VIBTRANSMITTER VT1002DK

USER MANUAL

EC SYSTEMS

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I. INTRODUCTION

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II. GENERAL INFORMATION

VIBTransmitter VT1002DK is a universal module for condition monitoring of **reciprocating compressors**.

The features of VT1002DK are as follow:

- ICP$^{®}$ (IEPE) standard accelerometer input,
- 4..20 mA output proportional to signal estimate,
- vibration velocity or acceleration measurement,
- calculation of RMS or PEAK values,
- configurable warning and alarm relay outputs, together with the delay of the output,
- built-in connector for the AC voltage signal from the vibration sensor (10 V_{pp}),
- DIN rail mounting.

The system is a perfect solution for automated protection systems of reciprocating compresors. The device can be integrated with the controller via the 4..20 mA current output. The 10 V_{pp} AC voltage output allows to control the vibration level using a portable vibration analyzer. In addition, the relay outputs can be used as safety features. If alarm level is exceeded VT1002DK module can turn off the unit before critical damage occurs.

III. MODULE DESCRIPTION
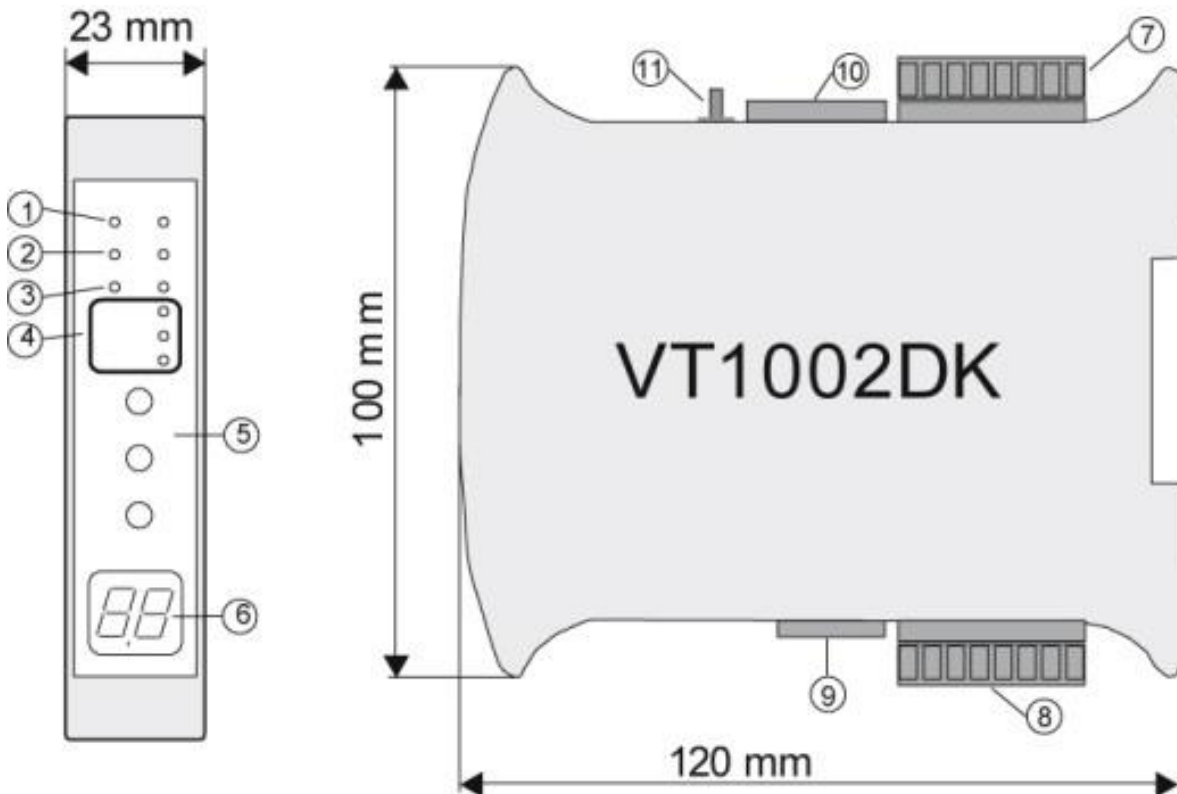
Figure 1 » VT1002DK dimension

The functionalities of the connectors indicated on the *Figure 1* are as follow:

1. IEPE sensor circuit signalisation:
   - *open* – open-circuit or sensor failure
   - *short* – short-circuit or sensor failure
2. Signal estimate signalisation – one can choose form RMS or PEAK values; the choice is indicated by appropriate diode
3. Measured value signalisation – one can choose form velocity or acceleration
4. Presentation of the outputs states
5. Keyboard
6. 2-digit LED display
7. Power connector and sensor input
8. 4..20 mA current loop and relay-outputs connector
9. Set of configurable switches (*SW2*)
10. Set of configurable switches (*SW1*)
11. SMB connector for voltage vibration output signal

IV. FRONT PANEL DESCRIPTION

IV.1. MEASUREMENT CHAIN DIAGNOSTICS FOR IEPE SENSOR

Red LEDs – indicator of the sensor status:

- *open* – open circuit or sensor failure
- *short* – short circuit or sensor failure

Green LEDs:

- indicator of the selected estimate:
  - *RMS* – RMS value of vibration signal
  - *PEAK* – maximum value of vibration signal (0-Peak)
- indicator of the selected measured value:
  - *acc* – acceleration
  - *vel* – velocity

IV.2. ALARM OUTPUTS AND PROPER WORK INDICATORS

Alarm outputs indicators:

- red LED – *ALARM* – the alarm threshold exceeded, alarm output ON
- yellow LED – *WARNING* – the warning threshold exceeded, warning ON
- green LED – *OK* – proper work indicator:
  - diode pulsing with frequency of 1 Hz indicates the correct operation of the device
  - rapid pulsing means entering the device setup menu

IV.3. KEYBOARD AND MEASURED VALUE INDICATORS

Keyboard:

- UP – up
- DN – down
- SET – set

Measured value – 2-digit LED display

V. INSTALLATION AND USAGE

V.1. MOUNTING

VIBTransmitter VT1002DK module is designed for mounting on 35mm DIN rail in an upright position. *Figure 2* presents the 3 VT1002DK modules mounted on a DIN rail.
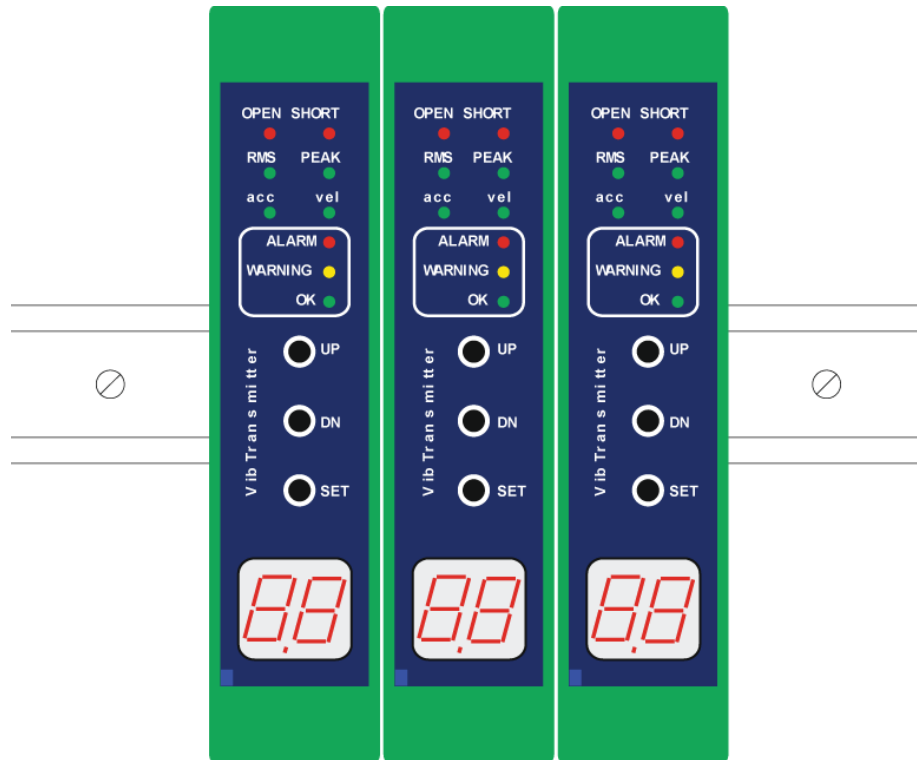
Figure 2 » Exemplary installation of 3 VT1002DK modules on a DIN rail

