kmo-VibroUniT™

Innovative Universal Transmitter for Eddy Current Probes

- Universal in use for measurement of rotor vibration and axial position
- Save high investment costs for the replacement of discontinued vibration monitors and still gain monitoring quality and adjusting comfort!
- **kmo-VibroUniT** enables full vibration monitoring even during the critical start-up period!
- Free adjustment of the sensitivity
- Combinable with all systems on the market; already installed components such as probes, oszillators, extension cables can be kept in use

Non-Contact Eddy Current Systems

In many cases eddy current probes are used on high-speed turbomachines to measure the rotor vibration and the axial shaft position. According to the eddy current principle metal surfaces can be scanned contactlessly with an accuracy down to 1 µm. Applications with frequencies up to 10 kHz can be accomplished.

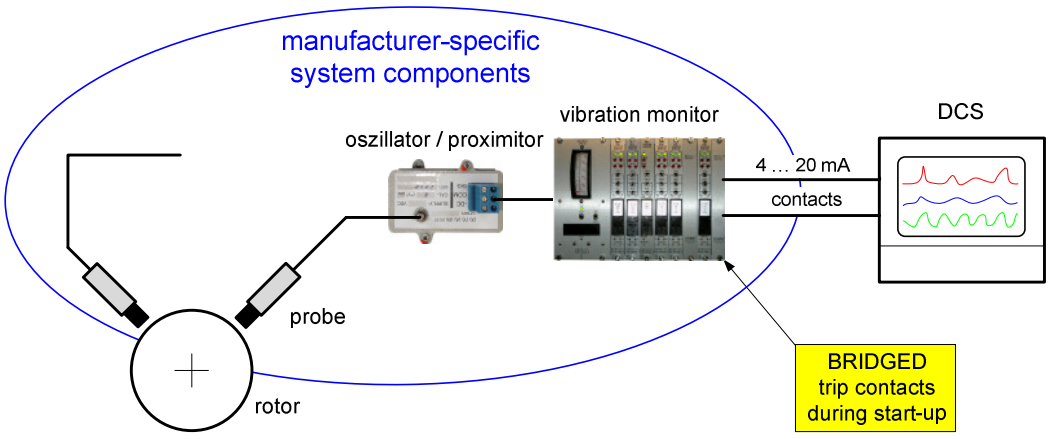
The typical setup consists of an eddy current probe, an extension cable, an oszillator placed in a local junction box and a vibration monitor mounted in a control cabinet.
Beyond that plain transmitter solutions are available; instead of the stand-alone oszillator, an oszillator and transmitter are merged in one unit. The transmitter output signals are monitored by a downstream system. Furthermore even probe designs with integrated oszillator, partly also with integrated transmitter exist.

Stand-alone vibration monitoring systems often overshoot the real demand

Digital control systems become increasingly popular. They are used for operation and visualization as well as for monitoring. Merely for the monitoring of the vibration and axial position of turbomachines expensive stand-alone monitoring systems are still common.

It is common practice that monitoring systems are discontinued within maximum 10 years. Usually after the discontinuation the prices for spare parts increase extremely. Follow-up models are equipped with new and comprehensive functions for analysis and diagnostics and thus are even more expensive.

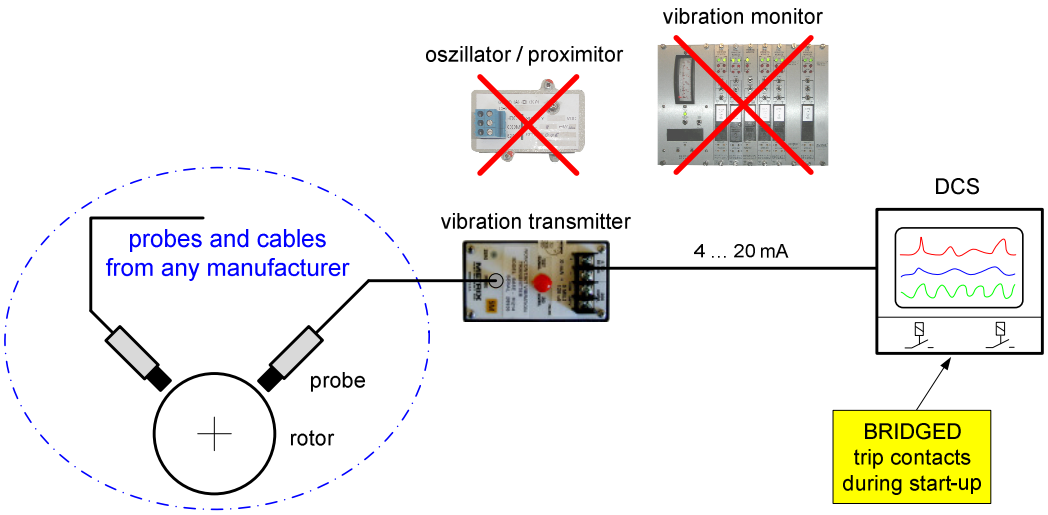
From experience, these new functions are hardly used. On the one hand there is no need for them, on the other hand there‘s a lack of specialists to properly interpret the gathered information. In most cases only the 4...20 mA signal is used to be monitored in the downstream DCS. From that point of view the expensive monitor is simply used as power supply for the oszillator and as a multi-channel transmitter.



