



**Brüel & Kjær Vibro**  
a spectris company

Hardware installation instruction

## **VIBRO Condition Monitoring 3 (VCM-3)**

Keep it accessible for future reference



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## 1 About this instruction

### 1.1 Scope

The scope of this document is to give instructions regarding the hardware installation of VCM-3. This document also refers to the following instructions:

- C107759002\_en\_v01 VCM-3 On-Site Commissioning Manual
- C107762002\_en\_v01 VCM-3 Homepage Manual

### 1.2 Document conventions

| Feature  | Comments  |
|--|---|
| Menu items, buttons, tabs, UI features, keyboard instruction | Indicated by <b>bold</b> type face. Examples: Click <b>Remove</b> . Press <b>Ctrl+Shift</b> or Press <b>F12</b> .     |
| Path denotations   | Example: File > Template > Load template  |
| Important Note!  | <b>Important Note</b> indicates information which is potentially serious to either personnel or to the unit.          |
| Note!  | <b>Note</b> text is for special attention. The information is very important for the correct operation of the system. |

## 2 Safe use of VCM-3

### 2.1 Disclaimer of liability

The observance of this technical documentation is essential for the proper and safe operation of the product. We assume no liability for injury to persons, damage to property or financial losses resulting from failure to comply with this technical documentation. In this case the liability for material defects is also excluded.

### 2.2 Intended use

The VCM-3 is intended for tapping and digitizing analog signals and to process these signals for utilization by Brüel und Kjær Vibro and 3rd party software.

The VCM-3 is only intended to be used indoor or mounted in a field cabinet. The input terminals of VCM-3 accept signals from a variety of sensors that can be supplied by a constant current source (CCS) or -24 V. Also buffered output signals from existing machine protection systems or external powered sensors can be connected to the terminals. Data may also be acquired via RS485 Interface or LAN connections. This functionality must be provided by the "Standard (Master) Monitoring Template" used for the application. Processed data are provided for other applications via LAN or RS485 interface.

## 2.3 General Information

Never operate damaged products. Upon delivery inspect the packaging for damage and compare the delivered item with the ordered items. If VCM-3 is used in a way that is not described in the present instruction, this may result in impairment of functions and of protection.

**Note!**

Observe the instructions in this document for safe installation, commissioning and disposal of VCM-3.

Also consider the datasheet for *VCM-3 – C107757.002 EN VCM-3 Product specifications and ordering information*

## 2.4 General warnings

### 2.4.1 Staff requirements

Transport, storage, installation, assembly, connection, commissioning, maintenance and service must be undertaken exclusively by qualified technicians. The following must strictly be observed:

- The instructions in this document
- The instructions for product and safety and the pictograms on the product
- Any product specific provisions and requirements
- All national and regional regulations for safety and accident prevention must be followed.

**WARNING!**

In the event of impermissible opening of the product or removal of components, improper use, or incorrect installation or operation there is a risk of personal injury or damage to property

## 2.5 Grounding information



The casing of the VCM-3 can be grounded through the Protective Earth Screw at the left side of the cabinet.

## 2.6 Approvals

- **CE** CE-compliant in accordance with
  - EMC Directive and EN 61326-1
  - ROHS directive and EN 50581

Refer also to CE Conformity Declaration in the appendices section of this document

## 3 Product Description

### 3.1 Main functionality

The VCM-3 supports any state-of-the-art condition monitoring method and provides a platform for customizations and development of future new monitoring methods.

VCM-3 provides early fault detection by using a large variety of descriptors (scalar values). Fast real time descriptors locked to the machine speed as well as advanced calculations using statistics and feature extraction from array measurements.

It has a large configurable history buffer which stores descriptor and array data with a high storage rate. Offline operation can last for several months in case of network outage and supports standalone operations for investigations at remote sites with no network connection.

Detailed investigation is supported by high resolution, event based, long duration time waveform recordings (time samples). Ideal for further detailed frequency analysis, and by high storage rate descriptor or array data from the history buffer as well as direct on-line reading of descriptor values down to second intervals.

VCM-3 Connects to a large variety of sensor types, accelerometers, displacement sensors, speed sensors, 4-20 mA type sensors for process values, DC input, buffered output from other devices and oil debris sensors or other Modbus enabled devices.

VCM-3 imports data via LAN from other data sources such as other VCM-3s, SCADA systems, or other subsystems related to the machine.

VCM-3 is user configurable both via direct or remote connection, this allows for simple and quick change of configuration for updates to the monitoring strategy. Therefore the “Standard (Master) Monitoring Template” can be edited (change of configure parameters) by an editor software application to create a “Machine Monitoring Template” suitable for the specific machine and monitoring strategy.

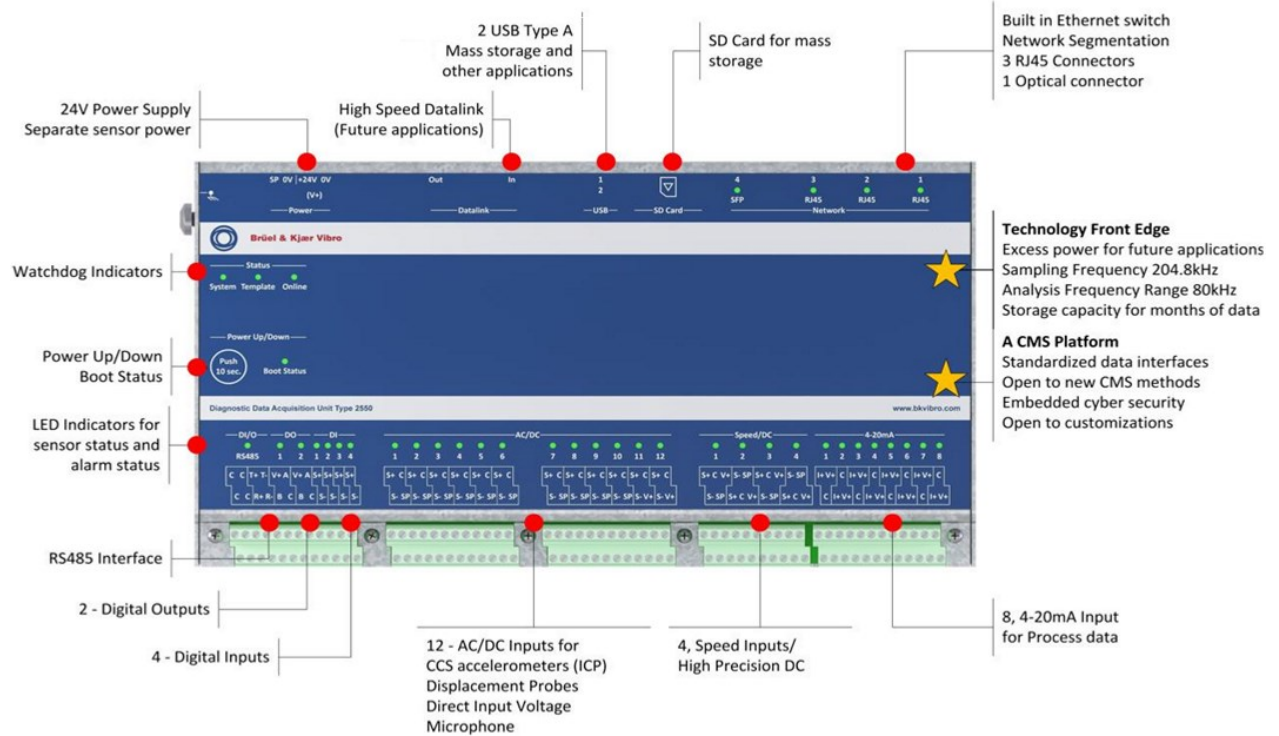
**Note!**

The range of functions is defined by the “Standard (Master) Monitoring Template”.

