Brüel & Kjær Vibro

A member of the NSK Group

Instructions

VIBRO Condition Monitoring 3
VCM-3
VCM-3 Ex

Retain for subsequent use

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Instructions - **VCM-3 / VCM-3 Ex**
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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 / VCM-3 Ex, bringing the VCM-3 in an operational state, and usage of its homepage (including configuration and commissioning, viewing data, etc.).

1.2 Document Conventions

Feature	Comments
Menu items, buttons, tabs, UI features, keyboard instruction	Indicated by **bold** type face. Examples: Click **Remove**. Press **Ctrl+Shift** or Press **F12**.
Path denotations	Example: File > Template > Load template
Reference to separate document	Example: *"VCM-3 Product Specifications and Ordering Information (C107757)"*

1.3 Pictograms and their Meaning

DANGER!

"DANGER" refers to a directly hazardous situation which, if not prevented, will lead to death or serious injuries.

WARNING!

"WARNING" refers to a potentially hazardous situation which, if not prevented, may lead to death or serious injuries.

CAUTION!

"CAUTION" refers to a potentially hazardous situation which, if not prevented, may lead to slight to moderate injuries.

NOTICE!

"NOTICE" refers to a situation which, if not prevented, may lead to material damage.

INFO

"INFO" contains general information about the product.

2 Safe Use of VCM-3 / VCM-3 Ex

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 & 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 Monitoring Template” used for the application. Processed data are provided for other applications via LAN or RS485 interface.

VCM-3 Ex variant is an EX-certified product and may be used in a hazardous area with flammable gases with apparatus groups IIC.
The equipment is certified for use in ambient temperatures in the range of -30 °C to +60 °C and must not be used outside this range.

2.2.1 Explosion Protection

ATEX	
Reference to standards	EN IEC 60079-0 EN IEC 60079-7
Marking	II 3G Ex ec IIC T4 Gc T_{amb} -30 °C ... +60 °C
EU type examination certificate	UL 20 ATEX 2467 X

IECEx	
Reference to standards	IEC 60079-0 IEC 60079-7
Marking	Ex ec IIC T4 Gc T_{amb} -30 °C ... +60 °C
Certificate	IECEx UL 20.0034X

UL HazLoc	
Reference to standards	UL 121201 CSA C22.2 NO. 213-17
Marking	Class I, Division 2, Groups A-D Class I, Zone 2, Group IIC T4 T_{amb} -30 °C ... +60 °C
Certificate	E470442

Applies only to the VCM-3 Ex variant identified for CCC!	
CCC Ex	
Reference to standards	GB/T 3836.1-2021 GB/T 3836.3-2021
Marking	Ex ec IIC T4 Gc
Certificate	2022322314004880

WARNING!

Explosion Hazard - Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.
Device is open-type and is meant to be installed in a suitably rated enclosure providing the appropriate type of protection such that the equipment is only accessible with the use of a tool.

2.2.2 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.

INFO

Observe the instructions in this document for safe installation, commissioning, and disposal of VCM-3.
Also consider the document *"VCM-3 Product Specifications and Ordering Information (C107757)"*.

2.3 General Warnings

2.3.1 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, incorrect installation or operation there is a risk of personal injury or damage to property.

2.4 Grounding Information

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

3 Product Description

3.1 Main Functionality

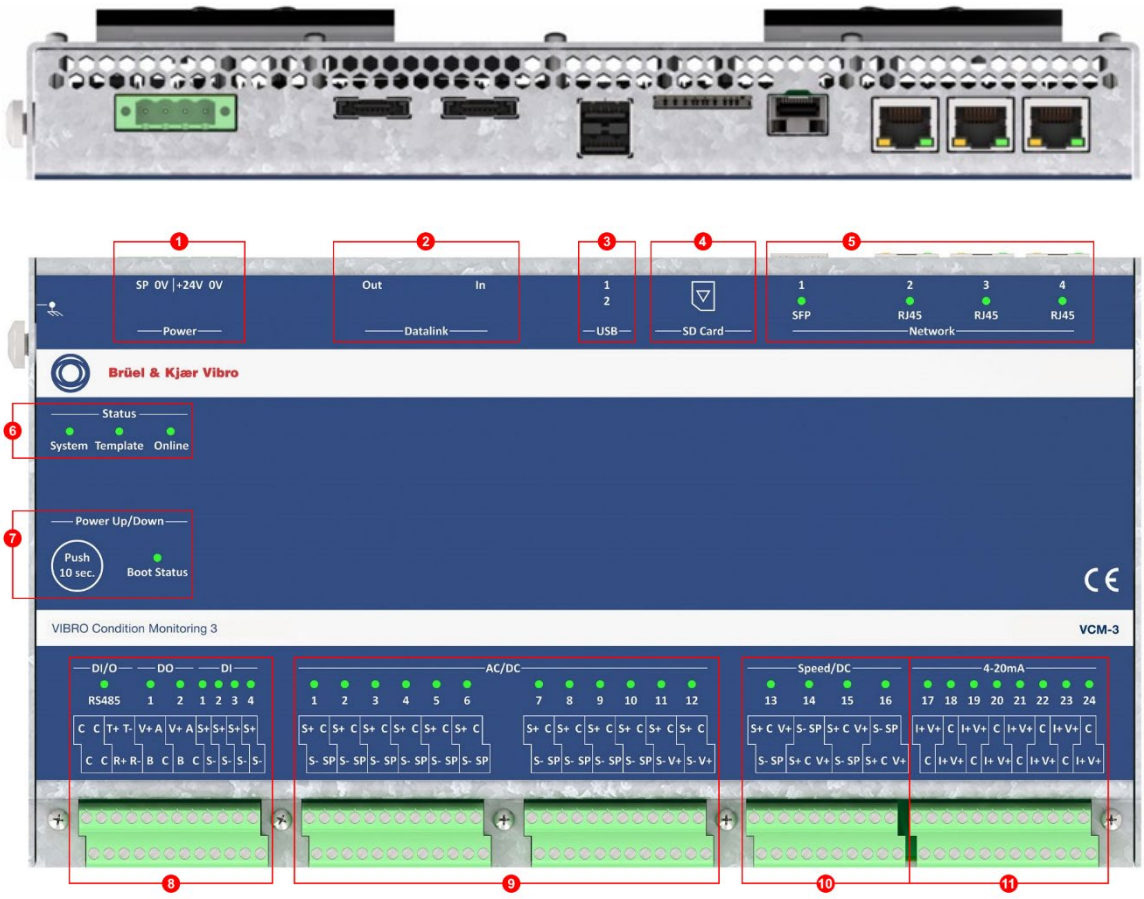
The VCM-3 supports any state-of-the-art condition monitoring method and provides a platform for customizations and development of future new monitoring methods.
VCM-3 provides early fault detection by using a large variety of descriptors (scalar values).
Fast real time descriptors locked to the machine 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 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.

INFO

The range of functions is defined by the “Standard Monitoring Template”.
The “Standard Monitoring Template” also determines which channel groups (AC/DC, Speed/DC, 4–20 mA, DO and DI) are enabled on the device. If a channel group is not enabled on the device, please do not connect it.

3.2 Overview of the VCM-3 Unit



1	**Power:** 24 V Power Supply separate sensor power	
2	**Datalink:** Currently not active	
3	**USB:** 2x USB Type A mass storage	
4	**SD Card:** SD card for mass storage	
5	**Network:** 1x Optical connector, 3x RJ45 connectors (Built-in Ethernet switch)	
6	**Status:** Watchdog Indicators	
7	**Power Up/Down:** Power Up/Down and Boot Status	
8	**DI/O:** RS485 Interface **DO:** 2x Digital Outputs **DI:** 4x Digital Inputs	Incl. LED indicators for sensor status and alarm status
9	**AC/DC:** 12x AC/DC Inputs for CCS accelerometers (ICP), Displacement Probes, Direct Input Voltage	
10	**Speed/DC:** 4x Speed Inputs	
11	**4-20mA:** 8x 4–20 mA Input for Process data	

Refer to document *"VCM-3 Product Specifications and Ordering Information (C107757)"* for further technical details.

3.3 Technical Specification Summary

This section lists the most important technical data. Please refer to document *"VCM-3 Product Specifications and Ordering Information (C107757)"* for further details.

Environmental	
Ambient Temperature	In operation. -30 °C to +60 °C (-22 °F to +140 °F) in accordance to EN/IEC 60068-2-2. Applies to device and to device mounted in cabinet. -40 °C (-40 °F) with reduced accuracy -70 °C (-94 °F) with de-rated Mean Time Between Failures (MTBF).
Ambient Temperature	Storage. -40 °C to +85 °C (-40 °F to +185 °F) 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	(over sea level): 2000 m max.
Inclination	According to IEC 60092-504.
IP Rating	The device IP rating is IP20 according to EN/IEC 60529 without cabinet. The VCM-3 Ex variant must be installed in an enclosure that provides a minimum ingress protection of IP54 in accordance with IEC 60079-0.
Pollution Degree	3
CE Marking	EMC acc. 2014/30/EU EN IEC 61326-1 ROHS acc. 2011/65/EU + (EU) 2015/863 EN IEC 63000:2018 ATEX acc. 2014/34/EU EN IEC 60079-0 EN IEC 60079-7
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) 18–26 VDC + power consumption of each sensor. Worst case sensor current consumption 1.6 A : 30 W (including network load)
Fuses	Power supply inputs are fused to protect against over-voltage and fire

4 Mechanical Installation

WARNING!

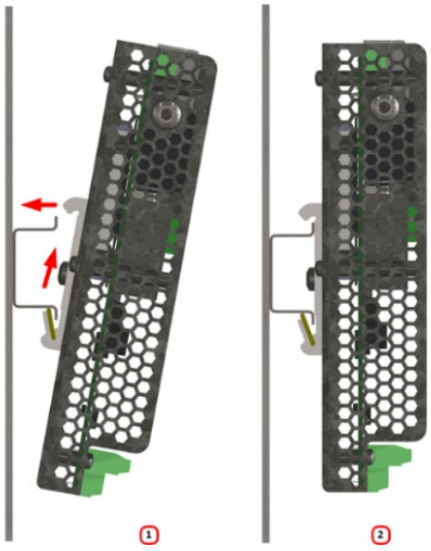
- "The equipment shall only be used in an area of at least pollution degree 2, as defined in IEC 60664-1."
- "The equipment shall be installed in an enclosure that provides a minimum ingress protection of IP54 in accordance with IEC 60079-0."
- External HMI (High Speed Datalink) – must not be used unless the area is known to be non-hazardous.

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 70 mm 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.

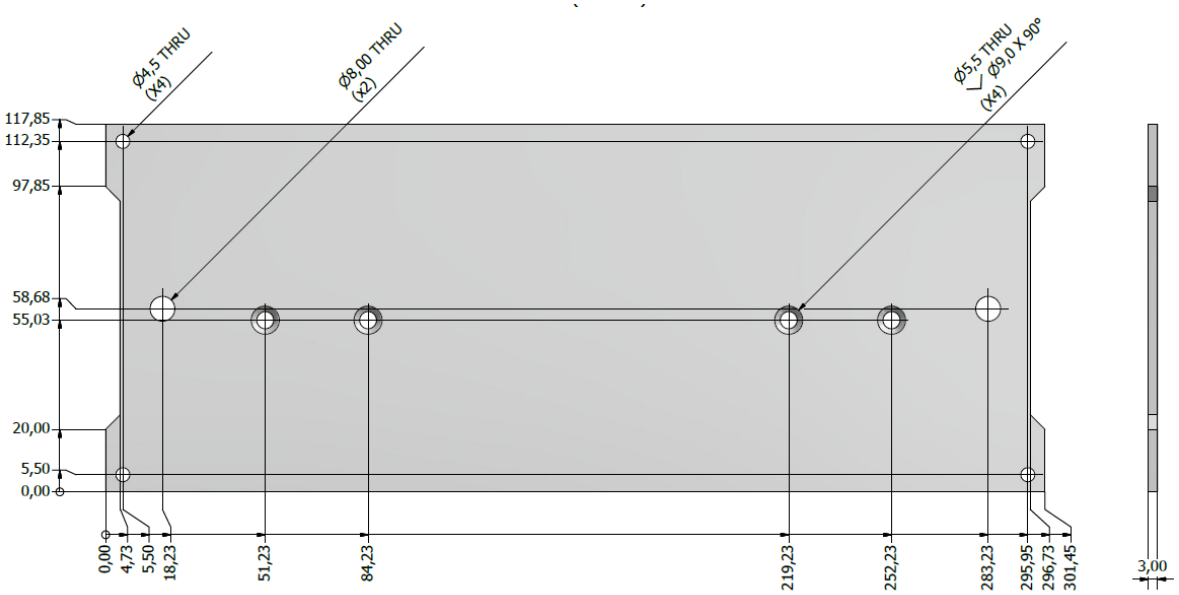
DIN Rail Mounting



When the VCM-3 is fitted on a 35 mm mounting rail (DIN EN 50022)

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. See chapter 9 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

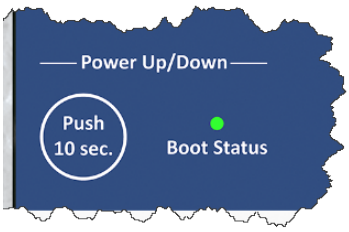
The LED (**L**ight **E**mitting **D**iodes) indicators on the VCM-3 front panel provide a quick visual overview of the state of the VCM-3. In general LED colors which has a color other than green or grey (switched off) indicates an abnormal condition. See chapter 10.1 for further description of the LED behaviour.
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 or not-OK input.

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
	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. Shows a green light when active.
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 listed below is to use the Power Up/Down button named Push 10 sec.

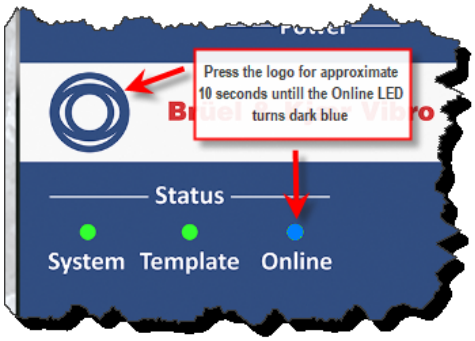


Power Up procedure		
Action	Boot Status LED	Explanation
Connection of power to the unit		Supply voltage is out of spec. Input voltage is in the 4.5 to 18 V range.
		Power is connected and within specifications
Press the power switch		Keep the switch pressed for 6–9 seconds. Release the switch when the LED start flashing green.
		During boot the LED will be flashing green
		Once the LED turns to solid green the unit starts running

Power Down procedure		
Action	Boot Status LED	Explanation
Power Down (Normal) Press the power switch for 3 seconds.		Soft Power down will close 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. Push the button for approximately 3 sec. until the Boot Status LED starts flashing orange/green. Release the button. The power down is now in progress.
		When the button turns into constant orange light, all data has been saved and the power plug can be removed/power can be turned off. To boot up from this state follow the Power Up procedure described below.
Hard Power Down (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) Keep pushing the button for approximately 10 sec. until the Boot Status LED starts flashing Red/White. Release the button.
		The Boot Status now turns into constant orange light. To boot up from this state follow the Power Up procedure described below.

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	Push the logo for approximately 10 seconds until the Online status LED turns into dark blue. (When you push the logo, you shall feel a tactile feedback)  When the Online status turns into dark blue the VCM-3 allows a user to login using the default IP address: https://192.168.2.202. The VCM-3 will remain in this state until a new IP address has been saved or the VCM-3 is rebooted. Change the laptop network settings to match the IP range of the VCM-3. E.g. Set the laptop to IPv4 address 192.168.2.199, Netmask 255.255.255.0
2	Log into the VCM-3. See chapter 12.
3	Select the “Commissioning Configuration” page. On this page the IP setting of VCM-3 is displayed. Change it if required. Remember to click **Save Changes**

6 Power Connections

6.1 Power Connection – Supply Current

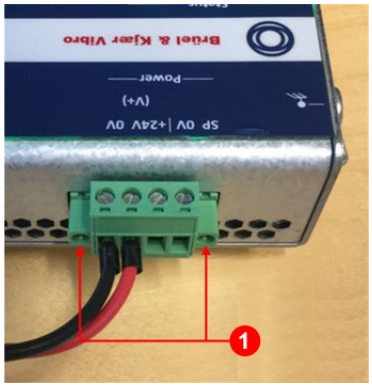
WARNING!