V.2. GALVANIC ISOLATION

VIBTransmitter VT1002DK guarantees full galvanic isolation between power supply of the module with the sensor, warning/alarm relay outputs and the current loop in the case of external supply of the 4..20 mA current loop. *Figure 3* presents the schematic block of above mentioned isolation.
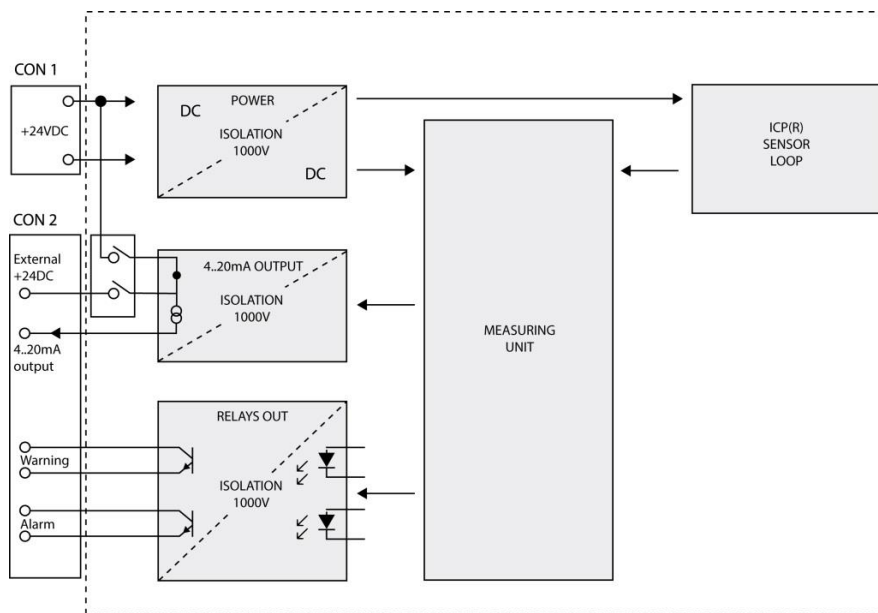
Figure 3 » VT1002DK isolation

V.3. ELECTRICAL CONNECTORS

Description of the connectors is presented on the *Figure 4*.
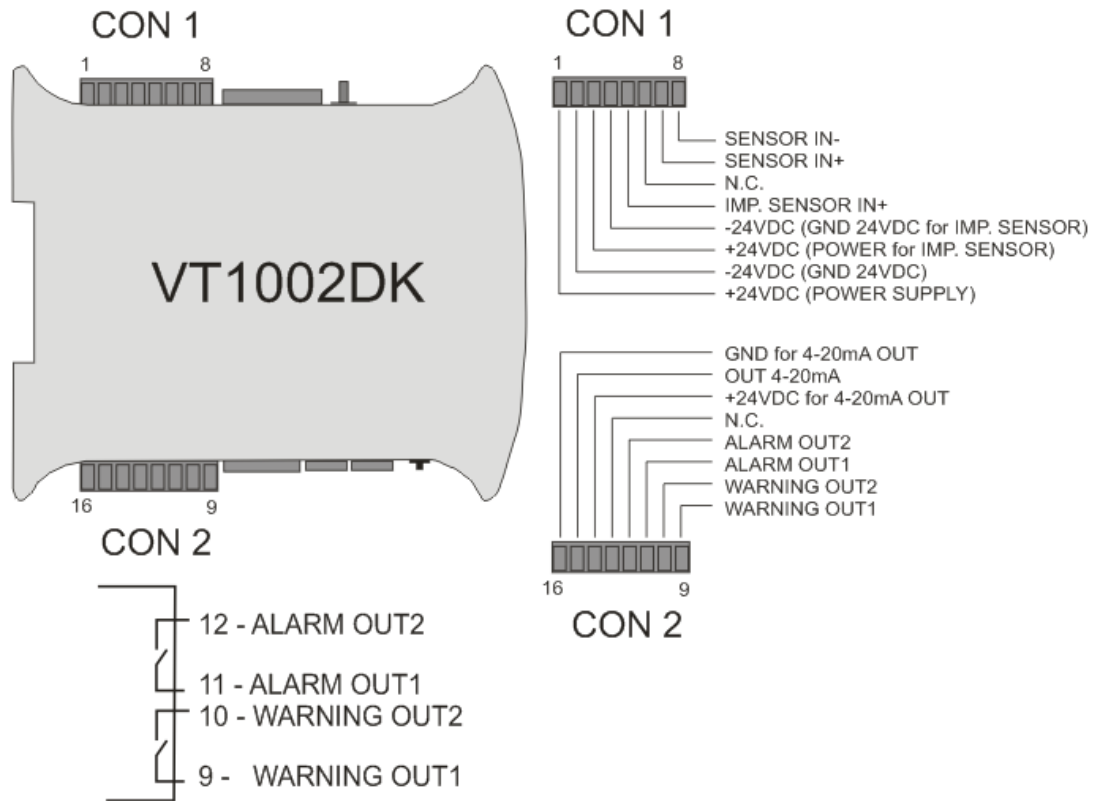
Figure 4 » VT1002DK connectors