The “Standard (Master) Monitoring Template” also determines which channel groups (AC/DC, Speed/DC, 4-20mA, DO and DI) are enabled on the device and which type of sensor (acceleration, velocity, displacement, speed etc.) can be used on these channels. If a channel group is not enabled on the device, please do not connect it.



## 3.2 Overview of the VCM-3 unit



Refer to *VCM-3 Product specifications and ordering information document C107757.002 EN* for further technical details.

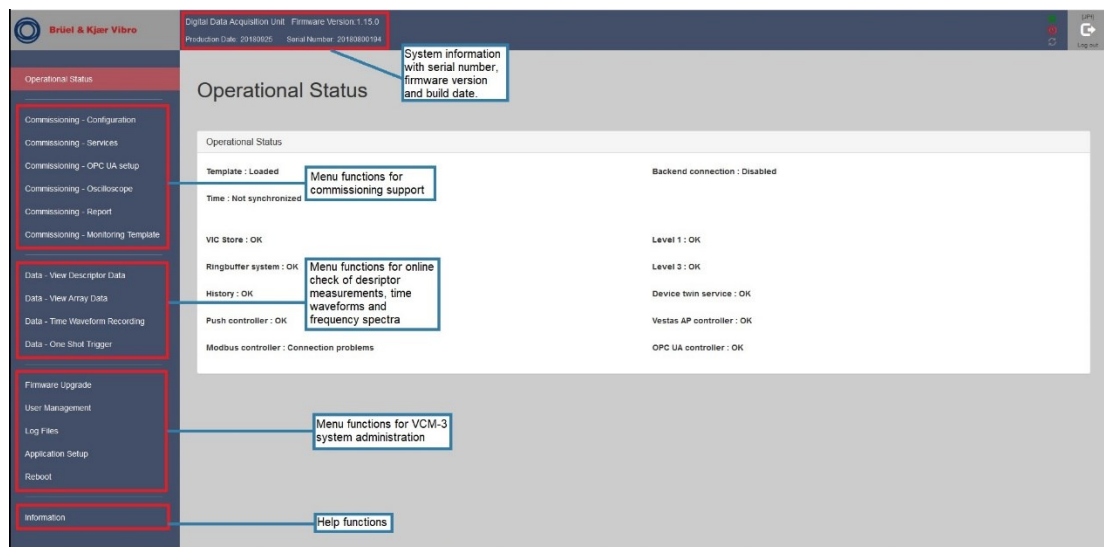


### 3.3 The VCM-3 Homepage

The VCM-3 Homepage can be accessed from any web browser. The VCM-3 Homepage provides the following main functions:

- On-site commissioning configuration and support
- On-line check of descriptor measurements, time waveforms and spectrum (array) data.
- VCM-3 system administration and commissioning such as upload of Standard Monitoring Templates, upload of firmware, password changes etc.

Below is shown an overview of the VCM-3 Homepage. Further information regarding the VCM-3 Homepage can be found in *C107762002 EN VCM-3 Homepage Manual*.



### 3.4 Technical specification summary

This section only lists the most important technical data. Please refer to the Product specifications and ordering information document C107757002 for further details.

| Environmental                      |   |
|------------------------------------|---|
| Ambient Temperature                | In operation. -30 °C - 60 °C (-22F to +140F) in accordance to EN/IEC 60068-2-2. Applies to device and to device mounted in cabinet. -40 °C (-40F) with reduced accuracy - 70 °C (-94F) with de-rated Mean Time Between Failures (MTBF). |
| Ambient Temperature                | Storage. -40 °C - 85 °C (-40F to +185F) in accordance to EN/IEC 60068-2-2   |
| Temperature Change                 | Operational during a temperature change rate of 1°C per minute in accordance to EN/IEC 60068-2-14   |
| Static Damp Heat, Cyclic Damp Heat | In operation. According to EN/IEC 60068-2-78, EN/IEC 60068-2-30 and EN/IEC 60068-2-38   |
| Random & Sine Vibration            | According to EN/IEC 60068-2-6.  |
| Rough Handling                     | Storage. According to EN/ IEC 60068-2-31.   |
| EMC                                | According to EN/IEC 61326-1, EN/IEC 61000-6-2 and 61000-6-3   |
| High Altitudes                     | According to EN/IEC 60068-2-13. Air pressure equivalent to 3500m altitude.  |
| Inclination                        | According to IEC 60092-504.   |
| IP Rating                          | The device IP rating is IP20 according to EN/IEC 60529 without cabinet. In cabinet rating is IP66   |
| Pollution Degree                   | 3   |
| CE Marking                         | In compliance with the EMC and RoHS 2011/65/EC Directives   |
| HALT Test                          | Has been subject to HALT test. Excessive vibration and temperatures and combinations hereof.  |
| Mechanical                         |   |
| Dimensions                         | 280 x 153.5 x 35 mm (11,02 x 6,02 x 1,38 in)  |
| Weight                             | 1.5 kg (3,31 lbs)   |
| Mounting                           | DIN Rail Mounting or via a mounting (adapter) plate.  |
| Material (adapter plate)           | 1.5 mm stainless steel plate.   |
| Power Supply                       |   |
| Voltage/Power Consumption          | Nominal +24V (SELV – Safety Extra Low Voltage)<br>18-26 VDC/10W + power consumption of each sensor.<br>Worst case sensor current consumption: 48W (including network load)  |
| Fuses                              | Power supply inputs are fused to protect against over-voltage and fire  |

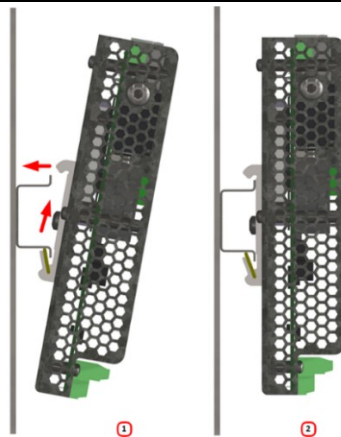
## 4 Mechanical installation

### Mounting of VCM-3

VCM-3 is intended to be mounted in enclosed cabinets and the like, that provide protection against fire hazards, environmental conditions and mechanical impact. Recommended minimum IP rating of the cabinets is 22. VCM-3 can either be mounted on a DIN rail or via a mounting (adapter) plate. (mounting method is part of the ordering information/order code)

1. The VCM-3 shall be mounted on a vertical metal plate, either directly or on a low profile DIN rail.
2. There shall be at least 70mm to other devices or sides of the cabinet on the TOP, BOTTOM and FRONT of the VCM-3.
3. There shall be at least 20 mm to other devices or sides of the cabinet on the LEFT and RIGHT of the VCM-3.
4. The metal plate on which the VCM-3 is mounted (either directly or on a low profile DIN rail) shall not exceed the maximum ambient temperature rating of the VCM-3.