Measuring and monitoring set-up according to the conventional "monitor solution"

Much more cost-effective is a transmitter solution

Here the oszillator is replaced by a vibration transmitter and the vibration monitor can be omitted. The manufacturers of vibration transmitters are flexible enough to adapt them to sensors from any manufacturer; this means, existing installations of probes and extension cables can stay in use and the monitoring is done in the DCS.



Measuring and monitoring set-up according to the "transmitter solution"

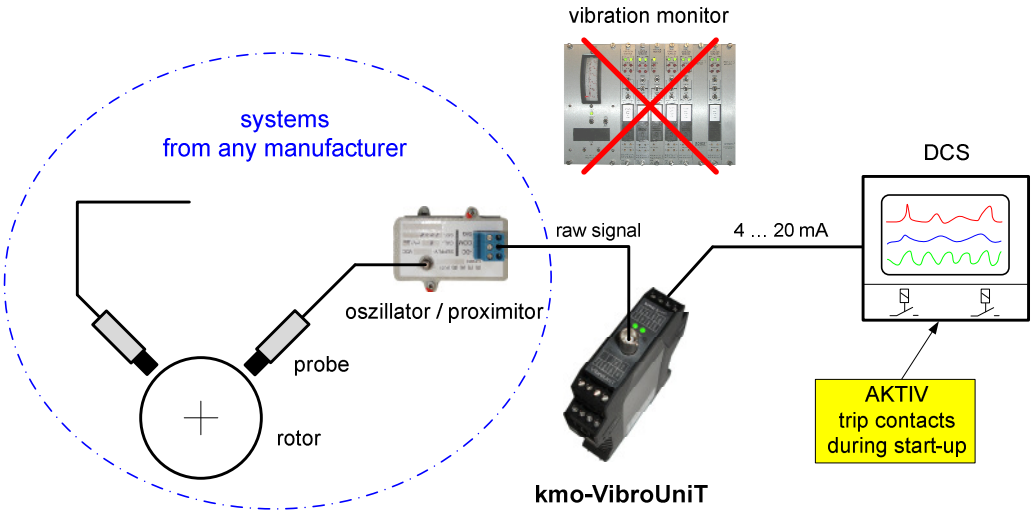
Both the monitor and the transmitter solution have disadvantages

During start-up period many turbomachines at certain measuring points show peaks of the vibration signal, which exceed the trip level. In order to avoid a machine shutdown during the start-up period it is usual to bridge the trip alarms or to increase the limit values. However from experience especially the most severe damages are caused during the critical start-up period.

Without special measures manufacturers of eddy current systems only guarantee an accuracy of up to ±12% (!). Generally, the manufacturers insist on using only original components and do not approve any combination with products of other manufacturers. Otherwise they predict measuring errors or malfunction. With the same argument they reject even the replacement of loose cable connectors or the repair of damaged cables.

With VibroUniT kmo turbo has developed a system, which eliminates existing disadvantages and offers functions truely convincing professionals

