



AV MONITOR 4000

MODULAR, MULTICHANNEL,
AND AUTONOMOUS SYSTEM
OPERATING CLOSE TO THE
MONITORED MACHINE

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USER MANUAL

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1. Introduction

In order to ensure quick and proper installation and commissioning of the system described in this manual, user absolutely must to read and comply with the recommendations contained therein.

1.1. Copyright

This manual, including drawings contained in it, are protected by copyright law. Copying, distributing and changing in whole or in part requires AMC VIBRO Sp. z o.o. written permission

Due to the continuous development of AVM 4000 devices, AMC VIBRO Sp. z o.o. reserves the right to modify this manual.

1.2. Configuration and handling

Installation, commissioning and operation should be entrusted to a person skilled in matters of electronics, industrial automation and measuring technology, or specially trained for this purpose. The manufacturer is not liable for any damage to the AVM 4000 equipment in part or in whole, as well as other related equipment as a result of improper use, non-use instructions described in this manual or maintenance and operation by unauthorized persons.

1.3. Symbols

NOTE!

Information marked with this sign are of particular importance to the safety of the system

1.4. Safety issues

NOTE!

Before performing the installation, module replacement, setup or wiring, switch off the system power supply.

1.5. Important recommendations

When replacing modules, the bus and signal connectors must be protected from dirt and contacts deformed.

If not all of the slots in the base plate are filled, the unused bus connector must be left free. It is unacceptable to short-circuit the terminals or attaching any devices to unused connectors in the base plate. The design of the system enables operating with as many modules as currently positioned correctly on the base plate.

System components are not resistant to aggressive cleaning agents, aerosols, alcohols and solvents. If necessary, dust can be removed with a dry brush, and larger dirt with a damp cloth.

Housings of base plate and individual modules are not resistant to environmental conditions such as moisture and dust. If installation in such an environment is necessary, the system must be equipped with appropriate housing, in the form of cabinets for automation components with an appropriate standard of IP protection.

The base plate, AVM PCS 100 processing module and AVM S 101 server module do not contain any internal regulatory or configuration elements, so it is prohibited to open the housing of these modules.

1.6. Electrostatic discharge

NOTE!

AVM 4000 system's components are equipped with electronic components that may be damaged by electrostatic discharge, in particular by the connector. While performing any tasks such as handling, mounting, packaging, etc. use the ESD protection.

2. AVM 4000 system

The following section presents basic information about the purpose of the AVM 4000 system. The basic version of the system (Entry Unit - EU) is described in details. Chapter II.3 presents AVM 4000 system's optional extensions.

2.1. Purpose of the system

AVM 4000 is a modular, multi-channel and stand-alone system running with the machine. System through conditioning, acquisition of high-quality signals and process parameters and their continuous analysis, monitors and protects the condition of machines. With the verification of real-time data, automatic detection of a machine's state and an advanced diagnostic analysis, system successfully detects anomalies in the early stage of development and significantly reduces the number of false alarms.

Extension of the system is possible by adding or replacing hardware functional cards. AVM 4000 EU is a base version of the system, which includes: processing card, server card, and vibro card.

2.2. AVM 4000 EU's structure

The AVM 4000 EU (basic version) is composed of the following parts:

- » Base Plate,
- » Processing card AVM PCS 100,
- » Server card AVM S 101,
- » Vibro card AVM 4000 V,
- » In addition, the system comes with a software tool:

AVM 4000 EU system is designed for installation in boxes with IP65 standard. If the AVM 4000 system is supplied with LCD panel, box is provided with glass door (IP65) which enables the display of the data presented by attached software.

The main advantages of the AVM 4000 EU system include:

- » Advanced diagnostic analysis
- » Parallel processing of analog and digital signals
- » The modular design
- » Signaling LED panels
- » Recording of historical data
- » Measurement resolution of 24bit, 100kHz sampling
- » Cooperation with SCADA systems
- » Control of external systems
- » Access from anywhere in the world (Ethernet)
- » Support for Modbus and OPC



The AVM 4000 EU can be extended by functional cards and peripherals that are presented in Chapters: 2.3 and 2.4. The modular design of the AVM 4000 system allows any hardware configuration, which enables the creation of a system that meets the exact requirements. The following chapters present the various elements of the AVM 4000 EU system.

AVM 4000 system is part of monitoring and diagnostic platform.

2.2.1. Base board

The base plate allows to connect one processing card (AVM PCS 100), one server card (AVM S 101) and up to six functional cards.

