VM2R
Vibration and displacement monitor 2-channel

- 2 inputs:
  for a vibration sensor type IEPE or
  eddy-current type displacement sensor
- input for phase marker sensor
- 2 galvanic isolated outputs 4-20mA with HART protocol
- RS-485 Modbus RTU, galvanic isolated
- WiFi radio output with ModbusTCP protocol
- 3 binary outputs of OC type with optical isolation

Application

The VM2R monitor is a 2-channel device dedicated for condition monitoring of rotating machinery, e.g. compressors, fans, blowers, pumps, electric motors.
It can be used for the purposes:
- measurement, visualisation and archiving of absolute vibration, relative vibration, axial position and rotating speed,
-signaling and protection of the machine from excessive level of vibration, displacement, rotating speed,
- analysis of the dynamic condition of the machine.

Description

It is designed to cooperate with sensors:

- piezoelectric accelerometers or piezovelocity sensors of vibrations with the 2-wire IEPE power supply standard,
- proximity eddy-current sensors and eddy-current contacting sensors with 3-wire interface and negative supply voltage (-24VDC power supply, common zero, -2 to -20V output signal).

The values of the measured estimates are available for the supervisory system in the form of:

- 4-20mA passive outputs with HART protocol,
- MODBUS RTU protocol on the RS485 output,
- MODBUS TCP via WiFi

Machine protection is carried out via 3 open collector type switching outputs, freely configurable by software within two measurement channels and the rotation channel and all estimates measured in these channels. The OC outputs are activated when the set threshold values of particular estimates are exceeded or because of the malfunction of measuring circuit. Two threshold values can be set for each of two basic channels and one phase marker/rpm channel.

Besides the measurement of different estimates of measured quantities, the monitor is a source of digital data representing sampled analog signal associated with the time stamp. These data transmitted to a diagnostic station via WiFi wireless connection or LAN access point, can be used for visualization, archiving and analysis of the dynamic state of the machine, to determine shaft trajectory in sleeve bearings, to determine spectrum and envelope spectrum of the vibration signals. Our company provides appropriate software.

The VM2R has the advantage of having galvanic isolation between transmitter power supply circuit and input/output circuits as well as between all inputs and outputs. This separation enables application of the transmitter in noisy industrial environments or in distributed systems, where the distance between elements of the system is considerable.

The monitor is made in a narrow housing for mounting on the TS35(DIN) rail. There are 24 screw terminals on the top and the bottom of the housing (4-pin detachable plugs) for connecting external input, output and power cables.

The device configuration is carried out via MCX, a miniature connector on the front side (PROG), the module can be programmed on the basis of the configuration program delivered with the device. Each of the two channels has its own three-colour signaling diode on the front of the module, informing about correct operation and exceeding both threshold values. In the version with the WiFi option, an antenna is additionally mounted on the front side.

In the rear part of the housing, within the TS35 rail, the module has an edge connector to which the TBUS bus can optionally be connected, it carries the 24VDC power supply and the RS485 signal, which can be used in case of mounting several measuring modules next to each other on the TS35 rail using the TBUS bus and analogous arrangement of contacts.

Specification

METROLOGICAL
Signal inputs (quantity:2) depending on the applied sensor interface:

- Vibration sensor (IEPE standard)

Sensitivity: 10; 100; 500; 1000 mV/g or 4; 20mV/mm/s

- Eddy current non - contacting or contacting sensor / transducer system:

Sensitivity: -0,066 do –8,00 V/mm
Input voltage range: –2V to –20V
Eddy-current transducer power supply: –24VDC
Phase marker sensor input (quantity:1):
Pulse train: 0-5V to 0-24V
Maximum pulse frequency: 1kHz
Power supply of phase marker sensor: +24VDC

Outputs:

- 2 galvanic isolated 4-20mA passive outputs with HART protocol,
  240Ω <Rload <900Ω.
  Outputs require 18-48VDC to power the loop from the receiving device.
- galvanic isolated RS-485 Modbus RTU (transmission rate 2400 to 256000 bauds)
- WiFi radio output with ModbusTCP
- 3 binary outputs, OC type with optical isolation, activated from: threshold values of measured quantities in two basic channels, rotating speed, malfunction of any measuring circuit and from any combination thereof.
  Alarm thresholds are programmed in the full range of changes of the measured value. The time delay of the OC output actuation is programmed within the range from 100ms to 10min. Choice of energization of the OC output.

Measured quantities and parameters:

Absolute vibration:
Quantities: acceleration in (m/s^2), velocity in (mm/s) or vibration displacement in (µm);
Attention: Vibration displacement measurement can be carried out only by using vibration velocity sensor.