4..20 mA current connection is shown on the *Figure 5*.
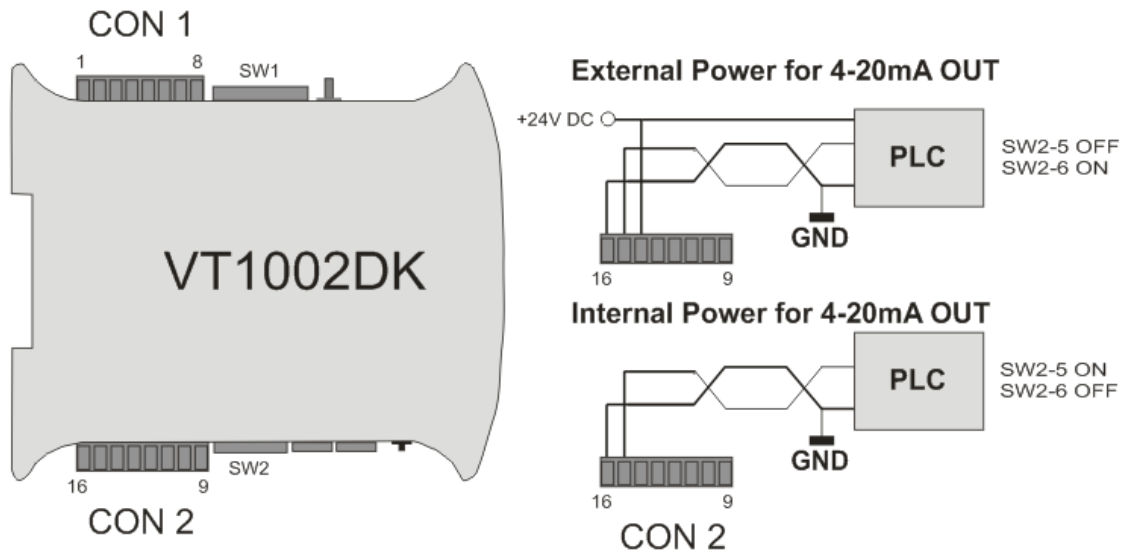
Figure 5 » VT1002DK current loop

V.4.   AC VOLTAGE OUTPUT

The usage of the voltage output of the module should be performed according to *Figure 6*.
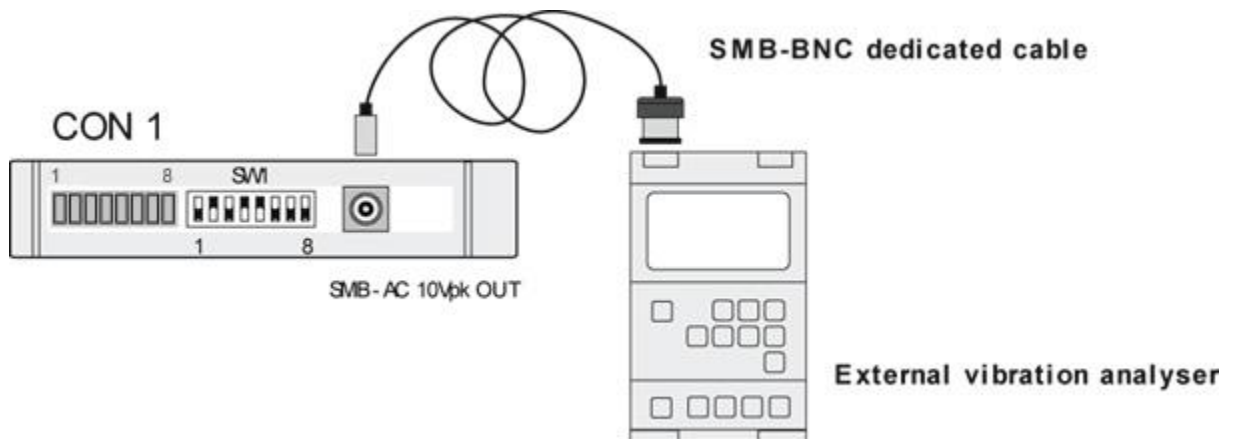
Figure 6: VT1002DK AC voltage output