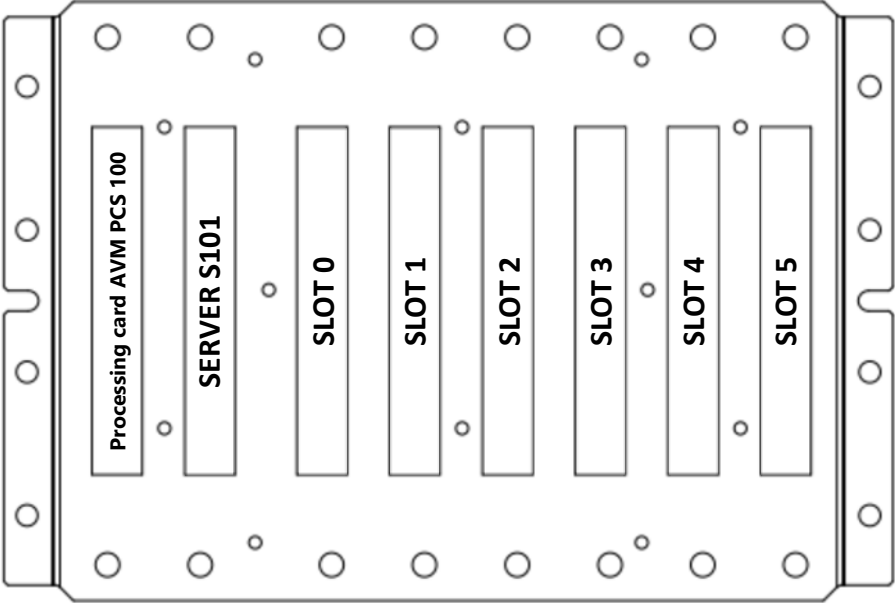


Figure 2-1 » Placement of the connectors on the base plate

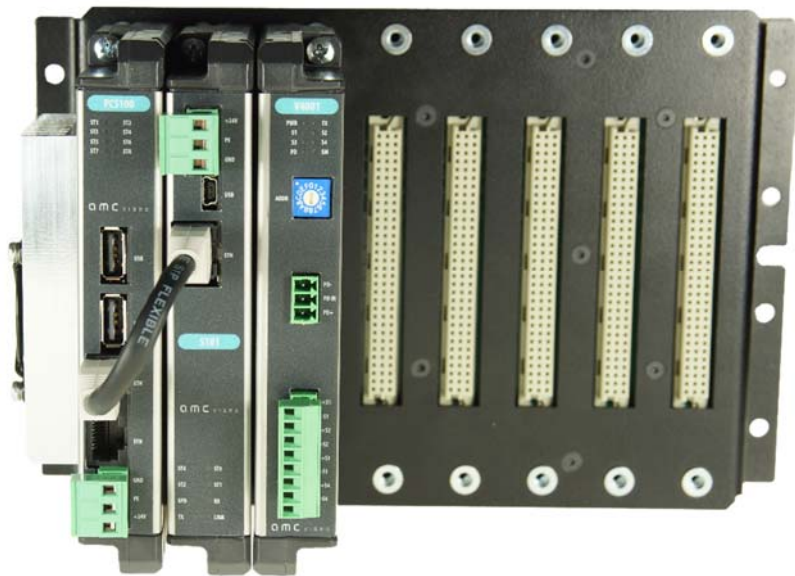


Figure 2-2 » Placement of the functional cards on the base plate

AVM 4000 system can be installed on a mounting panel or on a DIN rail TS-35. Mounting on a panel is reduced to attaching the base plate by screws or bolts to the mounting panel. The method of assembling is shown in the picture below.

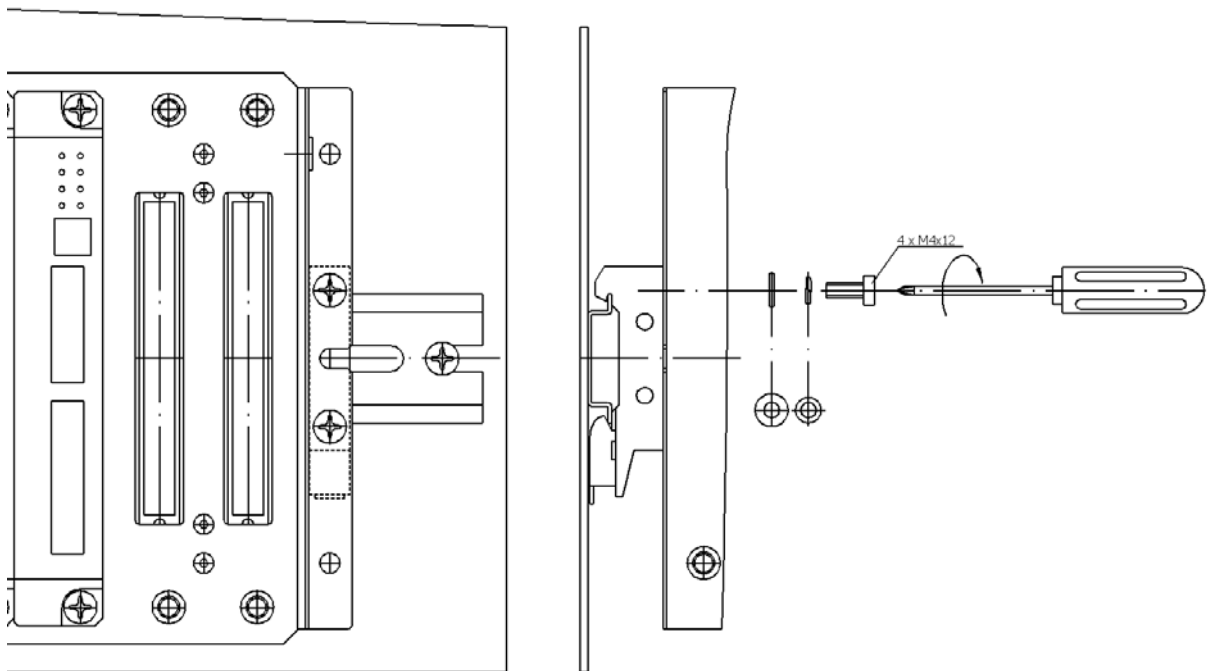


Figure 2-3 » A method of mounting on a TS-35 rail

All modules are equipped with convenient separable screw connectors. Connection of signals can be done by using wires or cables, bare or ended with gas-tight cable ends.