The VCM-3 (non-Ex) is powered by 24 V DC. We recommend the use of a switch mode power supply (e.g., PULS Types ML50.1... for non-Ex applications or a Traco TSP 090-124EX for Ex applications). Please consider local standards and demands concerning mains voltage. Power must be connected to the power supply only through insulating switches or circuit breakers. The insulating switches - or circuit breakers - must meet the IEC 60947-1 and IEC 60947-3 standards and must be suitable for the application.

CAUTION!

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 2.5 mm^2 with ferrule and plastic sleeve.
Power supply shall be connected between the +24 V and 0 V terminals.
Secure the power plug with the screws in the terminal block.



1	Screws for securing power plug

WARNING!

A surge protected +24 V (nominal) SELV DC power supply must be used as supply for the VCM-3 / VCM-3 Ex. (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 1.6 A and max. 30 W.
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.

The power supply must be insulated and limited energy in accordance with UL61010-1 or UL60950-1 or Class 2 in accordance with NEC.

The power supply must be connected through a circuit breaker that complies with IEC 60947-1 and IEC 60947-3.
If several VCM-3 are 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 -24 V 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 2.5 mm^2 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 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.

INFO

Supported channels and sensor types of your “Standard 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 Monitoring Templates” can be found in the document ”VCM-3 Product Specifications and Ordering Information (C107757)”.

INFO

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

DANGER!

- 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

CAUTION!

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

7.3 Shielding

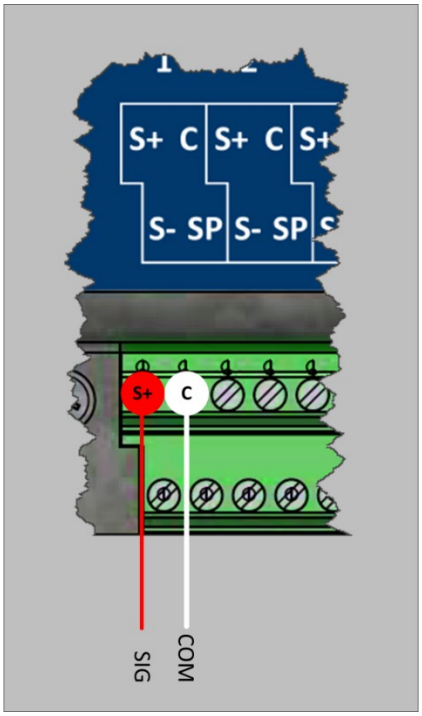
It is very important that the shields of the sensor cables and the housing of VCM-3 are connected to the same ground potential. That is, to the cabinet where they are mounted. On the side of VCM-3 housing a ground cable can be fastened to the cabinet. The sensor cables can be connected to the cabinet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

INFO

If a floating chassis/ground connection shall be used in connection with VCM-3, please refer to chapter 15 for an explanation.

7.4 Constant Current Line Drive Accelerometers (CCS) Channel 1–12

Constant current line drive accelerometers (CCS)



This type of sensor needs a constant current, which is supplied by the VCM-3 unit. Examples of high-quality accelerometers offered by Brüel & Kjær Vibro includes:

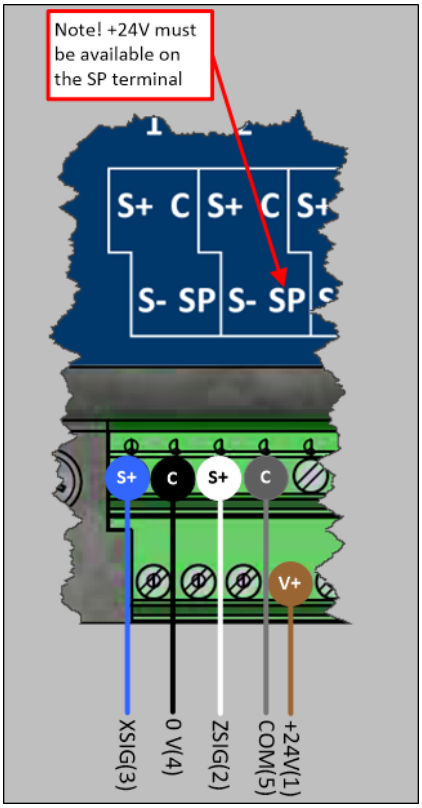
- AS-062; 100 mV/g
  (multi-purpose, integral cable)
- AS-667; 100 mV/g
  (multi-purpose, radial connector M12).
- AS-447; 500 mV/g
  (high sensitivity, axial connector M12).
- AS-068; 10 mV/g
  (low sensitivity, integral cable)

INFO

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.

7.5 Brüel & Kjær Vibro AS-247 Dual Axis Accelerometers on Channel 1–10

AS-247 sensor mounting.



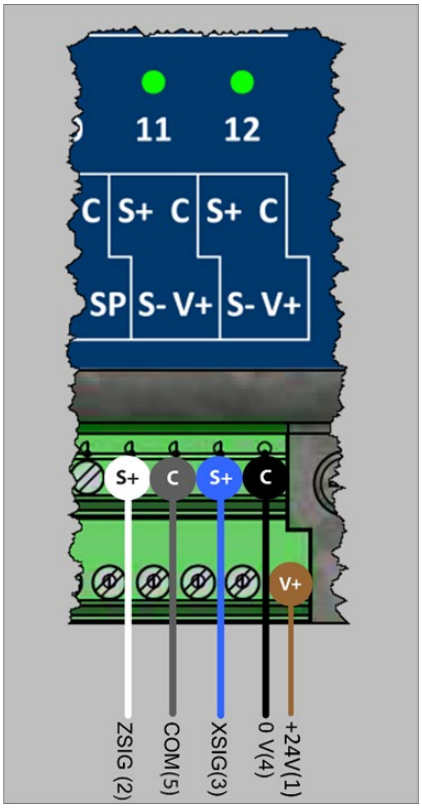
AS-247 is a biaxial sensor, that is, it produces two output signals, one for each axis. In the figure these two axes are denoted XSIG and ZSIG.
If the AS-247 sensor shall be connected to other AC/DC channels than channel 11 or channel 12, the +24 signal must be looped to the SP terminal. The +24 V supply 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 “Power 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.

INFO

Maximum current output in this configuration is 55 mA in total.

7.6 Brüel & Kjær Vibro AS-247 Dual Axis Accelerometers on Channel 11–12

AS-247 sensor mounting.



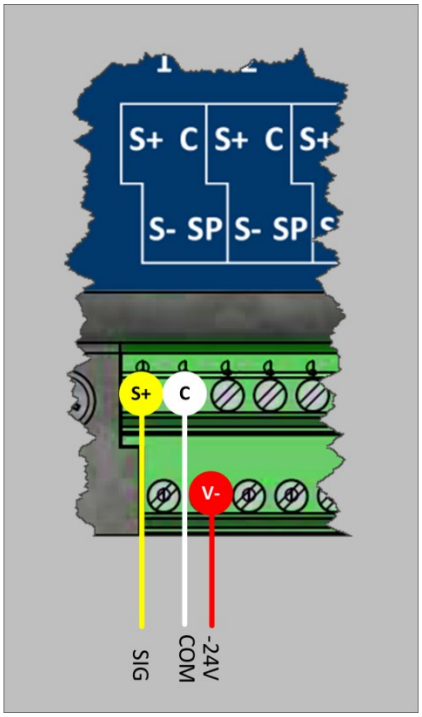
AS-247 is a biaxial sensor, that is, it produces two output signals one for each axis. In the figure these two axes are denoted XSIG and ZSIG.
This sensor needs a +24 VDC supply which is available on the (V+) terminals on AC/DC channel 11 and 12.
The color of the connection wires corresponds to sensor connection cable AC-1401.

INFO

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



INFO

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.

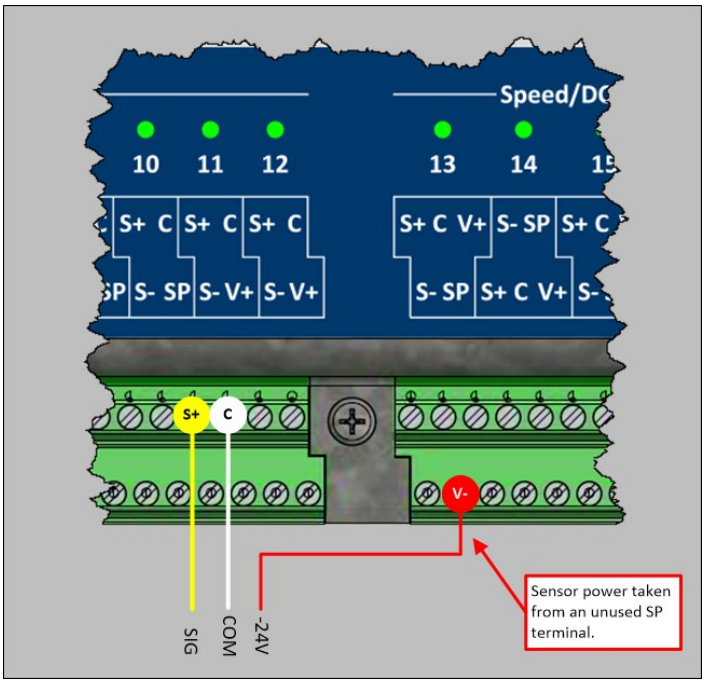
This type of sensor needs -24 VDC sensor power. This requires that a -24 V power supply is connected between 0 and SP in the power plug used for supply current to VCM-3.
Refer to the section “Power Connection – External Sensor Power” in the “Other Connections” section of this manual. The sensor power terminal “SP” is internally connected to the individual “SP” terminals for each sensor.

INFO

The color coding of the wires follows the colors of the IN-08x displacement sensor series from Brüel & Kjær Vibro.
Maximum current output in this configuration is 45 mA/Channel.

7.8 Displacement Sensors (Proximity Probes) Channel 11–12

Displacement sensor mounting on channel 11 and 12



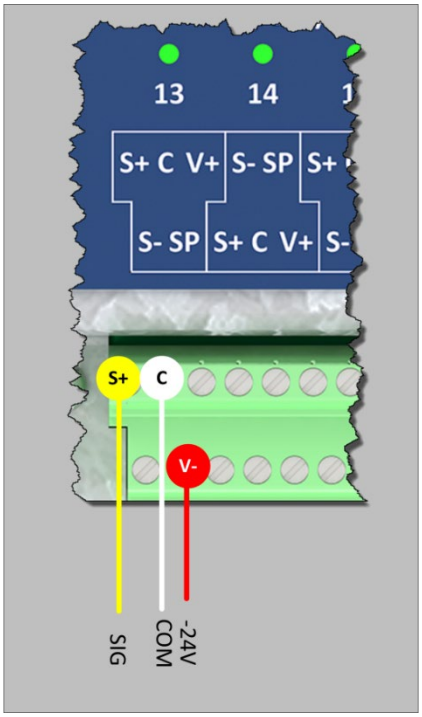
If a displacement sensor shall be mounted on channel 11 or 12 the -24 V sensor power cannot be taken directly from the channel connections as the sensor power for channel 11 and 12 is assigned only to a +24 V. In this case the sensor power can be taken from an unused sensor power terminal (SP) on the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

INFO

The color coding of the wires follows the colors of the IN-08x 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



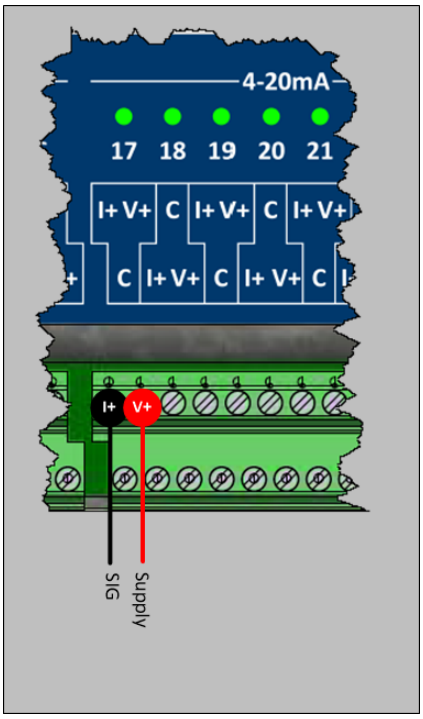
If high absolute accuracy is required on the displacement measurements, e.g. for position measurements channel 13–16 can be applied for proximity probes.
This type of sensor needs -24 VDC sensor power. This requires that a -24 V power supply is connected between 0 and SP in the power plug used for supply 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.

INFO

The color coding of the wires follows the colors of the IN-08x displacement sensor series from Brüel & Kjær Vibro.
Maximum current output in this configuration is 45 mA/Channel.

7.10 4-20mA Input Channel 17–24

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

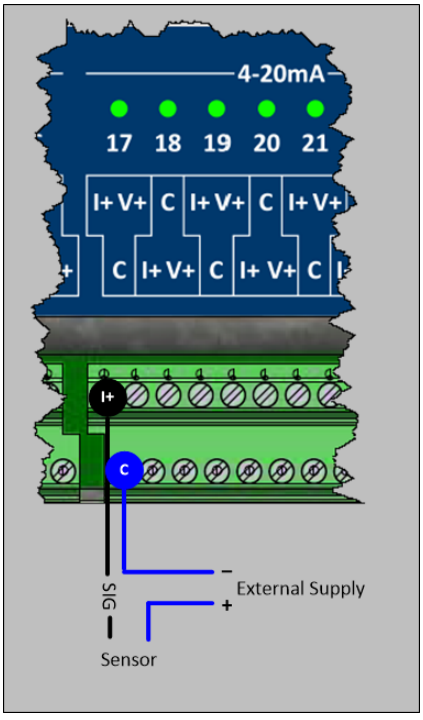


This input is used for 4–20 mA signals provided, for example, by a temperature transmitter. The current loop is driven by the VCM-3 power supply.
The current loop input provides “NAMUR” compatibility.
If the 4–20 mA sensor supplies “NAMUR” functionality this functionality can be enabled for usage with VCM-3 via the monitoring template.

INFO

Maximum current output in this configuration is 260 mA in total.

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

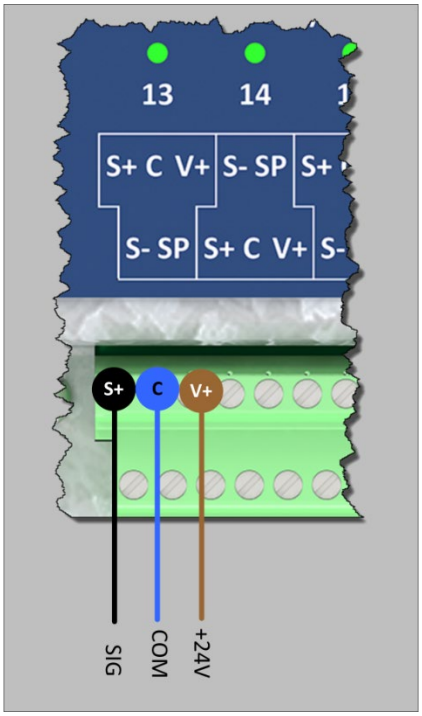


This example shows connections if the current loop is driven by an external power supply.
If the 4–20 mA sensor supplies “NAMUR” functionality this functionality can be enabled via the VCM-3 monitoring template.

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. 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. Some PLC's inputs need NPN, others need PNP. In Europe PNP is the most widespread, in Asia NPN tends to be the preferred. An NPN, or sinking output, accepts voltage and sinks it to ground to complete the circuit. A PNP, or source output, sources voltage and the external circuit sinks it to ground to complete the circuit.

