amc VIBRO

AV MONITOR 2000

CONDITION MONITORING SYSTEM WITH RELAY OUTPUTS

USER MANUAL

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1. Introduction

1.1. Description

AMC VIBRO MONITOR 2000 series is a dual-channel, fully programmable device for continuous monitoring and machines diagnostics. It was designed for a small or large rotary power machines with fixed or variable rotational speed and also compressors. This device detects and locates among other things: bearing faults, gearbox faults, unbalance, misalignment, looseness, overload and cavitation.

All versions of AVM 2000 have:

- 2 IEPE (ICP®) analog input channels,
- 2 speed/ phase marker input channels (PM),
- 5 relay outputs,
- 2 analog outputs (4-20 mA),
- RS-485 MODBUS RTU data interface.

Basic features of AVM 2000:

- Fully configurable and independent relay outputs,
- Warning and alarm for each channel and each analysis,
- Error signalization for sensor circuits,
- Easy integration with PLC systems,
- Dedicated PC configuration software,
- Compact design and DIN rail installation,
- Embedded LED display.

1.2. Versions

- **AVM 2105D** – for general purpose constant speed rotating machines (fans, pumps, compressors, etc.). The device can detect damage of the monitored machine.
- **AVM 2105DV** – for general purpose rotating machines (fans, pumps, compressors, etc.). The device enables to detect and locate of machines damage, i.e. indicate a specific gear stage or a damaged bearing. This version can save calculated estimates / analysis to the SD memory card.
- **AVM 2105DK** – for reciprocating compressors. The device performs measurements in 36 sections of full rotation of the machine. It has built-in speed stability analysis function to avoid false alarms. The DK type works in accordance with the IEPE (ICP®) standard. This version allows to save calculated estimates / analysis to the SD memory card.

  AVM 2115DA – for accurate monitoring of machines with variable speed. The device carries out calculations of advanced estimates: harmonics amplitude and order spectrum analysis. There is option to measure temperature. This version allows to save calculated estimates / analysis to the SD memory card.

	AVM 2105D	AVM 2105DV	AVM 2105DK	AVM 2115DA
Inputs	2 x IEPE (ICP®) 2 x Speed/ Phase Marker (PM) 1 x Temperature measurement (optionally for DA version)			
Outputs	5 x Relay (NO, NC) 2 x Analog (4-20 mA) RS-485 MODBUS RTU data interface			
SD card	X	√	√	√
Sensor type	Vibration Acceleration - D, DV, DK, DA versions			
Damage detection	√	√	√	√
Damage location	X	√	√	√
Calculated Estimates				
Acceleration and velocity RMS	√	√	√	√
Acceleration and velocity 0-Peak	√	√	√	√
Envelope RMS and Peak-Peak	√	√	√	√
Energy in 8 bands (BEC)	X	√	X	√
Sections of full rotation	X	X	√	X
Order spectrum analysis	X	X	X	√
Application	General for rotating machines	General for rotating machines	Reciprocating machines	Variable speed machines and/or sliding bearings
Examples of monitoring machines	Fans Pumps Compressors Motors	Fans Pumps Compressors Motors	Reciprocating compressors, Piston engines	Wind turbines Industrial steam turbines, Complex gears
Examples of detected failures	Increase in the vibration energy	Damage to the bearing, Unbalance Cavitation	Valve analysis Detection of the piston ring degradation	Diagnosis of damage of individual bearing components, Identification of gear failure, Cavitation

2. Operation of devices from AVM 2000 family

2.1. Description

All devices of AVM 2000 family has two IEPE analog inputs (ICP®). All versions has two speed/ phase markers (PM), five relay outputs and two analog outputs (4-20 mA). All relay outputs are fully configurable and can operate independently. They especially can:

- perform warning or alarm function for each of the channels by setting thresholds for each measured estimates,
- perform the security function,
- signal the sensor circuit faults,
- signal the speed/ phase marker current status.

The device has a LED display on the front panel, which presents the value of the selected vibration signal estimate on the selected channel. Compact design and DIN rail mounting allow to easy integrate with PLC systems in typical control units. Device configuration is performed by the front panel or by a dedicated PC software.

The AVM 2105D and 2105DV are ideally suited to automatic protection system for rotating machines. The AVM 2105DK is appropriate to automatic protection systems for piston machines and the AVM 2115DA is applicable to automatic protection systems for rotation machines with variable speed. All devices can be integrated with the machines controllers via 4-20 mA current outputs. In addition, the relay outputs can be used as safety elements. If an alarm threshold is exceeded, the relay will activated and – if configured so – it will switch off the machine before a serious damage occurs. For each IEPE channel it is possible to calculate the estimate of vibration acceleration (RMS, 0-Peak), velocity (RMS, 0-Peak) and envelope analysis (RMS, Peak-Peak). In the DV and DA variant are performed BEC analysis - energy in eight defined band. Additionally DA variant calculates order and harmonics amplitude analysis. All devices can work in two modes: from configurable length time buffer or full rotation based on speed/ phase marker pulses. Only DK version can calculate RMS and 0-Peak estimates of vibration acceleration and velocity in 36 sections of full rotation.

The appliances of AVM 2000 family, except D version, can save to the microSD memory card raw vibration signals, the calculated estimates results and all system events that occurred on the device.

The module also has been equipped with an innovative function for quick and easy automatic setting of warning and alarm thresholds. During a stable operating conditions the device takes a number of measurements, and automatically calculates proposed threshold values.

2.2. Technical parameters

Parameter	Description
Power supply	+24 VDC (18 - 36 VDC)
Operating temperature	-20 °C ... +80 °C

Parameter	Description
I/O insulation	1 kV
Power consumption	max. 4 W
Degree of enclosure protection and device installation	IP20 DIN rail
Low-power status/warning /alarm relay outputs	4 x relay output contacts type: NC or NO maximum switching voltage: 32 VDC rated current: 100 mA maximum contact resistance: 8 Ω (typical 4.8 Ω) maximum switching power: 400 mW
High-power status/warning /alarm relay output	1 x relay output three contacts: NC, Common, NO maximum switching voltage: 32 VDC rated current: 2 A maximum switching power: 50 W
IEPE (ICP®) inputs – D, DV, DK, DA versions	2 x IEPE (ICP®): vibration sensor input: working with IEPE 2-wire sensors, measuring range setting is possible by the operator panel (10, 25, 100 at 100 mV/g sensors), parallel processing of 2 channels, 16bit, 40 kSPS , sensor circuit status: OPEN/SHORT/OK, changing of IEPE sensor sensitivity is possible by the panel from 10 mV/G to 990 mV/G (default 100 mV/g). **The maximum standard measuring range is 100** (mm/s, m/s^2) for 100 mV/g sensors.
4-20 mA outputs	2 x current output (4-20 mA) current loop voltage range: +7.5 VDC to +36 VDC, resolution 12 bits
Speed/ Phase Marker (PM) inputs	2 x Phase Marker (PM) OC PNP (PushPull) The input frequency range for low speed machinery which the module performs analysis is 1 - 20 Hz
Measurement	Measured value is vibration acceleration. Calculated estimates: RMS - 0-Peak vibration acceleration (m/s^2) RMS - 0-Peak vibration velocity (mm/s) Envelope RMS and Peak-Peak Energy analysis in eight defined bands (BEC – Band Energy Calculations) - DV and DA version Measurements in 36 sections of full rotation – DK version Order and amplitude analysis – DA version Capability to average 1-10 measurements Learning option - automatically setting alarm and warning thresholds (except version D)

Parameter	Description
Temperature measurement (optionally for DA version)	The measurement using resistance temperature detector – Pt100. For the RTD input can be chosen 2-, 3-, or 4-wire measurement. 15-bit resolution (0.003125°C).
Interfaces	RS485 – Modbus RTU protocol USB – service and configuration microSD memory card (except version D)
Panel	2 x 7-segment display with decimal points 3 x configuration buttons 9 x Signal / Status LED

3. Front panel description

The front panel is divided into five sections:

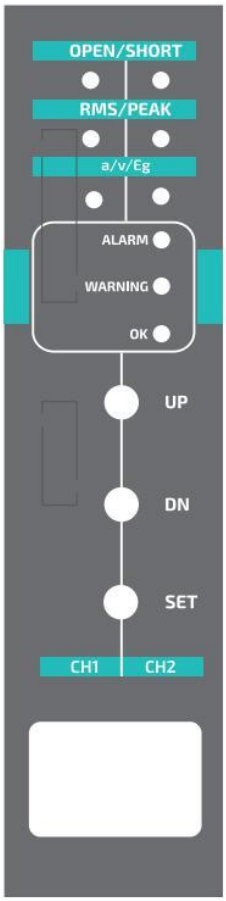
1. The first of these sections are the 6 diodes located at the top of the panel, which informs about the current calculations and status of the IEPE inputs. On the left there are the LEDs responsible for the sensor's first channel and on the right for the second channel.

2. The second section is responsible for displaying alarms and warnings. This field consists of 3 LEDs: *Alarm*, *Warning* and *OK*.

3. In the third section there are 3 buttons that serve the device menu.

4. The fourth section has a two-digit 7-segment display showing the selected measurement value.

5. In the fifth section there are interfaces: USB port and microSD memory card slot.



1. IEPE (ICP®) vibration sensor diagnostic section - red diodes:

» *LEDs OPEN / SHORT:* IEPE sensor status information:

- no light – correct work
- diode blinks – open circuit
- continuous light – short circuit

» *LEDs RMS / Peak:* currently displayed estimate / value:

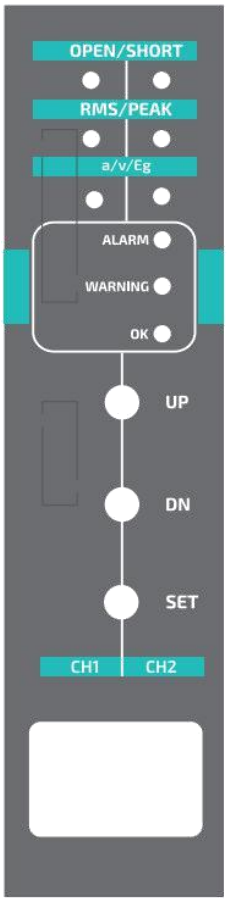
- no light – no measurements on the specific channel
- diode blinks (with a 1s period) – 0-Peak
- continuous light – RMS

» *LEDs a / v / gE:* displayed estimate/ value type - speed/acceleration/envelope

- no light – vibration acceleration
- diode blinks (with a 1s period) – vibration velocity
- continuous light – envelope

WARNING!