In order to ensure interference immunity only shielded cables should be applied to the transmission of vibration signals. Extensive sided contact needs to be ensured between shield of the cable and the PE

potential, only near the AVM 4000 unit. The base plate must be properly grounded in order to protect the system from the impact of interference.

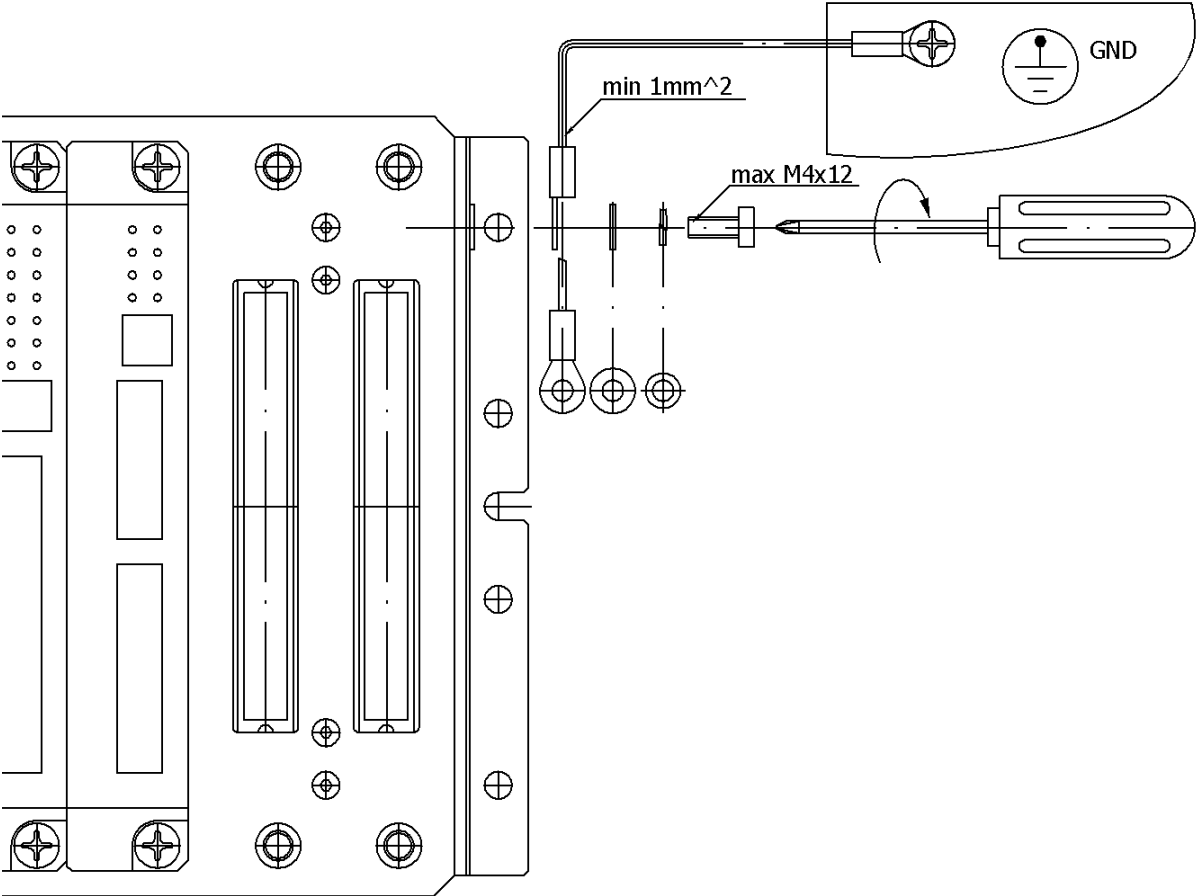


Figure 2-4 » AVM 4000 system ground

Before applying power, check for correct connections.

2.2.2. AVM PCS 100 – processing module

2.2.2.1. Description

AVM PCS 100 module is an industrial PC configured to management of AVM 4000 system. Allows data acquisition to the internal or external drive connected to the USB port. AVM PCS 100 module also allows remote access to the measurement server AVM S101 from anywhere via the Internet. AVM PCS 100 module consists of two Ethernet sockets and two USB ports which may be used to connect a keyboard, mouse or external drive.

2.2.2.2. Front panel view



Figure 2-5 » View of the front panel of the AVM PCS 100 module

Individual elements of the front panel of the AVM PCS 100 module are presented below:

- » Power connector:
 - GND
 - PE - must be connected to PE
 - + 24V - Power
- » 2 x ETH - Internet connection switch, one of the connectors must be connected to the AVM S 101 server card, second connector directly to the host PC.
- » LEDs:
 - ST1-ST8 - Status LEDs

2.2.2.3. Configuration

Configuration of the server card can be performed by connecting it to a PC via Ethernet. The default configuration of the server module AVM PCS 100 is as follows:

IP Address.....: 192.168.8.240
Subnet Mask.....: 255.255.255.0
Default Gateway.....: 192.168.8.1

2.2.2.4. Communication

To the single PC may be connected multiple AVM 4000 systems. The way of correct connection is shown below.