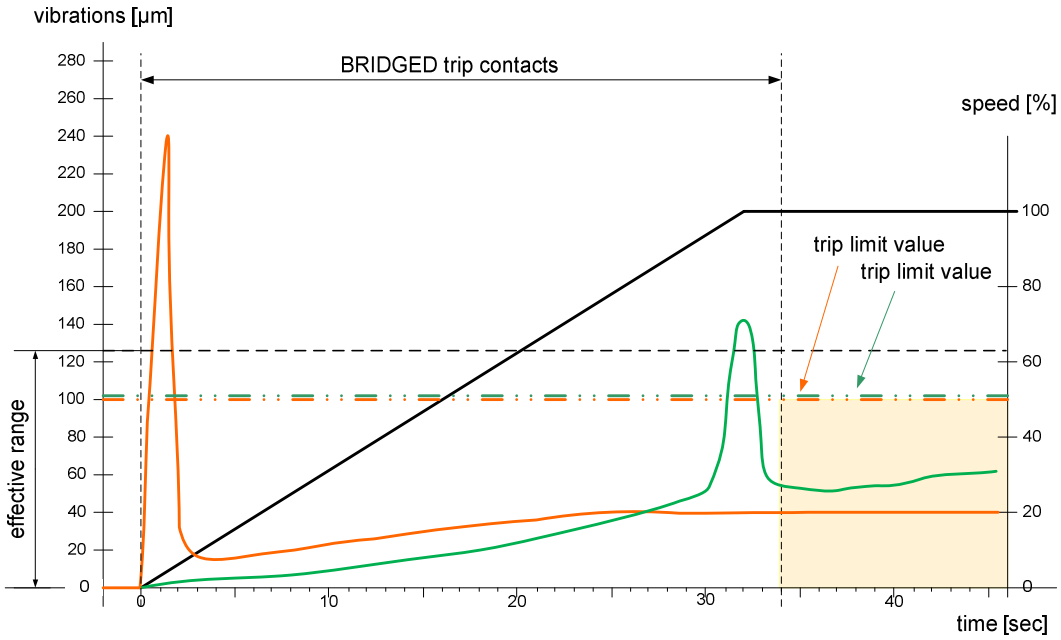
Sceptics of transmitter solutions argue that transmitters react on fast signal changes only with a delay. However they neglect to mention that each monitor system works with a trip delay, adjustable from 0,3 sec to more than 10 sec. **kmo-VibroUniT** works with a measuring time of 100 msec, which also represents the response time. Further special features of **kmo-VibroUniT** are presented on the following pages.



*Measuring and monitoring set-up according to the advanced **kmo** transmitter solution*

Irresponsible: no vibration monitoring during the start-up period!

Many machines, especially if they are driven via electric motor and spur gear, immediately after the start show peaks exceeding the trip level.



Possible causes: lifting of the pinion, passing the natural resonance frequency of the rotor or torque variations when synchronizing. These peaks are considered normal and must not lead to a machine shutdown.

Conventional approaches to avoid a not required machine shutdown:

1. Bridging the trip contact

The classic method is to bypass the vibration monitoring during the whole start-up period; regardless of for how many channels this is necessary and regardless of how long the excessive signal peaks really last. The expert knows that during the start-up period the most, often times severe, machine damages are caused. In many cases the extent of these damages could be reduced drastically with an active vibration monitoring. There are cases known from practice in which during the "bridged" start-up period the vibrations achieved such a high level, that the rotor touched the sensor tip and destroyed it. The signal of a defective probe drops to zero, which means, that even after the end of bridging machine shutdown due to rotor vibrations is impossible. Usually such circumstances lead to total loss!

2. General delay of the trip contact

Another occasionally used method is a general trip delay, that means that the limit value has to be exceeded for a pre-set time period. The big disadvantage of this is, that the delay is effective even after the start-up period and thus prevents a prompt reaction in case of a damaging.

3. Monitoring in the DCS reaches its limits

Monitoring via DCS fails, if a limit >100 % is needed, which happens quite often during the start-up period.

4. "TRIP-Multiplier"

Expensive stand-alone vibration monitoring systems offer the possibility to increase the limits according to related events. This function is technically neat but included the disadvantage for the user that he is bound to use the expensive monitor and has no possibility to set the limits comfortably and cost-effectively in the DCS.