Envelope is calculated as Peak-Peak or RMS of acceleration signal. Therefore, if the Envelope estimate is enabled, the 0-Peak/RMS LED will show continuous light or blink.



2. Signaling of alarm outputs status**:**

» ALARM – red diode – if the alarm threshold has been exceeded, the alarm output is switched on,

» WARNING – yellow diode – if the warning threshold has been exceeded, the warning output is switched on,

» OK – green diode – blinking diode (with a 2 s period) indicates no active warnings/ alarms.

3. Keyboard:

» UP – up,

» DN – down, »

SET – set.

4. Measured value:

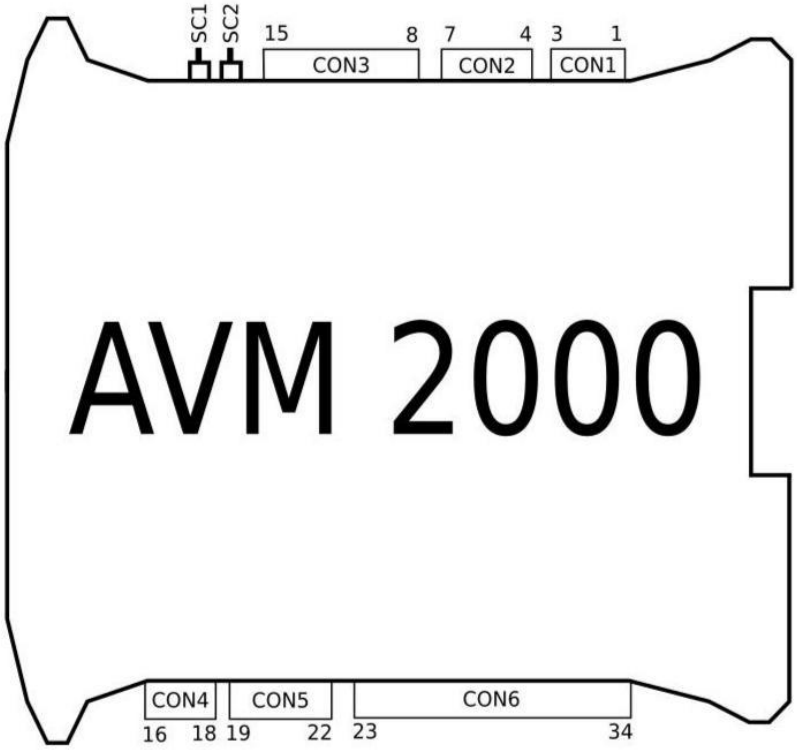
» 2-digit LED display with decimal points.

5. Interfaces:

» USB port,

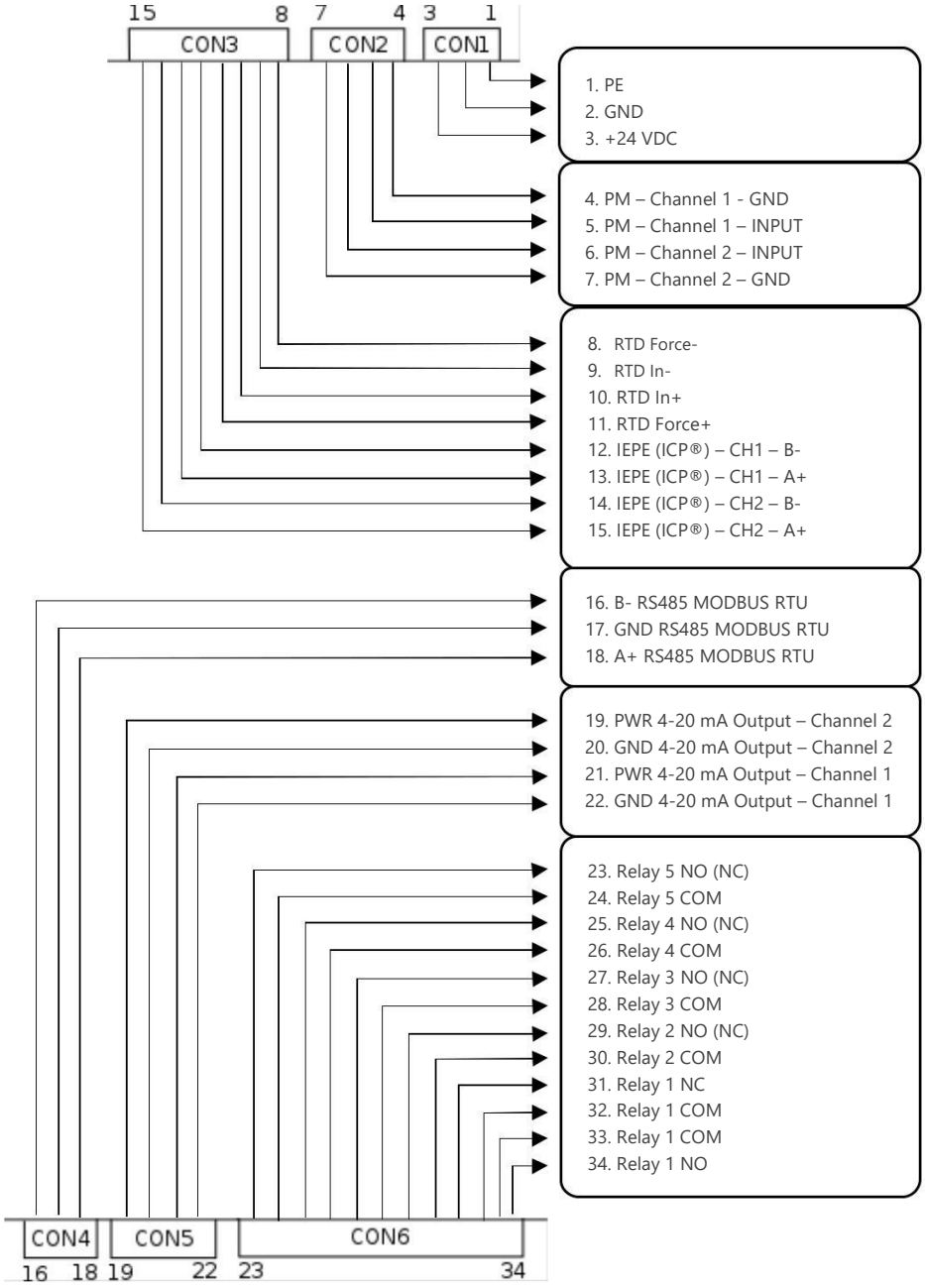
» microSD memory card slot.

4. AVM 2000 connectors



Connectors description::

- SC1 - AC buffered output (oscilloscope) of the first IEPE sensor channel
- SC2 - AC buffered output (oscilloscope) of the second IEPE sensor channel
- CON1 - power supply
- CON2 – speed/ phase marker channels 1 and 2. The speed/ phase marker should be powered by +24 VDC
- CON3 - IEPE sensor input channels 1 and 2 (and temperature sensor input for DA version)
- CON4 - RS-485 MODBUS RTU connector
- CON5 - 4-20 mA current loop output, channels 1 and 2
- CON6 - 5 relay outputs for warnings and alarms / status

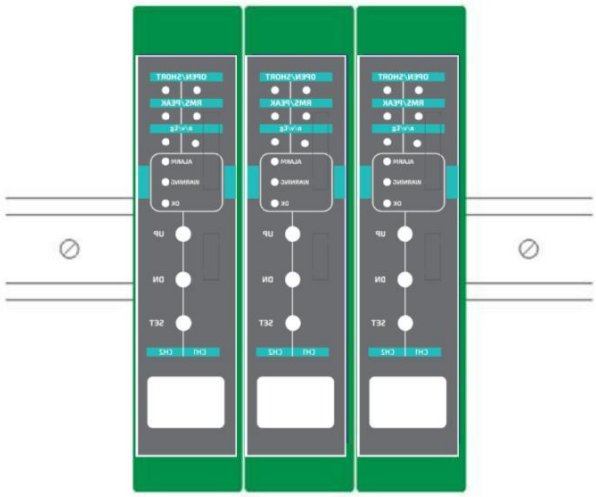


WARNING!

Only one cable may be connected to the PE connector of the AVM 2000. All PE wires should be connected in one point, on the PE rail or PE connector of power supply. The length of PE lead must be less than 30 cm. All sensors should be connected to the AVM 2000 by a shielded twisted pair and the shield should be connected to PE on the DIN rail.

5. Installation

The AVM 2000 is designed for a mount on a 35 mm DIN rail in a vertical position.



6. AVM 2000 start up

After connecting the power supply, AVM 2000 will perform the test procedure - all signaling LEDs and display segments will light up. Correct activation is signaled by blinking of the *OK* LED.

In case of detecting an error in the sensor circuit, the respective OPEN/SHORT LEDs will be turned on. Diode:

- no light – correct work,
- blinking – open circuit,
- continuous light – short circuit.

Type of calculating estimates is signaled by the RMS/PEAK LEDs group. Diode:

- no light – no measurements on the specific channel
- blinking (with a 1s period) – Peak
- continuous light – RMS

Estimates can be calculated from the acceleration signal (a), velocity (v) or envelope (gE), The chosen estimates is reported by the a/V/gE LEDs group. Diode:

- no light – vibration acceleration
- blinking (with a 1 s period) – vibration velocity
- continuous light – envelope

WARNING!

The AMC VIBRO MONITOR 2000 series allows to quick configuration of IEPE channels.
Quick configuration is available by FC option on the front panel. More in chapter: 7.6 Quick Setup.

7. Measurement

Each of the analog channels has 3 different measurement ranges: 10, 25 and 100 (m/s^2, mm/s) in order to match the measured vibration magnitudes and carry out appropriate scaling to the 4-20 mA output. The amplification for each sensor channel is individually configured.

For each of the analog channels the user can set the sensitivity of the IEPE sensors, which is within the range from 10 mV/g to 990 mV/g. Maximum standard measurement range is 100 (mm/s m/s^2) for the 100 mV/g sensor.