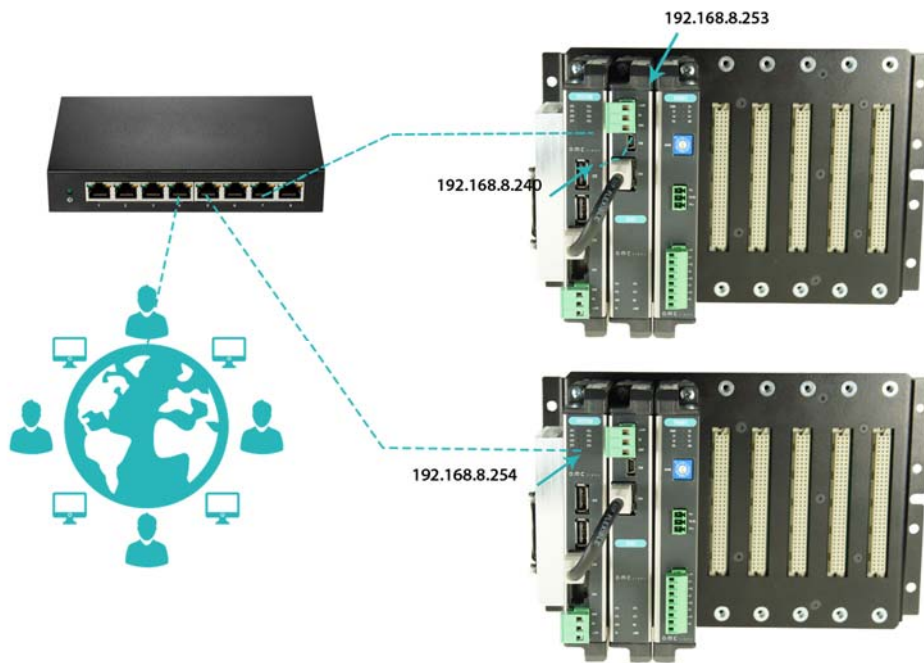


Figure 2-6 » Example of network configuration

2.2.2.5. Powering

AVM PCS 4000 module requires powering of 24 V DC with at least 12 W power.

NOTE!

PE conductor must be connected to the input of the EP.

2.2.2.6. Technical data

	Type of a module	AVM PCS 100 – processing module
Technical Data	Processor	Intel® Atom™ D2550
	Memory	2GB DDR3
	System's drive	4GB SSD
	Data disk	4GB - 8GB SSD SATA III
	External communication interface	Ethernet 10/100 Mb USB 2.0
	Internal communication interface	Ethernet 10/100 Mb, SATA III
	Power connector	Eurostyle terminal 5.08 mm ²
	System's bus interface	ZDIN-CM-96

	Communication connector	RJ45 connector, USB A connector
Operation Parameters	Power supply	24 VDC
	Power consumption	Max. 12 W
	Temperature range	-20..+60°C
	Humidity	<95% RH
	Protection	IP30
	Dimensions	96 x 147 x 40 mm
Mounting	Mounting	Screws (in set) to the base plate

2.2.3. AVM S 101– server module

2.2.3.1. Description

AVM S 101 module allows remote access to the AVM 4000 system, its modules, their configuration and reading the collected data from anywhere using the Internet. AVM S 101 module must be configured via Ethernet before using the system. After powering, a server is seen by two seconds at 192.168.8.253, at this time one can give it a new network address. After assigning of the network address, the server is reachable at this address; if within 15 seconds it does not receive any command from the PC, the default network address will be restored and the cycle will repeat until the server receives a command to execute.

Server module supplies power to all functional cards of the AVM 4000 system: Measurement cards, Process variables cards and Outputs cards.

2.2.3.2. Front panel view



Figure 2-7 » View of the front panel of the AVM S 101 module

Individual elements of the front panel of the module AVM S 101 are presented below:

- » Power connector:
 - GND,
 - PE - must be connected to PE,
 - + 24V - power,
- » USB - used only for the service purposes,
- » ETH - Internet connection, connect to an external switch, directly to a PC or to a processing module AVM PCS 100,
- » LEDs
 - LINK - Link Ethernet

- TX - Data transmission,
- RX - receive data,
- SPD - speed transmission,
- ST1 - ST4 module status LEDs.

2.2.3.3. Powering

AVM S 101 module requires powering of 24VDC \pm 1%. Server card also enables powering of the extension cards; therefore it is important to calculate the total power consumption of the system when the selecting of the power supply.

2.2.3.4. Technical data

	Module type	AVM S 101– server module
Technical data	No. of supported modules	6
	Processor	FPGA
	Memory	32 MB SDRAM
	External communication interface	Ethernet 10/100 Mb USB 1.0
	Internal communication interface	RS485, SPI
	Power connector	Eurostyle terminal 5.08 mm ²
	System's bus interface	ZDIN-CM-94
	Communication connector	RJ45, mini USB
Operational Parameters	Power supply	24 VDC
	Power consumption	max. 4 W
	Temperature range	-20..+60°C
	Humidity	<95% RH
	Protection	IP30
	Dimensions	96 x 147 x 23 mm
Mounting	Mounting	Screws (in set) to the base plate

2.2.4. AVM 4000 V – vibro card

2.2.4.1. Description

AVM 4000 V module contains 4 input channels, enabling:

- » conditioning of IEPE type signals,
- » the ability to amplify the signal (20 dB),
- » phase marker input.