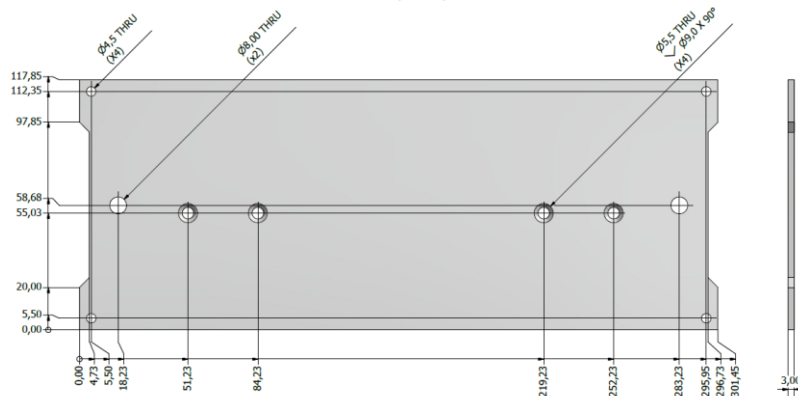
### DIN Rail Mounting



When the VCM-3 is fitted on a 35 mm mounting rail (DIN EN 50 022)

1. Place the fixture on the rear of the VCM-3 with the spring at the bottom of the mounting rail.
2. Turn the VCM-3 upwards, until the clamp is engaged.

### Adaptor Plate Mounting



The VCM-3 can also be mounted in a cabinet using an adaptor plate. The screw holes fit the holes used for the DIN clamps.

## 5 Basic operation of the VCM-3

### 5.1 First time the VCM-3 is powered up

The very first time a VCM-3 is powered up it will run with a factory default template. The intention of the factory template is to enable a first test of the installation. The factory default template provides the necessary descriptors for completing the initial commissioning procedure of the VCM-3. The readings of the descriptors are available via the Commissioning Report feature on the VCM-3 Homepage. Refer to *C107759002 On-site Commissioning Manual* for a further description of the factory default template and an instruction of how to carry out the initial commissioning test.

When the initial test has been completed the VCM-3 is ready for upload of the machine specific monitoring template.

### 5.2 About LED indicators

The LED (Light Emitting Diodes) indicators on the VCM-3 front panel provide a quick visual overview of the state of the VCM-3. In general LED colors which has a color other than green or grey (switched off) indicates an abnormal condition.

The following general rules apply for the LED colors:



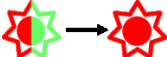






|        |  |
|--------|--|
| Green  | Function OK  |
| Grey   | Function not in use.   |
| Blue   | Functional problem. Most often due to wrong wiring. The problem can in nearly all cases be solved on-site by the service engineer.   |
| Yellow | Channel is on alert. The first setpoint of a channel was exceeded.   |
| Red    | Functional problem. Most often due to malfunction of the VCM-3 firmware (FW). May be solved by a reboot or FW upgrade. (A FW upgrade requires a B&K Vibro service engineer.) Or channel is on danger. The second setpoint of a channel was exceeded. |

| Overview of LED groups |   |   |
|------------------------|---|---|
| Group                  | Explanation   |   |
| Boot Status            | This LED indicates the different stages in the boot process |   |
| Status                 | System  | Indicates the state of the operating system and the connection to the backend server. |
|                        | Template  | Indicates the state of the loaded template  |
|                        | Online  | Indicates the on-line status of the VCM-3.  |
| Network                | SFP   | Indicates network activity  |
|                        | RJ45  |   |
| AC/DC                  | 1-12  | Indicates the state of each of the channels, OK, Not OK, Alarm etc.                   |
| Speed/DC               | 13-16   | Indicates the state of each of the channels. OK, Not OK, Alarm etc.                   |
| 4-20mA                 | 17-24   | Indicates the state of each of the channels. OK, Not OK, Alarm etc.                   |
| DI/O                   | RS485   | Indicates whether Modbus is enabled   |
| DO                     | 1-2   | Indicates the state of the Digital Output. If active it shows green light.            |
| DI                     | 1-4   | Indicates the state of the digital input. Shows a green light when active             |

### 5.3 Power Up/Down

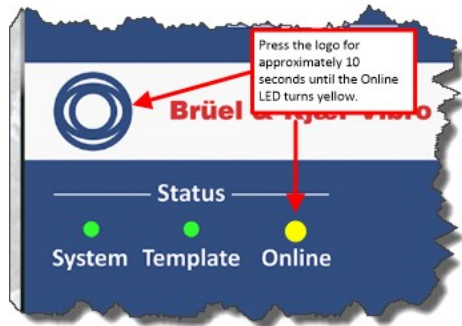
When the 24 V power supply is connected the VCM-3 will automatically boot up, the boot process is complete when the Boot Status LED shows constant green light.

If the VCM-3 shall be powered down or powered up, the normal procedure is to use the Power Up/Down button by one of the following procedures.

| Power Down procedures  |   |   |
|--|---|---|
| Action   | Boot Status LED   | Explanation   |
| Soft Power Down<br>(Normal)                                  |    | Soft Power down will shut down the VCM-3 in an orderly manner where it is ensured that all data is stored in non-volatile memory before power is taken off.<br>Push the button for approximately 3 sec. until the Boot Status LED starts flashing red/green. Release the button. The power down is now in progress  |
|  |    | When the button turns into constant red light, all data has been saved and the power plug can be removed/power can be turned off.<br>To boot up from this state follow the Power Up procedure described below.  |
| Hard Power Down<br>(On error conditions)                     |  | Hard Power Down corresponds to pulling the power plug. This can be applied in case the VCM-3 ends in a state where the watchdog has stopped the VCM-3 operation due to an error in one of its services. (System LED lights red)<br>Keep pushing the button for approximately 10 sec. until the Boot Status LED starts flashing Red/White.<br>Release the button |
|  |  | The Boot Status LED now turns into constant red light.<br>To boot up from this state follow the Power Up procedure described below.   |
| Power Up procedures  |   |   |
| Action   | Boot Status LED   | Explanation   |
| Power Up<br>(When the power cable is inserted into the plug) |  | Insert the power plug/turn power on. The Boot Status LED starts flashing green.   |
|  |  | When the button turns into constant green light, the boot process is complete. The monitoring template now starts and when the status light above the inputs lights up the unit is ready to measure   |
| Power Up<br>(From Hard or Soft Power down state)             |  | Hold down the button while the Boot Status is flashing red.   |
|  |  | When the Boot Status LED starts flashing green release the button. The VCM-3 will complete the boot sequence  |
|  |  | When the Boot Status LED turns into constant green light the VCM-3 is ready.  |