Speed sensor, PNP type - mounting

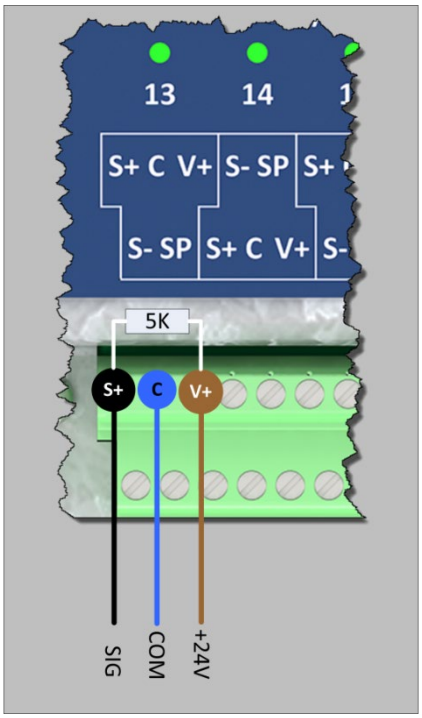


The +24 VDC supply for this type of sensor is supplied by the VCM-3 unit.

INFO

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.

INFO

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

INFO

A resistor between 1 kΩ and 10 kΩ needs to be mounted. With the lower resistor value, longer cables can be used. In this case, the VCM-3 must be supplied with more power.

Maximum current output in this configuration 45 mA/Channel.

7.12 Rogowski Probe for Current and Power Measurements

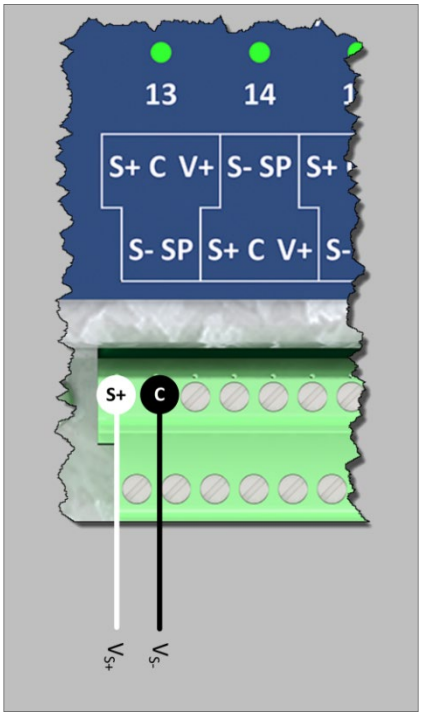
About Rogowski probes (Rogowski coils)

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 to the current flow through the cable encircled by the Rogowski coil.

This integrator is provided by the VCM-3; thus, no external adapters need 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

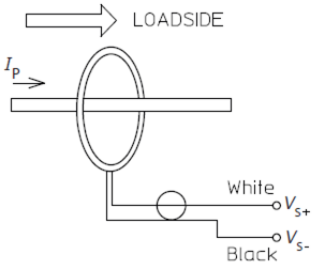


It is recommended to use the Speed/DC input channels for the Rogowski coils as this input has a high absolute DC accuracy.

NOTICE!

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.

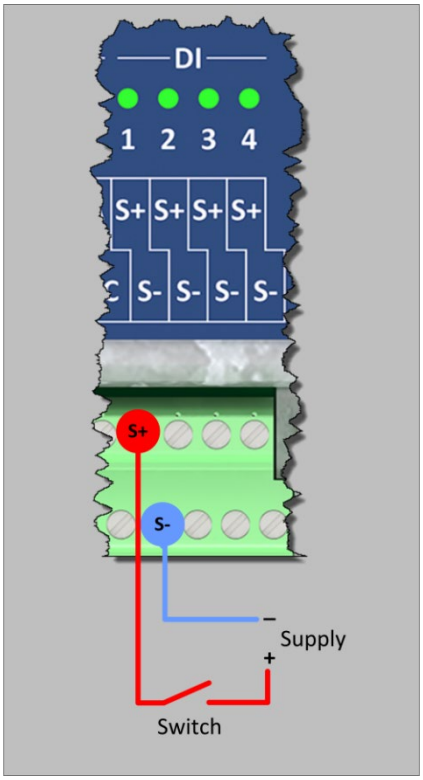
Connection

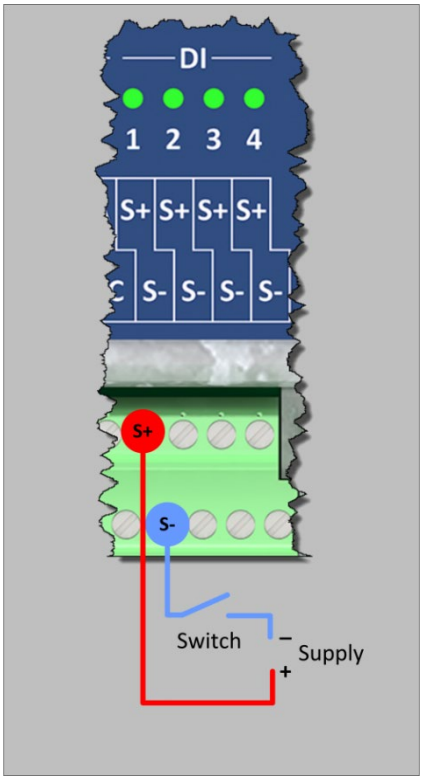


$V_{out} = V_{s+} - V_{s-}$ is positive when the current flows in the direction of the arrow.
The coil does not need to be physically fastened around the primary conductor. Should the coil be secured, make sure no mechanical stress is applied to the coil itself.

7.13 Digital Inputs

Digital Inputs





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.

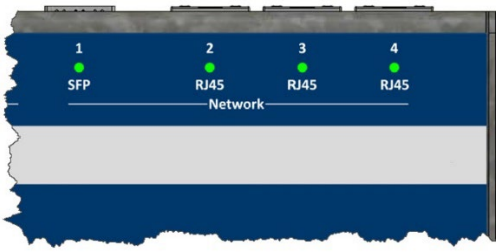
The Digital Input can receive a signal from the digital output on another VCM-3, thus making it possible to synchronize time waveform capture on several VCM-3 units with a delay less than 100 ms.
The S- connection is not connected to chassis ground.
The input is galvanically isolated up to a voltage of 125 Vrms
The digital inputs are designed according to IEC 946 Binary direct voltage signals for process measurement and control systems.
Digital Input Low voltage limits: [-3 – 5] V
Digital Input High voltage limits: [13 – 33] V

8 Other Connections

CAUTION!

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

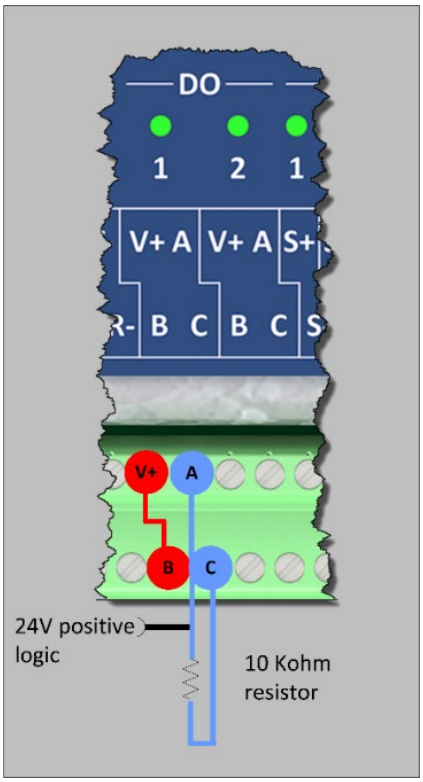
8.1 LAN Interface, RJ45, SFP

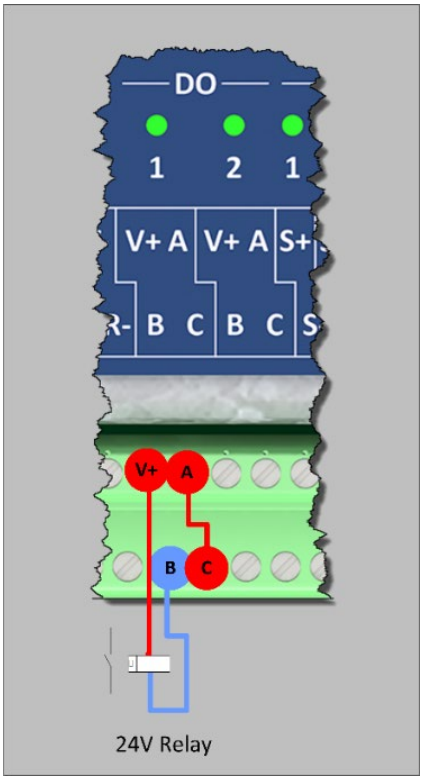
LAN interface connections	
	
The VCM-3 has four network connections: Three for RJ45 connectors and one for optical fiber. The connectors are organized as shown below.	
Item	**Details**
Auto detect	The RJ45 ports have an auto-detect functionality.
Switch functionality	The unit has built in switch functionality 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. 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 may be used. The SFP module must support 100BASE-FX over multi-mode fiber (MMF). Cables must be OM3 (50/125 µm) or higher with LC connectors. The following modules are verified to work: Avago HFBR-57E0ALZ and MicroOptics 100Mb LAN SFP transceivers.

8.2 Digital Output

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

Digital Output connections



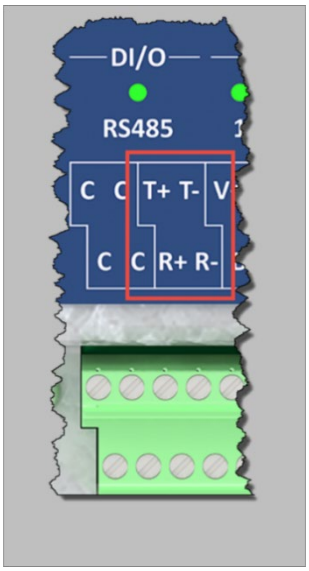


The digital output on VCM-3 is implemented using photo relays. The photo relays used for the digital outputs are rated for an on-current of 1 A up to 50 degC and 0.5 A at 85 C.
The max. off-voltage is 33 V. (The outputs are protected by 33 V TVS - Transient Voltage Suppression).
Source Output 470 Ω/ 2 W

> **INFO**
> The maximum current supplied by V+ output in this configuration is 55 mA in total.

8.3 RS485 Interface

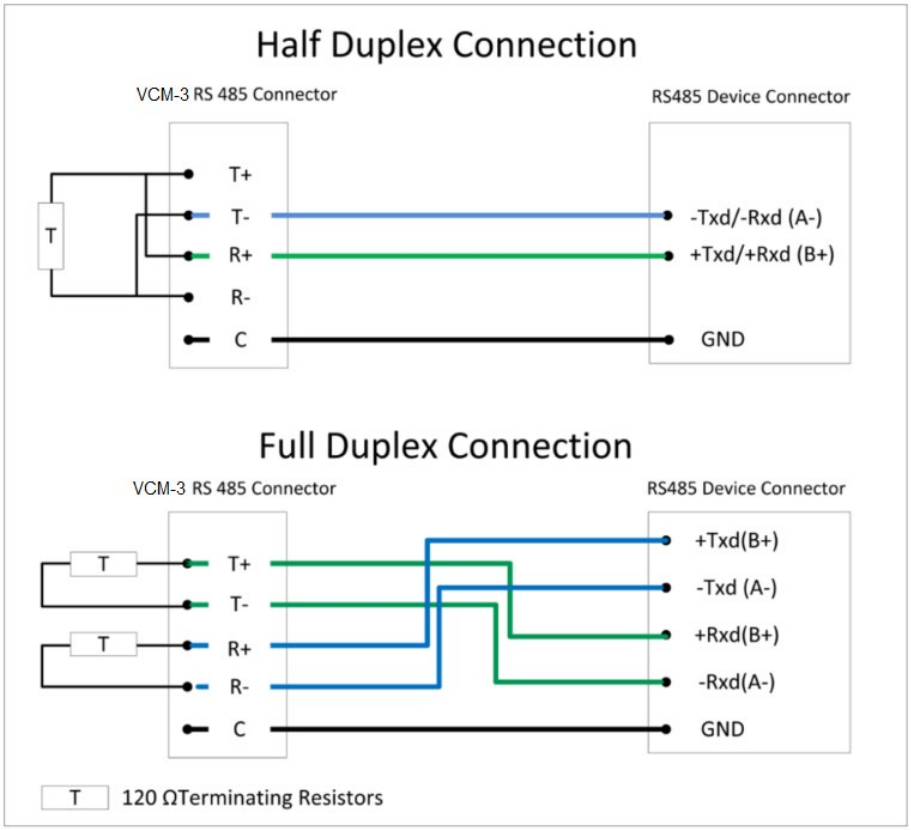
RS 485 connections



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.

INFO

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.



9 On-site Commissioning of VCM-3

9.1 Prerequisites

To complete the on-site commissioning procedure, the following must be available.

A service laptop with:

1. An up-to-date browser. Due to the installed security certificates on the VCM-3, browsers may have difficulties in showing the VCM-3 Homepage.
   When you open the VCM-3 Homepage some security alerts may be shown. These shall be ignored.
2. The latest VCM-3 firmware version. This is optional. Only to be used if you wish to install new FW version on-site.

10 Initial Power Up Test – Visual Check

Purpose:

1. To check that the VCM-3 can boot up correctly
2. To check that sensors are wired correctly
3. To check that the speed sensor is working

> **INFO**
>
> This visible check assumes that the VCM-3 is running the factory monitoring template.

Power Up	
1	Apply power to the VCM-3
2	Wait until the boot procedure is complete. When the **Boot Status** LED turns green, the boot procedure is complete.

All channels in the VCM-3 have been configured in the factory monitoring template. Therefore, you will see a blue color LED on the AC/DC channels with no sensor connection.

After power up the VCM-3 front panel shall look like the picture below.

If the LED's deviates from the description in the table below there is a problem with the VCM-3 or the installation of the sensors. This shall be investigated before the commissioning procedure is continued.

Initial LED status from factory		
Inputs/Outputs/System and associated LED color		**Explanation**
1	Network	Off – as the VCM-3 is not connected to any network (beside RJ45 connector)
2	Status: System	On – Blue, indicates that the VCM-3 is not connected to a server in the condition monitoring centre.
3	Status: Template	The factory template is loaded and running.
4	Status: Online	No gateway IP address is defined, the VCM-3 is not connected to the network
5	Boot Status	On-Green. This indicates the the VCM-3 has completed it's boot procedure correctly
6	DI/O	On – Green because Modbus is enabled in the factory template.
	DO	Off – as the digital output is not in use
	DI	Off – as the digital input is not in use
7	AC/DC	On – Green, input channels which are wired to an accelerometer. In this example channel 1 to 9.
	AC/DC	On – Blue, input channels which are configured as constant current source (CCS) accelerometers, but not wired to an accelerometer.
	AC/DC (11 and 12)	On – Blue, input channels which are configured for an AS-247 MEMS sensor with 24 V supply, but not wired to a sensor.
8	Speed/DC Speed/DC	On – Green. Speed inputs shows green light as all Speed/DC sensor inputs are enabled in the factory template. If an input is connected to a speed sensor the LED will flash between dark green and light green; If the machine is rotating slowly or you put a piece of metal in front of the mounted speed sensor, the corresponding LED will flash between light green and dark green.
9	4-20mA	On – Green, as all 4–20 mA sensor inputs are enabled in the factory template

10.1 Investigation of Deviations in LED Colors after initial Power Up

It is recommended to remedy any visible problems, if possible, before you proceed with the remaining part of the commissioning procedure.

10.1.1 Sensor Problems on connected Sensors (Signal Inputs)

Color	Explanation
Off	Channel disabled
Green	Channel enabled, no errors
Red	Template error
Blue	Channel voltage out of defined range Tacho out of range (for tacho channels)
Yellow (blinking)	Level 3 indication is controlled by the template (the blinking is combined with red, green, or blue)

If there is an error indication on the channel LED it is important to know what type of sensor you are working with. There are two types of sensors:

10.1.2 CCS (Constant Current Supply) Sensors

Color	Explanation
Blue	Sensor is connected correctly but it is outputting outside of the allowed range. Check the sensor's calibration. Check the allowed range in the template and the bias level in the tap test.
Blue	Sensor is not connected. Sensor is not connected correctly (S+ and S-/C interchanged). Sensor is not grounded (S+ and S- are connected, but S- are not connected to C).