Parameters:

- RMS - root mean square,
- Peak to Peak,
- CF - crest factor
- Vector - the amplitude and phase angle of the first and second harmonic and multiplicity of rotational speed selected with a multiplier in the configuration program.

Relative vibration:

- Peak to peak, in µm
- Smax - maximum shaft displacement in µm determined on the basis of shaft trajectory,
- Vector - the amplitude and phase angle of the first and second harmonic and multiplicity of rotational speed selected with a multiplier in the configuration program.

Displacement based on proximity sensor:
Proportional value – (a gap) AVG in µm,

Displacement based on eddy current contacting sensor:
Proportional value – AVG in µm,

Rotating speed: in rpm

All the above described measured parameters (estimates) are available in the Modbus protocol (RS485 and WiFi ports) for each of the two channels. In the Hart protocol, four freely chosen estimates are available for each of the two channels. One freely chosen estimate can be assigned to the current output (module configuration program).

Dynamic band

Absolute vibration
The dynamic band of the device is set individually for each channel from 2Hz to 20kHz with the possibility of smooth adjustment of the upper limit frequency from 20kHz to 20Hz.

RMS measurement
The possibility of measuring in two independent frequency bands in each channel with smooth adjustment of the lower and upper limit frequency within the set dynamic band of the device with a resolution of up to 1Hz. The two bands in a channel may be separate or may overlap, including one band within the other.

Peak-Peak – measurement is carried out in the set dynamic band of the device

Relative vibration
The dynamic band of the device is set individually for each channel from 0Hz to 20kHz with the possibility of smooth adjustment of the upper limit frequency from 20kHz to 20Hz

Measuring range (for outputs 4-20mA)
Absolute vibration:
Maximum range:
0-20mm/s RMS (default),
another - after arrangement
0-500m/s^2 RMS, another - after arrangement
0-200µm p-p, another - after arrangement
Ranges smaller than the maximum, as above, to be set in the configuration program

Relative vibration:
Maximum range: 0-500µm p-p (default),
another - after arrangement
Range smaller than the maximum, as above, to be set in the configuration program

Rotating speed: 0-60 000 rpm

Measurement error:
Vibration, displacement: ±1% of measuring range
Rotation speed: ±1rpm

ELECTRICAL
Power consumption: <3W
Power supply: 21,6 to 26.4 VDC,
Current consumption:< 100mA (at 24 VDC, without load on OC outputs),
Isolation: power supply -1kV,
analog output and RS485 -2,5kV within 1min

ENVIRONMENTAL
Ambient temperature: -30^{0}C to +70^{0}C
Relative humidity: 90% non condensing
CE requirements : Directive 2014/30/EC Electromagnetic compatibility

MECHANICAL
Weight: 150g
Enclosure material: ABS, mounted on TS35 rail
Dimensions (H x W x D): 22,5x99x114mm
Protection rating : IP20

Ordering information

	A	B	C
VM2R-	☐☐-	☐☐-	☐☐

A ☐☐ Type of input sensor (both channels)
0 1 IEPE standard vibration sensor. When ordering the nominal sensitivity of the sensor should be given in mV/g or mV/mms^{-1}
0 2 eddy current sensor, power supply: -24VDC, 3-wires, signal: -2V to -20V
B ☐☐ WiFi port
0 1 no WiFi port
0 2 device with WiFi port
C ☐☐ TBUS bus
0 1 no TBUS bus (hole in the housing closed with a plug)
0 2 with TBUS bus

In order to obtain a fully configured monitor, please give the following information in the order: sensor sensitivity at the input, measuring ranges for the analog outputs, threshold values for the actuation of relays, time delay of the relays actuation, method of energizing the relays (normally energized or de-energized).

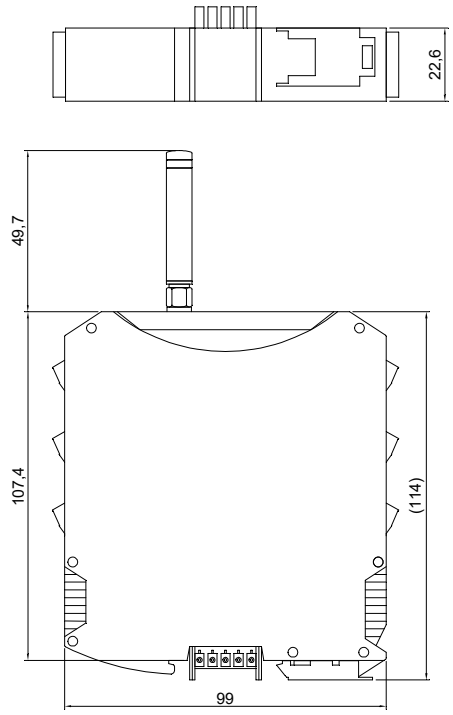

Fig1. VM2R – Dimensions

Ways of implementing digital communication between the VM2R monitor and a diagnostic station equipped with TNCScada diagnostic software based on wireless transmission using the WiFi port.