## 5.4 Reset to default IP address

In the case that the IP address is unknown it is possible to access the VCM-3 using the factory default IP address. Please follow the procedure below.

| How to reset the IP Address of VCM-3 to its default (temporarily) |   |
|---|---|
| Step  | Explanation   |
| 1   | <p>Push the logo for approximately 10 seconds until the Online status LED turns into yellow.<br/>(When you push the logo, you shall feel a tactile feedback)</p>  <p>When the Online status is yellow the VCM-3 firewall allows a user to login to the VCM-3 using the default IP address: <a href="https://192.168.2.202">https://192.168.2.202</a>.<br/>The VCM-3 will remain in this state until a new IP address has been saved or the VCM-3 is rebooted.<br/>Change the laptop network settings to match the IP range of the VCM-3.<br/>E.g. Set the laptop to IPv4 address 192.168.2.199, Netmask 255.255.255.0</p> <div> <p><b>Note!</b><br/>Refer to <i>C107762.002 EN VCM-3 Homepage Manual</i> for a description of the procedure of how to change the network settings of the laptop.</p> </div> |
| 2   | Log into the VCM-3. Refer to the description in <i>C107762.002 EN VCM-3 Homepage Manual</i>   |
| 3   | Select the "Commissioning Configuration" page. On this page the IP setting of VCM-3 is displayed. Change it if required. Remember to click <b>Save Changes</b>  |



## 6 Power connections

### 6.1 Power connection – Supply current



- Minimum temperature rating of the cable to be connected to the field wiring terminals, power supply shall be 85°C, minimum temperature rating for wiring to sensors and others 80°C.

Power supply shall be connected via the terminal block supplied with the VCM-3.

Max. wire size 2,5mm<sup>2</sup> with ferrule and plastic sleeve.

Power supply shall be connected between the +24V and 0V terminals.

Secure the power plug with the screws in the terminal block.



**Important Note:** A surge protected +24 V (nominal) SELV DC power supply must be used as supply for the VCM-3. (SELV – Safety Extra Low Voltage).

The power supply must have an output voltage from +18 V to +26 V and a current capacity of minimum 1.5A.

The output from the power supply should be 'floating' (above ground) and should not supply other equipment. This will ensure that noise is avoided in the system.

If several VCM-3's is mounted in the same enclosure, one common power supply can be used.

### 6.2 Power connection – External sensor power

The external sensor power SP terminal is connected internally to the SP terminal on channel 1-10 and 13-16 on the VCM-3. The most common application of this additional supply is -24V supply voltage for displacement sensors. However, sensors requiring positive supply voltage can also be supplied through this terminal. Use the free terminals in the power connection terminal block for connecting the sensor power.

Max. wire size 2,5mm<sup>2</sup> with ferrule and plastic sleeve

## 7 Termination of sensor signals

The following section describes how to connect the various sensors and inputs to the VCM-3.

The various types of channel inputs must have been enabled in the VCM-3 monitoring template in order to be used. If channel groups are not supported, please do not connect. A specific or custom "Standard (Master) Monitoring Template" is required for some of the sensors or input channels in order to enable this functionality. Configuration of VCM-3 monitoring template is not a part of this instruction.



**Note!** Supported channels and sensor types of your "Standard (Master) Monitoring Template" can be checked directly during configuration with the editor software application. Further information which input signals/channels are supported by a specific "Standard (Master) Monitoring Templates" can be found in the document VCM-3 „Product specifications and ordering information“.



**Important Note!** The shield connections of the cables are not shown on the connection drawings. The shield must be connected to ground as described below.

### 7.1 Electrical Parts



- Ensure that any electrical parts are disconnected before mounting the VCM-3 unit. Otherwise there can be a risk of death or severe personal damage
- Do not touch live electrical parts
- Disconnect electrical parts before any connections are made

### 7.2 Sensor connection terminals



- Accepts wires up to 0.5 mm<sup>2</sup> with ferrule and plastic sleeve.
- Cables shall have a minimum temperature rating of 80 °C

### 7.3 Shielding

It is very important that the shields of the sensor cables and the housing of VCM-3 are connected to the same ground potential. That is, to the cabinet where they are mounted. On the side of VCM-3 housing a ground cable can be fastened to the cabinet. The sensor cables can be connected to the cabinet through the EMC rail or other means.

Screw for fastening  
Protective Earth Cable (PE)



**Note!** If a floating chassis/ground connection shall be used in connection with VCM-3, please refer to Appendix 1 for an explanation.

## 7.4 Constant current line drive accelerometers (CCS) channel 1-12

| Constant current line drive accelerometers (CCS) |  |
|--|--|
|  | <p>This type of sensors needs a constant current, which is supplied by the VCM-3 unit. Examples of high quality accelerometers offered by Brüel &amp; Kjær Vibro includes:</p> <ul style="list-style-type: none"> <li>• AS-062; 100 mV/g<br/>(multi-purpose, integral cable)</li> <li>• AS-667; 100mV/g<br/>(multi-purpose, radial connector M12)</li> <li>• AS-447; 500mV/g<br/>(high sensitivity, axial connector M12)</li> <li>• AS-068; 10 mV/g<br/>(low sensitivity, integral cable)</li> </ul> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Note!</b><br/>The current source for the CCS sensors must be enabled in the channel setup of the VCM-3 monitoring template. If buffered output signals from existing machine protection systems or external powered sensors are used CCS should be disabled.<br/>Maximum current output is 10mA/Channel</p> </div> |

7.5 Brüel & Kjær Vibro AS-247 dual axis accelerometers on channel 11-12

AS-247 sensor mounting.

The diagram illustrates the terminal block for the AS-247 sensor. It shows two channels, 11 and 12, each with a common (C), signal positive (S+), and signal negative (S-) terminal. The signal positive terminals are connected to the S+ and S- terminals of the sensor. The signal negative terminals are connected to the S- and S+ terminals of the sensor. The common terminals are connected to the COM terminal of the sensor. The sensor also has a +24V supply terminal and a ground terminal. The connections are color-coded: blue for S+, black for C, white for S-, and brown for +24V. The ground terminal is connected to the COM terminal.

AS 247 is a bi-axial sensor, that is, it produces two output signals one for each axis. In the figure these two axes are denoted XSIG and ZSIG.

This sensor needs a +24 VDC supply which is available on the (V+) terminals on AC/DC channel 11 and 12.