V.5.   ACTIVATION

After connecting the power, the VT1002DK module enters into testing procedure. Subsequently all LEDs will flash for a short period of time. If everything is operating properly, then LED is pulsing with a frequency of approximately 1 Hz. Once the testing procedure is over, the device is ready to operate. If an error of a sensor circuit is detected, then corresponding LED will lit.

VI. CONFIGURATION OF THE VT1002DK

The front panel of the VT1002DK module contains three buttons, labeled subsequently UP, DN and SET. These buttons are used to edit the module functions.

VI.1. ENTERING THE MENU

During normal operation of the VT1002DK module, pressing UP or DN button will cause entering into the device menu, which is indicated by rapid blinking of the *OK* LED.

While in edit mode, buttons UP/DN scroll the menu items:

- A – alarm,
- U – warning,
- d – thresholds activation delay,
- L – latching of alarm threshold or warning threshold violation,
- CA – alarm activation in case of the sensor circuit failure,
- CU – warning activation in case of the sensor circuit failure,
- SC – correction of values indicated by the module,
- Er – turning display off on sensor failure,
- AU – selection of vibration signal estimate.

VI.2. SETTING UP OF THE ALARM THRESHOLD – 'A'

The VIBTransmitter VT1002DK has the ability to activate the built-in relay, when the signal from the vibration sensor exceeds the threshold value.

To set the alarm threshold one should perform the following procedure:

1. Press *UP/DN*. Afterwards the *OK* LED will blink rapidly, which indicates entering into the device menu.
2. By pressing *UP*/*DN* set the letter 'A' on the display.
3. Confirm by pressing the *SET* button.
4. Use the *UP*/*DN* buttons to select the desired alarm threshold value in the range from 0.0 to 99. Alarm threshold value cannot be lower than the warning threshold value.
5. To confirm the change, press the *SET* button.

If the vibration sensor signal will exceed the alarm threshold value and will remain above it for the time the configured delay, the alarm relay will be activated.

To disable the alarm threshold, instead of the numerical value from the range from 0.0 to 99, set the 'FF' value on the display and confirm by pressing the *SET* button.

VI.3. SETTING UP OF THE WARNING THRESHOLD – 'U'

The second relay installed in the VT1002DK module is marked warning. It informs about excitation of the warning level of the vibration signal.

To set the warning threshold one should perform the following procedure:

1. Press *UP/DN*. Afterwards the *OK* LED will blink rapidly, which indicates entering into the device menu.
2. By pressing *UP/DN* set the letter 'U' on the display.
3. Confirm by pressing the *SET* button.
4. Use the *UP/DN* buttons to select the desired alarm threshold value in the range from 0.0 to 99. <u>Warning threshold value cannot be greater than the alarm threshold value.</u>
5. To confirm the change, press the *SET* button.

To disable the warning threshold, instead of the numerical value from the range from 0.0 to 99, set the 'FF' value on the display and confirm by pressing the *SET* button.

VI.4. SETTING UP OF THE THRESHOLD ACTIVATION DELAY – 'd'

In the VT1002DK module the user can define how long the alarm threshold or the warning threshold should be exceeded before activating the relay output.

To set the delay one should perform the following procedure:

1. Press *UP/DN*. Afterwards the *OK* LED will blink rapidly, which indicates entering into the device menu.
2. By pressing *UP/DN* set the letter 'd' on the display.
3. Confirm by pressing the *SET* button.
4. Use the *UP/DN* buttons to select the desired delay time in the range from 0 to 16 s.
5. To confirm the change, press the *SET* button.

VI.5. SETTING UP THE LATCH OF ALARM THRESHOLD OR WARNING THRESHOLD VIOLATION – 'L'

VIBTransmitter VT1002DK has the ability to store the information about the violation of the warning or the alarm threshold. When the violation occurs, after the delay 'd', proper output is activated until the user erases the violation information by pressing the *SET* button.