kmo-VibroUniT – the new universal transmitter for Eddy Current Probes

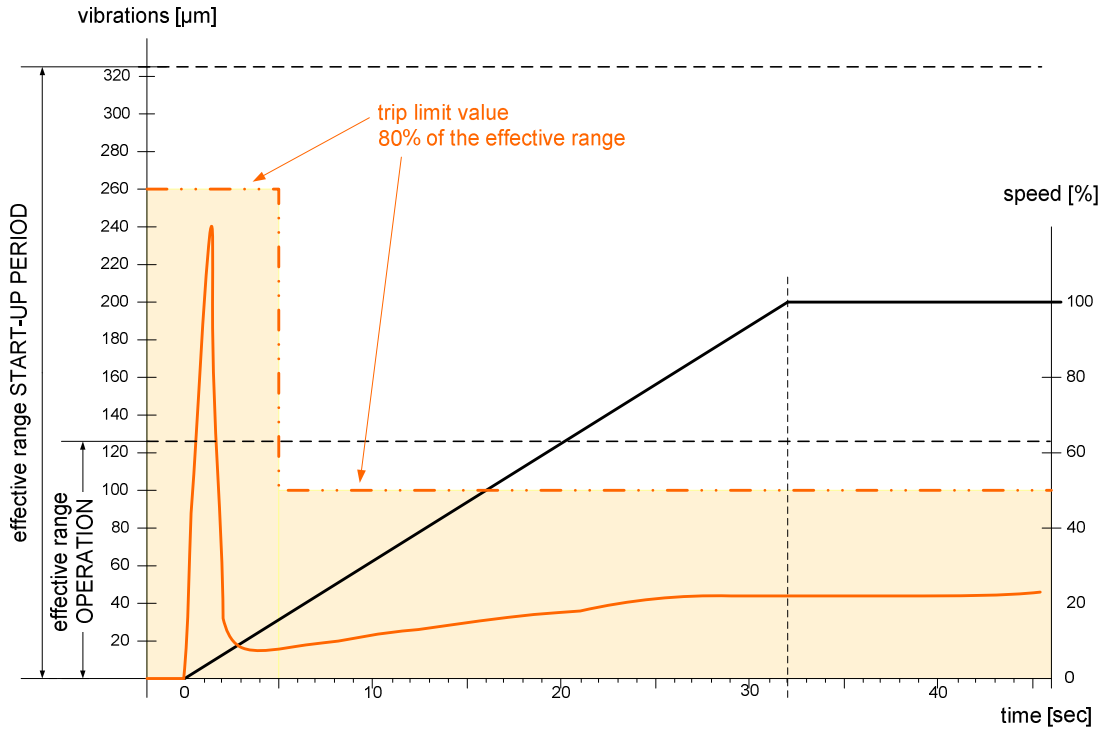
Due to an event-controlled switching between two measuring ranges **kmo-VibroUniT** enables the full vibration monitoring even during the critical start-up period!

kmo-VibroUniT allows the adaption of the effective range according to the requirements during start-up and operation. The switching of the ranges can be activated optionally by an external contact or internally by automatic detection of the standstill respectively the start of the machine.

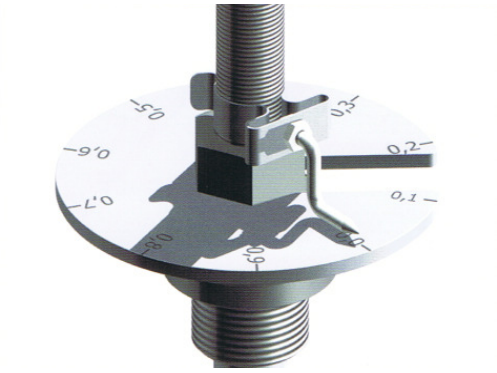
Internal detection: kmo-VibroUniT already switches to the higher measuring range as soon as the vibration level falls below a pre-set threshold after machine shutdown. The restart of the machine will be detected by exceeding again this threshold. After a predetermined time period from the start, **kmo-VibroUniT** will switch over to the normal operating range.

External switchover: With "circuit breaker OFF" **kmo-VibroUniT** will switch over to the higher range. Compared with the internal detection this has the advantage that excessively high vibration values during the run-down period cannot be wrongly interpreted as reason for a machine shutdown. After a predetermined time period from "circuit breaker ON" it will switch over to the normal operating range. Certain periods can be set individually for each channel. The external contact can also be used to avoid a shutdown of the machine caused by rotor vibrations due to surging of a turbo compressor.

The vibration values are monitored in a PLC respectively in a DCS downstream to the transmitter. **Thanks to the event-controlled switching of measuring ranges one single limit value per channel is sufficient to monitor the whole operating range.** Weak compromises such as bridging or delaying trip contacts belong to the past!



Only with the **kmo-VibroUniT** the sensitivity of the measuring loop can be adjusted precisely. A so far unreached indication accuracy is achieved if the exact sensitivity is determined by using the **kmo probe mounting system**. To measure the sensitivity there is no need to dismantle the sensor. Inaccuracies due to badly tuned eddy current measuring systems are compensated.

