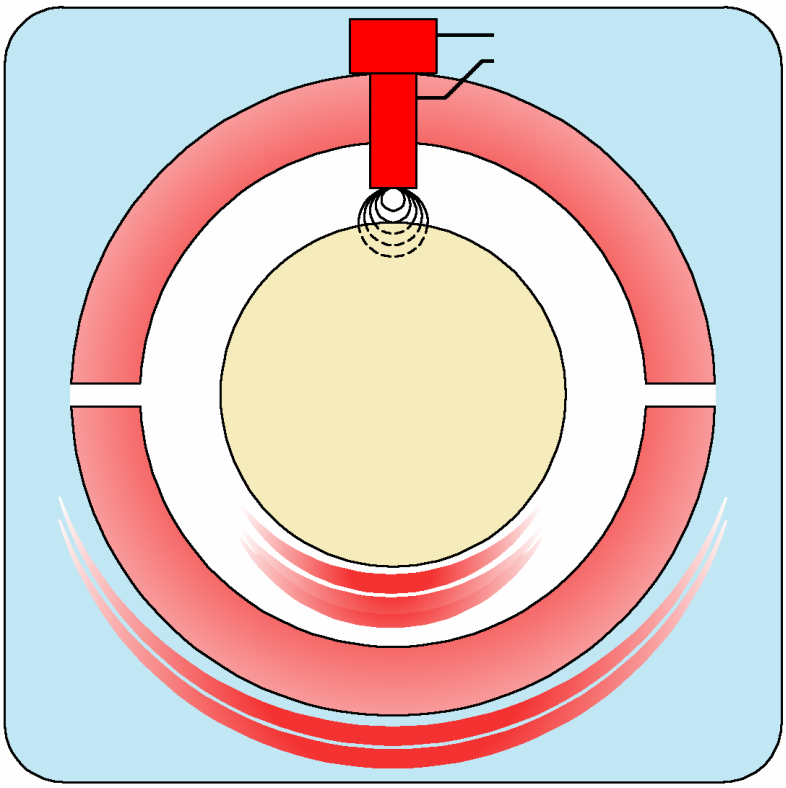
MMS 6140
Monitor for Absolute Shaft Vibration



- **Part of the MMS 6000 Machine Monitoring System**
- **For connection of one eddy current sensor and one seismic or piezo-electric transducer.**
- **Signal frequency ranges 1...250 resp. 5....2000 Hz**
- **Both channels may also be used in single-channel-mode, channel 1 for shaft vibration and channel 2 for bearing vibration.**
- **Measuring results of both channels to be combined with each other for calculation of the absolute shaft vibration.**
- **Sensor supply balanced to ground to suppress disturbances in industrial environments**
- **RS 232 interface for configuration and reading out of measuring results**
- **RS 485 interface for connection to epro's MMS 6800 analysis and diagnosis system or to host computers**

Applications:

The **MMS 6140** dual-channel monitor has been designed for the use with two different transducers. Channel 1 operates with eddy current sensors and channel 2 with seismic or piezoelectric sensors.
Each measuring channel can operate separately or the results of both channels may be used to calculate the difference. By means of calculating the difference of these signals, the absolute shaft vibration results.

At the **MMS 6140** monitor the relative shaft vibration is measured with an eddy current sensor and the absolute bearing vibration with a seismic or piezo-electric sensor.

The phase shift between the signals, caused by the different measuring principles, is compensated by the electronics. In the following, the bearing vibration signal is subtracted from the shaft vibration signal. The time signal arising thereof is then processed like a normal vibration signal, converted to a characteristically value according to the configuration parameters, output as current signal and supervised on limit exceedings (see fig. right)

The measurement of absolute shaft vibrations serve the construction of turbine protection systems. They provide signals for analysis and diagnosis systems to be further processed in field bus systems and networks.

Such cards of the **MMS 6000** family are suitable to build up systems for increasing performance, efficiency and safety of operation and to extend the machines' life times. Application fields of the **epro** measuring amplifiers are steam, gas and water turbines, compressors, fans, centrifuges and other turbo machinery.

epro

Technical Data:

Sensor inputs:
Two independent sensor inputs. Channel 1 for eddy current sensors, channel 2 for seismic or piezo-electric sensors. The signal inputs are differential inputs, galvanically isolated from the system supply, open circuit and short circuit proof.