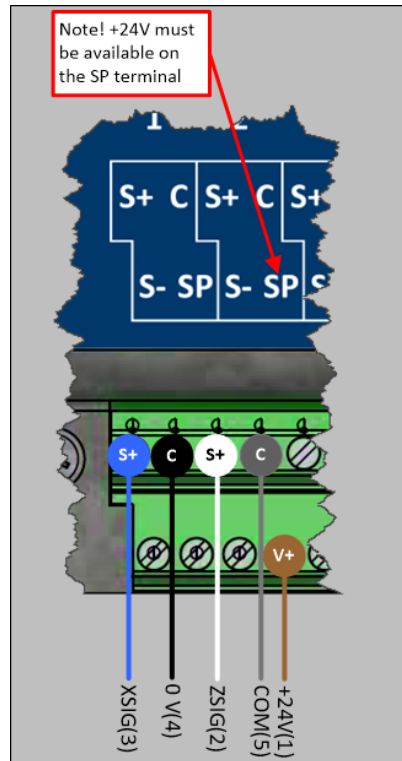
The color of the connection wires corresponds to sensor connection cable AC-1401.

i

**Note!**  
Maximum current output in this configuration is 55 mA in total

## 7.6 Brüel & Kjær Vibro AS-247 dual axis accelerometers on channel 1-10

### AS-247 sensor mounting.



AS 247 is a bi-axial sensor, that is, it produces two output signals one for each axis. In the figure these two axes are denoted XSIG and ZSIG.

If the AS 247 sensor shall be connected to other AC/DC channels than channel 11 or channel 12 the +24 signal must be looped to the SP terminal. The +24 V supply may also be connected to the sensor power input besides the power connector on the top of the VCM-3. Refer to the section "Power Connection – External Sensor Power" in the "Other Connections" section of this manual. The sensor power terminal "SP" is internally connected to the individual "SP" terminals for each sensor.

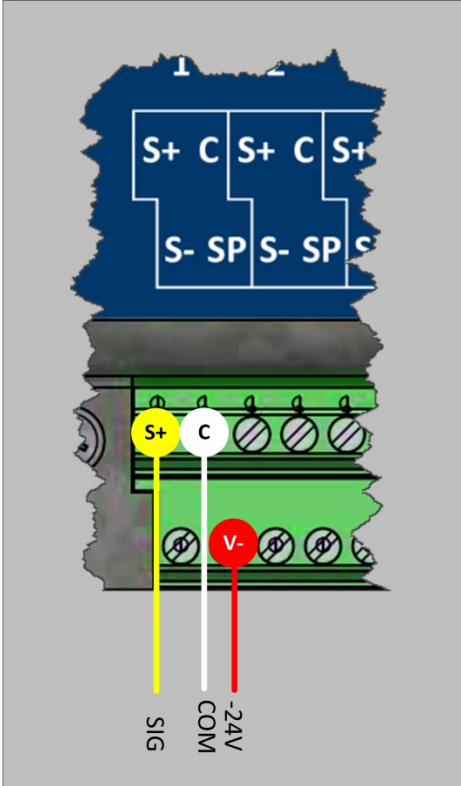
The color of the connection wires corresponds to sensor connection cable AC-1401.



**Note!** Maximum current output in this configuration is 55 mA in total

## 7.7 Displacement sensors (proximity probes) channel 1-10

**Displacement sensor mounting on channel 1-10**



**Note!**  
This prescription is only valid for channel 1-10. On channel 11 and 12 no SP terminal is available. If displacement sensors are mounted on channel 11 and 12, the sensor power wire must be looped to a terminal with -24 V supply. See next section.

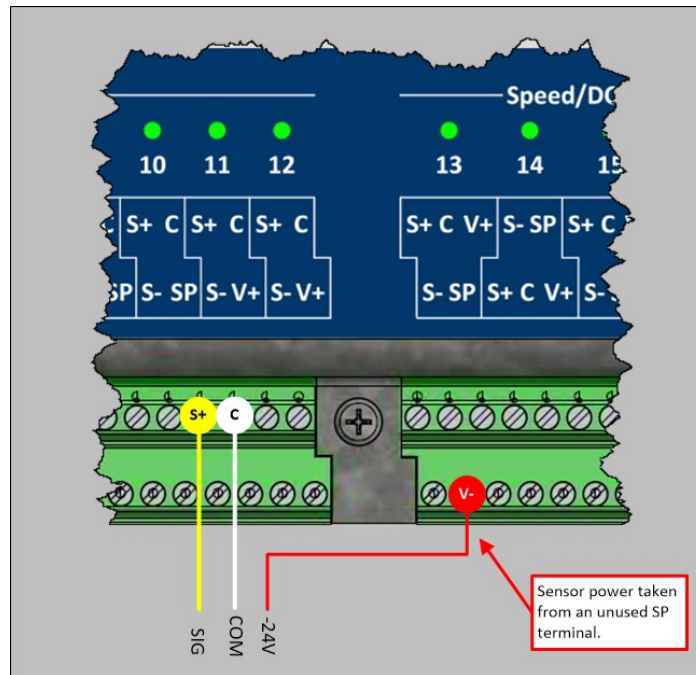
This type of sensor needs -24 VDC sensor power. This requires that a -24 V power supply is connected between 0 and SP in the power plug used for supply current to VCM-3.

Refer to the section “Power Connection – External Sensor Power” in the “Other Connections” section of this manual. The sensor power terminal “SP” is internally connected to the individual “SP” terminals for each sensor.

**Note!**  
The color coding of the wires follows the colors of the IN08x displacement sensor series from Brüel & Kjær Vibro. Maximum current output in this configuration is 45 mA/Channel

## 7.8 Displacement sensors (proximity probes) channel 11 and 12

Displacement sensor mounting on channel 11 and 12



If a displacement sensor shall be mounted on channel 11 or 12 the -24 V sensor power cannot be taken directly from the channel connections as the sensor power for channel 11 and 12 is assigned only to a +24 V. In this case the sensor power can be taken from an unused sensor power terminal (SP) on the VCM-3.

Refer to the section "Power Connection – External Sensor Power" in the "Other Connections" section of this manual. The sensor power terminal "SP" is internally connected to the individual "SP" terminals for each sensor.



**Note!** The color coding of the wires follows the colors of the IN08x displacement sensor series from Brüel & Kjær Vibro  
Maximum current output in this configuration is 45 mA/Channel



7.9 Displacement sensors (proximity probes) channel 13-16

Displacement sensor mounting

The diagram shows a terminal block with two rows of terminals. The top row is labeled 13, 14, and 15. The bottom row is labeled 16, 17, and 18. Wires are connected to terminals 13, 14, 16, 17, and 18. The connections are as follows:

| Terminal | Wire Color | Label |
|----------|------------|-------|
| 13       | Yellow     | S+    |
| 14       | White      | C     |
| 16       | Red        | V-    |
| 17       | White      | COM   |
| 18       | Red        | -24V  |

Below the terminal block, the labels SIG, COM, and -24V are shown with lines pointing to the corresponding wires.

If high absolute accuracy is required on the displacement measurements, e.g. for position measurements channel 13-16 can be applied for proximity probes.