2.2.4.2. Module view



Figure 2-8 » View of the front panel of the AVM 4000 V module

Individual elements of the front panel of the AVM 4000 V module are presented below:

- » LEDs:
 - PWR - indicates the presence of power
 - TX - module <-> server transmission,
 - S1 to S4 - the status of the analog inputs:
 - LED blinking - no sensor (OPEN)
 - LED continuous light - short-channel (SHORT)
 - LED is not lit - the sensor is connected,
 - PD - phase marker,
- » ADDR – enables setting address, depending on the number of the slot where the card has been installed,
- » Phase marker connector:
 - PD-phase marker (GND)
 - PDIN - phase marker input,
 - PD + - power output of the phase marker (+24V),
- » Analog Input connector:
 - + S1 to + S4 - hot wire of vibration sensor,
 - S1 to S4 - cold wire of vibration sensor.

2.2.4.3. Configuration

AVM 4000 V module has an phase marker input, which can be configured as NPN or PNP. Configuration is done by the manufacturer. The user is obliged to specify the module operating type: NPN or PNP.

Note!

One need to set the correct address for each module depending on the slot number position in the base plate. Slots must be occupied in turn starting with the slot 0 . The AVM 4000 V cards should be placed closest to server card. Optional cards should be placed after VM-4001 cards.

2.2.4.4. The parameters of the measuring path

Name of the parameter	Value
Gain	x1, x2, x5, x10
Sensor power supply	4 mA, 20 VDC
FGP filter cutoff frequency	0.16 Hz
FDP filter cutoff frequency	12 kHz

2.2.4.5. How to connect IEPE sensors

The module consists of 4 input channels, designed for use with IEPE type vibration sensors. During installation, pay the particular attention to the power plug polarity. To connect the sensor with AVM 4000 V card twisted pair cable should be used in the shield. The shield should be tucked into the PE potentials at one point. Example of connecting the sensor to the module is shown in the figure below.

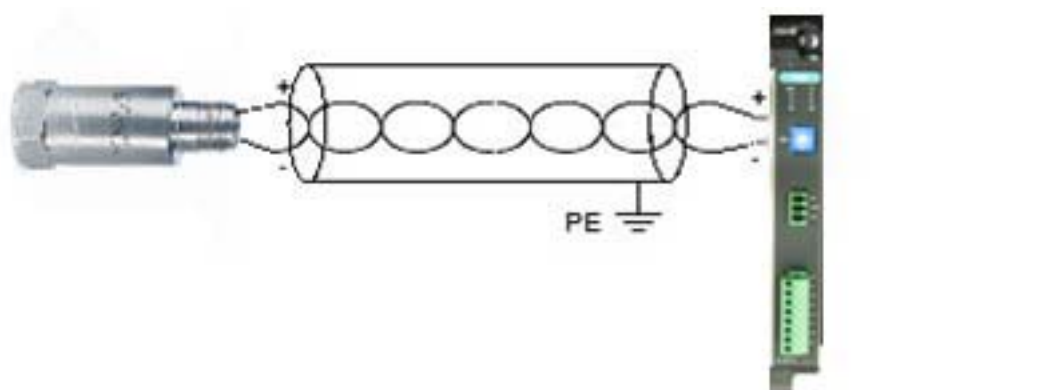


Figure 2-9 » How to connect the IEPE sensor

2.2.4.6. Phase marker input

Phase marker's input is connected with 4 vibration input channels. It can be configured as NPN or PNP (active low or high). The connection schemes for both NPN and PNP configurations are shown in the following figures.

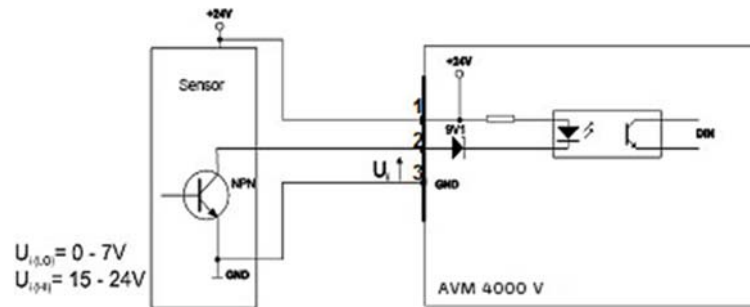


Figure 2-10 » Configuration NPN

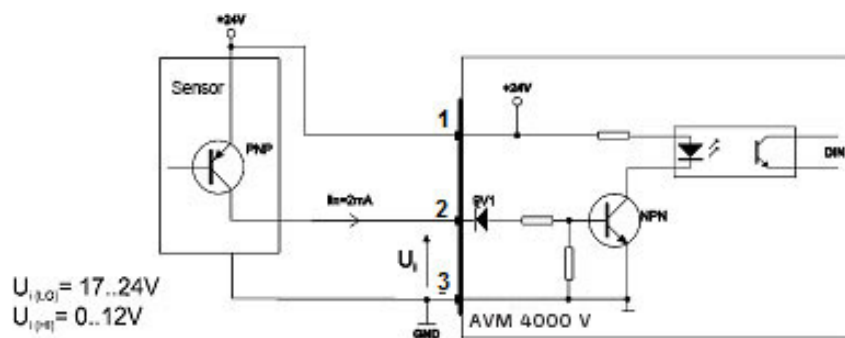


Figure 2-11 » Configuration PNP

NOTE!