Channel 1 eddy current sensors:
Input impedance:
≥ 100 kΩ
Input voltage range:
-1…-23 V
Signal frequency range:
1/5…50…2000 Hz
Signal voltage range:
minimum range: 0… 400 mV_{pp}
maximum range: 0…2000 mV_{pp}
freely configurable
Sensor supply:
The sensors has an individual supply output, galvanically separated from all system voltages and the power supply of the monitor and is open circuit and short-circuit proof.
Parallel connection with other modules possible without mutual influences.
Nominal voltage:
-26,7 V
Available output current:
typ. 20 mA / max. 35 mA

Channel 2 seismic /piezo-electric:
Input impedance:
≥ 100 kΩ
Input voltage range:
-5…+15 V
Signal frequency range:
5/10…50…1000/1600 Hz
according to VDI 2056 / DIN 45666 / ISO 3945; 10…1000 Hz with corresponding filter characteristics
Signal voltage range:
minimum range: 311 mV_{pp}
maximum range: 9500 mV_{pp}
freely configurable
Sensor supply when operating with piezo-electric transducer:
Galvanically separated from the supply voltage, open circuit and short-circuit proof.
Current range:
0...8 mA; programmable in steps of 40 µ A
Accuracy:
±0.5% of the measuring range; 0.5% of the adjusted value
Permissible load:
≥ 3,4 kΩ bei 8 mA
≥ 13,6 kΩ bei 2 mA
Control inputs:
Common logical binary inputs for both channels.
For choosing the operating mode of the limit values for „warning“ and „danger“
- open circuit and closed circuit mode
- Channel or module inhibit
Measuring range multiplier to modify the alarm limits during run-up or run-down; adjustable within 1.000 to 4.999; 24 V logic.
Input resistance:
≥ 30 kΩ
Key pulse input:
1 pulse per revolution for analysis purposes of the system:
24 V Logic
Input resistance:
> 30 kΩ
Pulse duration:
min. 10µs (edge-triggered)
Voltage inputs:
0…10 V; (Two, one for each channel)
Input impedance:
> 100 kΩ
Resolution:
10 bit

Important hint!
When operating the monitor for measuring the absolute shaft vibration, the filter of the monitor must be adapted to the frequency response of the used bearing vibration sensor.
This adjustment may only be made at epro's.

Measuring modes:

General:
Each channel must individually be configured via the available interfaces. The configuration may be changed any time during operation.

Measuring modes for the dual channel mode: .
Channel 1:
Measurement of the relative shaft vibration.
S_{o-p} / S_{p-p}

Channel 2:
Measurement of the absolute bearing vibration Veff according to VDI 2056.
S_{o-p} / S_{p-p}
Measurement according to DIN 4566 and ISO 3945

Measuring mode for the dual channel mode:
The bearing vibration signal is subtracted in-phase from the shaft vibration signal to calculate the absolute shaft vibration.
S_{o-p} / S_{p-p}

Programmable measuring parameters:

- Measuring range
- Measuring unit
- Transducer sensitivity
- Warning and alarm limits
- Filter frequency ranges
- High pass filter 2nd order:
  12 dB/Okt.; 20 dB/decade
  Butterworth 1/5 Hz (channel 1)
  Butterworth 5/10 Hz (channel 2)
- Low pass filter 5th order;
  24 dB/Okt.; 40 dB/decade
  Butterworth 50..2000Hz (channel 1)
  Butterworth 50..1000Hz (channel 2)
  adjustable in steps of 10 mHz
- Channel identification by means of KKS numbers or freely selectable designations
- combination of channel values
- Order analysis function:
  With function order analysis characteristical variables of 5 freely selectable harmonics are calculated according to their amounts of amplitude and phase (within the range ¼, ½, 1. up to the 10th harmonic)
- Hysteresis

Limit supervision:

There are 2 alarm limits for each channel, adjustable independently from each other. Supervision of the limit values may be disabled with an external digital signal or via the Channel-Clear function in case of a module error.
Having loaded a new parameter configuration to the module, the alarm outputs remain blocked for a delay time of 15 sec.

Adjustment range limit values:
5....100% of f.s.d

Resolution and reproducibility:
1‰ of f.s.d

Delay time:
0-1-2-3-4-5 sec. adjustable

Switching characteristics:
rising signal level

Switching hysteresis:
configurable
(only at falling signal levels)

Outputs:
via potential-free opto coupler outputs at the rear connector

U_{max} = 48 V DC
I_{max} = 100 mA

Module and sensor supervision:

The internal module supervision comprises the following functions:

- Transducer signal within a predefined good range
- Wiring between transducer and module (short-circuit, interruption)
- System supply voltage within predefined limits
- Configuration and parameter setting OK
- Measuring values within measuring range
- Operating temperature of the module
- System watchdog

During the change from the error to the ok-state and after power-on of the module, all functions of the module are blocked for a delay time of 15s (alarm enable after 60 s).

A green LED on the module front indicates the "Channel clear" state. During an error state, this LED is switched off, during the delay period it flashes.