The AVM 2000 measures and stores in a buffer samples for up to 2 seconds period for each of the IEPE channels. Measurement can be triggered periodically or by external signals – speed/ phase markers. The shaft rotation frequency of the protected machine should be between 1 Hz and 20 Hz. For low speed machinery. In case frequencies outside the range an error will be reported. For typical machinery with 3000 RPM AVM module should work in time depend mode.

Possible triggers:

- Triggered by speed/ phase marker channels 1 or 2 without fixed measurement time (measurements time mustn't be longer than 1 second, end of measurement is triggered by next phase marker impulse),
- Triggered periodically by fixed measurement time (measurements time mustn't be longer than 2 seconds).

WARNING!

The time of a periodically triggered measurement should be within the range: 0.1 s to 2 s.
The time of a phase marker triggered measurement should be within the range: 0.05 s to 1 s.

7.1. Calculated estimates

The whole AVM family performs calculations the following vibration estimates:

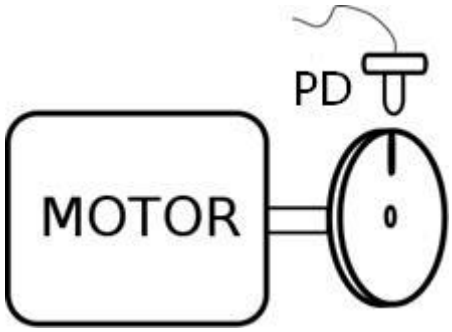
- Acceleration 0-Peak (0.2 Hz – 12 kHz),
- Acceleration RMS (0.2 Hz – 12 kHz),
- Velocity 0-Peak (0.2 Hz – 12 kHz),
- Velocity RMS (0.2 Hz – 12 kHz),
- Velocity ISO RMS (10 Hz – 1 kHz), according to ISO 10816,
- Acceleration Envelope Peak-Peak and RMS (4 kHz – 12 kHz),
- Acceleration and Velocity Crest Factor,
- Acceleraion and Velocity Kurtosis,
- and also Speed/ Phase Markers frequency (RPM).

In addition :

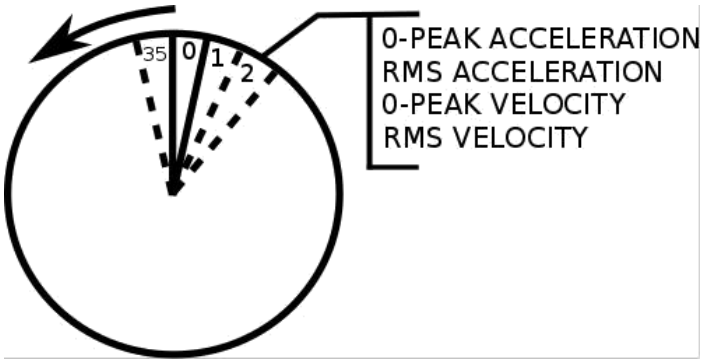
- DV and DA version calculates energy in eight defined bands (BEC – Band Energy Calculation),
- DK version executes measurements in 36 secionts of full rotation,
- DA version works out harmonics amplitude and order analysis and also may measure temperature (°C).

7.2. Working with sections of full rotation

The AVM 2105DK carries out calculations from 36 sections of full rotation of a shaft. The full rotation is determined by the successive pulses of the phase marker.



The shaft rotation is divided into 36 sections every 10^{O} that the vibration acceleration (0-Peak and RMS) and the vibration velocity values (0-Peak and RMS) are calculated in. Furthermore, the device provides minimum and maximum value that occur within all sections. Estimates based on sections of full rotation can also be sources of warnings and alarms.



7.3. Detection of threshold violations

Event thresholds are set in 4 cases:

- Alarm level for channel 1 of the IEPE sensor (levels adjustment for specific estimates),
- Warning level for channel 1 of the IEPE sensor (levels adjustment for specific estimates),
- Alarm level for channel 2 of the IEPE sensor (levels adjustment for specific estimates),
- Warning level for channel 2 of the IEPE sensor (levels adjustment for specific

estimates). For these options the following parameters are available

- disable threshold checking (setting value 0),
- threshold level - when the level of the selected estimate exceeds this value, a warning or an alarm is reported.

AVM 2000 detects violations of the defined threshold levels as well specific hardware errors (e.g. sensor Open/Short) and reports warnings or alarms. This device has 5 relay outputs on which warnings and alarms can be reported. In addition, module can send the value of the calculated estimate through 4-20 mA outputs e.g. into a SCADA systems or other devices.

After detection of a threshold violation, the device can execute following actions:

- activate LED on the front panel,
- activate the relay output (there can be several thresholds assigned to a single relay),
- set the status on the MODBUS RTU register data link.

The sources of violations are the vibration signals from the two IEPE channels and phase markers status:

- measured and calculated value compared to alarms and warnings thresholds,
- incorrect sensors works (detection a short or an open IEPE circuit),
- incorrect phase marker status - wrong level or measured frequency outside of the declared range.

WARNING!

When setting the violation levels, the selected measuring range must be taken into account - alarm and warning thresholds are given as absolute values.

7.3.1. Threshold violation delay and clearing

When the threshold violation is detected, the counting of the delay time is started and after this time elapses and the source is still active, the device activates the suitable relay output.

There are two ways to reset violations and it depends on the chosen mode. The first one is disappearance of the overshoots in the specified holding time, when normal mode is enabled. The second way is to delete the overshoots by pressing together the buttons "SET" + "DOWN" on the front panel for about 3 seconds when latch mode is enabled.

7.3.2. Incorrect work of IEPE (ICP®) sensor

The error status can be triggered by incorrect work of the IEPE sensor: short or open circuit of a measurement channel.

ERROR	DESCRIPTION
Short circuit error 1	Detection of a short circuit in the IEPE sensor channel 1
Open circuit error 1	Detection of an open circuit in the IEPE sensor channel 1
Short circuit error 2	Detection of a short circuit in the IEPE sensor channel 2
Open circuit error 2	Detection of an open circuit in the IEPE sensor channel 2

7.3.3. Phase marker - digital input state

The alarm state can be also triggered by the wrong signal level on the speed/ phase marker input or frequency outside of the declared range.

Possible incorrectly digital inputs sates:

ERROR	DESCRIPTION
Too high frequency input 1	Detection of too high frequency of phase marker 1. Default 20 Hz. If the frequency is over 20 Hz, an error is reported.
Too high frequency input 2	Detection of too high frequency of phase marker 2. Default 20 Hz. If the frequency is over 20 Hz, an error is reported.
Too low frequency input 1	Detection of too low frequency of phase marker 1 or lack of impulses. Default 1Hz. If the frequency is below 1 Hz, an error is reported.
Too low frequency input 2	Detection of too low frequency of phase marker 2 or lack of impulses. Default 1 Hz. If the frequency is below 1 Hz, an error is reported.

Frequency on the digital inputs is based on the time measurement between 2 successive pulses of the phase marker.

7.4. Digital outputs

The module has 5 digital outputs: 4 low-power relay outputs up to 32 VDC and 100 mA and 1 high-power relay output up to 32 VDC, 2 A. Selecting the output type NO or NC of low-power relays is done at the production stage. The high-power relay has NO, NC and common contacts.

Digital outputs are configured by the menu where the user first selects an active state of relay contacts for the chosen output (normal or latch), and then the signal source, which activated the relay.

The sources can be:

- detection of alarms or warnings on the IEPE channels (threshold violation on a calculated value/ estimate),
- detection of incorrect IEPE sensor operation (short or open circuit),
- incorrect states of machine speed or AVM device.

Digital outputs can be triggered by multiple alarms/ warnings. Sources for triggered alarms and warnings are summed (logical sum OR).

7.5. 4-20 mA outputs

AVM 2000 has two independent 4-20 mA analog outputs. It is possible to choose a calculated value/ estimate, whose values will be sent to the selected output. The value of the selected estimate is appropriately converted into a 4-20 mA current value. The possible 4-20 mA output values are:

- 3.5 mA - detection of open IEPE sensor circuit,
- 4-20 mA - measuring range; in this range the value of the currently chosen estimate is sent to the current loop,
- 22 mA - detection of short IEPE sensor circuit.

7.6. Quick setup

Quick setup is selected in the menu by the "FC" - Fast Configuration option. It allows quickly set up AVM device settings. After selecting a quick configuration, the user goes through a number of options called in the following order:

1. FC Start => Selecting a IEPE channel:
    - -1 first
    - -2 second
    - FC return

2. Selecting a type of measurement:
    - _C fixed-time mode
    - _o speed/ phase marker triggering mode
    - F0 return
3. Choice of estimate to displaying:
    - -1 Acceleration 0-Peak
    - -2 Acceleration RMS
    - -3 Velocity 0-Peak
    - -4 Velocity RMS
    - -5 Velocity ISO RMS
    - -6 Envelope acceleration Peak-Peak
    - -7 Envelope acceleration RMS
    - F1 return
4. Relays mode:
    - _1 relays related to warnings and alarms react only to events associated with an estimate chosen at the item above,
    - _A relays related to warnings and alarms react to events associated with all estimates.
    - F2 return

    In the case of fast configuration, errors in the sensor circuit (short and open circuit) are signaled on relay 1, alarms are signaled on relay 2, and warnings are signaled on relay 3.
5. Measurement range:
    - _1 - 100 (m/s^2, mm/s)
    - _4 - 25 (m/s^2, mm/s)
    - 10 - 10 (m/s^2, mm/s)
    - F3 return
6. Finish

When the last option is set, relay reconfigurations, 4-20 mA outputs, display value and measurement channels are reconfigured. Quick configuration should goes twice: first for the first IEPE channel, and then for the second one.

7.7. RS485 - MODBUS RTU protocol

The AVM 2000 supports RS-485 Modbus RTU protocol communication in RTU mode at 115200 baud. Another transmission parameters are: 8 data bits, none parity bit, 1 stop bit. The order of bytes is Big Endian.

In the registers map we can distinguish three groups. The first are bit flags that come from events, alarms, and warnings that can be used for example to control digital outputs. The second and the third groups are registers containing values of estimates and device status.
Following functions are supported: Read Coils 0x01 and Read Holding Registers 0x03. The first one is used for reading bit status from group I (addresses beginning with 0x) and the second one is used for reading registers from groups II and III (addresses beginning with 4x). A full Modbus RTU registers map is included in the attachment to the user manual. In addition, the second and third groups has been shown in the following section.