10.1.3 Non-CCS Sensors

Color	Explanation
Blue	Sensor is not connected. Sensor is not connected correctly (S+ and S- interchanged). Check the sensor's calibration. Check the allowed range in the template and the bias level in the tap test.
Blue	For non-CCS sensors this is indicating a serious problem with the sensor. If it is a tacho sensor that is outputting >25V you can safely ignore this error, but in all other cases you should check the sensor.

10.1.4 VCM-3 Hardware (Device) Problems

System LED

Color	Explanation
Green	Connected to backend
Yellow	Disconnected from backend (was previously connected)
Blue	Disconnected from backend
Red	Watchdog error/reboot imminent
White	Firmware is upgrading
Purple	System is sampling real-time
Cyan	System has stopped real-time sampling

Template LED

Color	Explanation
Green	Template loaded
Green (blinking)	Wrong Template setup. Contact Brüel & Kjær Vibro Technical Support: techsupport@bkvibro.com
Yellow	Template not loaded
Blue	Template error
Red	Fatal error (both template and fallback template failed)

Online LED

Color	Explanation
Green	Gateway pingable
Yellow	Factory settings
Blue	Gateway not pingable
Red	Configuration error / gateway not reachable (reachable before)
Dark blue	Reseting to default IP address

Device Status / LED color	Explanation
Status: System	On – Red. Watchdog about to reboot the VCM-3 **Action:** 1. If watchdog reboot does not help, reboot the device. The reboot activates some repair facilities. 2. If 1) does not help, upgrade the firmware. Refer to the procedure in chapter 12.13. 3. If 2) does not help the VCM-3 or the running template has a fault. Try changing to the factory template. If that solves the problem the template must be replaced or updated. If the problem is present with the factory template, contact Brüel & Kjær Vibro Technical Support.
Status: Template	On – Red. Fatal template error **Action:** 1. Reboot the VCM-3 and check if the problem disappears. The reboot activates some repair facilities. 2. If 1) does not help, upgrade the firmware. Refer to the procedure in chapter 12.13. 3. If 2) does not help the VCM-3 has a fault. You cannot complete the commissioning procedure. Contact Brüel & Kjær Vibro Technical Support.
Status: Online	On – Red. Either default gateway cannot be reached (but before) or network has a configuration error. (Maybe the specified IP address is illegal) **Action:** 1. Reboot the VCM-3 and check if the problem disappears. The reboot activates some repair facilities. 2. If 1) does not help go to the Network configuration page and check.
Boot Status	On – Red. Unit is off and power is within specification. Ready to be turned on. **Action:** 1. Push the **Power Up/Down** button but only with a short push. If this turns the **Boot Status** into green the VCM-3 is OK. 2. If 1) does not help then reboot the VCM-3 and check if the problem disappears. The reboot activates some repair facilities. 3. If 2) does not help the VCM-3 has a fault. You cannot complete the commissioning procedure. Contact Brüel & Kjær Vibro Technical Support.

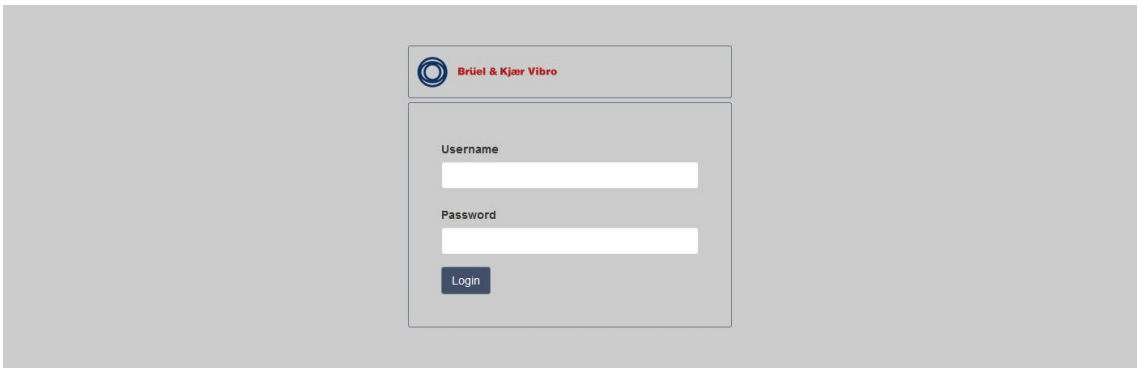
11 VCM-3 Homepage Commissioning Procedure

After the visible inspection check the on-site commissioning procedure shall be continued using the functionality of the VCM-3 Homepage.

Via the Homepage the following steps shall be completed:

1. Check the VCM-3 firmware version
2. Check the Operational Status
3. Check the sensor bias voltages
4. Perform a Tap test of all accelerometers in order to check the correct mounting of the accelerometers
5. Check the rotational speed sensor signal using a piece of metal
6. Configure the VCM-3 with the correct IP addresses and enable services
7. Save the commissioning report
8. Reboot the VCM-3 after completion
9. Inspect the VCM-3 front plate after reboot

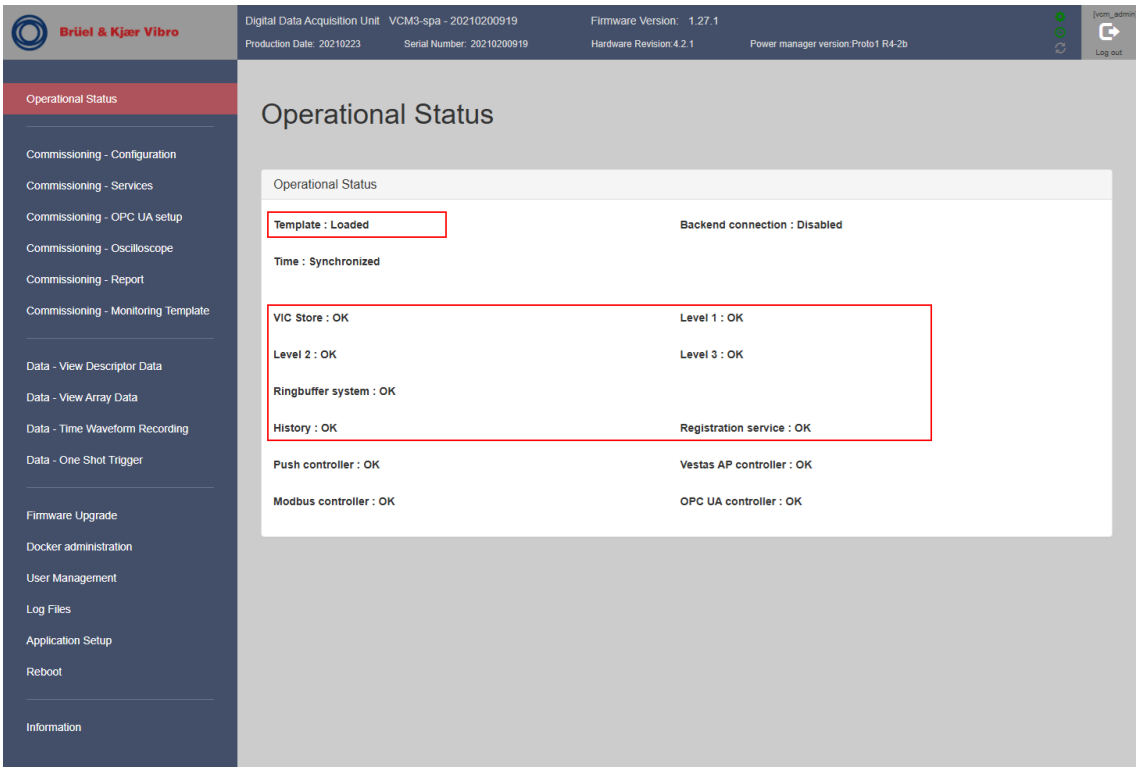
11.1 Log into the VCM-3 Homepage

How to connect a laptop and perform the login	
1	Change the laptop network settings to match the ip range of the VCM-3. Factory default network settings of VCM-3 are as follows: • VCM-3 Ipv4 address: 192.168.2.202 • Netmask (subnet mask): 255.255.255.0 **INFO** Brüel & Kjær Vibro recommends to set the laptop to Ipv4 address 192.168.2.199 Netmask 255.255.255.0
2	Connect the laptop to one of the RJ45 ports of the VCM-3 unit using a LAN cable.  RJ45 cable connector.
3	Write the VCM-3 IP address in the browser. Ignore the security notifications and proceed to the VCM-3 login page.
4	 Use the following credentials: Username: **vcm_service** Password: **VCM3-Service**

11.2 Check the VCM-3 Firmware Version and update Firmware

To learn how to update the VCM-3 firmware, please refer to chapter 12.13.

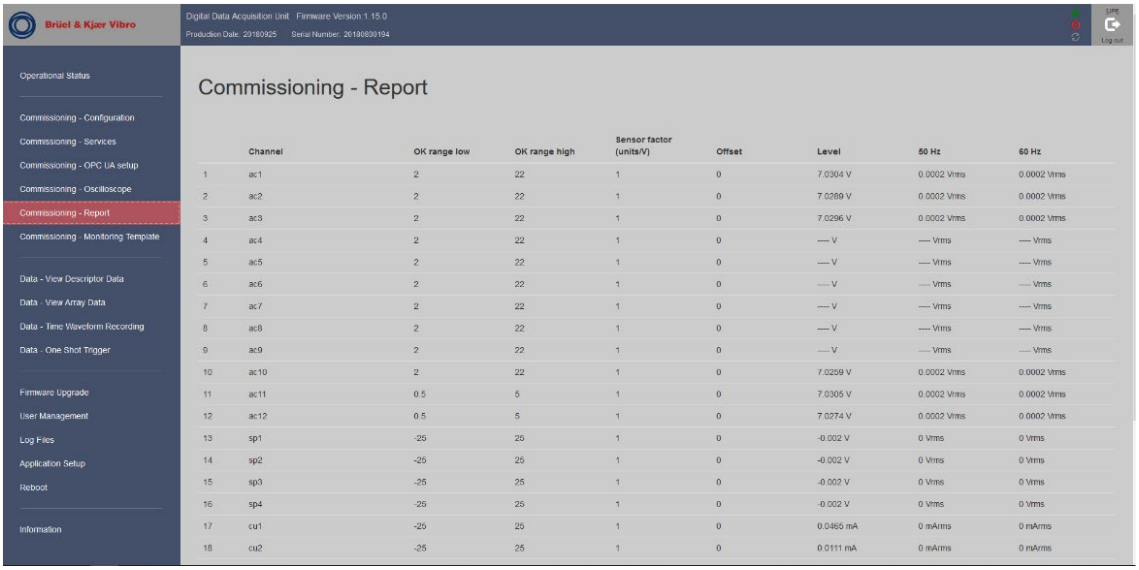
11.3 Check the Operational Status

How to inspect the Operational Status page	
1	 After login the Operational Status page is shown. This page gives an overview of the present status of the VCM-3. As a general rule the status indicators in the red boxes must have the status as shown on the screenshot. Otherwise, there is a problem with the VCM-3. The other status indicators are dependent upon the state of the commissioning procedure.
2	If the status indicators in the red boxes show a different result, try to reboot the VCM-3 and inspect the Operational Status page again. 1. Reboot the VCM-3 and check if the problem disappears. The reboot activates some repair facilities. 2. If 1.) does not help, please upgrade the firmware. 3. If 2.) does not help, contact Brüel & Kjær Vibro Technical Support.

11.4 Check Bias Voltages of Sensors

Use the Commissioning Report feature to check the bias voltages of the connected sensors.

> **INFO**
>
> The Commissioning Report is only supported with an activated Factory Monitoring Template, which is not to be exchanged with the Standard Monitoring Template and/or the customized Monitoring Template.

View Commissioning Report	
1	Select Commissioning Report from the VCM-3 Homepage menu
2	

	Channel	OK range low	OK range high	Sensor factor (units/V)	Offset	Level	50 Hz	60 Hz
1	ac1	2	22	1	0	7.0304 V	0.0002 Vrms	0.0002 Vrms
2	ac2	2	22	1	0	7.0289 V	0.0002 Vrms	0.0002 Vrms
3	ac3	2	22	1	0	7.0296 V	0.0002 Vrms	0.0002 Vrms
4	ac4	2	22	1	0	---- V	---- Vrms	---- Vrms
5	ac5	2	22	1	0	---- V	---- Vrms	---- Vrms
6	ac6	2	22	1	0	---- V	---- Vrms	---- Vrms
7	ac7	2	22	1	0	---- V	---- Vrms	---- Vrms
8	ac8	2	22	1	0	---- V	---- Vrms	---- Vrms
9	ac9	2	22	1	0	---- V	---- Vrms	---- Vrms
10	ac10	2	22	1	0	7.0259 V	0.0002 Vrms	0.0002 Vrms
11	ac11	0.5	5	1	0	7.0305 V	0.0002 Vrms	0.0002 Vrms
12	ac12	0.5	5	1	0	7.0274 V	0.0002 Vrms	0.0002 Vrms
13	sp1	-25	25	1	0	-0.002 V	0 Vrms	0 Vrms
14	sp2	-25	25	1	0	-0.002 V	0 Vrms	0 Vrms
15	sp3	-25	25	1	0	-0.002 V	0 Vrms	0 Vrms
16	sp4	-25	25	1	0	-0.002 V	0 Vrms	0 Vrms
17	cu1	-25	25	1	0	0.0465 mA	0 mArms	0 mArms
18	cu2	-25	25	1	0	0.0111 mA	0 mArms	0 mArms

Inspect the report.

- The bias voltages (Level) of CCS sensors shall be between 11 and 14 Volts
- The bias voltages (Level) of the AS-247 MEMS sensor on Channel 11 and 12 (if present) shall be between 1.5 and 3 Volts
- Put a piece of metal in front of the rotational speed sensor. It shall show approximately 25 V. The 50/60Hz noise shall be in the mV range