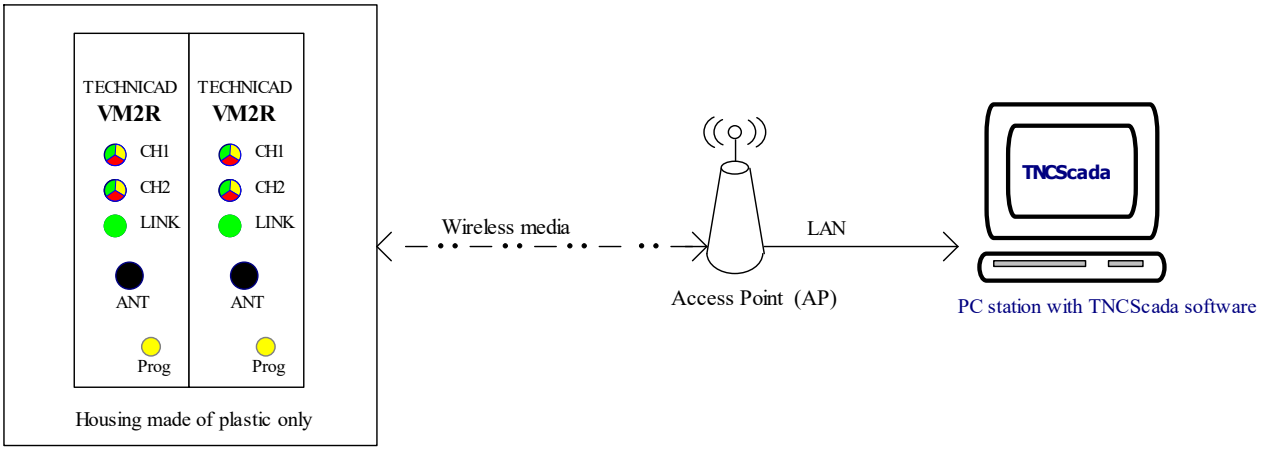

Fig.1 VM2R monitors installed in a non-metal housing (no screening of the WiFi signal). The solution is possible when there are no obstacles to WiFi transmission, e.g. in the form of reinforced walls and the presence of a local WiFi access point in the facility's infrastructure.

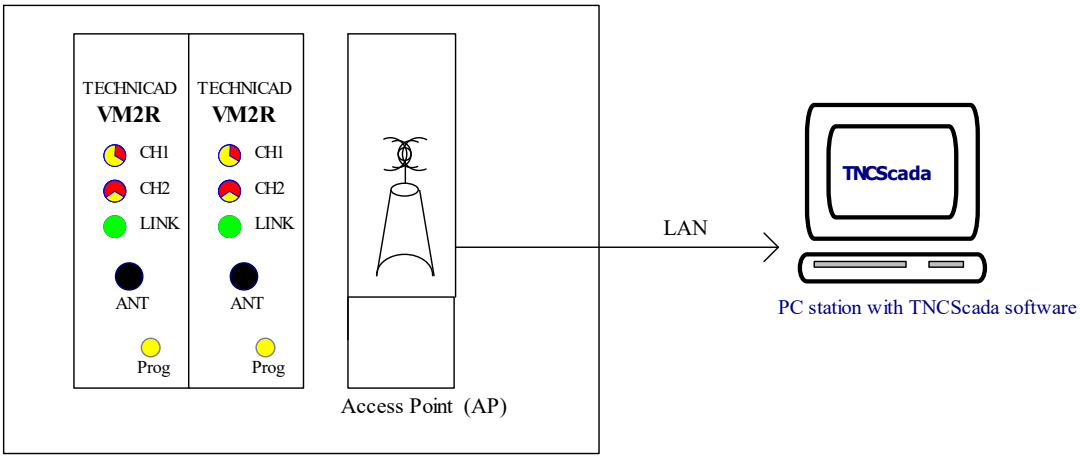

Fig.2 VM2R monitors installed in a metal housing, no WiFi access point in the facility infrastructure. This solution requires the use of an AP (Access Point) module inside the housing with monitors, which will enable the conversion of WiFi wireless transmission into wired Ethernet transmission, used for communication with the diagnostic station.