The states for both channels are output to the connecting strip at the rear via optocouplers for the purpose of galvanically separation

U_{max} = 48 V DC
I_{max} = 100 mA

Reasons for module disturbances can be read out in detail via the communication interface. This permits the technicians to remove the reason for the fault immediately.

Signal outputs at the connecting strip:

Connecting strip:
according to type F48M, DIN41612
RS 485 communication interface
One current output per channel, proportional to measuring range and chosen variable.

Nominal range:
0/4...20 mA
open circuit and short-circuit proof
Permissible burden:
≤500 Ω
Resolution:
16 bit
Accuracy:
±1% of f.s.d
Settling time:
0…10 s; in steps of 1 s; separately adjustable for each channel.

One voltage output per channel, proportional to chosen variable and measuring range.

Nominal range:
0...+10 V
open circuit and short-circuit proof
Load resistance:
≥10 kΩ
Resolution:
8 bit
Accuracy:
±1% of f.s.d

One voltage output per channel, proportional to the dynamic part of the signal.

Nominal range:
0…20 V_{pp}
open circuit and short-circuit proof
Load resistance:
> 10 kΩ

Frequency range:
Channel 1:
0,1 Hz…16 kHz (±20 % / -3 dB)
Channel 2:
0,1 Hz…5 kHz (±20 % / -3 dB)
Only channel 1:
One voltage output, proportional to the dc part of the sensor signal (basic distance "GAP" between sensor and shaft)
Nominal range:
0…10 V DC (NGL) open circuit and short-circuit proof
Load resistance:
> 10 kΩ
Accuracy:
±1% of f.s.d.
Resolution:
12 bit

Operating elements at the module front:

Two sensor signal outputs, independently from each other, one for each channel:
The signals are proportional to the sensor signals and can be tapped at the SMB sockets on the module front.

Channel 1 range: -1…-24 V
Channel 2 range: ±10 V
Load resistance: ≥100 kΩ
Internal resistance: 1 kΩ
Frequency range:
Channel 1: 0…16 kHz; ±20 %
Channel 2: 0,1…5000 Hz; ±20 %

2 green LEDs
indicate "Channel Clear" separately for channel 1 and channel 2.
2 red LEDs:
indicate pre and main alarm separately for both channels.

1 Mini DIN diode socket:
RS232 interface for connection of a computer for configuration and data interchange with the module.
Handle:
To pull out and insert the module and for labelling purposes.

Power supply:

Redundant supply input via two supply inputs, decoupled via diodes. At least one supply input is required for the supply of the module.
Supply voltage:
18....24....31.2 V dc
according to IEC 654-2, class DC4

Power consumption:
max. 8 W (max. 300 mA at 24 V)

Other supply voltages can be realized with additional system power supplies.

System design:

At stand-alone operation, unlimited number of modules.
Max. 31 modules / 62 channels may be operated at one RS 485 bus
If more modules / channels are necessary, e.g. with an MMS 6855, another RS 485 bus must be installed.

Environmental conditions:

Protection class:
Module: IP 00 according to DIN 40050
Front plate: IP21 according to DIN 40050

Climatic conditions:
according to DIN 40040 class KTF
Operating temperature range::
0....+65°C
Temperature range for storage and transport:
-30....+85°C

Permissible relative humidity:
5....95%, non condensing

Permissible vibration:
according to IEC 68-2, part 6
Vibration amplitude:
0.15 mm in range 10...55 Hz

Vibration acceleration:
16.6 m/s^2 in range 55...150 Hz

Permissible shock:
according to IEC 68-2, part 29
peak value of acceleration:
98 m/s^2
nominal shock duration:
16 ms

EMC resistance:
according to EN50081-1 / EN50082-2

Dimensions:

PCB/euro card format according to DIN 41494 (100 x 160 mm)
Width: 30,0 mm (6 TE)
Height: 128,4 mm (3 HE)
Length: 160,0 mm
Net weight: approx. 320 g
Gross weight: approx. 450 g
including standard export packing
Packing volume: approx. 2,5 dm3
Required space:
14 modules (28 channels) per 19 " frame