11.5 Make Tap Test of the Accelerometers

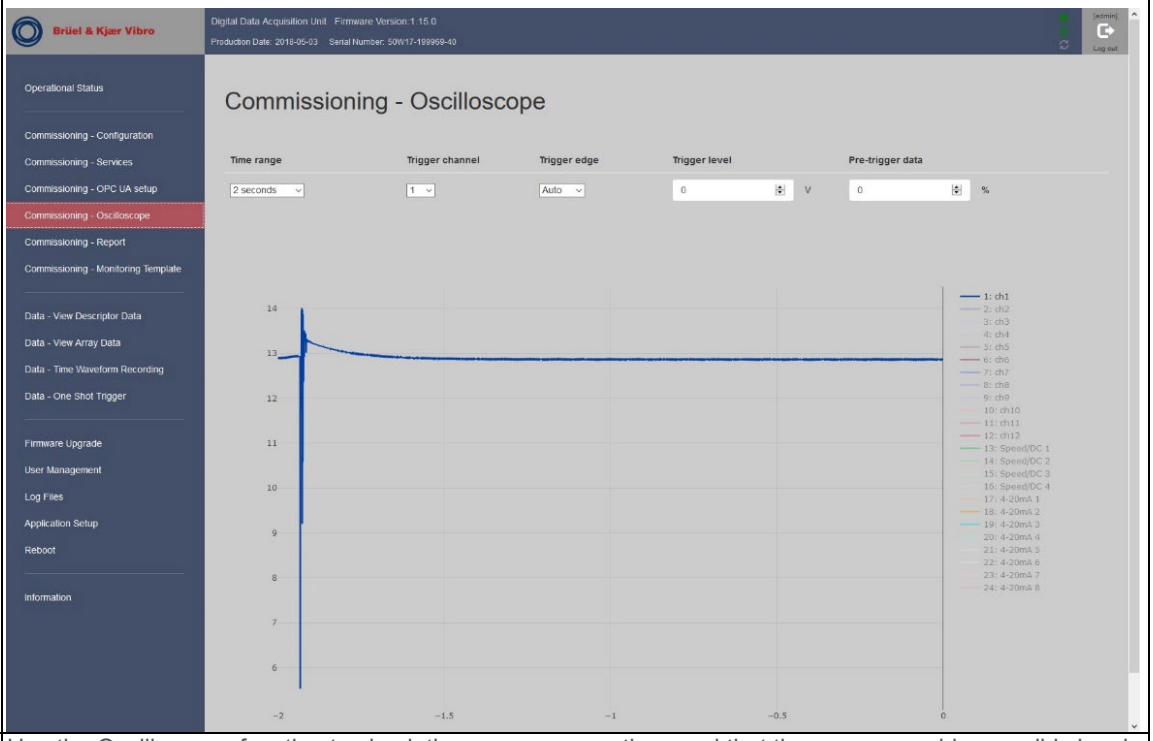
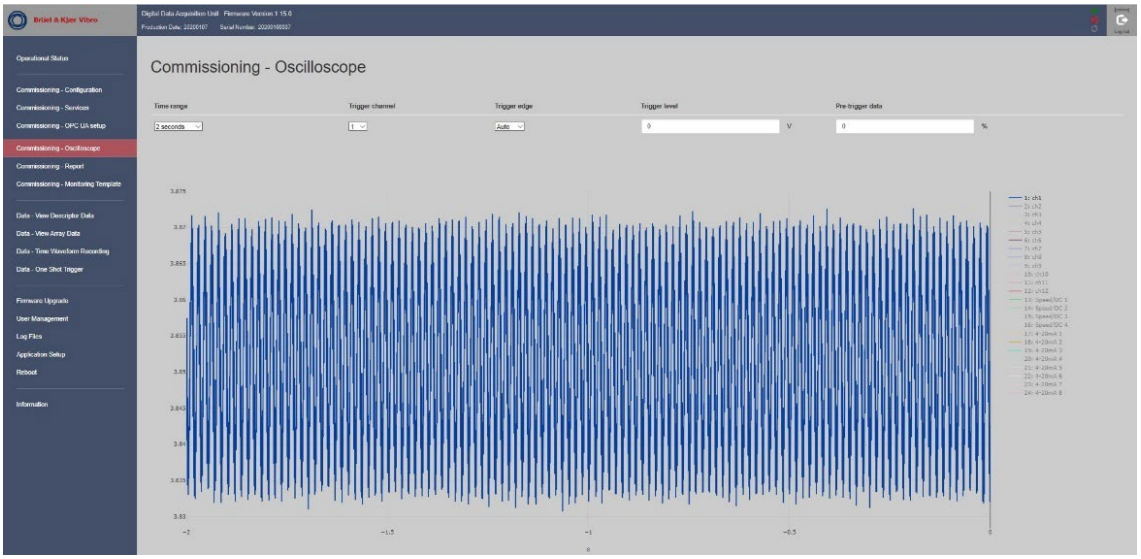
The tap test allows you to check the signal from each connected accelerometer and the speed sensor using the Oscilloscope function on the VCM-3 Homepage. In addition, it can be checked whether the sensors are connected correctly to the VCM-3 input channels.

INFO

The intended use of the Oscilloscope function is during commissioning to check the input channel signal (raw sensor signal).
The Oscilloscope function should only be used with the factory monitoring template for commissioning.
By using this function with other templates than the commissioning (factory monitoring) template, the Oscilloscope plot can freeze or the VCM-3 Homepage becomes unresponsive.
When this condition occurs, the user usually has to call up another function on the VCM-3 Homepage and then return to the Oscilloscope view.

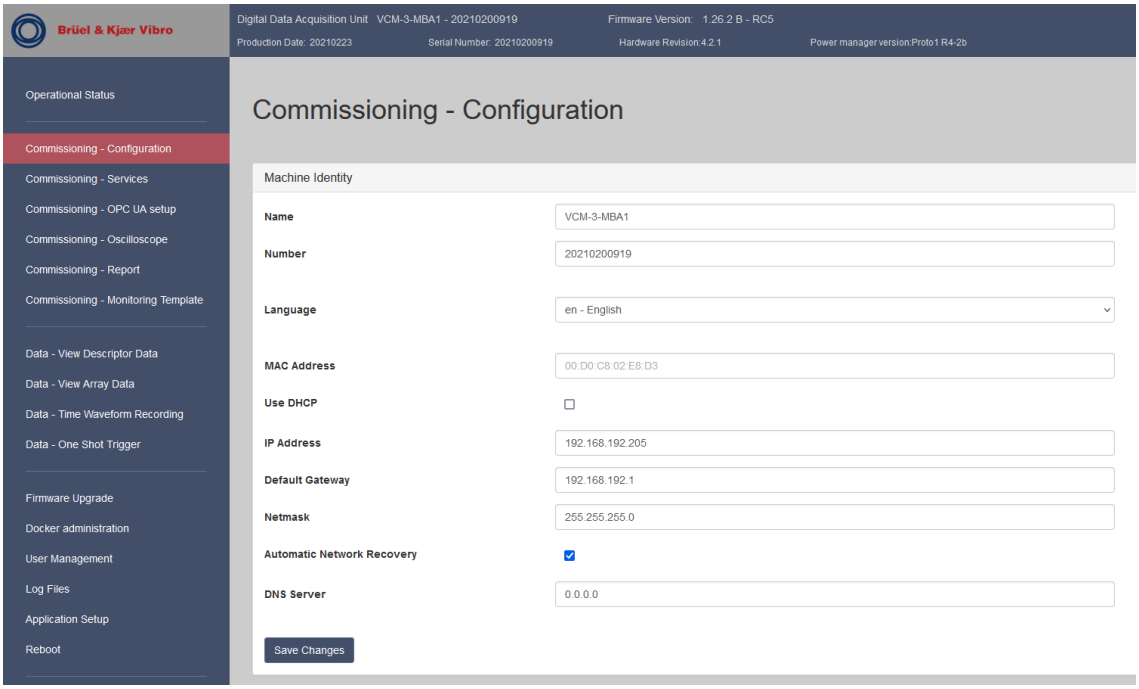
INFO

The measurement functionality of the VCM-3 is not affected by this behavior! All measurement functions of the VCM-3 hardware/firmware continue to run, alarm states are registered, and communication via MODBUS or OPC is maintained.

Select the Oscilloscope window on the VCM-3 Homepage	
1	The oscilloscope shows the time waveform from all sensor signals. When tapping each of the accelerometers you can check whether the respons from the accelerometer appears on the expected channel. The update rate of the display can be adjusted so it is possible to tap a group of sensors in a certain sequenceand then check the result afterwards. 
2	Use the Oscilloscope function to check the sensor connections and that the sensor provides a valid signal. 

11.6 Configuration

> **INFO**
>
> It is essential that this manual process is done correctly, otherwise you may require an extra visit to rectify the information.

Configure network and machine specification	
1	Select the **Commissioning – Configuration** page on the VCM-3 Homepage.  For further details see chapter 12.4.
2	On the **Commissioning – Configuration** page – provide following data • Name: Enter a machine name • Number: Enter a number • Language: Select available language If you want to use DHCP activate by selecting “Use DHCP”. Or provide • IP Address • Default Gateway • Netmask
3	Remember to click **Save Changes**

11.7 Document the completed Commissioning Process

Use the Commissioning Report feature to document the final commissioning result.

11.8 Completing On-site Commissioning – Visible Check

> **INFO**
>
> This visible check assumes that the VCM-3 is running the factory monitoring template.

When commissioning has completed, the VCM-3 front panel shall look as shown in the following picture.

LED color	Explanation
Network Flashing	On – flashing green. The LED on the connector where a LAN cable is connected flashes green. The VCM-3 is connected to the network.
Status – System	On – Blue, indicates that the VCM-3 is **not** connected to a server in the condition monitoring centre. On – Green, indicates that the VCM-3 is connected to a server in the condition monitoring centre. Both states are valid depending upon the actual network state.
Status – System	
Status – System	On – White, VCM-3 is commissioning BKV Go (Firmware Version 1.26.2 and higher).
Status – Template	The factory template is loaded and running.
Status – Online	A green color shows that the VCM-3 can ping the specified gateway. This tells that the VCM-3 is integrated into the network setup.
Boot Status	On – Green. This indicates the the VCM-3 has completed it's boot procedure
DI/O	On – Green, as Modbus is enabled in the factory template.
DO	Off – as the digital output is not in use.
DI	Off – as the digital input is not in use.
AC/DC	On – Green, input channels which are wired to an accelerometer. In this example channel 1–9.
AC/DC	On – Blue, input channels which are configured as constant current source (CCS) accelerometers, but not wired to an accelerometer.
AC/DC	On – Blue, input channels which are configured for an AS247 MEMS sensor with 24V supply, but not wired to a sensor.
Speed/DC Speed/DC	On – Green, as all Speed/DC sensor inputs are enabled in the factory template If the machine is rotating slowly or you put a piece of metal in front of the mounted speed sensor, the corresponding LED will flash between light green and dark green.
4-20mA	On – Green, as all 4–20 mA sensor inputs are enabled in the factory template.

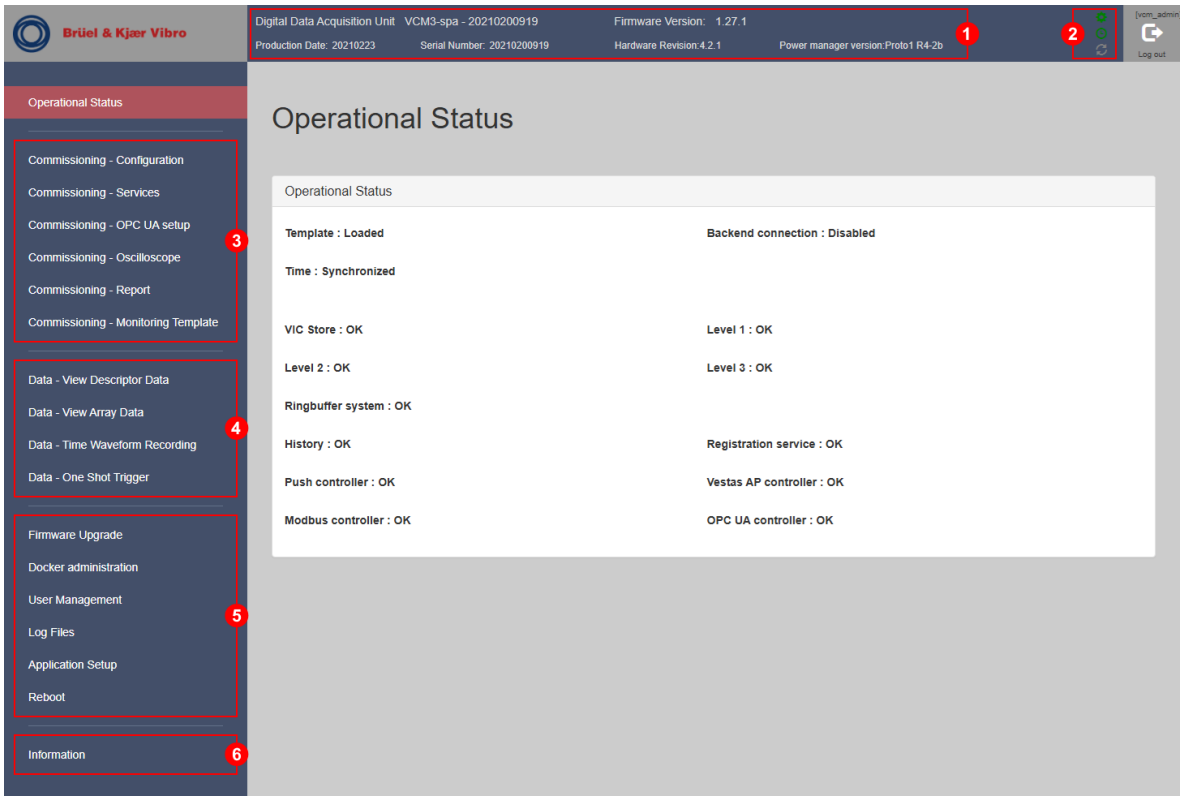
12 The VCM-3 Homepage

12.1 Introduction

The configuration of VCM-3 is done via the VCM-3 Homepage. No software installation required. The VCM-3 Homepage is divided into three main blocks:

1. Commissioning configuration: This part is utilized during initial on-site commissioning of a machine and for later adjustment by remote access if required.
2. Remote/On-site check of descriptors, time waveforms (input channel/sensor raw signal and frequency spectra.
3. Administrative configuration: This part is used by system administrators. Normally this is done through remote access when the system has been commissioned at the machine.

Please find below an overview of the VCM-3 Homepage.



1	System information with serial number, firmware version, build date, and power manager version
2	Icons showing the state of the device. From top indicating the following: If template is running If VCM-3 is time synchronized
3	Menu functions for commissioning support
4	Menu functions for online check of descriptor measurements, time waveforms and frequency spectra
5	Menu functions for VCM-3 system administration
6	Help functions

12.2 Login and Default IP Address

On first time login to the VCM-3, you may use the following credentials:

Administrator Users
A user which has administrator rights on the VCM-3 Homepage. All parts of the VCM-3 Homepage can be altered by this user including create and modify users.

Username: **vcm_admin**
Password: **VCM3-CMS-Management**

Username: **admin**
Password: **DDAU3-CMS-Management**

Service Users
All parts of the VCM-3 Homepage can be altered by this user except create and modify users.

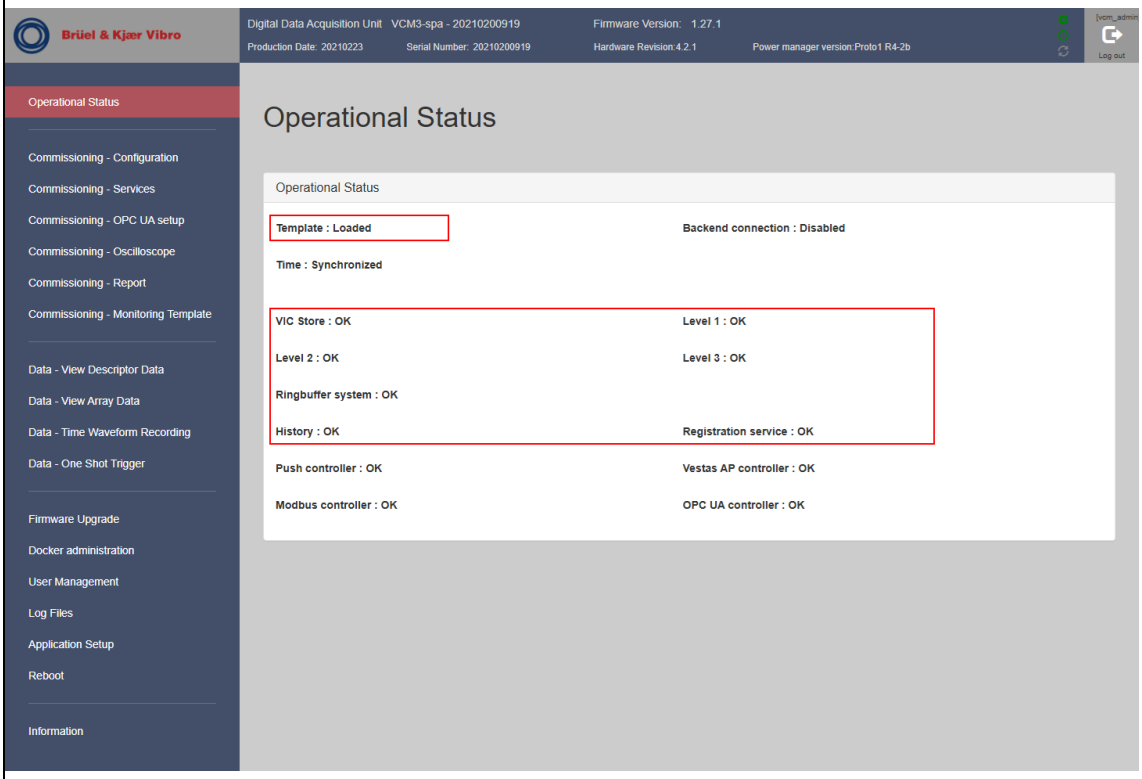
Username: **vcm_service**
Password: **VCM3-Service**

Username: **service**
Password: **DDAU3-Service**

Ordinary User
A user with privileges only to view the content of the homepage is available.

