



# Instruction Manual

## Vibration Switch VS6

### 1. Purpose

The Vibration Switch VS6 is suitable for machine monitoring in a very simple and economical way. Model VS6 measures vibration velocity (often called vibration severity) at rotating machinery to ISO 10816 in connection with predictive maintenance. The VS6 can also be used as limit switch for other types of vibration.

In the past, mechanical switches have often been used for such applications. They consist of a spring-mass system, where the vibrating mass at a certain deflection shuts a contact. The decisive advantage of the VS6 compared to such mechanical solutions is the simplicity of adjustment and its higher reliability.

Two selectable gain ranges, two high pass frequencies, its wide supply voltage range and its protection grade IP65 make the VS6 ideal for many applications including, for example, the monitoring of:

- Compressors
- Pumps
- Blower fans
- Generators
- Rail vehicles
- Quality control
- Transport of fragile goods
- Doors and gates

### 2. Function

By means of the built-in piezoelectric accelerometer, the VS6 monitors vibrations perpendicular to the lid of its case. It measures both positive and negative excitation. The piezoelectric sensing element and the construction of its case make the VS6 very sturdy.

Figure 1 shows the main components of the circuit.

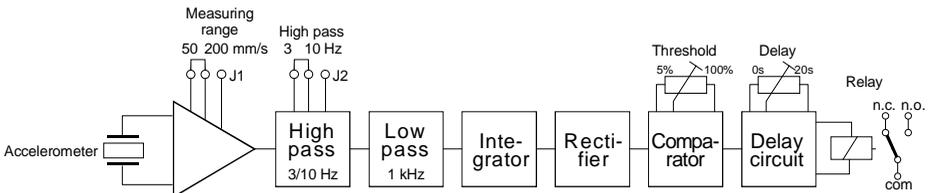


Figure 1: Block diagram

According to the standard ISO 10816 the signal passes a 10 Hz high pass filter and a 1 kHz low pass filter. For slow running machines the high pass can also be switched to 3 Hz. The output signal of the built-in accelerometer passes an integrator in order to obtain vibration velocity. Vibration velocity is advantageous as monitoring quantity since it is a measure of the energy content of vibrations. Two measuring ranges of 50 and 200 mm/s will cover most applications. The RMS rectifier is followed by a comparator. The threshold of the built-in relay can be adjusted by a potentiometer knob. The delay time  $t_d$  before the relay switches after exceeding the threshold can be adjusted between 0 and 20 s by another potentiometer. By selecting an appropriate delay time is guaranteed that no alarm will be tripped by short signal transients. They may occur during machine start up or under the influence of a short mechanical shock pulse. The minimum hold time of the relay is 2 s. This will ensure safe switching of external equipment.

Figure 2 shows the switching behavior of the built-in relay. At point ① the adjusted threshold was exceeded. Now the delay time  $t_d$  starts. It can be adjusted at the front panel between 0 and 20 s. Since the

signal drops below the threshold at point ② before the delay time was over, no alarm will be tripped at point ③. At point ④ the alarm threshold is exceeded again and the delay time starts for the second time. Now an alarm will be tripped since after  $t_d$  at point ⑤ the alarm threshold is still exceeded. The relay remains active until the vibration level drops below the limit at point ⑥. Now the alarm hold time  $t_h$  begins. When this hold time is over at point ⑦ the relay switches back.

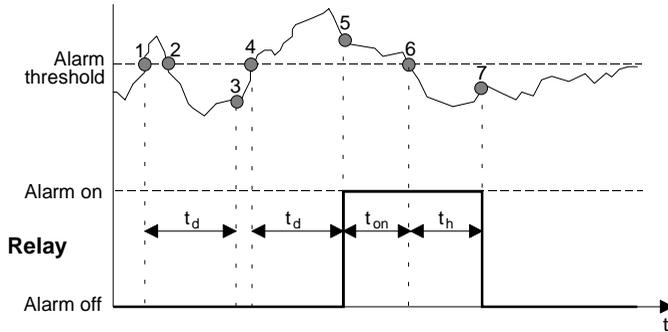


Figure 2: Switching behavior of the relay

If no alarm is tripped, the relay coil is current-carrying. In the alarm condition the coil is currentless. Hence, a failure of the power supply voltage will cause the relay to switch into alarm position. In this way the power supply of the VS6 is monitored.

The VS6 is powered from a DC voltage source from 5 to 30 V. Thus it is suitable for both battery operation or supply from industrial 24 VDC networks.

### 3. Installation

The adjustment points become visible after unscrewing the lid of the case. Figure 3 shows the inside of the case.

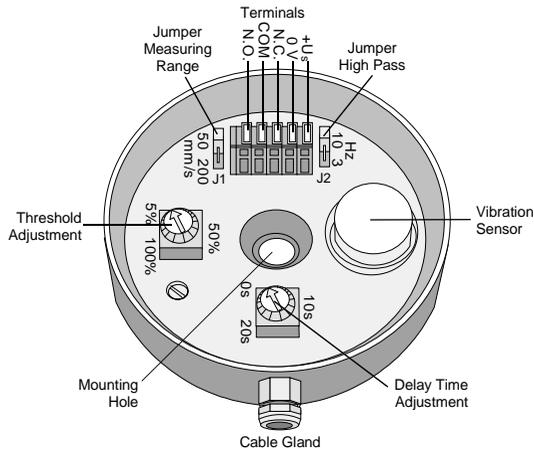


Figure 3: View into the opened case

#### 3.1. Mounting and Connection

Typical attachment points for the VS6 are stiff components like cast iron cases, bearing housings or foundations. Flexible components like thin sheet metal or plastic parts are unsuited. The VS6 can be mounted in vertical or horizontal direction, preferably by means of the supplied M8 screw. Before tightening the screw, make sure that the cable gland faces towards the right direction. To provide IP65 sealing the sup-

plied “O” ring (size 7x2) must be put under the screw head. The sealing of the lid (“O” ring size 58x3) should also be in good condition.