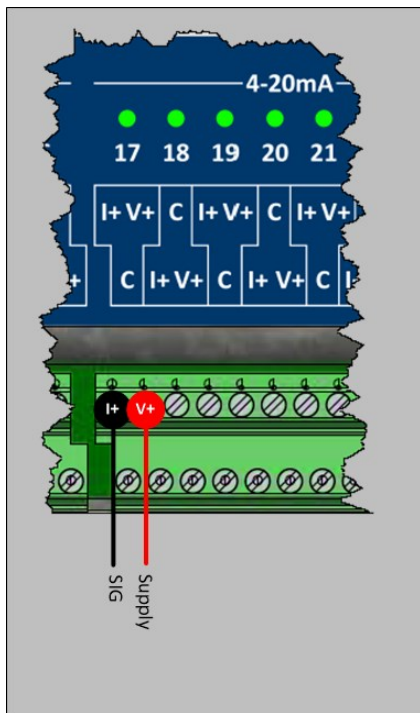
This type of sensor needs -24 VDC sensor power. This requires that a -24 V power supply is connected between 0 and SP in the power plug used for supply current to VCM-3.

Refer to the section “Power Connection – External Sensor Power” in the “Other Connections” section of this manual. The sensor power terminal “SP” is internally connected to the individual “SP” terminals for each sensor.

**Note!** The color coding of the wires follows the colors of the IN08x displacement sensor series from Brüel & Kjær Vibro. Maximum current output in this configuration 45 mA/Channel.

## 7.10 4-20 mA input channel 17-24

### 4-20 mA input mounting. Current for the loop supplied by the VCM-3



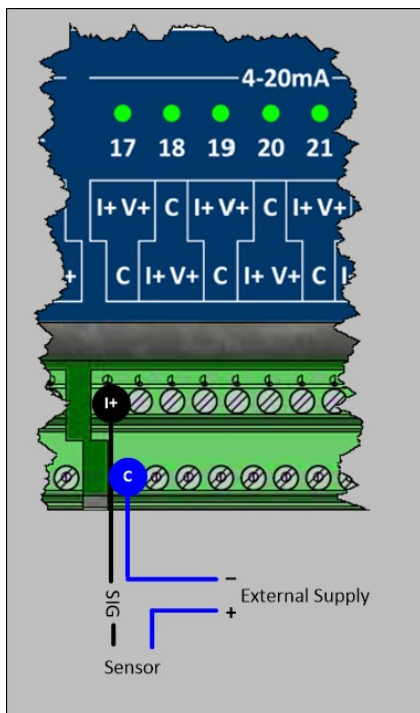
This input is used for 4 – 20 mA signals provided, for example, by a temperature transmitter. The current loop is driven by the VCM-3 power supply.

The current loop input provides “NAMUR” compatibility. If the 4-20 mA sensor supplies “NAMUR” functionality this functionality can be enabled for usage with VCM-3 via the monitoring template.



**Note!** Maximum current output in this configuration is 260 mA in total

### 4-20mA input mounting. Current for the loop supplied by an external current source.



This example shows connections if the current loop is driven by an external power supply.

If the 4-20 mA sensor supplies “NAMUR” functionality this functionality can be enabled via the VCM-3 monitoring template.

7.11
 Speed sensor, proximity switch, PNP and NPN type

| About PNP and NPN sensor types       |   |
|--------------------------------------|---|
| General information                  | This type of sensor is for measuring the speed of a shaft.<br>The +24 VDC supply for this type of sensor is supplied by the VCM-3 unit.   |
| When to use PNP or alternatively NPN | It makes no difference to the speed detection whether the sensor is PNP or NPN.<br>Some PLC's inputs need NPN, other needs PNP. In Europe PNP is the most widespread, in Asia NPN tend to be the preferred.<br>An NPN, or sinking output, accepts voltage and sinks it to ground to complete the circuit. A PNP, or sourcing output, sources voltage and the external circuit sinks it to ground to complete the circuit. |

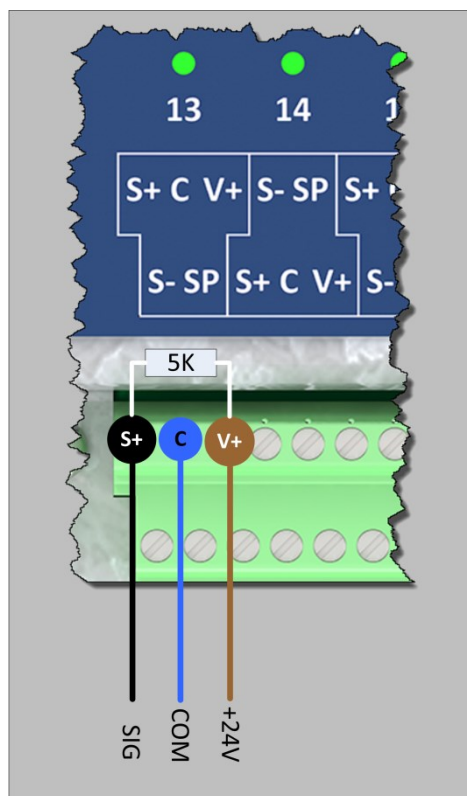
Speed sensor, PNP type - mounting

The +24 VDC supply for this type of sensor is supplied by the VCM-3 unit.

i

**Note!** The color coding of the wires follows the standard for proximity switches.

## Speed Sensor, NPN type – mounting



The +24 VDC supply for this type of sensor is supplied by the VCM-3 unit.

**Note 1!**

The color coding of the wires follows the standard for proximity switches.

**Note 2!**

A resistor between 1 k $\Omega$  and 10 k $\Omega$  needs to be mounted. With the lower resistor value longer cables can be used. However, on the cost of more power to be supplied by the VCM-3.

Maximum current output in this configuration 45mA/Channel

## 7.12 Rogowski probe for current and power measurements

### About Rogowski probes (Rogowski coils)

#### General information

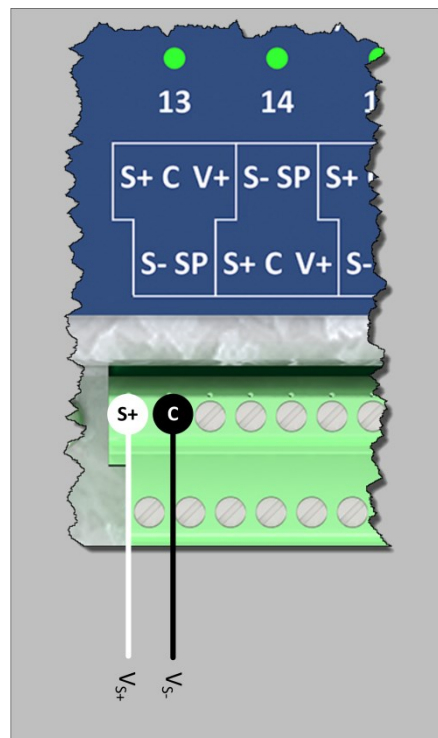
An alternating or pulsed current in a conductor develops a magnetic field and the interaction of this magnetic field and the Rogowski coil local to the field gives rise to an induced voltage within the coil. If the coil constitutes a closed loop with no discontinuities the voltage  $E$  induced in the coil is proportional to the rate of change of the encircled current. The output voltage  $E$  from the Rogowski probe is sent through an integrator to produce an output voltage proportional the current flow through the cable encircled by the Rogowski coil.