Shorted power supply outputs of phase marker (pin 1 and pin 3) may cause permanent damage to the module and the system.

2.2.4.7. Technical data

	Module type	AVM 4000 V – vibro card
Technical Data	Vibration sensors input type	IEPE (24V DC 4.0 mA)
	No. Of channels	4
	Gain	x1, x2, x5, x10
	High pass filter	0.16 Hz, 12 dB/oct.
	Low pass filter	12 kHz, 24 dB/oct.
	Input status	OPEN, SHORT, OK
	Channels auto-calibration	Yes
	Type of a/d converter	delta-sigma
	Sampling frequency	25kHz, 50kHz or 100kHz
	Resolution	24 bit
	Internal communication interface	RS485, SPI
	Sensor input connector	Eurostyle terminal 3.81 mm ²
	Phase marker input connector	Eurostyle terminal 3.81 mm ²
System's bus interface	ZDIN-CM-64	
Operating Data	Power supply	24 VDC, via AVM S 101 module
	Power consumption	max. 6 W
	Temperature range	-20..+60°C
	Humidity	<95% RH
	Protection	IP30
	Dimensions	96 x 147 x 23 mm
Mounting	Mounting	Screws (in set) to the base plate

2.3. Extensions of AVM 4000 system – functional cards

This section provides the information about possible extensions (functional cards) of AVM 4000 system.

2.3.1. AVM 4000 V – vibro card

Additional AVM 4000 V vibro card contains four vibro inputs:

- » Input type: IEPE (ICP),
- » Resolution: 24bit,
- » Sampling frequency: 25,50,100kHz,
- » Parallel processing,
- » 1x phase marker.

The detailed specification is shown in chapter 2.2.4.



2.3.2. Process variables card AVM 4000 P

2.3.2.1. Description

The card contains:

- » 4x analog input:
 - 0-10 V or 4-20 mA industrial standard,
 - resolution of 16bit,
 - sampling frequency of 1kHz,
 - parallel processing,
- » 2x digital input:
 - 24VDC, NPN or PNP,
- » 3x relay output:
 - contact load 36VDC, 120mA, NC.



2.3.2.2. Module view



Figure 2-12 » The front panel of the AVM 4000 P module

- » LEDs:
 - PWR - indicates the presence of power,
 - TX - module <-> server transmission,
 - DO1 to DO3 - the status of the digital outputs,
 - DI1 to DI2 - the status of digital inputs,
- » ADDR - enables setting address, depending on the number of the slot where the card has been installed,
- » Digital output connectors to control the relays:
 - DO1-1 to DO3-1 - hot wire,
 - DO1-2 to DO3-2 - neutral wire,
 - relay outputs are characterized by the following parameters:
 - 36V - maximum voltage between DOx-1 and DOx-2,
 - 120mA - the maximum load current,
 - 16Ω - maximum resistance.
- » Dual state digital input connector operating mode: NPN, PNP
 - -DI1 and -DI2 – GND,
 - IN-DI1 and DI2-IN - digital signal input,
 - + DI1 and DI2 + power output +24VDC.
- » Analog input connectors:
 - + AIN1 to + AIN4 - positive analog input,
 - -AIN1 to -AIN4 - negative analog input,
 - the parameters of the analog inputs:
 - 4-20mA - current input,
 - 0-10 VDC - voltage input.

2.3.2.3. Configuration

Configuration is done by the manufacturer. The user is obliged to specify the module operating type, according to the formula shown below.

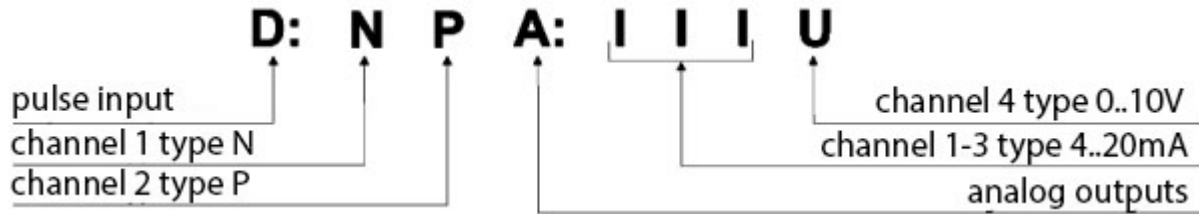


Figure 2-13 » Method of marking module configuration

Module AVM 4000 P has digital inputs that can operate as an impulse ones, they might be configured as NPN or PNP, relay outputs and analog inputs that can be configured as current (I) or voltage (U).

2.3.2.4. Analog input

The 4..20mA input is protected against short circuit. The device is also able to detect open-circuit. The figure below is an example of connecting the transmitter to the 4..20mA input.