Username: **user**
Password: **Good-Vibrations**

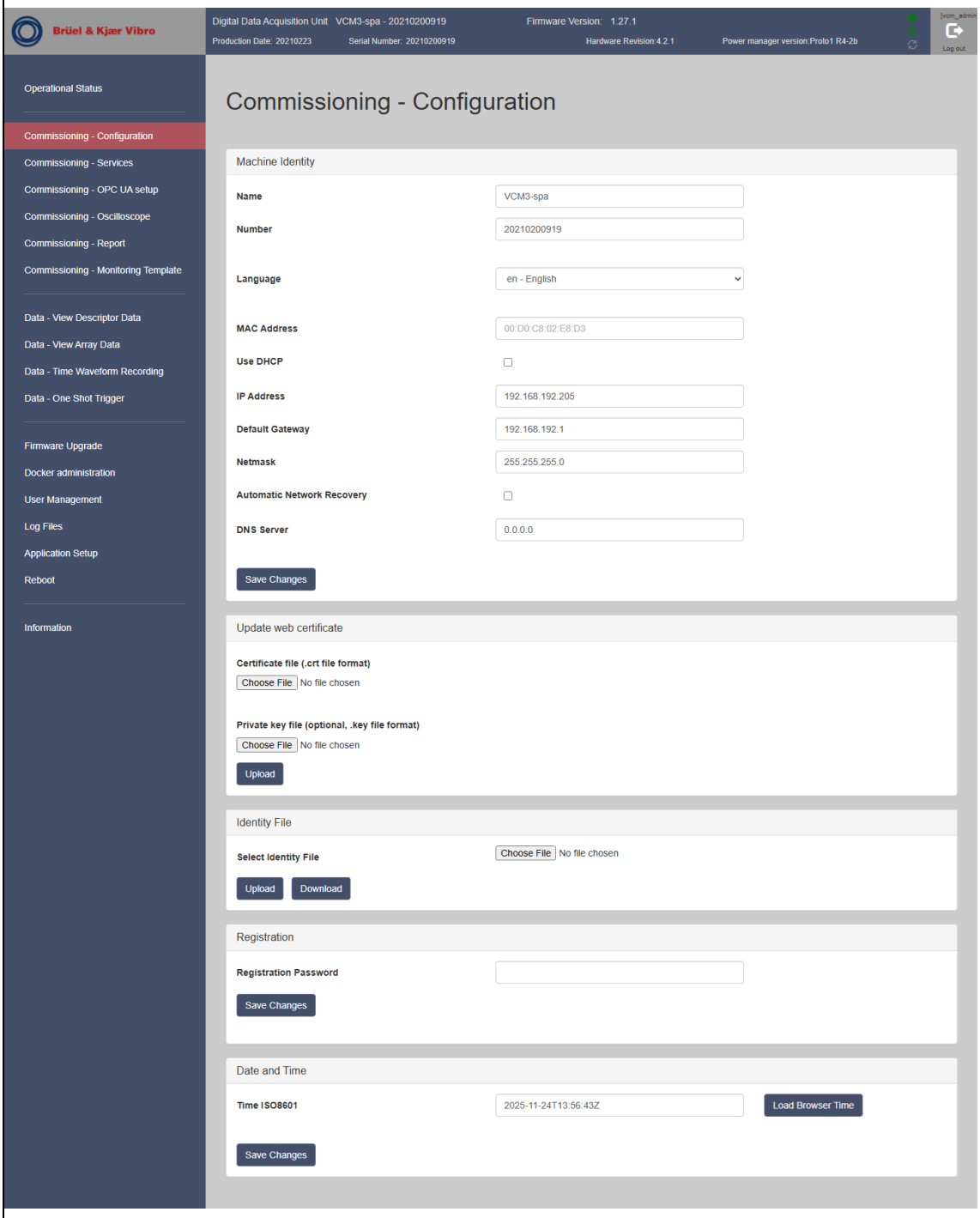
12.3 The Operational Status Page

How to inspect the Operational Status page	
1	 After login the Operational Status page is shown. This page gives an overview of the present status of the VCM-3. As a rule, the status indicators in the red boxes must have the status as shown on the screenshot. Otherwise, there is a problem with the VCM-3. The other status indicators are dependent upon the state of the commissioning procedure.
2	If the status indicators in the red boxes show a different result, try to reboot the VCM-3 and inspect the Operational Status page again. 1. Reboot the VCM-3 and check if the problem disappears. The reboot activates some repair facilities. 2. If 1) does not help, please upgrade the firmware. 3. If 2) does not help, contact Brüel & Kjær Vibro Technical Support.

12.4 Commissioning – Configuration

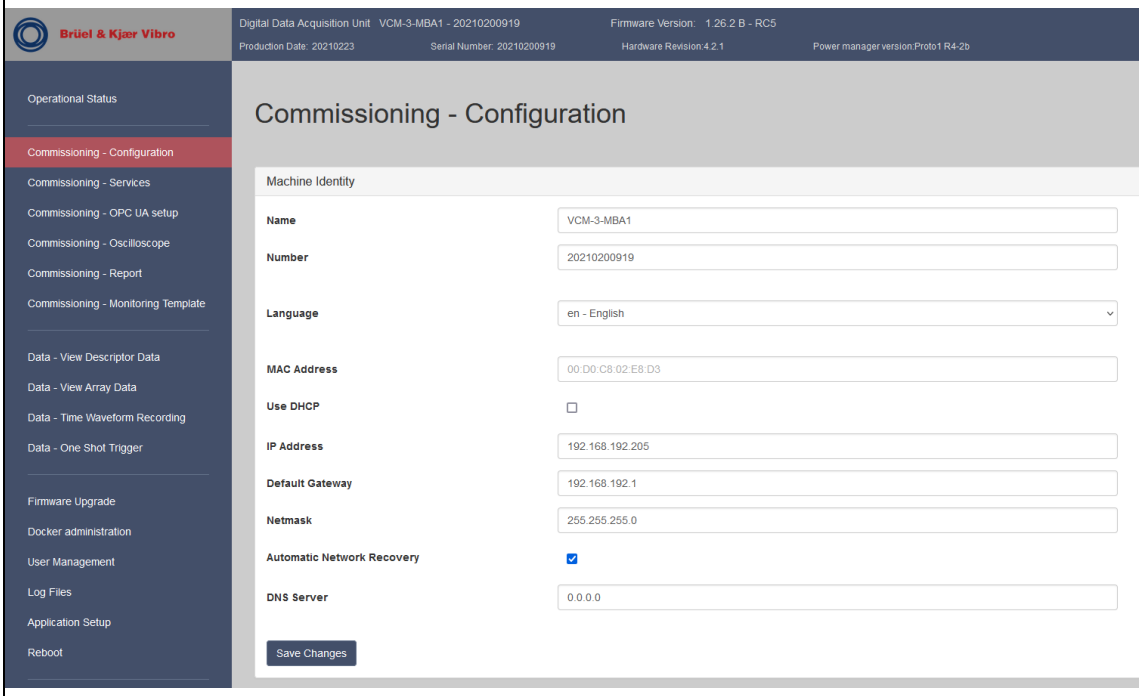
How to enter VCM-3 network parameters

1 Select Commissioning - Configuration from the VCM-3 Homepage menu



Machine Identity

1



Enter **Name** and **Number** of the monitored machine.
These fields are used to identify the VCM-3 data records.

2

Either activate DHCP by selecting “Use DHCP” or change the fields

- IP Address
- Default Gateway
- Netmask

as required from the site.
Specifying a **DNS Server** is not required unless the built-in OPC Client is used and the OPC Client is using certificates as part of the security settings.

> **INFO**
>
> Activating **DHCP** requires a DHCP server in your network. Check with your local IT administrator.
> **Automatic Network Recovery** is designed for keeping the device networking ability alive in noisy network environments. It requires that the Default Gateway will return ICMP echo (ping) requests.

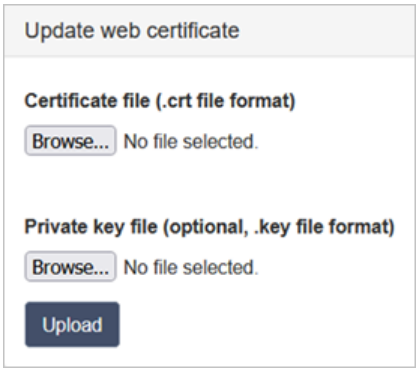
3

Click **Save Changes**. Contact may be lost to the VCM-3 due to IP address changes.
Close the Homepage and log in again.

<table>
<tr><th colspan="3">Update web certificate</th></tr>
<tr><td>1</td><td colspan="2">It is possible to upload your own certificate and private key to enable (HTTPS) secure, authenticated, and tamper-proof communication between the web browser (client) and the VCM-3's web server.

To update the web certificate, login as user “admin” or user “service”.

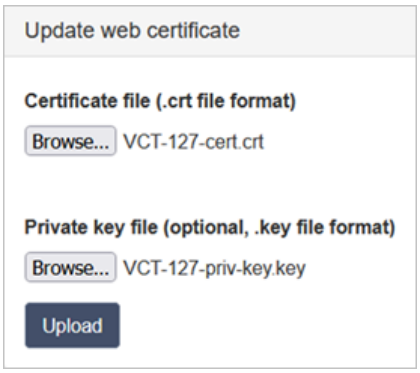
• Select "Commissioning – Configuration"
• Scroll down to "Update web certificate"

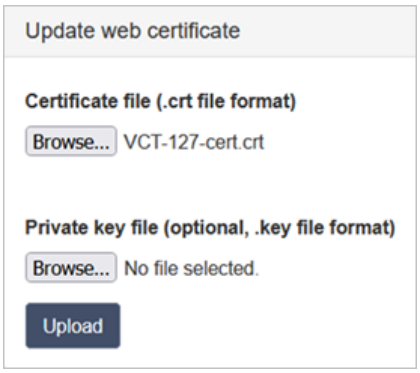
 
</td></tr>
<tr><td></td><td>Update Certificate and Private Key</td><td>Update Certificate only</td></tr>
<tr><td>1</td><td>Click on "Browse / Choose file" under "Certificate file (.crt file format)".

• Select your certificate file

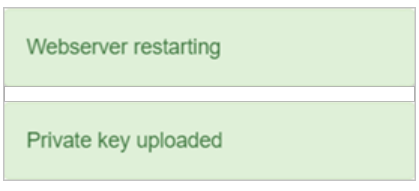
Click on "Browse / Choose file" under "Private key file (optional, .key file format)".

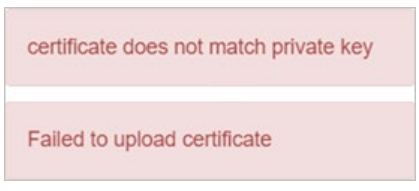
• Select your private key file</td><td>Click on "Browse / Choose file" under "Certificate file (.crt file format)".

• Select your certificate file</td></tr>
<tr><td>2</td><td> 

Click "Upload"</td><td> 

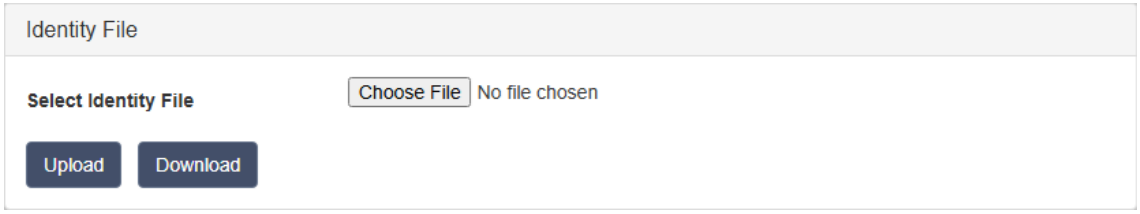
Click "Upload"</td></tr>
<tr><td>3</td><td>If successful you will get a notification at the bottom of the web page.

 
</td><td>NOTE: If you get an error message (see picture below) make sure that you either have a certificate that matches your private key or upload the certificate and the private key.

 
</td></tr>
<tr><td>4</td><td>Restart your browser.</td><td>Restart your browser.</td></tr>
</table>

Identity File

1

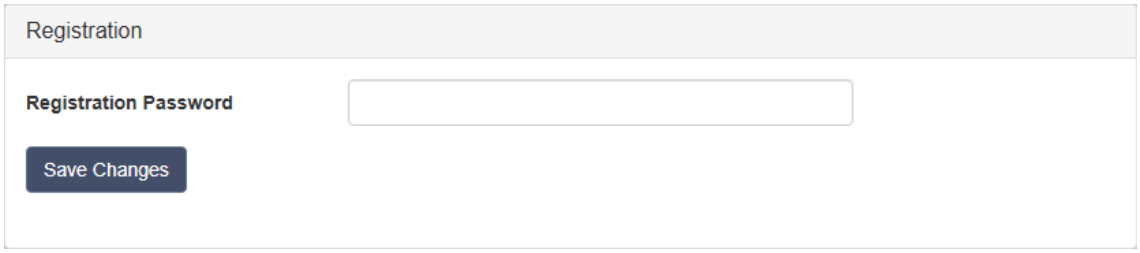


INFO

Not relevant for VCM-3 users.

Registration

1



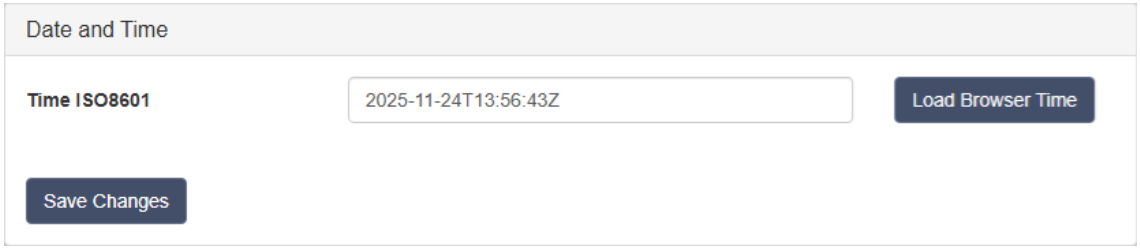
INFO

Not relevant for VCM-3 users.

Date and Time

1

You may update the date and time of the VCM-3 by loading the browser time.

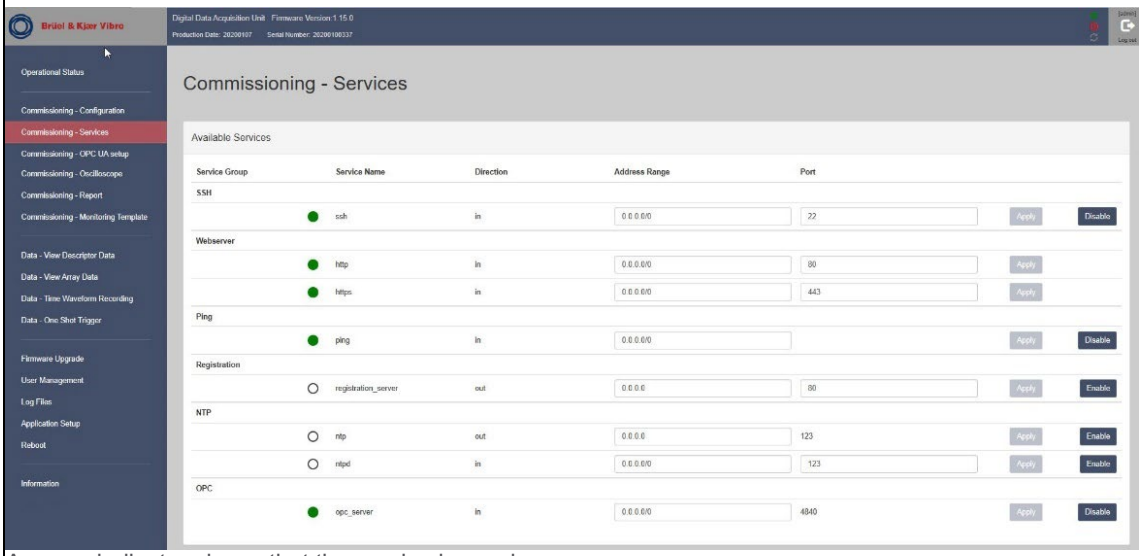


INFO

This time might belong to a different time zone. It may influence the time stamps in the log files.