In question the second group is divided into 40 subgroups, which determine the source of the calculated values/ estimates:

- estimates per period,
- estimates per rotation,
- 36 groups of estimates from rotation sections (only for DK version).
- minimum estimates values from 36 rotation sections (only for DK version),
- maximum estimates values from 36 rotation sections (only for DK version).

The table below shows the register map containing calculated values/ estimates. The addresses are given by the equation where "s" is the selected source: 0 means estimates per period, 1 means estimates per rotation and "c" is the number of channel (1 or 2).

Estimate	Start address	Nr of registers	Format	Available for a given version
Acceleration 0-Peak	40001 + (c - 1)*60 + s*120	2	Float32_t	D, DV, DK, DA
Acceleration RMS	40003 +(c - 1)*60 + s*120	2	Float32_t	D, DV, DK, DA
Velocity 0-Peak	40005+(c - 1)*60 + s*120	2	Float32_t	D, DV, DK, DA
Velocity RMS	40007 +(c - 1)*60 + s*120	2	Float32_t	D, DV, DK, DA
Velocity ISO RMS	40009 +(c - 1)*60 + s*120	2	Float32_t	D, DV, DK, DA
Envelope Peak-Peak	40011 +(c - 1)*60 + s*120	2	Float32_t	D, DV, DK, DA
Envelope RMS	40013 +(c - 1)*60 + s*120	2	Float32_t	D, DV, DK, DA
Acceleration Kurtosis	40015 +(c - 1)*60 + s*120	2	Float32_t	D, DV, DK, DA
Acceleration Crest Factor	40017 +(c - 1)*60 + s*120	2	Float32_t	D, DV, DK, DA
Velocity Kurtosis	40019 +(c - 1)*60 + s*120	2	Float32_t	D, DV, DK, DA
Velocity Crest Factor	40021+(c - 1)*60 + s*120	2	Float32_t	D, DV, DK, DA
BEC1	40023 +(c - 1)*60 + s*120	2	Float32_t	DV, DA
BEC2	40025 +(c - 1)*60 + s*120	2	Float32_t	DV, DA
BEC3	40027 +(c - 1)*60 + s*120	2	Float32_t	DV, DA
BEC4	40029 +(c - 1)*60 + s*120	2	Float32_t	DV, DA
BEC5	40031 +(c - 1)*60 + s*120	2	Float32_t	DV, DA
BEC6	40033 +(c - 1)*60 + s*120	2	Float32_t	DV, DA

Estimate	Start address	Nr of registers	Format	Available for a given version
BEC7	40035 +(c - 1)*60 + s*120	2	Float32_t	DV, DA
BEC8	40037 +(c - 1)*60 + s*120	2	Float32_t	DV,DA
Order 1	40039 +(c - 1)*60 + s*120	2	Float32_t	DA
Order 2	40041 +(c - 1)*60 + s*120	2	Float32_t	DA
Order 3	40043 +(c - 1)*60 + s*120	2	Float32_t	DA
Order 4	40045 +(c - 1)*60 + s*120	2	Float32_t	DA
Order 5	40047 +(c - 1)*60 + s*120	2	Float32_t	DA
Order 6	40049 +(c - 1)*60 + s*120	2	Float32_t	DA
Order 7	40051 +(c - 1)*60 + s*120	2	Float32_t	DA
Order 8	40053 +(c - 1)*60 + s*120	2	Float32_t	DA
Shaft Harmonic 1	40055 +(c - 1)*60 + s*120	2	Float32_t	DA
Shaft Harmonic 2	40057 +(c - 1)*60 + s*120	2	Float32_t	DA
Shaft Harmonic 3	40059+(c - 1)*60 + s*120	2	Float32_t	DA
Frequency PM1	40849	2	Float32_t	D, DV, DK, DA
Frequency PM2	40851	2	Float32_t	D, DV, DK, DA

The values of estimates from 36 sections of full rotation are available in DK version. There have been placed in registers, which are described in the next table. In the start address equation the variable "i" can take the following values:

- from 0 to 35 – the number of specific section,
- 36 for the minimum estimates values from all sections,
- 37 for the maximum estimates values from all

sections. The variable "c" is the channel number (1 or 2).

Estimate	Start address	Nr of registers	Format	Available for a given version
Acceleration 0-Peak	40241 + (c - 1)*8 + i*16	2	Float32_t	DK
Acceleration RMS	40243 + (c - 1)*8 + i*16	2	Float32_t	DK
Velocity 0-Peak	40245+ (c - 1)*8 + i*16	2	Float32_t	DK
Velocity RMS	40247+ (c - 1)*8 + i*16	2	Float32_t	DK

The third group of registers is related to the device status and warning/ alarm events. It has been presented in the next table.

Object	Start address	Nr of registers	Format	Additional information	Available for a given version
Device Status	41001	2	Uint32_t	Bitmask contains device status. Meaning of individual bits:	
				Bit 01=Module is starting	D, DV, DK, DA
				Bit 1 1=Module is ready to use	D, DV, DK, DA
				Bit2 1=Short circuit CH1	D, DV, DK, DA
				Bit3 1=Open circuit CH1	D, DV, DK, DA
				Bit4 1=Short circuit CH2	D, DV, DK, DA
				Bit5 1=Open circuit CH2	D, DV, DK, DA
				Bit6 1=Too low frequency PM1	D, DV, DK, DA
				Bit7 1=Too low frequency PM2	D, DV, DK, DA
				Bit8 1=Too high frequency PM1	D, DV, DK, DA
				Bit9 1=Too high frequency PM2	D, DV, DK, DA
				Bit10 1=Too high frequency deviation PM1	D, DV, DK, DA
				Bit11 1=Too high frequency deviation PM2	D, DV, DK, DA
				Bit12 1=Virtual COM Port mode	D, DV, DK, DA
				Bit13 1=Mass storage mode	DV, DK, DA
				Bit14 1=Ready for sending RAW samples	DV, DK, DA
				Bit15 1=Sending RAW samples	DV, DK, DA
				Bit16 1=Saving estimates to SD card	DV, DK, DA
				Bit17 1=Ready for saving RAW samples to SD card	DV, DK, DA
				Bit18 1=Saving RAW samples CH1 to SD card	DV, DK, DA
				Bit19 1=Saving RAW samples CH2 to SD card	DV, DK, DA
				Bit20 1=Saving advantage estimates to SD card	DV, DA

Object	Start address	Nr of registers	Format	Additional information	Available for a given version
				Bit21 1=Create files copy	DV, DK, DA
				Bit22 1=Learning mode	DV, DK, DA
				Bit23 1=SD card error / SD card missing	DV, DK, DA
				Bit24 1=SD card critical error	DV, DK, DA
Basic Estimates Alarm CH 1	41003	1	Uint8_t	Bitmask describes alarms and warnings. Value 1 means that alarm/ warning from a given source is up. Bit 0 1 = Acceleration 0-Peak Bit 1 1 = Acceleration RMS Bit 2 1 = Velocity 0-Peak Bit 3 1 = Velocity RMS Bit 4 1 = Velocity ISO RMS Bit 5 1 = Envelope Peak-Peak Bit 6 1 = Envelope RMS	D, DV, DK, DA
Basic Estimates Warning CH 1	41004	1	Uint8_t		
Basic Estimates Alarm CH 2	41005	1	Uint8_t		
Basic Estimates Warning CH 2	41006	1	Uint8_t		
BEC Alarm CH 1	41007	1	Uint8_t	Bitmask describes alarms and warnings. Value 1 means that alarm/ warning from a given source is up. Bit 0 1 = BEC1 Bit 1 1 = BEC2 Bit 2 1 = BEC3 Bit 3 1 = BEC4 Bit 4 1 = BEC5 Bit 5 1 = BEC6 Bit 6 1 = BEC7 Bit 7 1 = BEC8	DV, DA
BEC Warning CH 1	41008	1	Uint8_t		
BEC Alarm CH 2	41009	1	Uint8_t		
BEC Warning CH 2	41010	1	Uint8_t		
Order Alarm CH 1	41011	1	Uint8_t	Bitmask describes alarms and warnings. Value 1 means that alarm/ warning from a given source DA is up. Bit 0 1 = Order1	
Order Warning CH 1	41012	1	Uint8_t		

Object	Start address	Nr of registers	Format	Additional information		Available for a given version
Order Alarm CH 2	41013	1	Uint8_t	Bit 1	1 = Order2	
				Bit 2	1 = Order3	
Order Warning CH 2	41014	1	Uint8_t	Bit 3	1 = Order4	
				Bit 4	1 = Order5	
				Bit 5	1 = Order6	
				Bit 6	1 = Order7	
				Bit 7	1 = Order8	
Shaft Harmonic Alarm CH 1	41015	1	Uint8_t	Bitmask describes alarms and warnings. Value 1 means that alarm/ warning from a given source is up.		
Shaft Harmonic Warning CH 1	41016	1	Uint8_t			
				Bit 0	1 = Shaft Harmonic 1	
Shaft Harmonic Alarm CH 2	41017	1	Uint8_t	Bit 1	1 = Shaft Harmonic 2	DA
				Bit 2	1 = Shaft Harmonic 3	
Shaft Harmonic Warning CH 2	41018	1	Uint8_t			
Device Time - Year	41019	1	Uint16_t			D, DV, DK, DA
Device Time - Month	41020	1	Uint8_t			D, DV, DK, DA
Device Time - Day	41021	1	Uint8_t			D, DV, DK, DA
Device Time - hour	41022	1	Uint8_t			D, DV, DK, DA
Device Time - minute	41023	1	Uint8_t			D, DV, DK, DA
Device Time - second	41024	1	Uint8_t			D, DV, DK, DA
Hardware Version	41025	1	Uint16_t			D, DV, DK, DA
Software Version	41026	1	Uint16_t			D, DV, DK, DA

7.8. Saving data to microSD memory card

The AVM 2000 can save to the microSD card raw vibration signals from IEPE inputs, the calculated estimates results and all system events that occurred on the device.