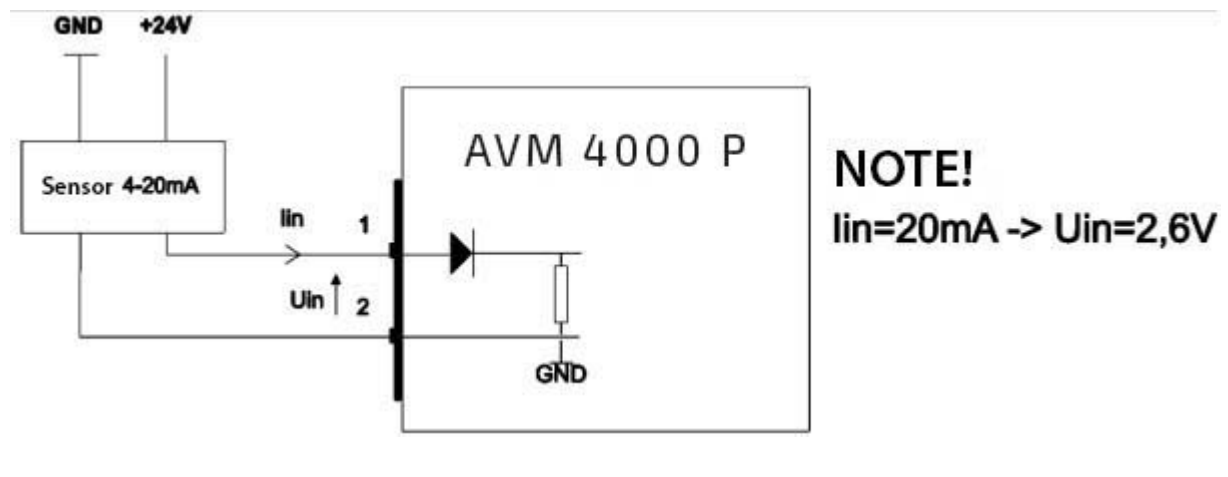


Figure 2-14 » Example of connecting the transmitter to the 4..20mA input

2.3.2.5. Digital input

These inputs are designed to work with voltage in the range of 0..24 V DC. Examples of connection of proximity sensors with NPN and PNP output are shown respectively in the figures below.

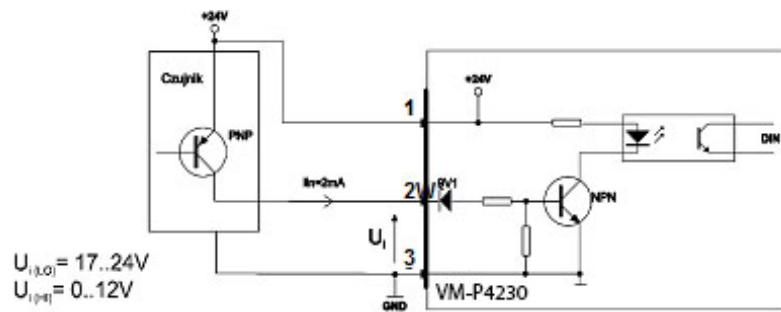


Figure 2-15 » Configuration NPN

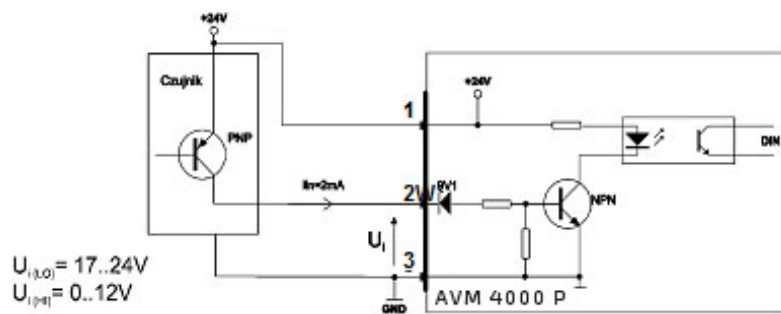


Figure 2-16 » Configuration PNP

NOTE!

Shorted power supply outputs of phase marker (pin 1 and pin 3 or pin 4 and pin 6) may cause permanent damage to the module and the system.

2.3.2.6. Digital output

Module AVM 4000 P allows the connection of up to three relays. The relays should be attached as shown below.

