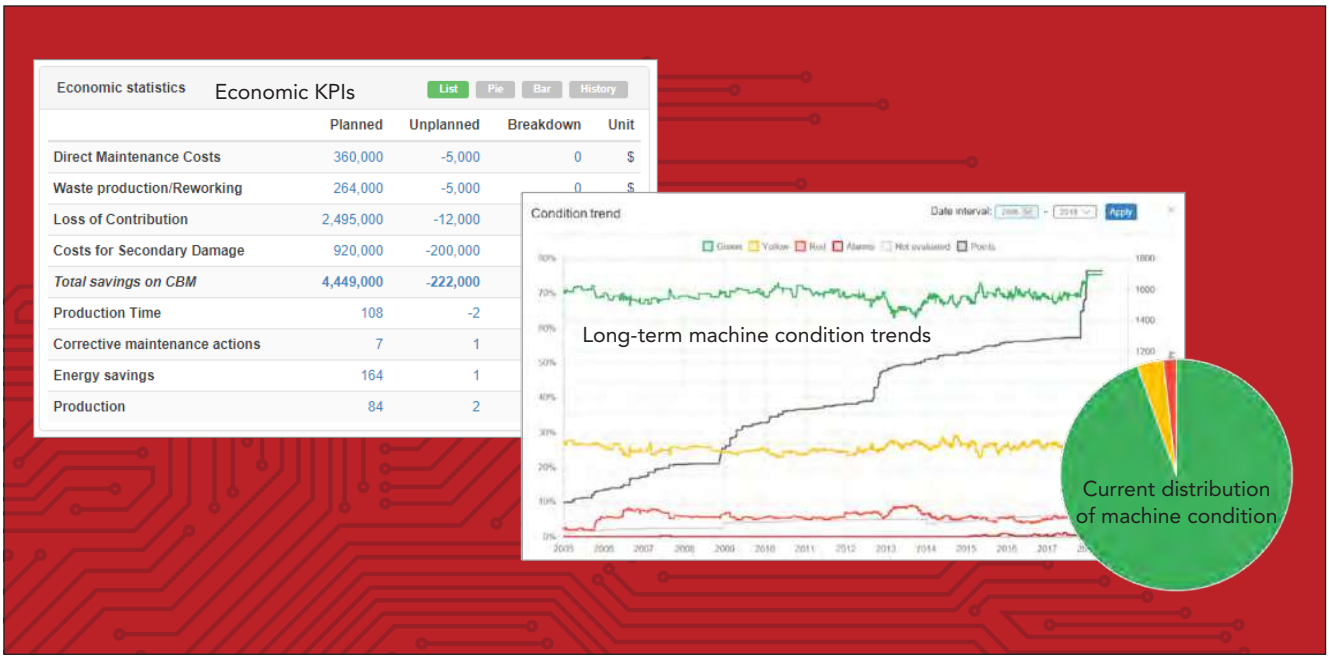
If for instance there are high readings on a pump housing, the reason is most likely cavitation. If this condition arises, RBE could be set up to rectify the problem. The suggested actions might be to open valves, change speed or other relevant measures to correct the faulty condition.

Part numbers
MOD181 Rule-Based Evaluation, RBE

This option is not included in this Basic software package but is available as an add on to the software platform.

SPM

Condmaster® Ruby – Plant Performer™



Plant Performer compiles and visualizes statistics relating to technical and economic KPIs (Key Performance Indicators) in the OEE/TEEP area for display and evaluation in Condmaster.NET. Plant Performer, a part of the Condmaster Ruby platform (TD-583), demonstrates the benefits of condition monitoring and communicates its technical and economic impact to all levels of the organization.

Basic data, including machine types, for the generation of Plant Performer statistics is entered in Condmaster Ruby. When corrective measures is taken, users enter information in a Corrective maintenance comment, which is then used to generate economic KPI statistics, such as Direct Maintenance Costs, Loss of Contribution, and Costs for Secondary Damage.

Technical KPIs are created at the measuring point level and linked to folders in the Measuring Point Tree. They can be calculated for all or a subset of machine types. For instance, the overall vibration level for electrical motors in a department, or an entire plant, calculated at user-defined intervals. Plant Performer offers the possibility to follow up on MTBF (Mean Time Between Failure), as well prewarning and planning times, per machine type.

Plant Performer includes database statistics, such as the number of measuring points or measuring rounds, or database size.

Statistics can be viewed at aggregate or database level with drill-down options, presented in lists, as pie or bar charts, and in timelines. Filter options can be used for a more narrow selection of data.

For economic statistics and machine condition trends, data can include either a specific year or all historic data, while current machine condition and database statistics provide a snapshot of the current situation.

Statistics from an unlimited number of Condmaster databases can be exported and imported into Plant Performer – such as from other divisions, production units, plants, or an entire group – for easy comparison of data.