The tree of saved files looks like this:

- **Estimates (folder)**
  - **CH1 (folder)**
    - **Old (folder)**
    - **RAW (folder)**
      - dd_mm_yyyy__hh_mm_ss.txt
      - ...
      - dd_mm_yyyy__hh_mm_ss.txt
    - 0_35.txt
    - ...
    - 35_35.txt
    - Estimates.txt
    - Estimates_Per_Round.txt
    - Max.txt
    - Min.txt
  - **CH2 (folder)**
    - **Old (folder)**
    - **RAW (folder)**
      - dd_mm_yyyy__hh_mm_ss.txt
      - ...
      - dd_mm_yyyy__hh_mm_ss.txt
    - 0_35.txt
    - ...
    - 35_35.txt
    - Estimates.txt
    - Estimates_Per_Round.txt
    - Max.txt
    - Min.txt
- Conf.vt2g
- Log.txt

***Estimates* directory** contains the results of the calculated estimates for both IEPE sensors channels - in *CH1* and *CH2* directories, raw signal samples - in *RAW* directory and archival data – in *Old* directory.

***Estimates.txt* file** contains the results of estimates based on a fixed-time buffer.

***i_35.txt* file** (only for DK version) contains the results of calculated estimates from sections of full rotation, where „i" is a number of a next section from 0 to 35.

***Estimates_Per_Round.txt* file** contains the results of estimates based on intervals determined by phase markers.

***Max.txt* file** (only for DK version) contains the maximum values of estimates from 36 sections.

***Min.txt* file** (only for DK version) contains the minimum values of estimates from 36 sections.

Files: *i_35.txt / Estimates.txt / Estimates_Per_Round.txt / Max.txt / Min.txt*, containing values of calculated estimates, inlude also the headline that describes the meaning of each column. The columns are separated by tabulators.

***Conf.vt2g* file** stores the configuration of the device. The settings are stored on the SD card and in the non-volatile internal memory of the AVM 2000 device (configuration will not lost if the power will turned off). If you want to move configuration from one AVM module to another you simply copy configuration file into the card used in this module. When the device will find a new configuration file on the card it will load that and updates previously settings. In the absence of a file or if the file will have wrong structure after detection of the SD card, the AVM 2000 will create a new one on the basis of settings in non-volatile memory.

***Log.txt* file** includes a record of all events detected by AVM 2000.

***RAW* directory** contains raw vibration signals collected from IEPE sensor. They are in files whose names are created by following formula: dd_mm_yyyy__hh_mm_ss. The meaning is as follows:

- dd - Day (1 - 31)
- mm - Month (1 - 12)
- yyyy – Year
- hh - hour (0 - 24)
- mm - minute
- ss - second

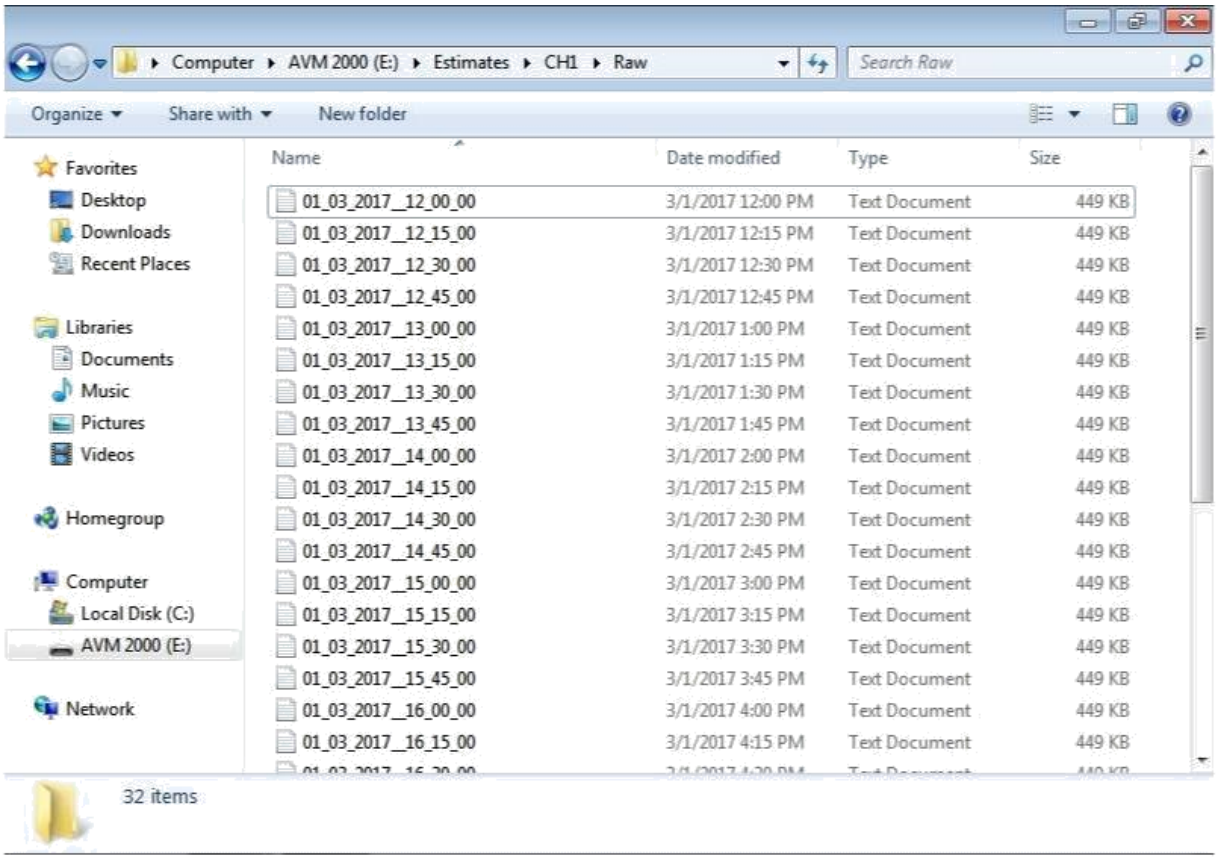
Names of these files informe of a moment when data was collected. When an unusual situation occurs e.g. the device want to create a file with an existing name, in order to keep both files the _N ending is added to the name of the newly created file. N is a number of the next file with the name comprising the same date. This rule applies to all files created by the device except Conf.vt2g and Log.txt.

To keep the compatibility of date in file names with the currently time, setting the device clock before first use is necesarry. In case power supply failure AVM 2000 keeps their own clock for 1 weak up and running. If the power supply failure takes longer, after restarting of device the right time setting is needed.

***Old* directory** consist of files with archival estimates. They are created when the number of saved estimates in any file exceeds limit of 100 records *(*from any source: configurable length time buffer, full rotation or sections of full rotation*)*. In that case the file with archival estimates is moved to the *Old* directory and a prefix containing the time of backup create is added to the filename. The prefix is created in the same way as in the *Raw* folder.

By default, the estimates are writing to the SD card every 10 minutes and the raw data are not saving.

The sample view from the Windows® 7 explorer shows the files with raw vibration signal from IEPE channel 1 in the *RAW* directory.



WARNING!

The microSD card must have one *primary* type partition and be formatted in FAT32 file system. The card should be inserted into the device before connecting the power supply. The card can be removed only after disconnecting the power supply.

7.9. Automatically setting alarm and warning thresholds

The AVM 2000 allows to automatically set levels of thresholds. To do this, user enters the number of estimates, from which the device calculates average values as well as the alarm and warning factors. Alarms and warnings thresholds are calculated as the product of the alarm/ warning factor and the averaged values of estimates.

WARNING!

The learning time, in which the device automatically will calculate threshold levels, depends on two factors:

- **the number of estimates taken into account when calculating the average value,**
- **saving interval to the SD card.**

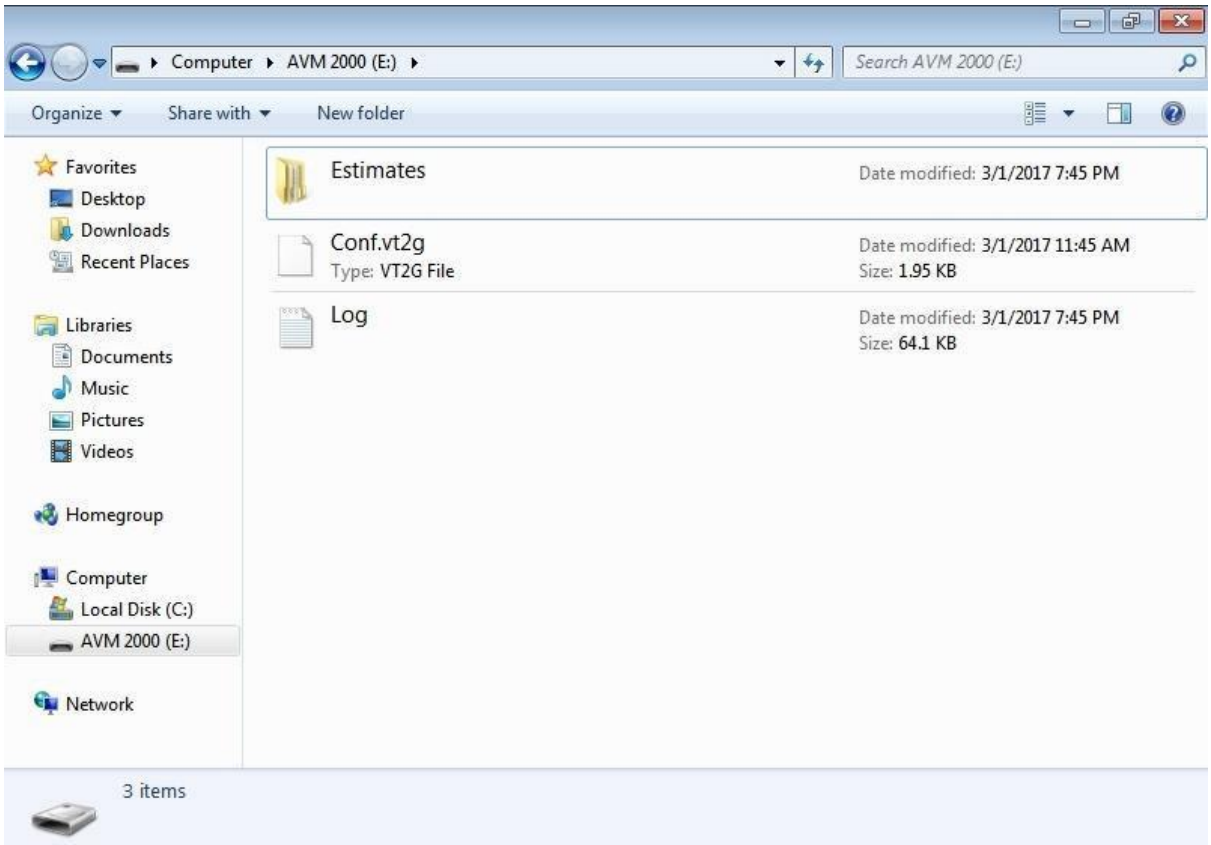
The learning time is equal to the product of two the factors above

7.10. USB port configuration

USB mode setting is configurable by "UC" menu, available on front panel. There are two modes of operation:

- **Virtual COM** (visible on the LED display as "Co") - USB is seen by the host system as a virtual serial port (COM). This mode is used for configuration the module by the PC.
- **Mass storage** (visible on the LED display as "Sd") - the AVM 2000 is presented in the host system as a mass storage device. In this mode you can perform operations on files stored on the SD card, e.g. copy the stored data.