To set up the latch one should perform the following procedure:

1. Press *UP/DN*. Afterwards the *OK* LED will blink rapidly, which indicates entering into the device menu.
2. By pressing *UP/DN* set the letter 'L' on the display.
3. Confirm by pressing the *SET* button.
4. Use the *UP/DN* buttons to select the *ON* option.
5. To confirm the change, press the *SET* button.

To turn off the latch one should perform the following procedure:

1. Press *UP/DN*. Afterwards the *OK* LED will blink rapidly, which indicates entering into the device menu.
2. By pressing *UP/DN* set the letter 'L' on the display.
3. Confirm by pressing the *SET* button.
4. Use the *UP/DN* buttons to select the 'oF' option.
5. To confirm the change, press the *SET* button.

VI.6. SIGNALING OF THE SENSOR FAILURE – 'CA', 'CU'

For full control of the measurement chain VT1002DK can activate relay output when the measurement chain or vibration sensor is damaged.

Sensor failure alarm can be attributed to the triggering alarm or warning relay. Triggering of the relay occurs after 5 seconds of open/short sensor failure.

To set up the sensor failure signaling on the alarm output one should perform the following procedure:

1. Press *UP/DN*. Afterwards the *OK* LED will blink rapidly, which indicates entering into the device menu.
2. By pressing *UP/DN* set the 'CA' on the display.
3. Confirm by pressing the *SET* button.
4. Use the *UP/DN* buttons to select the *ON* option.
5. To confirm the change, press the *SET* button.

To set up the sensor failure signaling on the warning output one should perform the following procedure:

1. Press *UP/DN*. Afterwards the *OK* LED will blink rapidly, which indicates entering into the device menu.
2. By pressing *UP/DN* set the 'CU' on the display.
3. Confirm by pressing the *SET* button.
4. Use the *UP/DN* buttons to select the *ON* option.
5. To confirm the change, press the *SET* button.

To turn off the sensor failure signaling 'CA'/'CU' one should perform the following procedure:

1. Press *UP/DN*. Afterwards the *OK* LED will blink rapidly, which indicates entering into the device menu.
2. By pressing *UP/DN* set the 'CA'/'CU' on the display.
3. Confirm by pressing the *SET* button.
4. Use the *UP/DN* buttons to select the 'oF' option.
5. To confirm the change, press the *SET* button.

VI.7. SETTING UP THE CORRECTION OF VALUES INDICATED BY THE MODULE – 'SC'

The VT1002DK module is designed to work with ICP® (IEPE) accelerometers with sensitivity of 100 mV/g, however it is possible to set up set correction of values indicated by the module to adjust the module to a sensor with sensitivity slightly different than 100 mV/g. The 'SC' parameter indicates how much the presented values are being increased or decreased.

To set correction of values indicated by the module one should perform the following procedure:

1. Press *UP/DN*. Afterwards the *OK* LED will blink rapidly, which indicates entering into the device menu.
2. By pressing *UP*/*DN* set the 'SC' on the display.
3. Confirm by pressing the *SET* button.
4. Use the *UP*/*DN* buttons to select the desired correction value within the -10 up to +10 range. Negative values are indicated by glowing decimal point on the right display.
5. To confirm the change, press the *SET* button.

VI.8. TURNING DISPLAY OFF ON SENSOR FAILURE – 'Er'

The module enables to mask the incorrect measurement values in the case of sensor circuit failure. Activating this feature results in display of the "--" symbol in the case of open or short circuit.

To enable the feature one should perform the following procedure:

1. Press *UP/DN*. Afterwards the *OK* LED will blink rapidly, which indicates entering into the device menu.
2. By pressing *UP*/*DN* set the 'Er' on the display.
3. Confirm by pressing the *SET* button.
4. Use the *UP*/*DN* buttons to select the *ON* option.
5. To confirm the change, press the *SET* button.

To disable the feature one should perform the following procedure:

1. Press *UP/DN*. Afterwards the *OK* LED will blink rapidly, which indicates entering into the device menu.
2. By pressing *UP*/*DN* set the 'Er' on the display.
3. Confirm by pressing the *SET* button.
4. Use the *UP*/*DN* buttons to select the 'oF' option.
5. To confirm the change, press the *SET* button.

VI.9. SELECTING THE MEASURED VIBRATION SIGNAL ESTIMATE – 'AU'

The VT1002DK module enables measuring RMS or 0-PEAK values of vibration acceleration or velocity.

ATTENTION! The configuration must be confirmed using *SW1* and *SW2* configuration switches described in the following chapter (*VI.10. Measurement parameter configuration*).