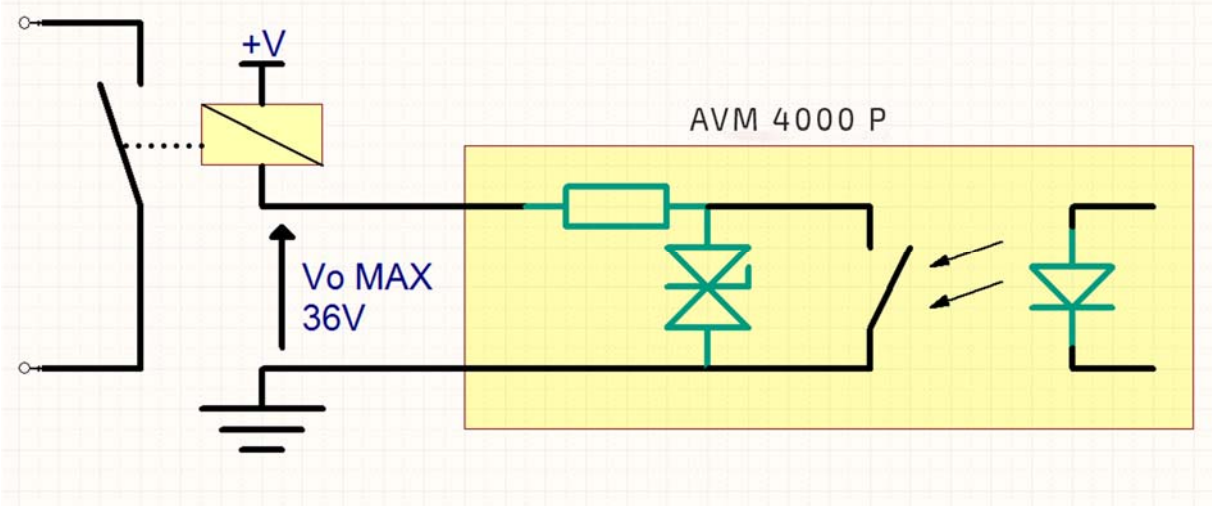


Figure 2-17 » Example connection of digital outputs

2.3.2.7. Technical data

	Module type	AVM 4000 P – process values module
Analog inputs	No. of analog input channels	4
	Analog channels types	configurable 0..10V, 4..20mA
	Sampling frequency	1000 Hz
	Resolution	16 bit
	A/D converter	SAR
	Anti-aliasing filter	yes
	Input status	OK, out of range
Digital inputs	No. of digital input channels	2
	Digital channels types	24V DC (configurable NPN, PNP)
Digital outputs	No. of digital output channels	3
	Maximum operating voltage	36VDC
	Maximum load current	120mA
	System's bus interface	ZDIN-CM-64
Operating parameters	Power supply	24 VDC, via AVM S 101 module
	Power consumption	max. 2,5W
	Temperature range	-20..+60°C
	Humidity	<95% RH
	Protection	IP30
	Dimensions	96 x 147 x 23 mm
	Mounting	Screws (in set) to the base plate

2.3.3. Outputs card AVM 4000 U – ANDout card



A card containing:

- » 4 x 4-20 mA output,
- » 8 x relay output:
 - contact load: 30 VDC, 1A, NO/NC.

2.3.3.1. Technical data

	Type Of Module	AVM 4000 U – ANDout Card
Analog Outputs	No. Of Analog Channels	4
	Type Of Analog Channels	4..20ma
	Sampling Frequency	1000 Hz
	Resolution	16 Bit
Digital Outputs	No. Of Digital Channels	8
	Maximum Working Voltage	30 V DC
	Maximum Load Current	100mA/1A
Operating Parameters	Power supply	24 V DC
	Power Consumption	45 W
	Temperature Range	-20..+60°C
	Humidity	<95% RH
	Protection	IP30
	Dimensions	96 x 147 x 23 mm
	Mounting	Screws (in set) to the base plate

1.1.1.1 Configuration

Configuration is done by the manufacturer. The user is required to specify the operation type of the module, according to the formula, as shown below.

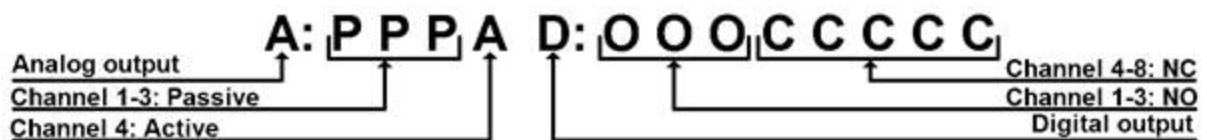


Figure 2-18 » Method of marking the modules configuration

AVM 4000 U module is provided with analog outputs that can be active or passive. In the first case, channels are powered by AVM 4000 U card, in the second case the power supply must be supplied externally between terminals +24 V and GND of each channel.

If more than one channel is configured as active, outputs "GND" of individual channels are at the same potential, the same is true for the outputs marked "+24 V".

2.4. Extensions of AVM 4000 system – peripheral devices

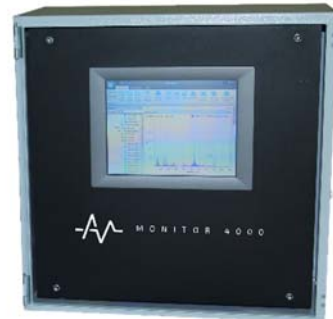
This section provides the information about possible peripheral extensions of AVM 4000 system.

2.4.1. AVM LCD PANEL – LCD panel

TFT LCD LED 12.1" touch panel is compatible with IP 65 standard. The panel allows to display the visualization of vibration estimates presented in the attached software:

- » RMS,
- » PP,
- » Kurtosis,
- » RMS envelope (Envelope RMS).

Additionally, the panel allows one to visualize violations of alert and alarm thresholds.



2.4.1.1. Technical data

Technical parameters are included in the accompanying specification of the module.

2.5. Powering the system

AVM 4000 system requires power supply of 24 V DC. Power supply should be connected only to the processing module and server module. Other modules are powered by internal bus interface. It is necessary to provide interference-free power supply. It is most preferred to use a separate power supply only for the AVM 4000 system. In particular, avoid common circuit with power contactors and relays. Use a miniature circuit breaker 2A characteristic C.

2.6. Mounting of the AVM 4000 system

The choice of a system's installation place is important. Avoid direct neighborhood of devices generating electromagnetic interference, in particular, inverters, commutator motors, contactors and relays, as well as power cables of medium and high voltage. Prior to installation, check the system for signs of damage and whether it is complete.

2.7. Operation and exploitation

A properly configured and connected system is designed for continuous, maintenance-free operation. We recommend periodic overview of the system once a year by an employee of AMC VIBRO.

3. Recycle

3.1. 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.



3.2. 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.