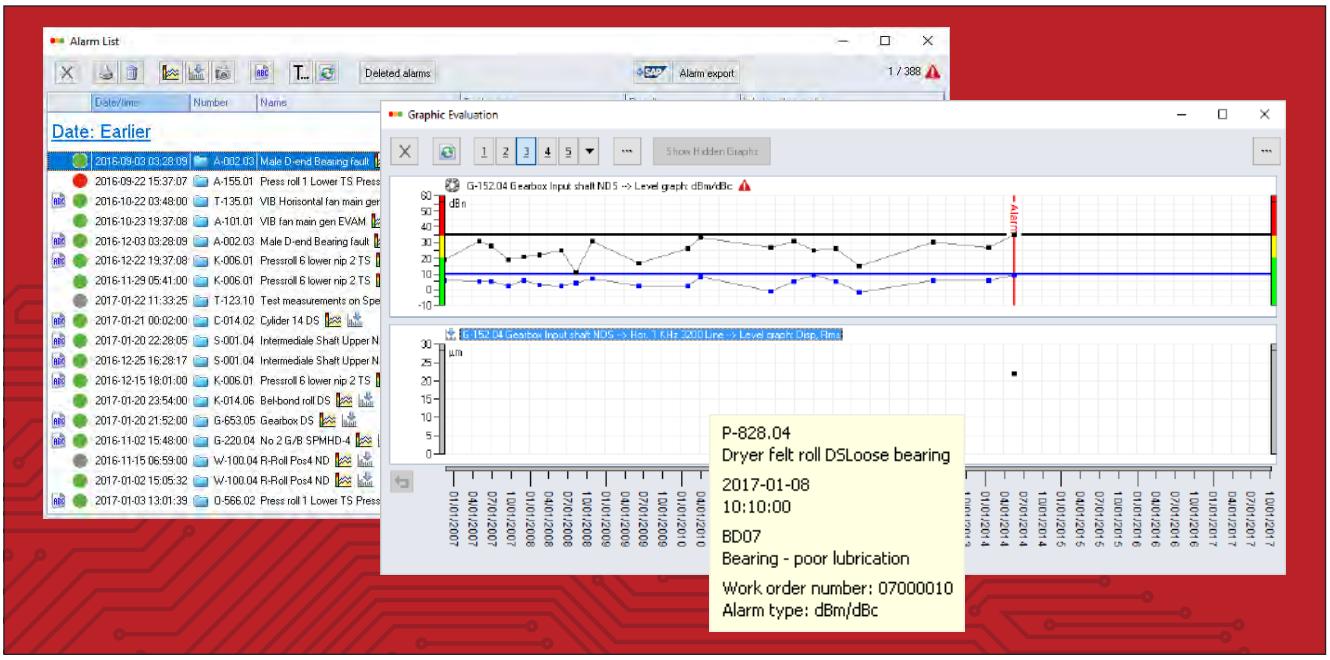
Plant Performer data can be exported from Condmaster Entity Server to other systems by means of an application programming interface (API).

Statistical examples include:

- Total Loss of Contribution.
- Overall vibration level for a department/for all fans/for entire plant, etc.
- Operating condition (green – yellow – red) for all electrical motors.
- Number of fans in alert condition.
- MTBF for centrifugal pumps with criticality A.

SPM

Condmaster® Ruby – SAP and AMOS links



The SAP and AMOS links are included in the Condmaster Ruby platform (TD-583).

The function provides a link to SAP and/or AMOS software. Clicking the **Alert export** (for AMOS) or **SAP** button on the Condmaster alert list sends the marked alert message to the receiving software. Returned is a SAP or AMOS work order number that locks the alert, until a second message from SAP or AMOS deletes the alert and sets a comment on the Condmaster measuring point, stating what has been done. In addition, the Condmaster measuring point setup now contains an optional field for SAP equipment numbers.

The operation requires no extra data input. The Condmaster operator simply presses the **SAP** or **Alert export** button when an alert merits a work order. The SAP or AMOS operator responds by sending a Standard Comment to a text file.

Standard Comments are a user-defined register of short messages in Condmaster, e.g. "Bearing replaced". The SAP/AMOS operator can add free text. On receiving the comment, Condmaster deletes the alert. The comment is added to the list of comments under the measuring point and is visible in the measuring result diagram.

Specific functions are required in the SAP/AMOS software for the communication to work properly. These functions are not provided by SPM Instrument AB, only a protocol description of the functions as seen from Condmaster.