To select desired estimate one should perform the following procedure:

1. Press *UP/DN*. Afterwards the *OK* LED will blink rapidly, which indicates entering into the device menu.
2. By pressing *UP*/*DN* set the 'AU' on the display.
3. Confirm by pressing the *SET* button.
4. Use the *UP*/*DN* buttons to select one of the following option:
    a. 'PU' – 0-PEAK value of the velocity signal,
    b. 'rU' – RMS value of the velocity signal,
    c. 'PA' – 0-PEAK value of the acceleration signal,
    d. 'rA' – RMS value of the acceleration signal,
5. To confirm the change, press the *SET* button.

VI.10. MEASUREMENT PARAMETER CONFIGURATION

Measurement parameter configuration is set by proper set-up of configuration switches *SW1* and *SW2*. Description of switches *SW1* and *SW2* is presented in the following table and *Figure 7*:

Functions of configuration switches	
SW1	*SW2*
S1: • ON – HPF = 10 Hz • OFF – HPF = 3 Hz S2: ON – range 100 S3: ON – range 10 S4: ON – range 25 S5: ON –LPF = 300 Hz S6: ON –LPF = 10 kHz S7: ON – acceleration S8: ON – velocity	S1: • ON – range 10 • OFF – range 100 S2: • ON – range 25 • OFF – range 100 S3: • ON – acceleration • OFF – velocity S4: • ON – RMS • OFF – PEAK S5: ON – internal power supply +24 V for 4..20 mA S6: ON – external power supply for 4..20 mA
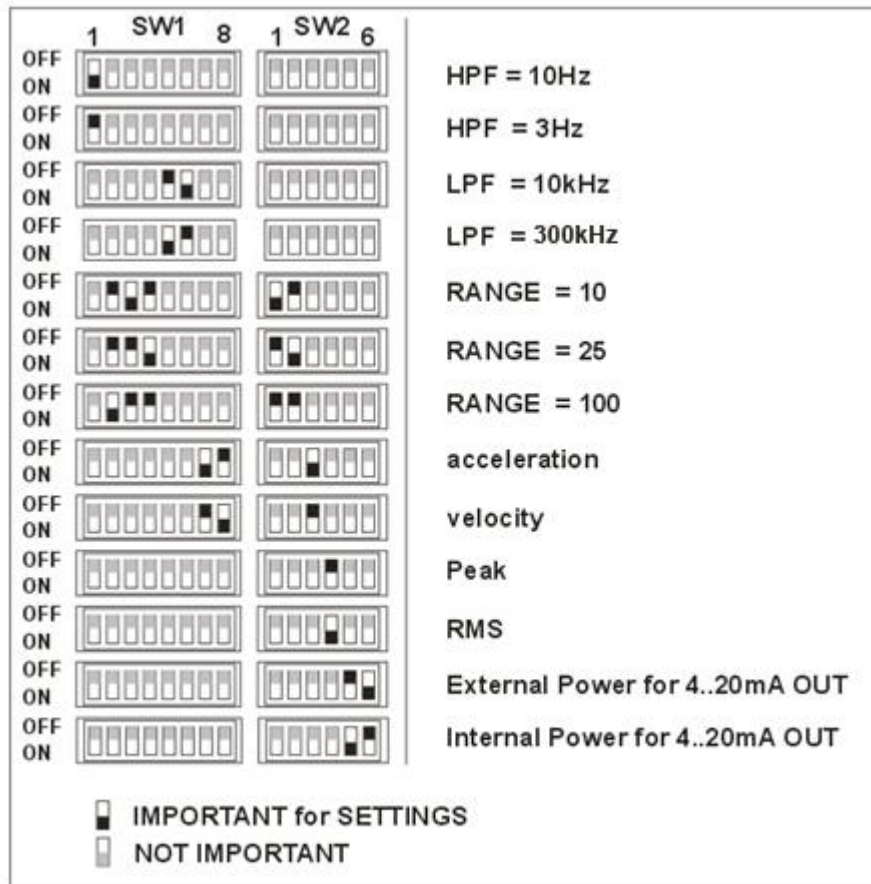
Figure 7 » Functions of configuration switches

Example:

Monitoring of the RMS of the vibration signal velocity, using 3 Hz high pass filter and 10 KHz low pass filter, for 100 mm/s range and internal power loop. The following configuration of the switches must be set:

SW1								SW2					
OFF	ON	OFF	OFF	OFF	ON	OFF	ON	OFF	OFF	OFF	ON	ON	OFF
1	2	3	4	5	6	7	8	1	2	3	4	5	6

WARNING!