This integrator is provided by the VCM-3; thus, no external adapters needs to be supplied.

The VCM-3 integrator output shall be scaled into the appropriate units for current or power using the information provided in the technical information of the Rogowski probe. This scaling takes place in the VCM-3 monitoring template.

### Rogowski coil - mounting



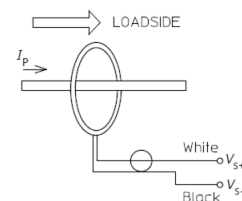
It is recommended to use the Speed/DC input channels for the Rogowski coils as this input has a high absolute DC accuracy.



#### Warning!

Do not stress the coil by applying any kind of mechanical force (i.e. twisting, puncturing, excessive pressure, tight bending, etc. which will dramatically degrade the device's accuracy.

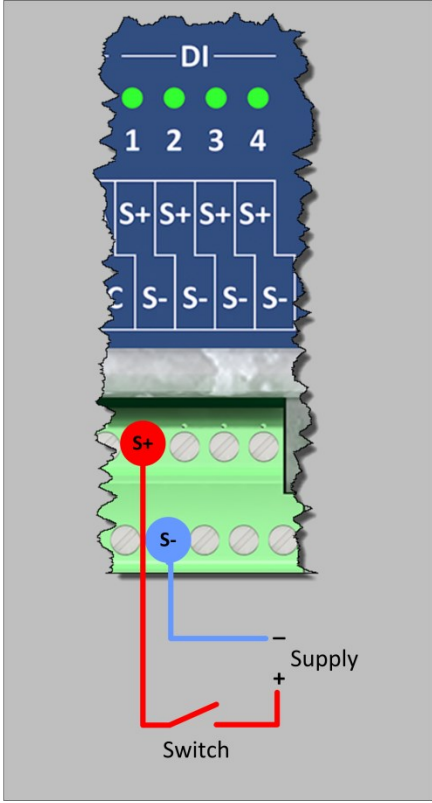
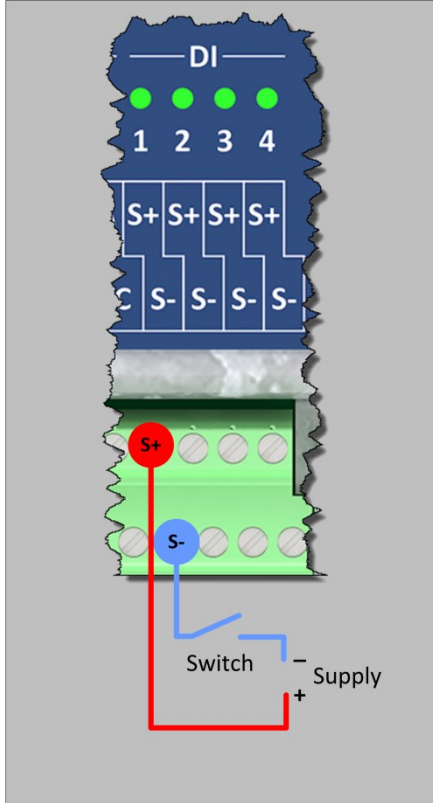
#### Connection



$V_{out} = V_{S+} - V_{S-}$  is positive when the current flows in the direction of the arrow.

The coil does not need to be physically fastened around the primary conductor. Should the coil be secured, make sure no mechanical stress is applied to the coil itself.

## 7.13 Digital inputs

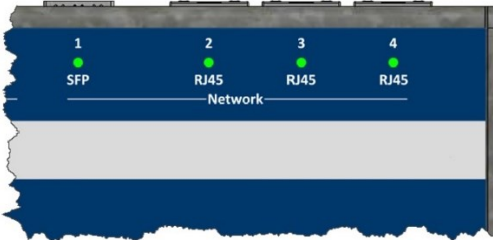
| Digital Inputs  |  |
|---|--|
|   |  |
| <p>The Digital Input can be used to trigger the capture of time waveforms but can also be used for other purposes such as trip override functions for the alarm system.</p> <p>The Digital Input can receive a signal from the digital output on another VCM-3, thus making it possible to synchronize time waveform capture on several VCM-3 units with a delay less than 100ms.</p> <p>The S- connection is not connected to chassis ground.</p> <p>The input is galvanically isolated up to a voltage of 125Vrms</p> <p>The digital inputs are designed according to IEC 946 Binary direct voltage signals for process measurement and control systems.</p> <p>Digital Input Low voltage limits:    [-3, 5] V</p> <p>Digital Input High voltage limits:    [13,33] V</p> |  |

8 Other connections



Please note that cables for these connections shall have a minimum temperature rating of 80 °C

8.1 LAN interface, RJ45, SFP

| LAN interface connections  |  |
|--|--|
|    |  |
| The VCM-3 has four network connections: Three for RJ-45 connectors and one for optical fiber. The connectors are organized as shown below. |  |
| Item   | Details  |
| Auto detect  | The RJ-45 ports have an auto-detect functionality.   |
| Switch functionality   | The unit has built in switch functionality which allows for "daisy chaining" of the VCM-3s on a network. The maximum number of VCM-3s allowed in the chain is five.  |
| Optical fibre port   | The small form-factor pluggable optic transceiver accepts a Duplex LC optical interface for multi-mode fibres, amongst others.<br>Only optical transceivers / OFCS modules (providing SFP port) which are in compliance with Class I device acc. 21 CFR 1040 and IEC/EN 60825-1 maybe used |

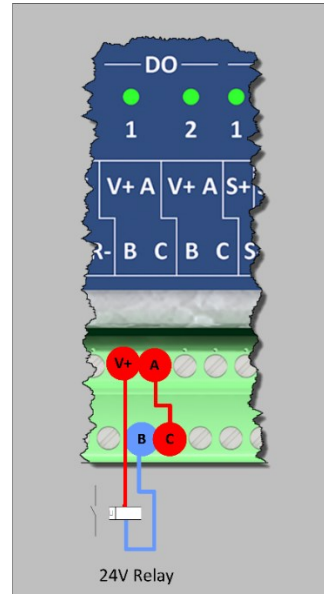
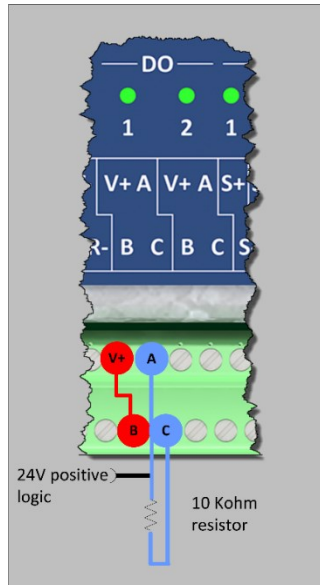


## 8.2 Digital Output



**Note!** The Digital Output functionality is supported from VCM-3 Firmware version 1.15 or higher.

### Digital Output – connections



The digital output on VCM-3 is implemented using photo relays. The photo relays used for the digital outputs are rated for an on-current of 1A up to 50 degC and 0,5 A at 85 C. The max. off-voltage is 33 V. (The outputs are protected by 33V TVS - Transient Voltage Suppression).