12.5 Commissioning – Services

The VCM-3 contains several services. Use this page enable or disable services, specify relevant IP addresses, configure the VCM-3 firewall by specifying allowed IP address ranges for clients contacting VCM-3.

How to configure VCM-3 Commissioning - Services	
1	 A green indicator shows that the service is running. Click **Apply** to save an entry of IP address or port number.
2	**SSH (server)** Configure allowed address range for SSH clients. Click **Apply** to save configuration.
3	**Webserver** Configure allowed address ranges for clients to the http and https services. The default port number for these services can also be changed. Click **Apply** to save configuration.
4	**Ping** Allow other devices to ping the VCM-3. You may specify the IP range of the devices which is allowed to ping.
5	**NTP (server)** Configure the address of the NTP server used for time synchronizing the VCM-3. Click **Apply** to save the configuration. The port number for the NTP time synchronization cannot be changed.
6	**OPC (server)** Allow OPC Clients to read data from the VCM-3 by enabling the OPC Server. Specify the allowed IP address range for OPC Clients and start the service. **INFO** Usage of the VCM-3 OPC Server requires that the VCM-3 monitoring template has been configured with the namespace and other settings of the VCM-3 OPC Server.

12.6 Commissioning – Oscilloscope

Use the Oscilloscope function to view the raw time waveform recorded from each of the sensors while commissioning. Use the Oscilloscope function to check the sensor connections and that the sensor provides a valid signal.
For further information see chapter 11.6.

INFO

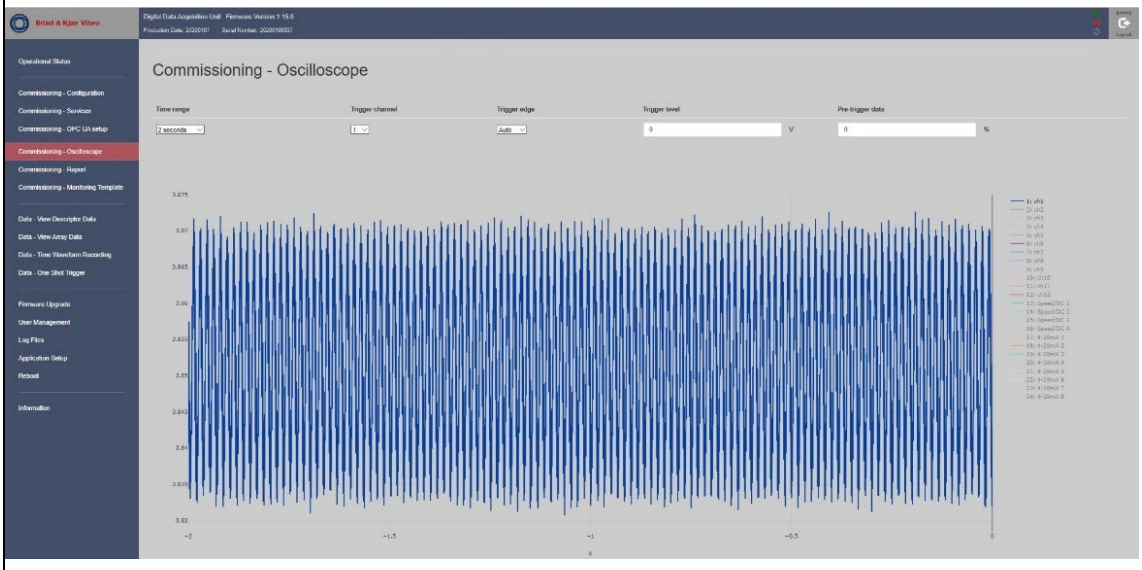
The intended use of the Oscilloscope function is during commissioning to check the input channel signal (raw sensor signal). The Oscilloscope function should only be used with the factory template for commissioning. By using this function with other templates than the commissioning (factory) template, the Oscilloscope plot could freeze, or the VCM-3 Homepage could become unresponsive. When this condition occurs, the user usually must call up another function on the VCM-3 Homepage and then return to the Oscilloscope view.

INFO

The measurement functionality of the VCM-3 is not affected by this behavior.
All measurement functions of the VCM-3 hardware/firmware continue to run, alarm states are registered, and communication via MODBUS or OPC is maintained.

How to view the raw time waveform of a sensor signal in an Oscilloscope display

1

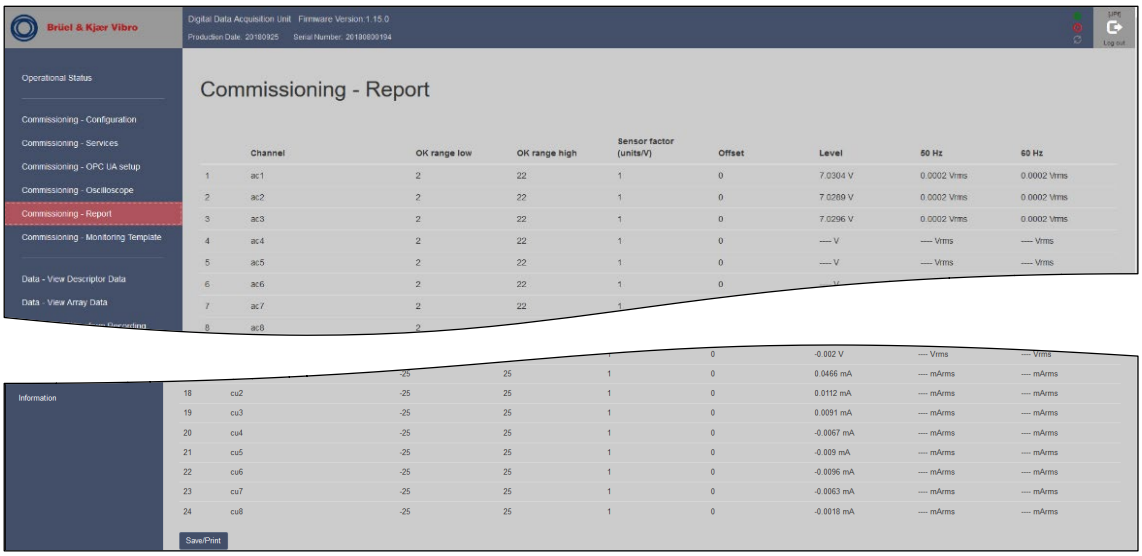


12.7 Commissioning – Report

This page shows the DC value of all sensors and the value of the 50 Hz and 60 Hz component.

> **INFO**
>
> This function is only supported with an activated Factory Monitoring Template, which must not be exchanged with the Standard Monitoring Template and/or the customized Monitoring Template.

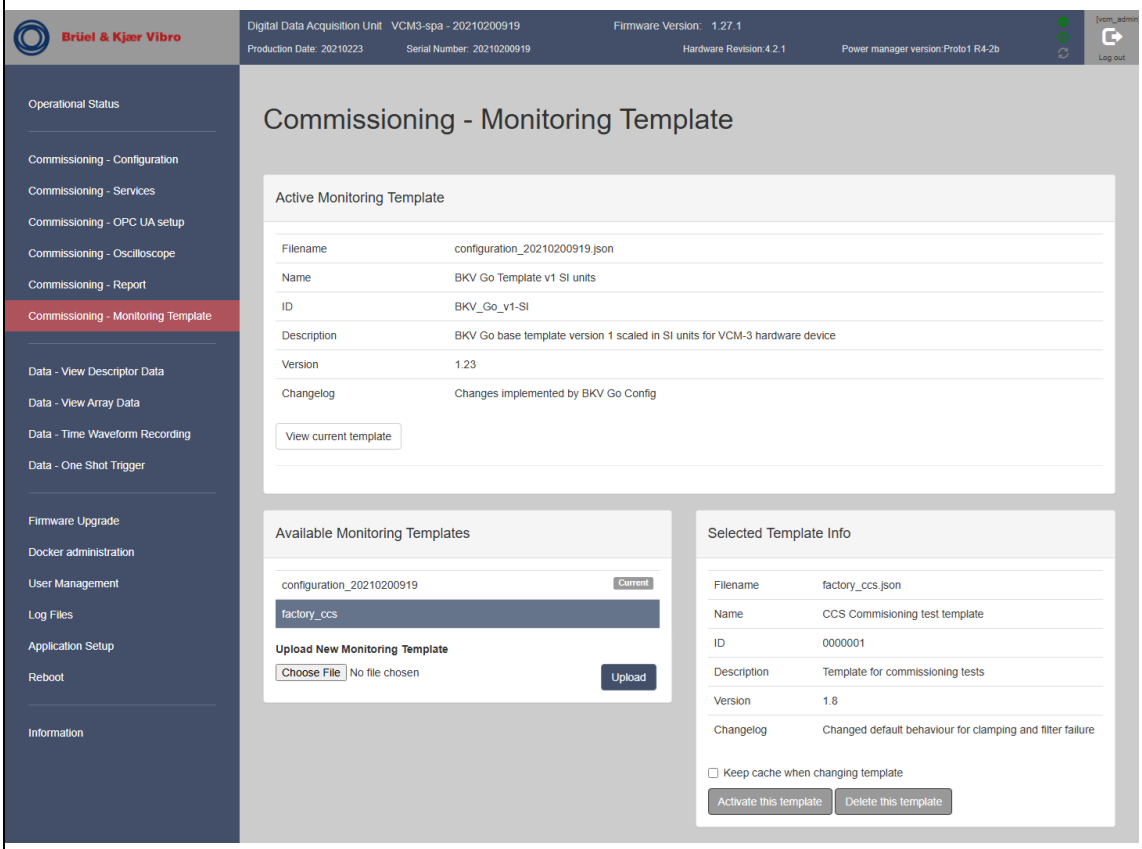
When commissioning has been completed a report with commissioning details can be printed or saved to a PDF file.
This PDF file also contains all current IP settings of the VCM-3 as well as the username of the current user.

How to view a Commissioning Report	
1	Select Commissioning - Report from the VCM-3 Homepage menu
2	

Download the Commissioning Report to the service PC	
1	Save the report by clicking **Save/Print** at the bottom of the Commissioning Report page. A print window is automatically opened. Select the save to PDF feature in the print window. Save the report with a machine name or number and the IP address. Then it is easy to recognize again.
2	The saved Commissioning report contains: • Machine Name • Machine Number • Firmware Version • Serial Number of VCM-3 • IP Address • MAC Address • Default Gateway • Netmask • DNS Server • Enabled services • Active monitoring template • Identification of the user • Bias voltages and 50/60Hz noise

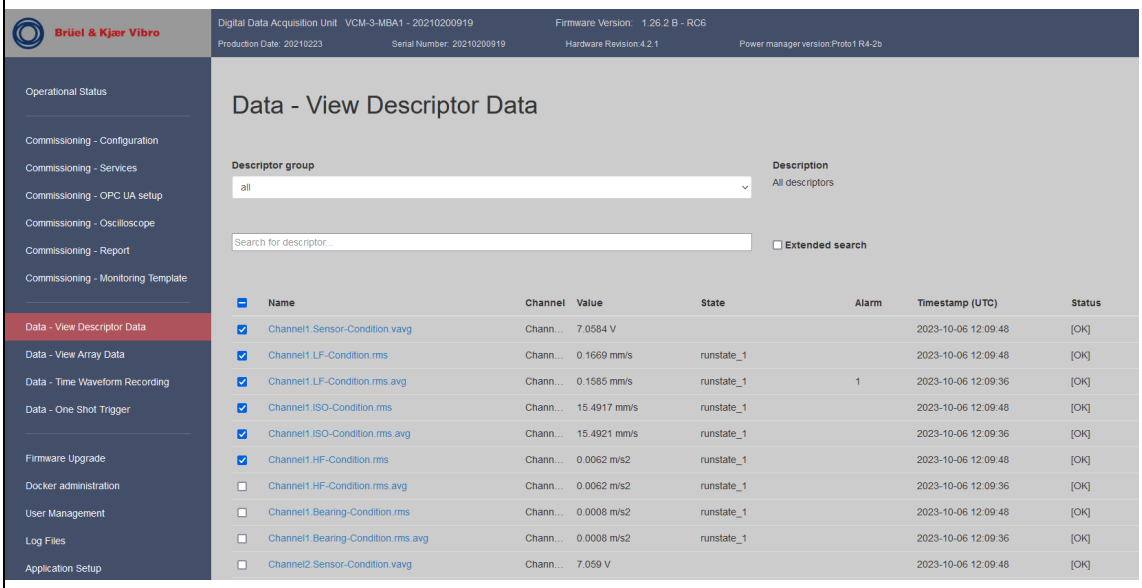
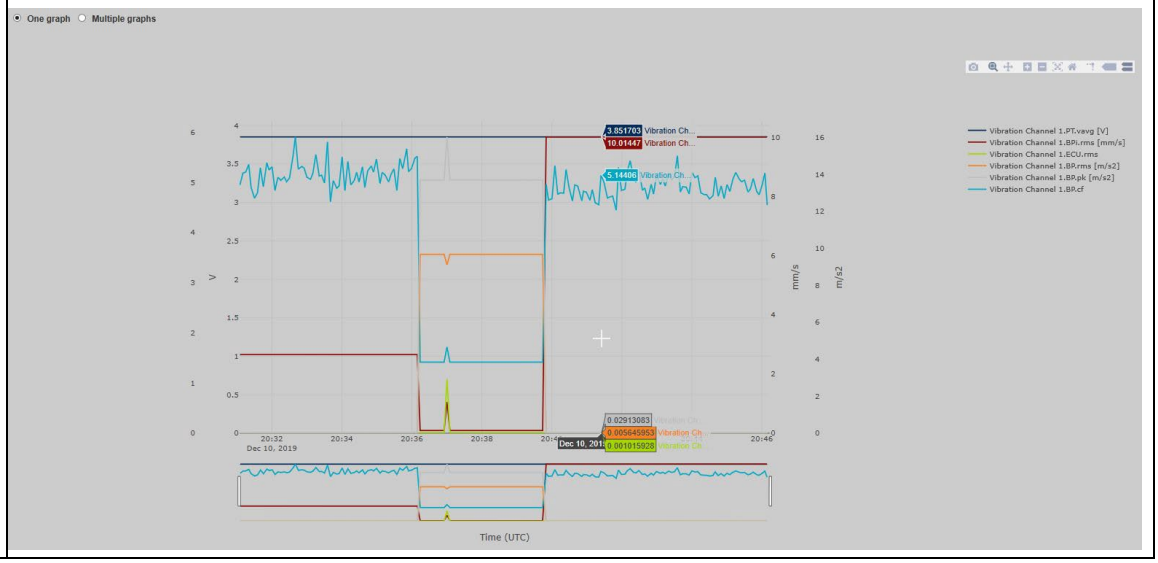
12.8 Commissioning – Monitoring Template

The VCM-3 is configured using Monitoring Templates. This page is used to upload new templates and change monitoring configuration by selecting another template.
Several monitoring templates may be uploaded simultaneously but only one monitoring template can be the active template.
The upper part of the page shows details about the active monitoring template. The lower part is used to upload and change the active template.

How to upload and change to a new (modified) Monitoring Template	
1	 The Monitoring Template file must be available on the PC where you are running the VCM-3 Homepage.
2	Click **Choose file** and browse to the folder on the laptop which contains the monitoring template. Select the required template.
3	Click the **Upload** button to upload the template to the VCM-3. The new template will be added to the list of **Available Monitoring Templates**.
4	Select the required template. A description of the template will appear in the window to the right. Click **Activate this template** to make the template operational, the text in the upper part of the window will change to the selected template.