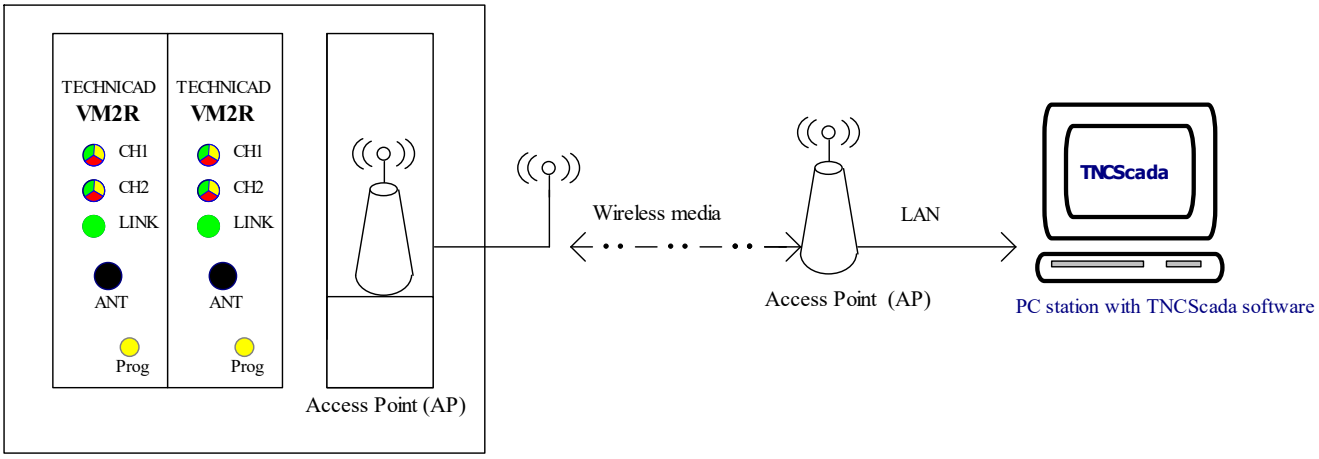

Fig. 3 VM2R monitors installed in a metal housing, there is a WiFi access point in the facility infrastructure. This solution requires the use of an AP (Access Point) module inside the housing with monitors, equipped with an external antenna, mounted on the external side of the metal housing with VM2R modules. Further communication takes place via the existing WiFi network.

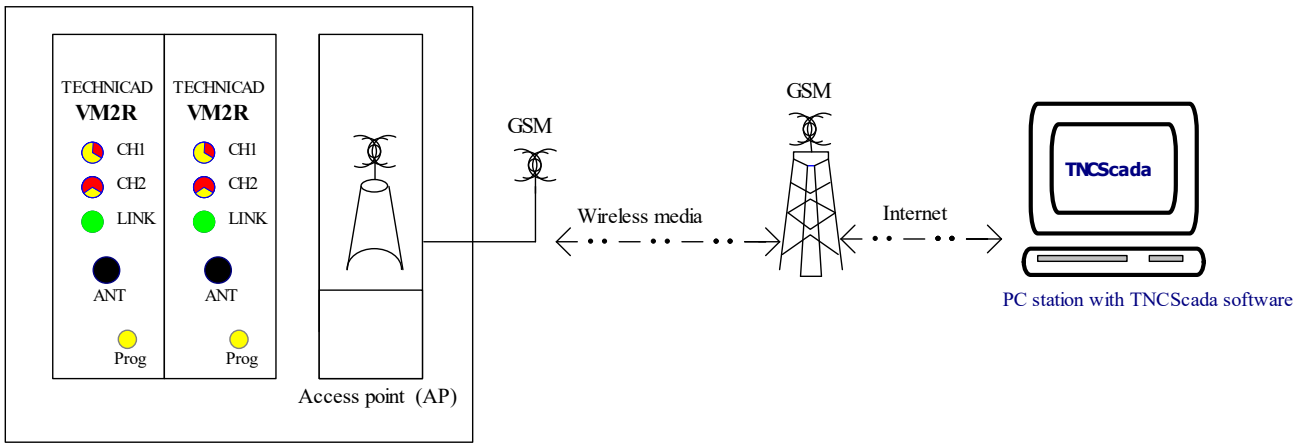

Fig. 4 VM2R monitors installed in a metal housing, no WiFi access point in the facility infrastructure. Subscription to GSM transmission required. This solution requires the use of an AP (Access Point) module inside the housing with monitors, equipped with a GSM modem with the possibility of installing an external GSM antenna. Communication with the diagnostic station takes place via the Internet.

The TNCscada diagnostic software is intended for the acquisition, archiving, visualization and analysis of measurement data of the monitoring system of rotating machines equipped with Technicad measuring devices. A single application installed on a PC / server can simultaneously download data (estimates and time samples) from many different monitors installed on different machines using the TNCbus protocol (Technicad's proprietary development). Time samples make it possible to perform a spectral analysis of signals and, for relative vibrations, to plot the trajectory of the shaft movement in the plain bearing shell. It will also be possible to present the signal's envelope and its spectrum.