**Note!** The maximum current supplied by V+ output in this configuration is 55 mA in total

8.3 RS485 interface

RS 485 connections

This connection is often utilized for serial MODBUS interface (not to be confused with Modbus TCP/IP). The interface in the VCM-3 supports both full duplex and half duplex communication. Please refer to the connection diagram below for details.

**Note!** Beware of ground loops. The GND is the local signal ground. If the cabinets of the RS485 devices are connected via earth ground unfortunate ground loops may be experienced. If this is the case, then omit the local signal ground connection. However, it is not advisable to use this method as earth ground is noisy and a potentially high impedance method for referencing local signal ground.

### Half Duplex Connection

DDAU3 RS 485 Connector

RS485 Device Connector

T

### Full Duplex Connection

DDAU3 RS 485 Connector

RS485 Device Connector

T

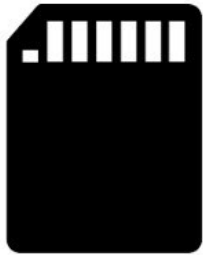
120  $\Omega$  Terminating Resistors

## 9 Internal storage and external storage devices


Any external storage device to be used with the VCM-3 the storage device must be formatted with a compatible file system format.

Currently supported formats for the USB and SD ports are:  
FAT32, exFAT and ext4 filesystem,

A maximum size of 1TB storage devices is currently supported by VCM-3

| SD Information   |   |
|--|---|
|  | The VCM-3 bus interface supports SD, SDHC and SDXC default bus speed 12.5 MB/s.                         |
|  | UHS type bus formats are <b>not</b> supported.  |
|  | To get maximum writing speed (12MB/s), Class 10 (C10) or faster cards should be used.                   |
|  | SD card storage devices must be pre-labeled "ext_storage" or "history_storage" to be accepted by VCM-3. |
|  | It is possible to use a combination of SD and USB<br>A label can only be used once!                     |

### 9.1 External storage – USB memory stick

| USB information   |   |
|---|---|
|  | The VCM-3 bus interface supports USB storage devices which comply to the USB 2.0 standard.              |
|   | USB 3.0 storage devices or devices with a current consumption >500 mA are currently not supported.      |
|   | The USB storage devices must be pre-labeled "ext_storage" or "history_storage" to be accepted by VCM-3. |
|   | It is possible to use a combination of SD and USB<br>A label can only be used once!                     |

## 10 Maintenance



**Note!** Maintenance and service work must only be performed by trained qualified personnel!

VCM-3 does not require any regular service or maintenance. It contains no moving parts and initial calibration is done at factory. For recalibration please contact Brüel & Kjær Vibro or your local sales representative.

In case of defects on the VCM-3, replace the VCM-3 and return the defect unit to factory for repair.

When cleaning the device on the outside, only use a damp cloth.

Be careful not to expose the inside of the device to humidity, i.e. from water or other liquids.

## 11 Disposal of product



VCM-3 is subject to the EU Waste Management Legislation for electrical and electronic devices.

Do not discard the device in the household waste and observe the local regulations for disposal of waste or return the device to Brüel & Kjær Vibro – Leydheckerstrasse 10 – 64293 Darmstadt – Germany. WEEE-Reg.-No DE 69572330.

## 12 Appendix 1: Floating VCM-3 chassis/ground connection

Special set-ups may require that the VCM-3 is isolated from the surrounding ground potential (floating - as for instance in some maritime cases).

Since ground (chassis) and signal return (GND) are connected internally in the VCM-3, the required isolation in these cases must be implemented outside the VCM-3.

To achieve this isolation it is required that the VCM-3 is powered through a power supply that is galvanic isolated and that any sensor connected to the VCM-3 is also isolated from the ground.

In order to have a VCM-3 isolated from the surrounding ground, the following steps must be carried out:

1. Use a galvanic isolated power-supply for the VCM-3
2. Isolate the VCM-3 housing from the ground which it needs to be isolated from.
3. Ensure that the connected sensors are isolated from the ground, or if that is not applicable then use an isolation barrier compatible with the sensor-type in question and if needed a separate sensor power supply (do not use the VCM-3 sensor power since this will short the isolation). Sensors with screened cable connections need special attention to avoid a shorting of the wanted isolation.
4. If sensors make use of an external power source, this must be isolated as well.
5. The digital in/output's must be supplied from an external supply  
**(not the VCM-3 internal power)**
6. If any external device is connected (USB, RS485, etc.) then this must be isolated as well.

Some of the connections to the VCM-3 are already isolated to a certain voltage level:

- The LAN-connection, wired or optical, is by design isolated to more than 125Vrms.
- The digital inputs are by design galvanic isolated to more than 125Vrms.
- The digital outputs are by design galvanic isolated to more than 125Vrms.

However, the digital in/out-put connections using the VCM-3 as power source shall not be used since the power must refer to the non-VCM-3 side of the isolation barrier and a separate supply must hence be used

After these steps have been completed, it is recommended to measure the required isolation resistance using the required isolation voltage levels before power is applied to the VCM-3.

## 13 Appendix 2: CE conformity declaration



Brüel & Kjær Vibro

### EU-Konformitätserklärung / EU- Declaration of conformity

Hiermit bescheinigt das Unternehmen / The company

**Brüel & Kjær Vibro GmbH**  
**Leydheckerstraße 10**  
**D-64293 Darmstadt**



die Konformität des Produkts / herewith declares conformity of the product

**VIBRO Condition Monitoring 3**

Typ / Type

**VCM-3**

mit folgenden einschlägigen Bestimmungen / with applicable regulations below  
EU-Richtlinie / EU-directive

**2014/30/EU EMV-Richtlinie / EMC-Directive**

**2011/65/EU Richtlinie zur Beschränkung der Verwendung bestimmter gefährlicher Stoffe in Elektro- und Elektronikgeräten/ EU Directive for the restriction of the use of certain hazardous substances in electrical and electronic equipment**

Angewendete harmonisierte Normen / Harmonized standards applied

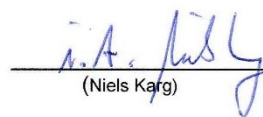
**EN 61326-1: 2013**

**EN 50581 : 2012**

Bereich / Division  
**Brüel & Kjær Vibro GmbH**

Unterschrift / Signature  
**CE-Beauftragter / CE-Coordinator**

Ort/Place **Darmstadt**  
Datum / Date **31.03.2020**

  
(Niels Karg)



## 14 Appendix 4: About this document

### 14.1 History

| Version           | Date     | Change        |
|-------------------|----------|---------------|
| C107758002_EN_v01 | May 2020 | First Edition |

### 14.2 Trademarks

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