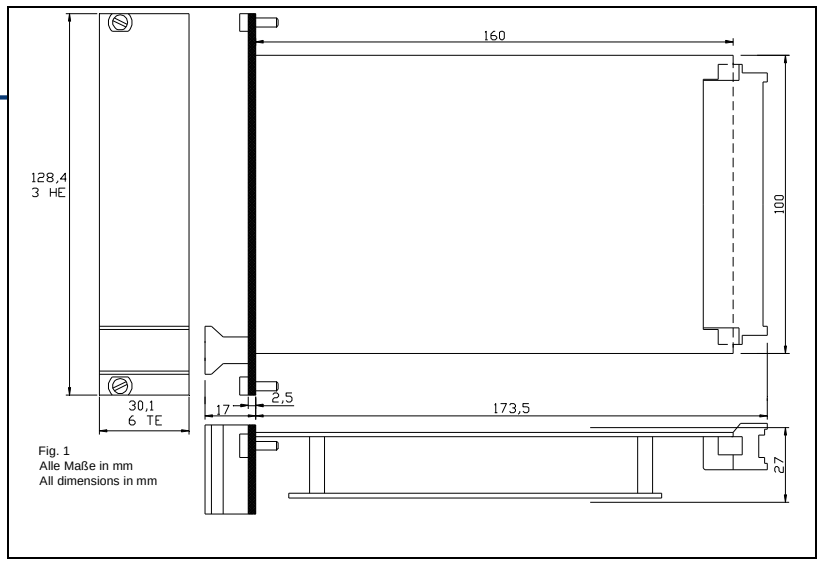


Fig. 1
Alle Maße in mm
All dimensions in mm

Requirements on configuration PC:

Configuration of modules is made via the RS 232 interface on the module front or via the RS 485 bus by means of a computer (laptop) with the following minimum specifications:

Processor:
486 DX, 33 MHz
Interfaces:
one free RS 232 interface (COM 1 or COM 2) with FIFO type 156550 UART

Capacity of hard disk:
min. 5 MB
Required working memory:
min. 620 KB
Operating system:
WIN® 98, NT 4.0 oder 2000

Connection diagram:

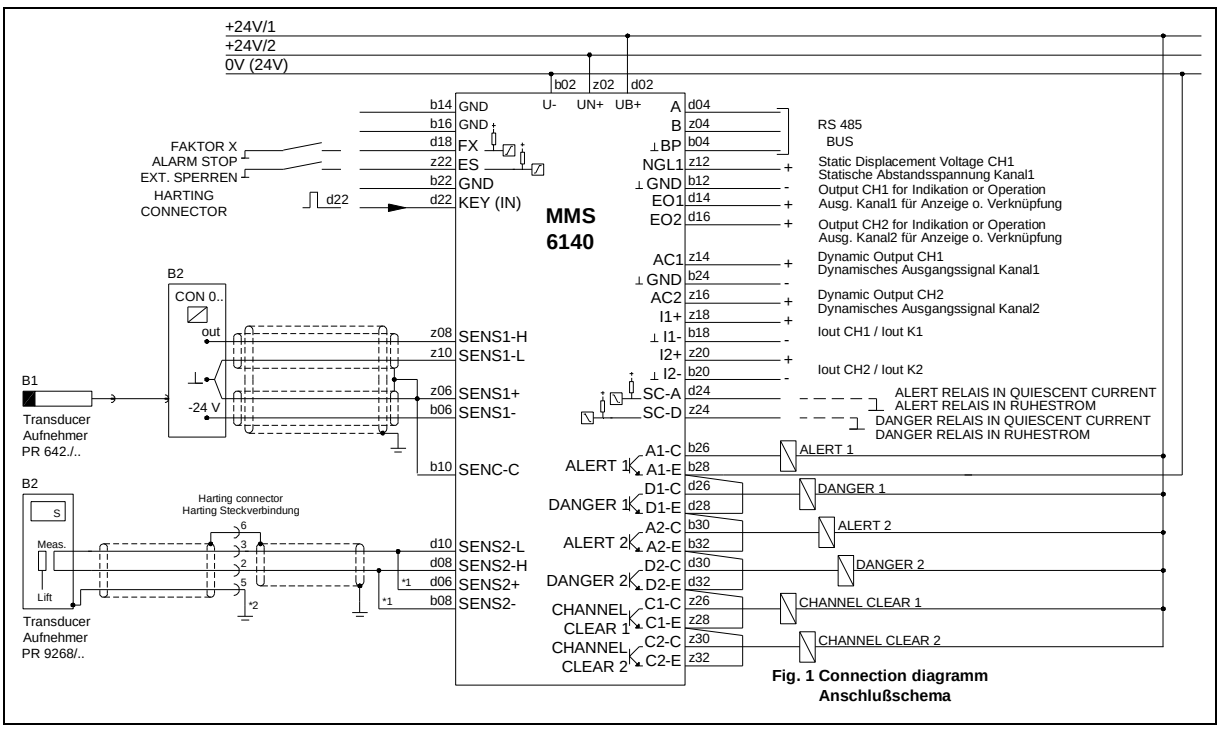


Fig. 1 Connection diagramm
Anschlußschema

Order numbers:

MMS 6140 Dual channel measuring amplifier for eddy current, seismic and piezoelectric sensors..... **9100 – 00058**
MMS 6910 Operating accessories ..... **9510 – 00001**
consisting of: operating and installation manual, configuration software and various connection cables

The F48M mating connector has to be ordered separately depending on the intended wiring technology.

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