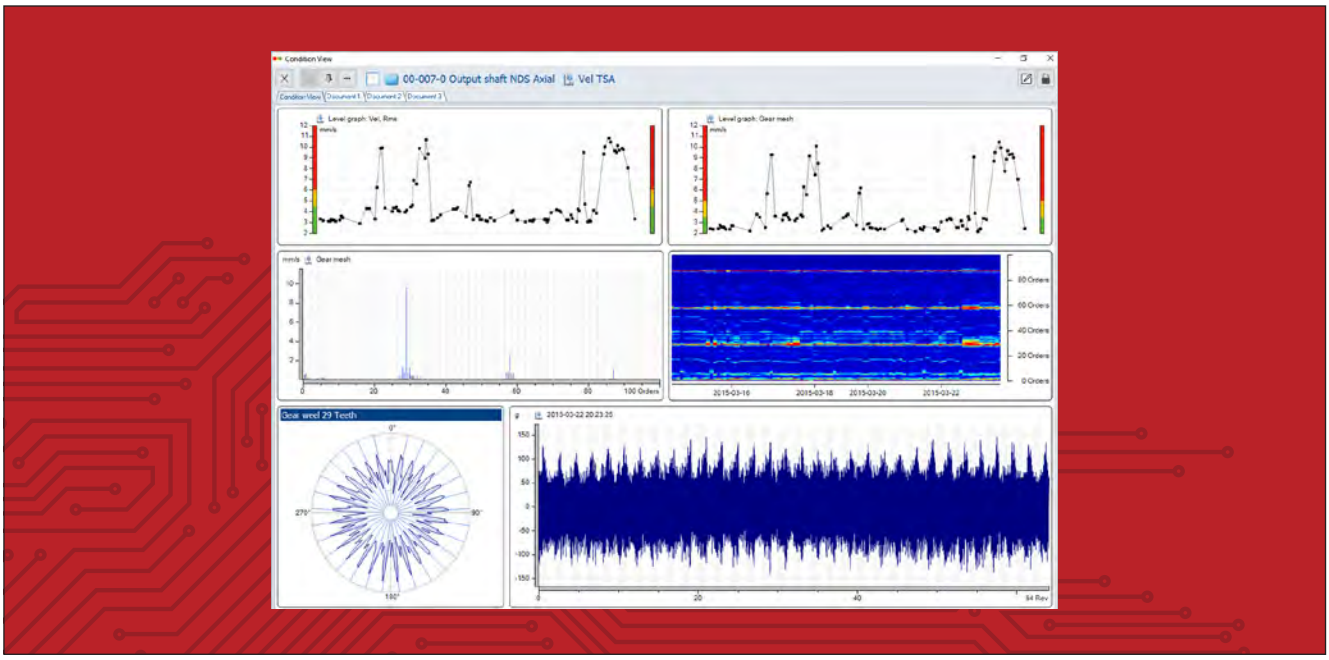
Running the AMOS link requires a CBM module in AMOS. A register of planned actions equivalent to that in Condmaster must be implemented, and component numbers need to be the same in both systems.

Z_Condmaster is the function that needs to be implemented in SAP software. Condmaster calls Z-Condmaster in SAP and sends the measuring point and alert information. SAP creates a work order and a file where Condmaster reads the SAP work order number. This file can be saved anywhere locally or on the server. It is normally placed in the Condmaster directory. The path has to be set in Condmaster.

There is no extra data input required on the SAP side. Condmaster measuring point numbers and Standard Comment codes are available to SAP software via a command to the SQL server that controls the Condmaster database.

SPM

Condmaster® Ruby – Condition View



Condition View is a flexible and powerful function that makes it possible to combine multiple graphs in Condmaster into a single window for presentation and further analysis. The function can be used to show current machine condition, recent condition development or maintenance actions, e.g. to clarify or justify planned maintenance activities.

Condition View provides a useful overview of the most interesting condition data and any complementary information for a particular measuring point. For one or more measuring points, trend graphs, spectrums, time signals, Colored Spectrum Overview graphs, and circular plots, etc. can be combined as desired. It is also possible to include different measuring techniques in the same view.