By default, the AVM 2000 works in Virtual COM mode. To go to the mass storage mode you need to select in the menu on the front panel "UC" option and then select "Sd" mode. After this operation the device will be automatically seen in the operating system as a removable drive. Before disconnecting from a PC the AVM 2000 should be safely ejected from the operating system (operation is shown in the view below). To exit the "Sd" mode and enter to the Virtual COM mode there is a need to select "UC" in the menu and than do "Co" mode. Other methods of returning from the "Sd" mode to the "Co" mode are to disconnect the USB cable or to disconnect and reconnect the power supply from the AVM 2000 device.



8. Digital processing parameters

Parameters of calculations:

Parameter	Value	Comment
Basic		
Sampling frequency – fs	**40 kHz**	
Analog bandwidth	**0.2 Hz - 12 kHz**	
Number of FFT samples	2048	
ISO RMS analysis bandwidth	10 - 1000 Hz	
The number of harmonics to track	3	first (velocity), second and third harmonic of velocity; there are always calculated based on spectrum in order domain (for fixed-time working mode of AVM device)
Time domain filters		
Cutoff_freq LP anty-aliasing	f(decimation)	it depends on decimation level
2xCutoff_freq BP	f(band)	it depends on analysis parameters
Envelope LP	4 kHz	possible to change (optionally)
Envelope HP	12 kHz	possible to change (optionally)
HP before integration	3 Hz	possible to change (optionally)

9. Parameters configuration

AVM 2000 parameters can be set with the front panel or via USB port and the PC application.

Before connecting AVM 2000 to a PC it is necessary to install *virtual COM* driver (if not provided with the device, the driver can be downloaded from the AMC Vibro website on request).

9.1. Configuring AVM 2000 by front panel

There are three keys on the AVM 2000 front panel, marked as: UP, DN, SET which are used for editing the device functions.

Pressing the UP or DN key during normal operation of the AVM 2000 will enter to the device menu. While in edit mode press the UP / DN key to move to the next menu option.

The menu structure is four-levels, in order to select the desired level press SET. A higher level in the menu structure is followed by the symbol that caused the entry into the structure, e.g. exit the "P-" submenu occurs after it has been selected again and confirmed by SET button.

9.1.1. „P-'' IEPE (ICP®) sensor channels configuration

You can choose options from P1 to P8, entering P- menu. The options are:

» P1 gain configuration of IEPE channel 1:

- _1 - range 100 (m/ s^2, mm/s),
- _4 - range 25 (m/ s^2, mm/s),
- 10 - range 10 (m/ s^2, mm/s).

» P2 gain configuration of IEPE channel 2:

- _1 - range 100 (m/ s^2, mm/s),
- _4 - range 25 (m/ s^2, mm/s),

  10 - range 10 (m/ s^2, mm/s).

WARNING!

The value 100 is displayed on the LED display as „99.".

» P3 method of phase marker triggering for IEPE channel 1:

- 1o – triggering by falling edge of phase marker 1,
- 1n – triggering by rising edge of phase marker 1,
- 2o – triggering by falling edge of phase marker 2,
- 2n – triggering by rising edge of phase marker 2.

» P4 method of phase marker triggering for IEPE channel 2:

- 1o – triggering by falling edge of phase marker 1,
- 1n – triggering by rising edge of phase marker 1,
- 2o – triggering by falling edge of phase marker 2,
- 2n – triggering by rising edge of phase marker 2.

» P5 measurements time. Time is common for both IEPE sensor channels. Time can be setting from 0.1 s to 2 s with step 0.1 s.

» P6 IEPE sensor 1 sensitivity, given in mV/g. Possible settings is from 1 (corresponding to 10 mV/) to 99 (corresponding to 990 mV/g).

» P7 IEPE sensor 2 sensitivity, given in mV/g. Possible settings is from 1 (corresponding to 10 mV/g) to 99 (corresponding to 990 mV/g).

» P8 numbers of averaged measurements: 1-10 measurements.

The result is the average of the set number of samples (current sample and n-1 previous). It is refreshing per every period based on the set time buffer or per every rotation based on phase marker pulses (depending on the set mode).

» P- return.

9.1.2. „i-'' Fixed-time or synchronous measurement mode, selecting of frequency ranges

You can choose options from i0 to i2, entering i- menu. The options are:

- i0 IEPE channels operation mode:
  - PE fixed-time mode. There are only estimates per period calculated. This time is selected in menu P5,
  - Fr phase marker triggering mode. Estimates are calculated per rotation.
- i1 selecting frequency range for phase marker inputs. The frequency is checked only for synchronous measurements:
  - -1 frequency upper limit for phase marker channel 1. Range from 1 Hz to 20 Hz with 1 Hz step,
  - -2 frequency upper limit for phase marker channel 2. Range from 1 Hz to 20 Hz with 1 Hz step,
  - -3 frequency bottom limit for phase marker channel 1. Range from 1 Hz to 20 Hz with 1Hz step,
  - -4 frequency bottom limit for phase marker channel 2. Range from 1 Hz to 20 Hz with 1Hz step,
  - -5 maximal frequency deviation for phase marker channel 1. Range from 1Hz to 9.9 Hz with 0.1Hz step,
  - -6 maximal frequency deviation for phase marker channel 2. Range from 1Hz to 9.9 Hz with 0.1Hz step,
  - i0 –return.
- i- return.

9.1.3. „A-'' Warnings and alarms setting

Menu A- is responsible for alarms and warnings setting.

- A0 machine start time. It is the time that passes from detecting activity on the phase marker input to the moment at which the machine is operating stable - at this point the AVM device starts measuring.
  - oF – turn off time checking,
  - 1 – 1 s delay time,
  - 99 – 99 s delay time,
  - 2. – 2 min delay time,
  - 99. – 99 min delay time.

  A1-A2 switch-on delay time of relay outputs after violation detection as well the holding time of error flags after disappearance of violation.

  A1 an alarm delay time - it is the time that determines how long the alarm threshold must be exceeded to report an alarm. The alarm holding time – it is the time that determines how long the alarm will be reported still after disappearance of violation.

A2 a warning delay time - it is the time that determines how long the warning threshold must be exceeded to report a warning. The warning holding time – it is the time that determines how long the warning will be reported still after disappearance of violation.

Each of these options has the following submenu:

- -1 delay time for warnings and alarms from acceleration signal, IEPE channel 1
  - oF – turn off delay time,
  - 1 – 1 s delay,
  - 99 – 99 s delay,
  - 2. – 2 min delay,
  - 99. – 99 min delay.
- -2 delay time for warnings and alarms from acceleration signal, IEPE channel 2 (setting as above),
- -3 delay time for warnings and alarms from velocity signal, IEPE channel 1 (setting as above),
- -4 delay time for warnings and alarms from velocity signal, IEPE channel 2 (setting as above),
- -5 holding time for warnings and alarms from acceleration signal, IEPE channel 1 (setting as above),
- -6 holding time for warnings and alarms from acceleration signal, IEPE channel 2 (setting as above),
- -7 holding time for warnings and alarms from velocity signal, IEPE channel 1 (setting as above),
- -8 holding time for warnings and alarms from velocity signal, IEPE channel 2 (setting as above),
- Ax return, where x is the number of current submenu.

» A3 – A6 warning and alarm levels:

A3 warning level for IEPE channel 1,

A4 alarm level for IEPE channel 2,

A5 warning level for IEPE channel 1,

A6 alarm level for IEPE channel 2.

Each of these options allows the following settings:

- -1 acceleration RMS threshold:
  - oF alarms/ warnings off,
  - alarms/ warnings is activated if the calculated estimate exceeds 0.1 m/s^2, ○ 99 alarms/ warnings is activated if the calculated estimate exceeds 99 m/s^2.
- -2 acceleration 0-PEAK threshold,
- -3 velocity RMS threshold,
- -4 velocity 0-PEAK threshold,
- -5 velocity ISO RMS threshold,
- -6 envelope Peak-Peak threshold,
- -7 envelope RMS threshold,
- Ax return, where x is the number of current submenu.

» A- return.

9.1.4. „o-'' Digital output setting

Menu o- is responsible for setting of the digital outputs and alarms / warnings.

» o0 working with the latch or normal mode of relay outputs

- -1 relay 1 mode
  - _n normal mode; when alarm or warning is detected a relay output is switched on and after the disappearance of the alarm event the relay output is switched off,
  - _L latch mode; when alarm or warning is detected a relay output is switched on and kept latching, reset of the relay output state takes place by pressing together the "SET" + "DOWN" buttons for about 3 seconds.
- -2 relay 2 mode (setting as above),
- -3 relay 3 mode (setting as above),
- -4 relay 4 mode (setting as above),
- -5 relay 5 mode (setting as above),
- o0 return.