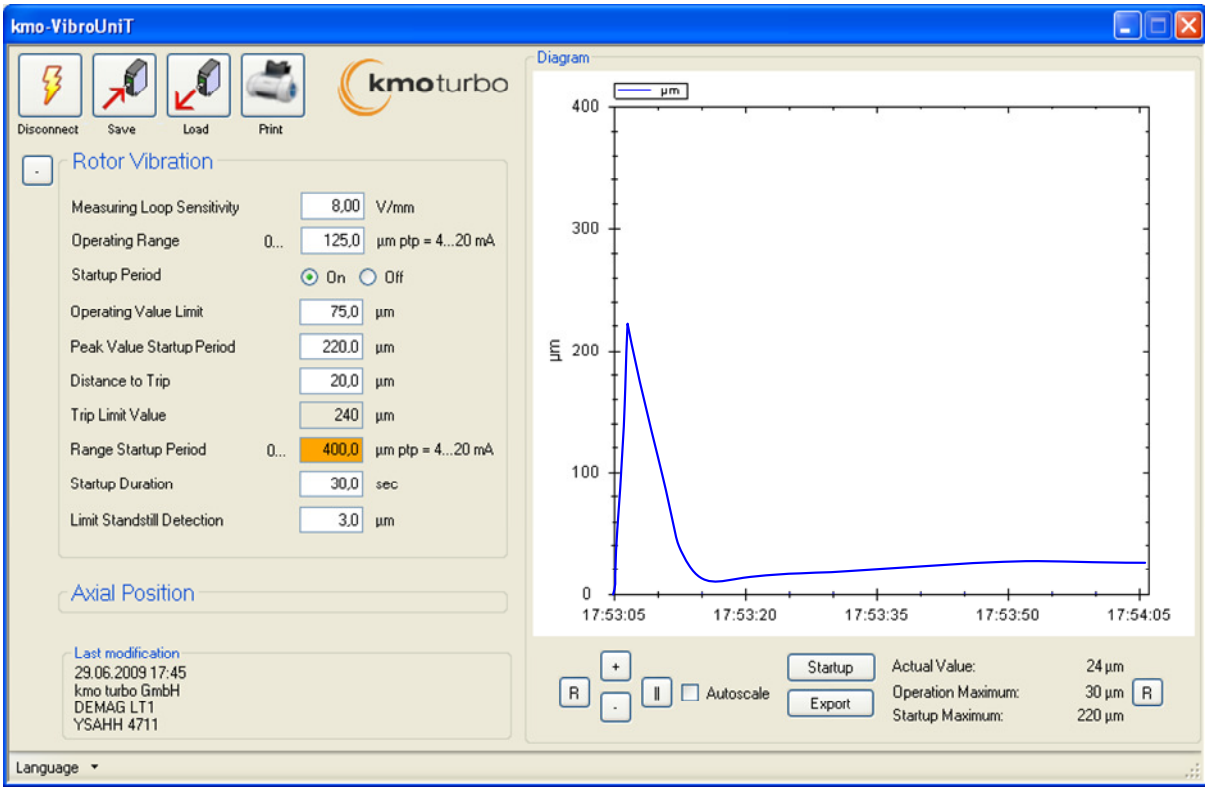


Special features of kmo-VibroUniT

kmo turbo offers ready-to-use transmitters, if the operating conditions are available before delivery. A sensitivity of 8 V/mm, a vibrations range of 0...100 µm and a GAP range of 2...20 V is factory set. GAP is OK between 4 and 18 V.

If during commissioning the vibration behaviour shows that the monitoring during the start-up period has to be adapted this can be done easily on-site.

kmo-VibroUniT is equipped with an interface for on-site configuration. Therefore an adapter and an easy-to-use software is provided. The input mask is divided: on the left hand side the parameters are entered, on the right hand side a 60 sec trend of the peak-to-peak value is displayed. It is recommended to acquire one adapter kit for each user.



Following two parameters have to be set:

- the **sensitivity of the measuring loop** and
- the **normal operating range**

For a special monitoring of the start-up period, following three parameters have to be set, too:

- the **trip limit for normal operation**
- the **peak value in the start-up period**
- the **deviation from trip to peak value during start-up period**

After setting these three values the trip limit as well as the range for the start-up period are calculated and indicated.
The necessary duration of the higher range can be read from the recorded vibration profile.
As standard standstill detection a threshold of 3 µm is factory set. Other values up to 10 µm are a matter of indivdual adjustment.