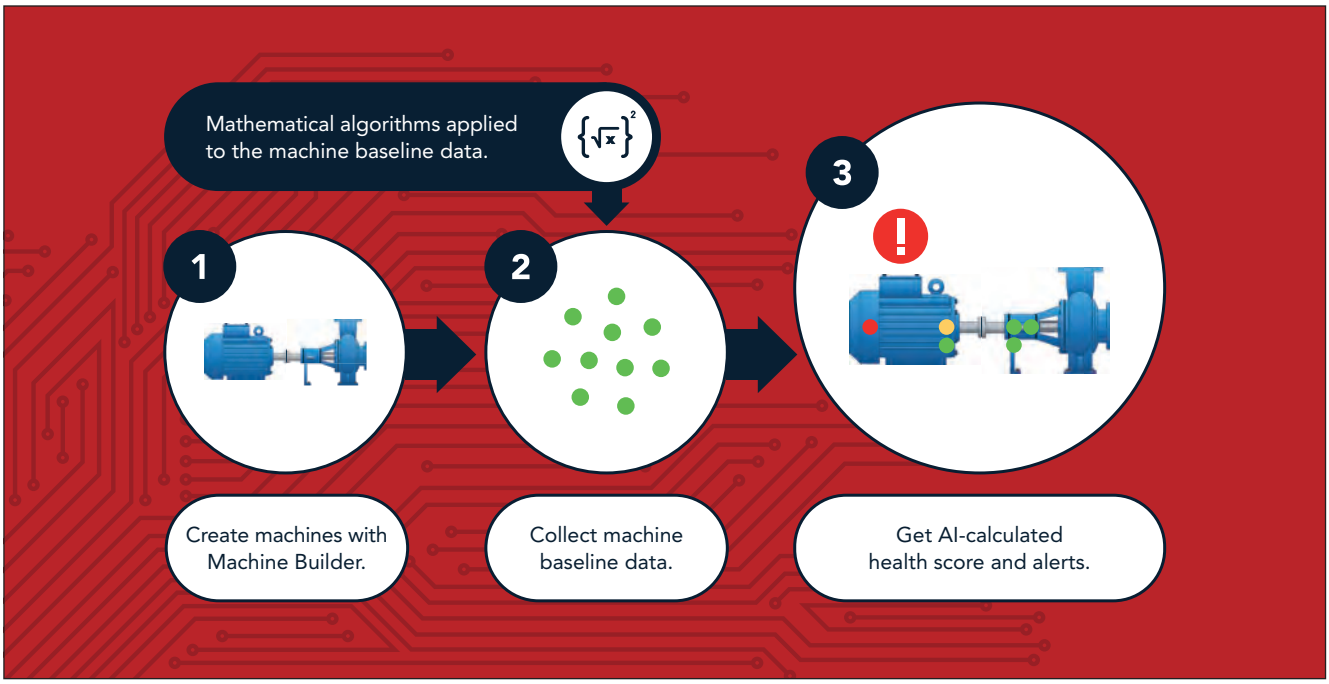
The default settings of the Condition View function can be modified to suit customer preferences.

The function is user-friendly, with ability to set cursors, zoom and rescale graphs directly in Condition View mode, and quickly navigate from there to individual graphic functions. The content can be printed and/or saved as MS Word files. Condition View also offers the possibility to customize and export its content, including cursors and notes, to the Condition View Report function as a basis for report generation.

The Condition View function is part of the Condmaster Ruby platform (TD-584).

SPM

Condmaster® Ruby – Decision Support System



The Decision Support System (DSS) provides users with predictions about machine damage and general machine health.

The overall purpose of the DSS is to relieve maintenance personnel from having to deal with vast amounts of measurement data to analyze and find insights into root causes and problem-solving. Instead, the DSS uses artificial intelligence, statistical analysis, and other algorithms to mine this data for information, automatically detecting the patterns that most warrant maintenance efforts. The DSS minimizes the time required for a correct assessment of machine condition without users needing in-depth knowledge of data analysis, and guides the user to informed and effective decisions.

The highly automated DSS learns from past operations and uses collected data to continuously provide better predictions.

In Condmaster Ruby, these standalone features form DSS:

- **Machine Builder**, where complete machines can be created from a component library. The feature generates suitable measuring points, measurement assignments, and machine fault symptoms. Assembled machines are added to the Graphical Overview as illustrations with associated color zones.
- **Signal Quality Test**, a background process that continuously checks for ski slopes and bias problems. The function can also identify issues with faulty or incorrectly connected transducers. The main purpose is to determine if the signal is of good quality.
- **Machine baseline**, where normal machine behavior can be determined. The machine baseline data, collected during a learning phase, can be used to automatically calculate deviations and potentially raise alerts for the machine fault symptoms and condition parameters.
- **Health score** is calculated by applying mathematical algorithms to the collected baseline data. The health score is presented in blue-green-yellow-orange-red-dark red colors for a detailed evaluation. The health score corresponds to a normalized floating-point value from 0 to 1, where 0.2 – visualized in green – represents the normal condition of the machine baseline.
- **Alerts** inform users about deviating machine conditions, highlighted DSS predictions via Entity rules, and other device events. Alerts offer flexible handling of actions based on the condition and criticality of the machine, which includes setting priority levels and status indications on individual alerts.
- **Entity rules**, a feature that is optionally used as a hub for expanding and customizing Condmaster with event-driven functions, as well as creating custom integrations with other IIoT systems. With Entity rules, it is possible to monitor a variety of events and automatically invoke actions based on these events.

All features of the DSS are included in the Condmaster Ruby platform. For further information, see technical data sheet TD-583.

SPM