The set-up of the switches configuration should be done on a switched off device. If the set-up was done on an operating module, it needs to be restarted in order to activate the new configuration.

VII.   MENU

Graphical representation of menu structure is presented on the *Figure 8* on the following page.

Figure 8 » Structure of the menu of VT1002DK

VIII. TECHNICAL PARAMETERS

The technical parameters of the VT1002DK module are as follow:

- power supply .... 24 VDC (18..36 VDC)
- power consumption ....<4 W
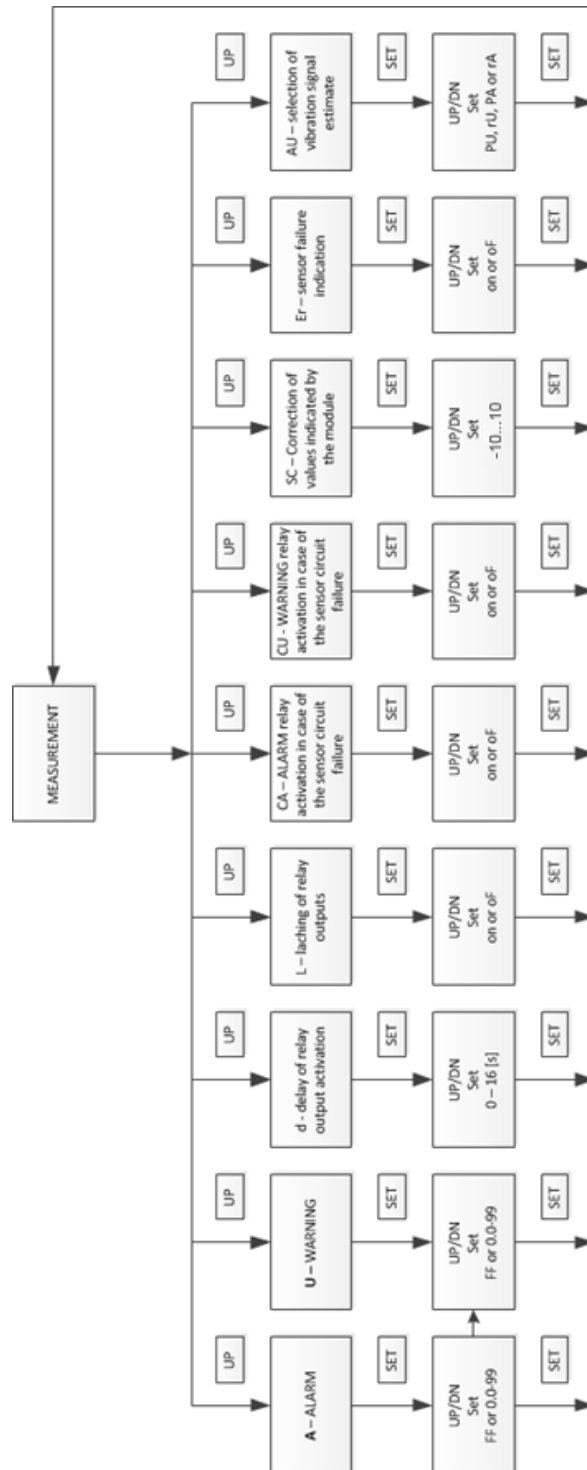- sensor type .... IEPE, 100 mV/g, 8 mA @ 20 V
- measured values...velocity, acceleration
- types of estimates .... RMS, 0-PEAK
- low-pass filter ....300 Hz/10 kHz, 24 dB/oct., 4th order
- high-pass filter .... 3/10 Hz, 12 dB/oct., 2nd order
- insulation .... 1 kVDC (2 or 3 kVDC optionally)
- current output .... 2 or 3 wired 4..20 mA current loop
- voltage output .... AC, 10 V_{pp} max.
- delay ....0-16 s with 1 s step
- warning level .... 0-99% of the range
- alarm level .... 0-99% of the range
- relay outputs.. NC, 100 mA @ 24 V
- operating temperature... -20..+60°C
- operating relative humidity..<95% RH
- protection class..IP40
- dimensions... 23 x 100 x 120 mm (W x H x L)
- weight .... 150 g
- mounting ....35 mm DIN rail

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