» o1 activation source of relay output 1. All parameters are summed on the basis of logical sum OR. Menu is divided as below:

- 1- relay output is activated if an alarm on channel 1 is detected. The sources of alarm can be below signals:
  - -1 acceleration 0-PEAK
    - oF – relay output is not active,
    - on – relay output is active if thresholds violation is detected.
  - -2 acceleration RMS (setting as above),
  - -3 velocity 0-PEAK (setting as above),
  - -4 velocity RMS (setting as above),
  - -5 velocity ISO RMS (setting as above),
  - -6 envelope Peak-Peak (setting as above),
  - -7 envelope RMS (setting as above),
  - –return.
- 2- relay output is activated if alarm on channel 2 is detected. Setting as above.
- 3- relay output is activated if warning on channel 1 is detected. Setting as above.
- 4- relay output is activated if warning on channel 2 is detected. Setting as above.
- 5- relay output is activated if IEPE channel 1 circuit is shorted,
- 6- relay output is activated if IEPE channel 2 circuit is shorted,
- 7- relay output is activated if IEPE channel 1 circuit is open,
- 8- relay output is activated if IEPE channel 1 circuit is open,
- 9- relay output is activated if frequency of phase marker channel 1 is too low,
- 10 relay output is activated if frequency of phase marker channel 2 is too low,
- 11 relay output is activated if frequency of phase marker channel 1 is too high,
- 12 relay output is activated if frequency of phase marker channel 2 is too high,

All parameters can set as "oF" (relay output is not active) or "on" (relay output is active if the violation was detected)

- ox return, where x is the number of current submenu.

» o2 activation source of relay output 2. Setting as above.

» o3 activation source of relay output 3. Setting as above.

» o4 activation source of relay output 4. Setting as above.

» o5 activation source of relay output 5. Setting as above.

» o- return.

9.1.5. „UC'' USB port configuration

Menu UC is responsible for configuring USB port mode.

» "Co": USB is seen by the host system as a virtual serial port (COM). This mode is used for configuration the module by the PC.

» "Sd": the AVM 2000 is presented in the host system as a mass storage device. In this mode you can perform operations on files stored on the SD card.

9.1.6. „LE'' Learning mode

Menu LE is responsible for an automatically setting alarm and warning thresholds.

» -1 factor for an automatically setting warning levles,

» -2 factor for an automatically setting error levles,

» -3 number of estimates, from which the device calculates average values of estimates in order to determine thresholds violation.

9.1.7. „dE'' Default setting

Menu dE is responsible for restoring the AVM device to the default settings.

» on restore the default settings,

» -- exit without reset the settings.

All default settings has been listed in chapter 9.1.11.

9.1.8. "FC '' Quick setup

» FC Start => Selecting a IEPE channel:

- -1 first
- -2 second
- FC return

» Selecting a type of measurement:

- _C fixed-time mode
- _o phase marker triggering mode

- F0 return

» Choice of estimate to displaying:

- -1 Acceleration 0-Peak
- -2 Acceleration RMS
- -3 Velocity 0-Peak
- -4 Velocity RMS
- -5 Velocity ISO RMS
- -6 Envelope acceleration Peak-Peak
- -7 Envelope acceleration RMS
- F1 return

» Relays mode:

- _1 relays related to warnings and alarms react only to events associated with an estimate chosen at above item,
- _A relays related to warnings and alarms react to events associated with all estimates.
- F2 return

In the case of fast configuration, errors in the sensor circuit (short and open circuit) are signaled on relay 1, alarms are signaled on relay 2 and warnings are signaled on relay 3.

» Measurement range:

- _1 - 100 (m/s^2, mm/s)
- _4 - 25 (m/s^2, mm/s)
- 10 - 10 (m/s^2, mm/s)
- F3 return

» Finish

9.1.9. „u-'' LED display and 4-20 mA outputs configuration

Menu u- is responsible for the configuration of the LED display on the front panel and 4-20 mA outputs:

» u0 LED display configuration. All kinds of displayed estimates:

- oF the display is disabled,
- 1P IEPE channel 1 acceleration 0-PEAK,
- 1r IEPE channel 1 acceleration RMS,
- 2P IEPE channel 2 acceleration 0-PEAK,
- 2r IEPE channel 2 acceleration RMS,
- 3P IEPE channel 1 velocity 0-PEAK,
- 3r IEPE channel 1 velocity RMS,
- 3n IEPE channel 1 velocity ISO RMS (10 Hz – 1 kHz),
- 4P IEPE channel 2 velocity 0-PEAK,
- 4r IEPE channel 2 velocity RMS,
- 4n IEPE channel 2 velocity ISO RMS (10 Hz – 1 kHz),
- 1E IEPE channel 1 envelope Peak-Peak,
- 2E IEPE channel 2 envelope Peak-Peak,
- 3E IEPE channel 1 envelope RMS,

- 4E IEPE channel 2 envelope RMS,
- F1 phase marker channel 1 frequency,
- F2 phase marker channel 2 frequency,
- u0 return.

» u1 configuration of 4-20 mA output, channel 1. The estimates available for sending to the analog output are the same as for LED display (listed at "u0" option), except for the frequency of phase markers.

- u1 return

» u2 configuration of 4-20 mA output, channel 2. The estimates available for sending to the analog output are the same as LED display (listed at "u0" option), except for the frequency of phase markers.

- u2 return

» u- return

All display methods - on the LED display and both 4-20 mA outputs, allow to display the values of the above mentioned estimates calculated from both source - from configurable length time buffer or full rotation based on speed/ phase marker pulses.

9.1.10. The menu structure accessible on the front panel

Symbol	1-	2-	3-	Description	Options
P-	...	...	...	IEPE channels configuration	
	P1	...	...	IEPE channel 1 gain	_1 – gain x1, range 100 (m/s^2, mm/s) _4 – gain x4, range 25 (m/ s^2, mm/s) 10 – gain x10 range 10 (m/ s^2, mm/s) **Default: _1 – gain x1**
	P2	...	...	IEPE channel 2 gain	as above
	P3	...	...	type of phase marker edge assigned to IEPE channel 1	1o - phase marker input 1 1n 2o - phase marker input 2 2n o - falling edge n - rising edge **Default: 1o – phase marker input 1, falling edge (if synchronous mode)**
	P4	...	...	type of phase marker edge assigned to IEPE channel 2	as above **Default: 2o – phase marker input 2, falling edge (if synchronous mode)**
	P5	...	...	measurements time	0.1 ... 2 seconds (the same for both channels) **Default: _1 – 1 second**
	P6	...	...	IEPE sensor 1 sensitivity	1 ... 99 which corresponds to 10 mV/g ... 990 mV/g **Default: 10 - 100 mV/g**
	P7	...	...	IEPE sensor 2 sensitivity	1 ... 99 which corresponds to 10 mV/g ... 990 mV/g **Default: 10 - 100 mV/g**
	P8	...	...	number of averaged measurements	1-10 measurements **Default: _1 – 1 measurement (no averaging)**
	P-	...	...	return	
i-	...	...	...	Working mode	

Symbol	1-	2-	3-	Description	Options
	i0	...	...	working mode: fixed-time or synchronous	PE – fixed-time mode. Estimates are calculated only per period. Fr – synchronous mode. Estimates are calculated per rotation, synchronous with successive phase marker impulses. **Default: PE – fixed-time mode is enabled**
	i1	...	...	selection of inputs frequency range	
		-1	...	frequency upper limit for phase marker channel 1	oF – frequency checking is disabled _1 – minimum frequency 1 Hz 20 – maximum frequency 20 Hz **Default: 20 - 20 Hz frequency**
		-2	...	frequency upper limit for phase marker channel 2	as above **Default: 20 - 20 Hz frequency**
		-3	...	frequency bottom limit for phase marker channel 1	as above **Default: _1 - 1 Hz frequency**
		-4	...	frequency bottom limit for phase marker channel 2	as above **Default: _1 - 1 Hz frequency**
		-5	...	maximal frequency deviation for phase marker channel 1	from 0.1 to 9.9 Hz wit 0.1 Hz step **Default: _2 - frequency deviation 2 Hz**
		-6	...	maximal frequency deviation for phase marker channel 2	from 0.1 to 9.9 Hz wit 0.1 Hz step **Default: _2 - frequency deviation 2 Hz**
		i1	...	return	
	i-	...	...	return	
A-	...	...	...	Warnings and alarms settings related to IEPE sensors	
	A0	...	...	machine start time	oF - turn off start time checking. In the case of synchronous mode the measurements will begin immediately after signal detection on the phase marker input.

Symbol	1-	2-	3-	Description	Options
					1 - 1 s delay 99 - 99 s delay 2 – 2 min delay, 99 – 99 min delay **Default: _3 - 3 seconds**
	A1	...	...	alarm delay and holding time	
	A2	...	...	warning delay and holding time	
		-1	...	delay time to report violation on channel 1 (acceleration signal)	oF - turn off delay time checking. If a signal is over the threshold, warning is immediately reported. 1 - 1 s start delay 99 - 99 s start delay 2. – 2 min start delay 99. – 99 min start delay **Default: _1 - 1 second**
		-2	...	delay time to report violation for channel 2 (acceleration signal)	as above
		-3	...	delay time to report violation for channel 1 (velocity signal)	as above
		-4	...	delay time to report violation for channel 2 (velocity signal)	as above
		-5	...	holding time for channel 1 (acceleration signal)	oF – turn off holding time 1 - 1 s holding time 99 - 99 s holding time 2. – 2 min holding time 99. – 99 min holding time _L – alarm/ warning state is latched **Default: _1 - 1 second**
		-6	...	holding time for channel 2 (acceleration signal)	as above
		-7	...	holding time for channel 1 (velocity signal)	as above
		-8	...	holding time for channel 2 (velocity signal)	as above

Symbol	1-	2-	3-	Description	Options
		Ax	...	return, where x corresponds to the current submenu number	
	A3	...	...	warning levels for channel 1	more in item A6
	A4	...	...	alarm levels for channel 1	more in item A6
	A5	...	...	warning levels for channel 2	more in item A6
	A6	...	...	alarm levels for channel 2	more in item A6
		-1	...	acceleration 0-Peak	oF – alarm/ warning is disabled 0.1 - the alarm/ warning is activated when the value of calculated estimate exceeds 0.1 m/s_2 99 - the alarm/ warning is activated when the value of calculated estimate exceeds 99 m/s_2 **Default: oF - alarm/ warning is disabled**
		-2	...	acceleration RMS	as above
		-3	...	velocity 0-PEAK	as above
		-4	...	velocity RMS	as above
		-5	...	velocity ISO RMS	as above
		-6	...	envelope Peak-Peak	as above
		-7	...	envelope RMS	as above
		Ax	...	return, where x corresponds to the current submenu number	
	A-	...	...	return	
o-	...	...	...	Digital outputs setting	
	o0	...	...	digital outputs active state selection	