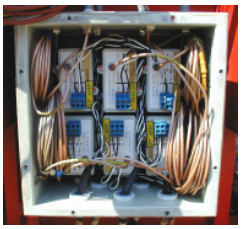
By uploading the parameters to the transmitter, “last modification“ information like username, date, time and two indentifiers is added. Below the chart the actual value, the maximum value of normal operating as well as the maximum of the start-up period are indicated.

Installation Advice

It is recommended to enlarge the oszillator box and to install an additional DIN-rail to snap on the **kmo-VibroUniT** modules.

kmo-VibroUniT determines the peak-to-peak value out of the raw signal according to the set sensitivity. Therefore it is connected to the buffered-out of the oszillator. The signal is then transformed to a 4...20 mA signal according to the range and transfered to a PLC or DCS for monitoring and visualization.

kmo turbo offers well-dimensioned junction boxes. At the cable entrance of the **kmo** junction box a 200 mm wide installation duct is foreseen for winding and storing of the excess lengths. Everything inside the box is clearly arranged and the danger of damaging a cable no longer exists.

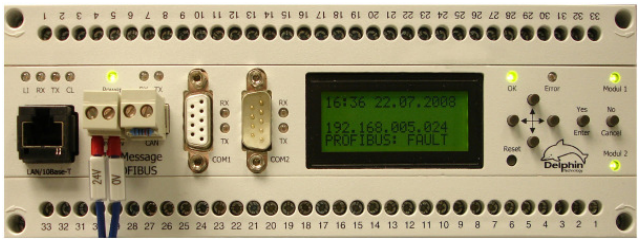


***Left picture*: negative example of a packed oszillator box**

***Right picture*: exemplary arrangement of a kmo turbo junction box**

Optimal Vibration Diagnosis

For fast and reliable diagnostics **kmo turbo** recommends an appropriately configured **TopMessage** system. With regard to short wiring paths it is recommended to snap on **TopMessage** on the DIN-rail inside the local junction box. Also with respect to easy wiring it is considerable to install external I/O's and to communicate with the PLC via Profibus.



Bearing Damage Indicator

kmo-VibroUniT also provides a mA-Signal proportional to the GAP. The **kmo Bearing Damage Indicator** (function module for a S7 PLC or a DIN rail module) evaluates this signal.

Measuring of Axial Position

kmo-VibroUniT is an universal module for measuring the rotor vibration as well as the axial position; this simplifies the stock-keeping.

Even for the axial position measurement **kmo-VibroUniT** provides something particular: Zero adjustment via mouse click. Often the axial position monitoring is done in a 2 out of 3 voting. Each operator becomes confused if three different values are indicated. With **kmo-VibroUniT** this belongs to the past. If the machine is running at normal conditions all three indications are set exactly to zero via a mouse click. Any irregularity will be realized immediately!

kmo-VibroUniT™

Technical Data

Universal Transmitter for Eddy Current Probes

Power supply:	18 - 30 V DC, reverse polarity protected
Power consumption:	100 mA max
Casing:	DIN rail housing 35 mm (EN 60715)
Dimensions:	130 x 100 x 22,5 mm
Weight:	120 g
Connection:	Spring clamp terminal, 4 x 4
Operating temperatur:	- 20 to + 85 °C
Protection class:	IP20
Directives:	RoHS, CE
Display:	LED: Power supply OK LED: GAP OK (4 - 18 V)
Analog input:	Raw signal from oszillator / proximitor Connection via BNC or spring clamp terminal
Analog output:	4 ... 20 mA, 2-wire, vibration peak-to-peak 4 ... 20 mA, 2-wire, GAP
Digital output:	GAP-OK (4 V to 18 V), floating 100 mA / 24 V
Digital input:	24 V DC, external switchover of range
Programming interface:	TTL serial 19200 Baud Configuration and parameter setting via PC

Pin assignment:

Terminal	Signal	Remark	
A1	GAP +	Analog output GAP	
A2	GAP -	Analog output GAP	
A3	ptp +	Analog output vibration	
A4	ptp -	Analog output vibration	
B1	VCC	5 V DC	
B2	TxD	Output TTL	Programming interface
B3	RxD	Input TTL	
B4	GND	Ground	
C1	DI +	External switchover	
C2	DI -	External switchover	
C3	SW +	Raw signal +, parallel BNC	
C4	SW -	Raw signal -, parallel BNC	
D1	POW +	Power supply 18 - 30 V DC	
D2	POW -	Power supply -	
D3	OK +	Digital output GAP-OK	
D4	OK -	Digital output GAP-OK	

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