The cable is lead-in through a waterproof cable gland. It can be used for cable multi-wire cables with diameters between 3.5 and 5.5 mm. The supply voltage is connected to the orange terminal blocks “0 V” and “+ U<sub>s</sub>”. The VS6 is protected against false polarization.

The relay of the VS6 has a “Form C” contact. The three gray relay terminals are assigned as follows:

COM: Common

N.C. This contact is closed after alarm tripping or power supply failure.

N.O. This contact is opened after alarm tripping or power supply failure.

The maximum switching capacity is 30 W or 60 V or 1 A.

After installing and adjusting the VS6 according to chapter 3.2, the lid can be screwed on. Tighten it firmly so that the serial number faces towards the cable gland.

### 3.2. Adjustments

The measuring range can be selected between 50 and 200 mm/s vibration velocity by means of jumper J1 (see Figure 3). The alarm threshold is adjusted by the potentiometer knob. The scale marking 5 - 50 - 100 % refers to the selected measuring range. The alarm delay time is adjusted by another potentiometer between 0 and 20 s.

To determine an appropriate alarm threshold for your machine, the recommendations of the standard ISO 10816 may be useful (Figure 4). It defines four machine groups depending on their power and corresponding vibration velocity values for different levels of “machine health” between “good” and “unacceptable”. These recommendations can only provide a rough orientation, however. During practical operation you will find better alarm limits for the machine possibly.

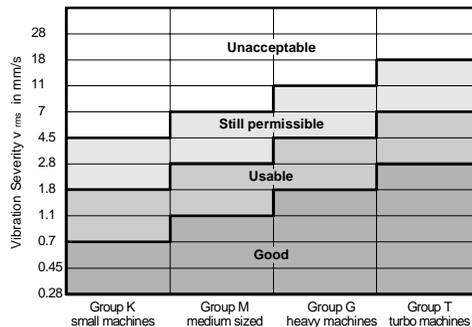


Figure 4: Assessment classes of vibration severity

Machines may be classified as belonging to the following groups (compare Figure 4):

- Group K:** Components of motors or machines which are rigidly coupled to the entire machine, like electric motors up to 15 kW.
- Group M:** Electric motors from 15 kW up to 75 kW without special foundations, rigidly mounted motors or machines up to 300 kW with special bed-plates.
- Group G:** Big driving engines and other machines with rotating masses on rigid and heavy foundations which are relatively stiff in the direction of the measured vibration
- Group T:** Big driving engines and other machines with rotating masses on foundations which are relatively flexible in the direction of the measured vibration, like turbo generator blocks and gas turbines above 10 MW.

Reciprocating engines, like combustion engines and compressors may require to monitor frequencies below 10 Hz. In this case the high pass filter of Model VS6 can be switched to 3 Hz by jumper J2. The jumper positions can be found in Figure 3.

## 4. Technical Data

Measuring ranges:	Vibration velocity 50 / 200 mm/s (RMS)
Frequency range:	3 / 10 .. 1000 Hz (-3 dB limits)
Adjustable alarm threshold:	5 .. 100 % of measuring range FSO
Accuracy of alarm threshold scale:	± 10 %
Transverse sensitivity:	< 10 % of main sensitivity
Destruction limit:	1000 g / 10 000 m/s <sup>2</sup>
Relay output:	Form C, P <sub>max</sub> = 30 W; U <sub>max</sub> = 60 V; I <sub>max</sub> = 1 A
Power supply:	5 .. 30 VDC / < 40 mA
Protection grade:	IP65
Operating temperature range :	-20 .. 70 °C
Mounting:	M8 screw (supplied accessory)
Weight:	205 g
Dimensions:	Ø 70 mm; height 38 mm

### Limited Warranty

Metra warrants for a period of  
**24 months**

that its products will be free from defects in material or workmanship and shall conform to the specifications current at the time of shipment.

The warranty period starts with the date of invoice.

The customer must provide the dated bill of sale as evidence.

The warranty period ends after 24 months. Repairs do not extend the warranty period.

This limited warranty covers only defects which arise as a result of normal use according to the instruction manual.

Metra's responsibility under this warranty does not apply to any improper or inadequate maintenance or modification and operation outside the product's specifications.

Shipment to Metra will be paid by the customer.

The repaired or replaced product will be sent back at Metra's expense.



### Declaration of Conformity

Product: Vibration Switch

Model: VS6

It is hereby certified that the above mentioned product complies with the demands pursuant to the following standards:

- EN 50081-1
- EN 50082-1

Responsible for this declaration is the producer

Metra Mess- und Frequenztechnik, Meißner Str. 58, D-01445 Radebeul

Declared by Manfred Weber

Radebeul, 22<sup>nd</sup> of September, 2003