Symbol	1-	2-	3-	Description	Options
		-1	...	output 1 active state selection	_n – normal mode; the output is active only during the alarm or warning _L – latch mode; after alarm or warning event the relay output is latched continuously **Default: _n - normal mode**
		-2	...	output 2 active state selection	as above
		-3	...	output 3 active state selection	as above
		-4	...	output 4 active state selection	as above
		-5	...	output 5 active state selection	as above
		o0	...	return	
	o1	...	...	activation source of output 1	more in item o5
	o2	...	...	activation source of output 2	more in item o5
	o3	...	...	activation source of output 3	more in item o5
	o4	...	...	activation source of output 4	more in item o5
	o5	...	...	activation source of output 5	more in item o5
		1	...	detection of alarm on the IEPE channel 1	more in item 4
		2-	...	detection of alarm on the IEPE channel 2	more in item 4
		3-	...	detection of warning on the IEPE channel 1	more in item 4
		4-	...	detection of warning on the IEPE channel 2	more in item 4
			-1	acceleration 0-Peak	oF – no reaction on – reaction to violation **Default: oF – no reaction to violation**

Symbol	1-	2-	3-	Description	Options
			-2	acceleration RMS	as above
			-3	velocity 0-PEAK	as above
			-4	velocity RMS	as above
			-5	velocity ISO RMS	as above
			-6	envelope Peak-Peak	as above
			-7	envelope RMS	as above
			--	return	
		5-	...	short circuit of IEPE channel 1	as above
		6-	...	short circuit of IEPE channel 2	as above
		7-	...	open circuit on IEPE channel 1	as above
		8-	...	open circuit on IEPE channel 2	as above
		9-	...	too low frequency phase marker channel 1	as above
		10	...	too low frequency phase marker channel 2	as above
		11	...	too high frequency phase marker channel 1	as above
		12	...	too high frequency phase marker channel 2	as above
		ox	...	return, where x corresponds to the current submenu number	
	o-	...	...	return	
UC	...	...	...	USB port configuration	
	Co	...	...	virtual COM mode	
	Sd	...	...	mass storage mode	

Symbol	1-	2-	3-	Description	Options
LE	...	...	...	Learning mode	
	-1	...	...	factor for warning levles	1.0 .. 99 **Default: 2.5 – factor x2.5**
	-2	...	...	factor for error levles	1.0 .. 99 **Default: 10 – factor x10**
	-3	...	...	number of estimates to calculation of average	1 .. 99 **Default: 10 – average from 10 last estimates**
	LE	...	...	return	
dE	...	...	...	restore the default settings	
	on	...	...	restore the default settings	
	--	...	...	exit without reset the settings	
FC	...	...	...	Quick setup	
u-	...	...	...	LED display and 4-20 mA outputs configuration	
	u0	...	...	LED display configuration. Choice of displayed estimate.	oF – displaying is disabled 1P – 0-PEAK 1r – RMS n – ISO RMS 1P, 1r acceleration IEPE channel 1 2P, 2r acceleration IEPE channel 2 3P, 3r, 3n velocity IEPE channel 1 4P, 4r, 4n velocity IEPE channel 2 1E, 2E – envelope Peak-Peak IEPE channel 1 and 2 3E, 4E – envelope RMS IEPE channel 1 and 2 1F, 2F – phase marker frequency channel 1 and 2 **Default: 1P – acceleration 0-Peak IEPE channel 1**
		u0	...	return	

Symbol	1-	2-	3-	Description	Options
	u1	...	...	4-20 mA output 1 configuration. Choice of estimate to send.	oF - displaying is disabled 1P – 0-PEAK 1r – RMS n – ISO RMS 1P, 1r acceleration IEPE channel 1 2P, 2r acceleration IEPE channel 2 3P, 3r, 3n velocity IEPE channel 1 4P, 4r, 4n velocity IEPE channel 2 1E, 2E – envelope Peak-Peak IEPE channel 1 and 2 3E, 4E – envelope RMS IEPE channel 1 and 2 **Default: 1P - acceleration 0-Peak IEPE channel 1**
		u1	...	return	
	u2	...	...	4-20 mA output 2 configuration. Choice of estimate to send.	oF 1P – 0-PEAK 1r – RMS n – ISO RMS 1P, 1r acceleration IEPE channel 1 2P, 2r acceleration IEPE channel 2 3P, 3r, 3n velocity IEPE channel 1 4P, 4r, 4n velocity IEPE channel 2 1E, 2E – envelope Peak-Peak IEPE channel 1 and 2 3E, 4E - envelope RMS IEPE channel 1 and 2 **Default: 2P - acceleration 0-Peak IEPE channel 2**
		u2	...	return	
	u-	...	...	return	
--	...	...	...	Exit menu	

9.1.11. Default settings

Option	Channel or Output	Deafult setting	Device version
4-20 mA output	Output 1	displaying is stopped (at that time value of current is 4 mA)	all versions
4-20 mA output	Output 2	displaying is stopped (at that time value of current is 4 mA)	all versions
Alarms/ warnings delay time	IEPE CH1 & CH2	1 second	all versions
Alarms/ warnings holding time	IEPE CH1 & CH2	1 second	all versions
Alarms/ warnings levels	IEPE CH1 & CH2	alarms and warnings are disabled (value 0)	all versions
BEC1	IEPE CH1 & CH2	0 Hz - 100 Hz, acceleration signal	DV, DA
BEC2	IEPE CH1 & CH2	100 Hz - 200 Hz, acceleration signal	DV, DA
BEC3	IEPE CH1 & CH2	200 Hz - 400 Hz, acceleration signal	DV, DA
BEC4	IEPE CH1 & CH2	400 Hz - 600 Hz, acceleration signal	DV, DA
BEC5	IEPE CH1 & CH2	600 Hz - 1000 Hz, acceleration signal	DV, DA
BEC6	IEPE CH1 & CH2	1000 Hz - 2500 Hz, acceleration signal	DV, DA
BEC7	IEPE CH1 & CH2	2500 Hz - 5000 Hz, acceleration signal	DV, DA
BEC8	IEPE CH1 & CH2	5000 Hz - 10000 Hz, acceleration signal	DV, DA
Delta Harmonics	IEPE CH1 & CH2	0	DA
Delta Order	IEPE CH1 & CH2	0	DA

Option	Channel or Output	Deafult setting	Device version
Digital outputs mode	Output 1..6	normal mode	all versions
Digital output trigger source	Output 1..6	alarms and warnings are disabled	all versions
Envelope passband	IEPE CH1 & CH2	4 kHz - 12 kHz (possible to change optionally)	all versions
IEPE channel gain	IEPE CH1 & CH2	1 (100% of the measurements range)	all versions
IEPE sensor sensitivity	IEPE CH1 & CH2	100 mV/g	all versions
IEPE channel 1 trigger source – if synchronous mode	IEPE CH1	phase marker 1, falling edge	all versions
IEPE channel 2 trigger source – if synchronous mode	IEPE CH2	phase marker 2, falling edge	all versions
Interval of saving estimates to the SD card	IEPE CH1 & CH2	10 minutes	DV, DK, DA
Interval of saving raw data to the SD card	IEPE CH1 & CH2	saving disabled	DV, DK, DA
Learning mode - factor for alarms	IEPE CH1 & CH2	learning mode is disabled by deafult	DV, DK, DA
Learning mode - factor for warnings	IEPE CH1 & CH2	learning mode is disabled by default	DV, DK, DA
Learning mode - number of estimates to calculation of the average	IEPE CH1 & CH2	learning mode is disabled by default	DV, DK, DA
LED display	LED display	there is displayed the value of 0-Peak acceleration from IEPE channel 1	all versions
Machine start time	IEPE CH1 & CH2	3 seconds	all versions
Measurements time	IEPE CH1 & CH2	1 second	all versions

Option	Channel or Output	Deafult setting	Device version
Modbus RTU address	RS-485	1	all versions
Modbuss RTU transmission parameters	RS-485	RTU mode, 115200 baud, 8 data bits, none parity bit, 1 stop bit, order of bytes: Big Endian. (change is not possible)	all versions
Number of averaged measurements	IEPE CH1 & CH2	1 (no averaging of measurements)	all versions
Order1	IEPE CH1 & CH2	to set by the user, acceleration signal	DA
Order2	IEPE CH1 & CH2	to set by the user, acceleration signal	DA
Order3	IEPE CH1 & CH2	to set by the user, acceleration signal	DA
Order4	IEPE CH1 & CH2	to set by the user, acceleration signal	DA
Order5	IEPE CH1 & CH2	to set by the user, acceleration signal	DA
Order6	IEPE CH1 & CH2	to set by the user, acceleration signal	DA
Order7	IEPE CH1 & CH2	to set by the user, acceleration signal	DA
Order8	IEPE CH1 & CH2	to set by the user, acceleration signal	DA
Phase marker frequency bottom limit	PM CH1 & CH2	1 Hz	all versions
Phase marker frequency deviation	PM CH1 & CH2	2 Hz	all versions
Phase marker frequency upper limit	PM CH1 & CH2	20 Hz	all versions

Option	Channel or Output	Deafult setting	Device version
Relays: contact type of low-power relays	Relays 2..5	normally open (choice at the production stage)	all versions
Relays: contact type of power relay	Relay 1	normally open, common, normally closed	all versions
Relays: output mode	Releys 1..6	normal mode	all versions
USB port configuration	USB	virtual COM mode	all versions
Working mode	IEPE CH1 & CH2	fixed-time mode	all versions

10. Recycle

10.1. Hazardous Materials

AVM 2000 devices do not use any hazardous materials outlined by RoHS. These regulations confirm that lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls, polybrominated diphenyl ether, or other battery related materials are limited to no more than trace amounts.

10.2. Recycling Facilities

When decommissioning out of use devices, minimize the impact of the waste created. Refer to local waste removal administration for current information on proper material collection and recycling.