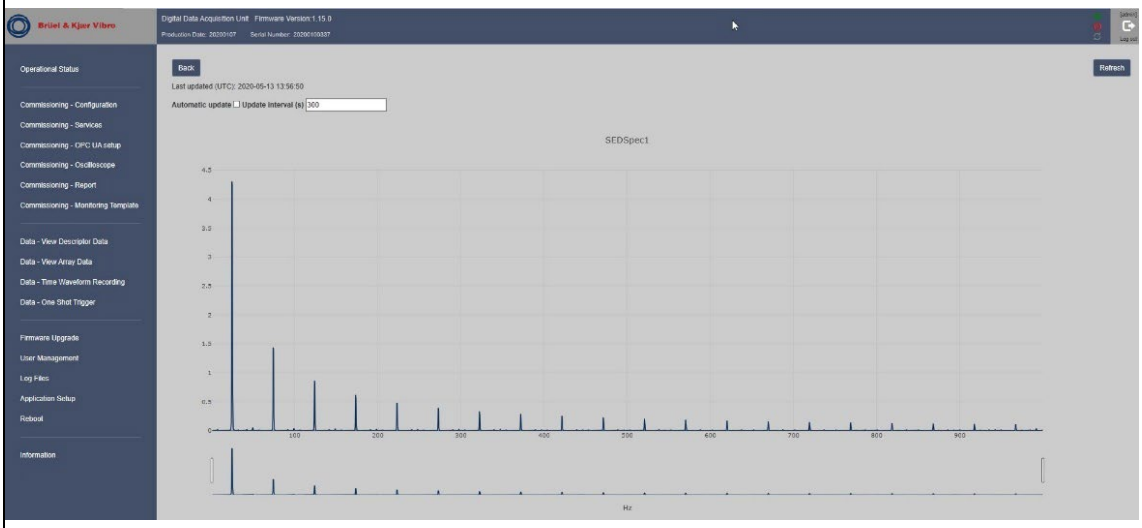
12.9 Data – View Descriptor Data

All descriptor (measurement) values measured by the VCM-3 can be viewed on this page. A selection of maximum six descriptor values can be plotted as a continuously updated trend curve.

How to View Descriptor Data	
1	 All descriptor data can be viewed in the list if “all” is selected in the **Descriptor group** list.
2	If descriptor groups have been defined in the monitoring template the list may be shortened down by selecting one of these groups. E.g., a group may have been defined for all descriptors measured on a gearbox high speed stage or another group may be defined to show all ISO RMS values in the template.
3	Use the search field to display desired descriptors in the list. Key in more than two letters, to find desired elements in the list.
4	Use the checkboxes to the left of the list to select descriptors for trend display. A maximum of 6 can be selected simultaneously.
5	Scroll to the bottom of the list to view the trend curves for the parameters. Display them as an overlay plot or as a single plot for each descriptor. 

12.10 Data – View Array Data

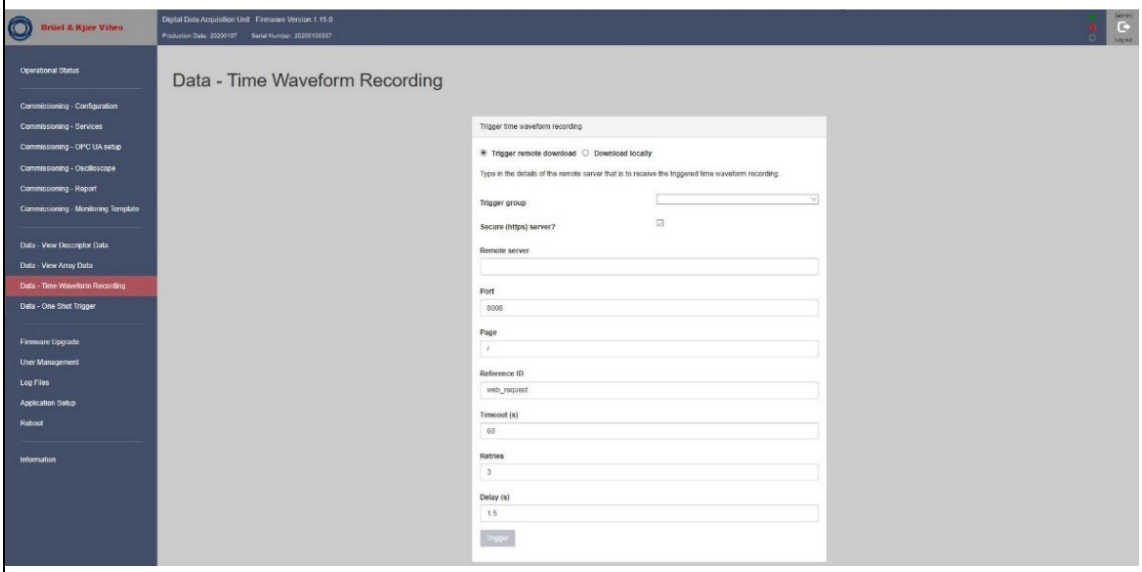
The Array data which have been configured in the template can be displayed.
That is, Auto-spectrum, Envelope spectrum, Cepstrum etc.

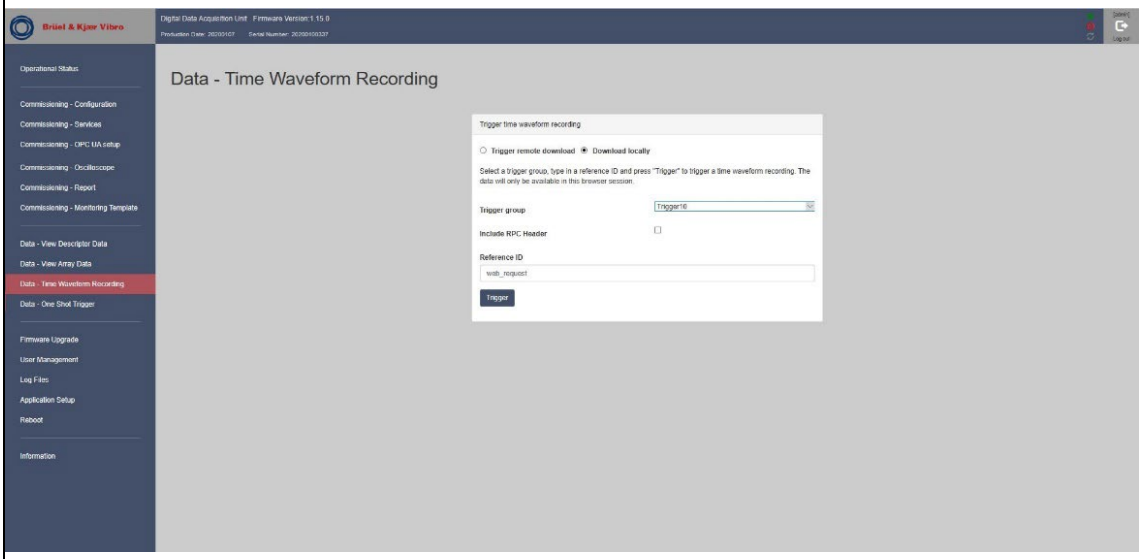
How to View Array Data	
1	Click the desired array measurement from the list 
2	 After a little while – please be patient - the array measurement is displayed. The update rate is defined in the template; it will normally be around 15–20 seconds.
3	Select **Automatic update** to get the spectra updated automatically.
4	Click **Refresh** to update the plot manually.

12.11 Data – Time Waveform Recording

> **INFO**
>
> Usage of this function requires that a minimum of one-time waveform trigger and one ring buffer have been defined in the monitoring template.
> You must have a description of the configured triggers and ring buffers in the actual template as a help to configure time waveform recording.

This function can be used to initiate an immediate download of time waveform files to a remote server or the PC running the browser with the homepage. The download format is a .json file.
This can be applied by a diagnostic engineer when a machine fault is suspected.
If the time waveform is downloaded to a server or directly to the PC, a conversion program is required which can convert the .json file to a format which is compatible with the tools for further analysis.

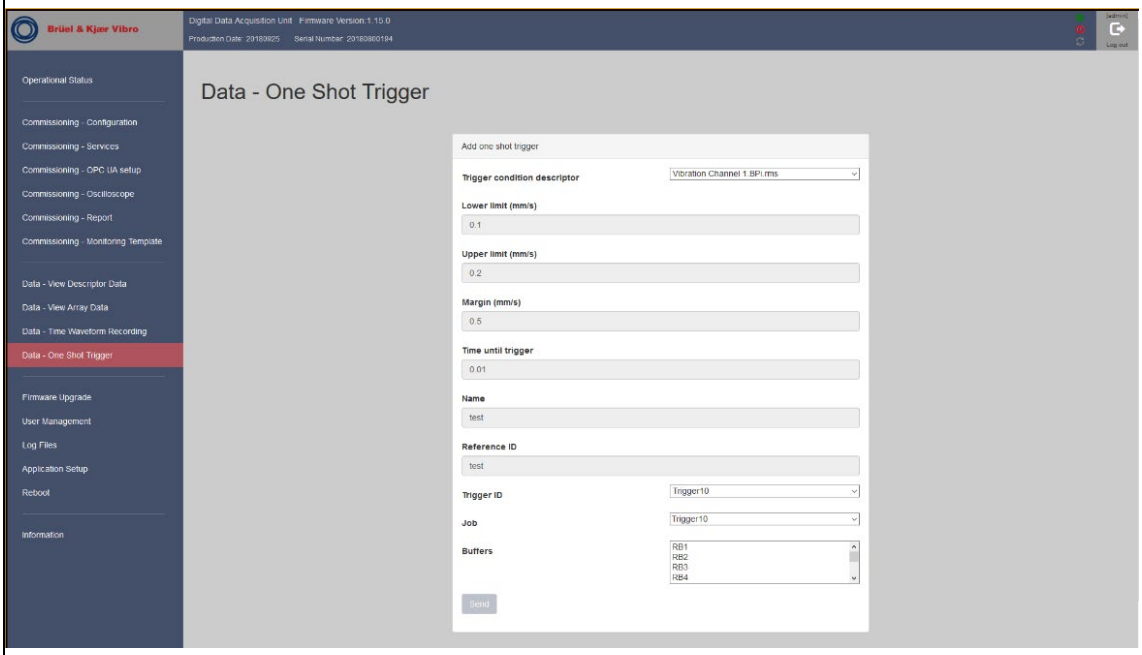
How to initiate a Time Waveform Recording with download to a remote server	
1	 Select **Trigger remote download**
2	Select the **Trigger group**. The trigger group is defined in the monitoring template and defines which ringbuffers shall be downloaded when the trigger is activated.
3	Specify the IP address of the **Remote Server.** A web service on the remote server must be available to receive the download request from the VCM-3.
4	Enter a **Reference ID.** This is a free text string used to identify the particular download.
5	Specify **Timeout(s).** The remote server must have responded within the time specfied.
6	Specify number of **Retries** in case of timeout
7	Specify **Delay(s).** This is the period of time between retries
8	Click the **Trigger** button to activate the download

How to initiate a Time Waveform Recording with download to a local PC	
1	 Select **Download locally.**
2	Select the **Trigger group.** The trigger group is defined in the monitoring template and defined which ringbuffers shall be downloaded when the trigger is activated.
3	Specify if RPC header shall be included in the downloaded .json file. This is used if the files shall be sent to a remote WEB service
4	Enter a **Reference ID.** This is a free text string used to identify the particular download
5	Click the **Trigger** button to activate the download

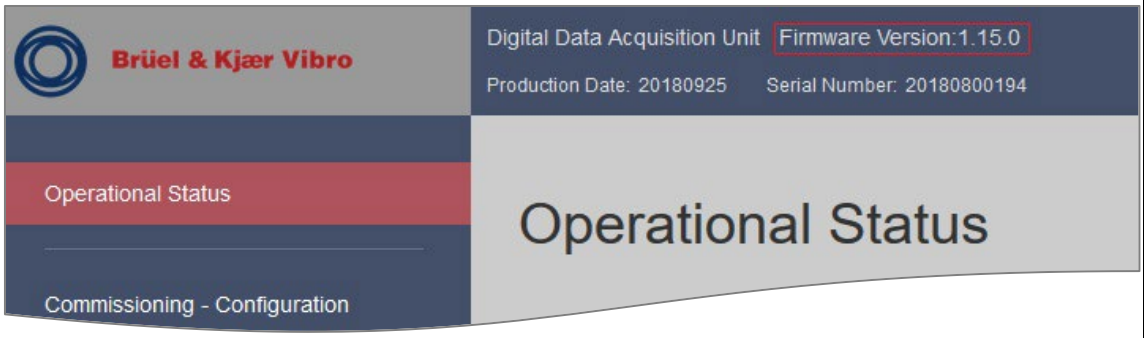
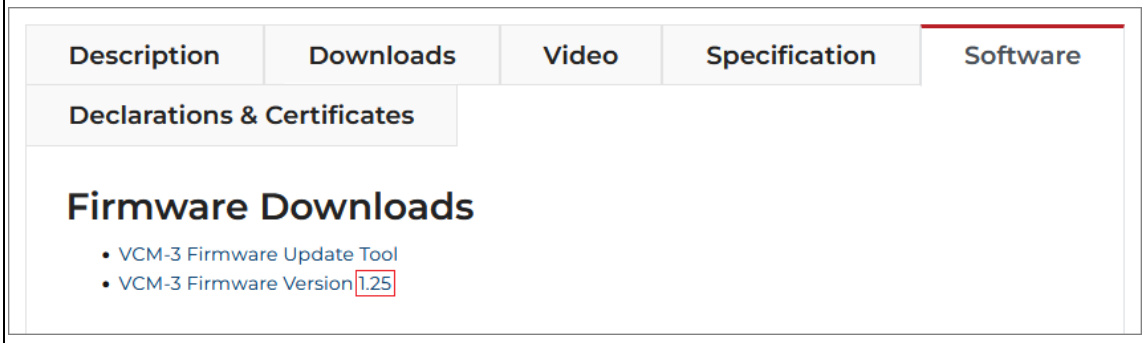
12.12 Data – One Shot Trigger

> **INFO**
>
> Usage of this function requires that a minimum of one-time waveform trigger, one ring buffer and one push job have been defined in the monitoring template.
> You must have a description of the available triggers, ring buffers and jobs in the actual template as a help to configure the One-Shot Triggers.

The One-Shot Trigger is activated once and then forgotten by the VCM-3. Cyclic triggers can be defined via the monitoring template.
A manual arming of a One-Shot Trigger can be configured via this function. Once the defined trigger condition is fulfilled the raw data in the ring buffers linked to the trigger setup is downloaded to the remote server.
The One-Shot Trigger is a tool which can help the diagnostic engineer to get data in addition to the more regular data specified in the monitoring template and to get data under a certain machine condition.
The data which is recorded as result of the defined trigger is downloaded to the server(s) specified in the selected **Job**. This is a so-called push job and must be part of the current monitoring template.
The push job contains the IP address(es) of the server(s) which shall receive the data.
If data is pushed to a server a web service on the remote server must be available to receive the download request from the VCM-3.

How to initiate a time waveform using One Shot Trigger	
1	 Select the descriptor to be used for defining the trigger condition.
2	Define the activation range for the trigger by defining the **Lower limits** and **Upper limits** of the selected descriptor.
3	Define the **Margin** and **Time until trigger**. This is a stability criterion where the margin defines the allowed variation of the descriptor in the defined time window when the descriptor value is in the activation range.
4	Select the **Trigger ID**. This ID defines which group of ring buffers shall be downloaded when the trigger is activated.
5	Select the **Job**. This defines the server destination(s) of the recorded ring buffer data.
6	Select which **Buffers** belonging to the trigger request shall be downloaded.
7	Click **Send** to activate the One-Shot Trigger.

12.13 VCM-3 – Firmware Update

Check firmware version	
1	 After the login procedure is completed, check the **Firmware Version** number in the page header.
2	Visit https://www.bkvibro.com/product/vcm-3/ and click on the **Software** tab to learn about the latest firmware version. 
Download latest firmware version	
3	If the firmware version of your VCM-3 is lower than the latest released version, your VCM-3 must be updated. In this case download the following: • VCM-3 Firmware Version x.xx includes document *"VIBRO Condition Monitoring 3 Firmware Release Notes (C107825)"* • VCM-3 Firmware Update Tool includes document *"VCM-3 Firmware Update Tool Instructions (C108141)"*
Install latest firmware version	
4	Update your VCM-3 to the latest firmware version according to the Firmware Update Tool Instructions.

Contact Brüel & Kjær Vibro Technical Support techsupport@bkvibro.com for information about updating your device.

12.14 Docker Administration

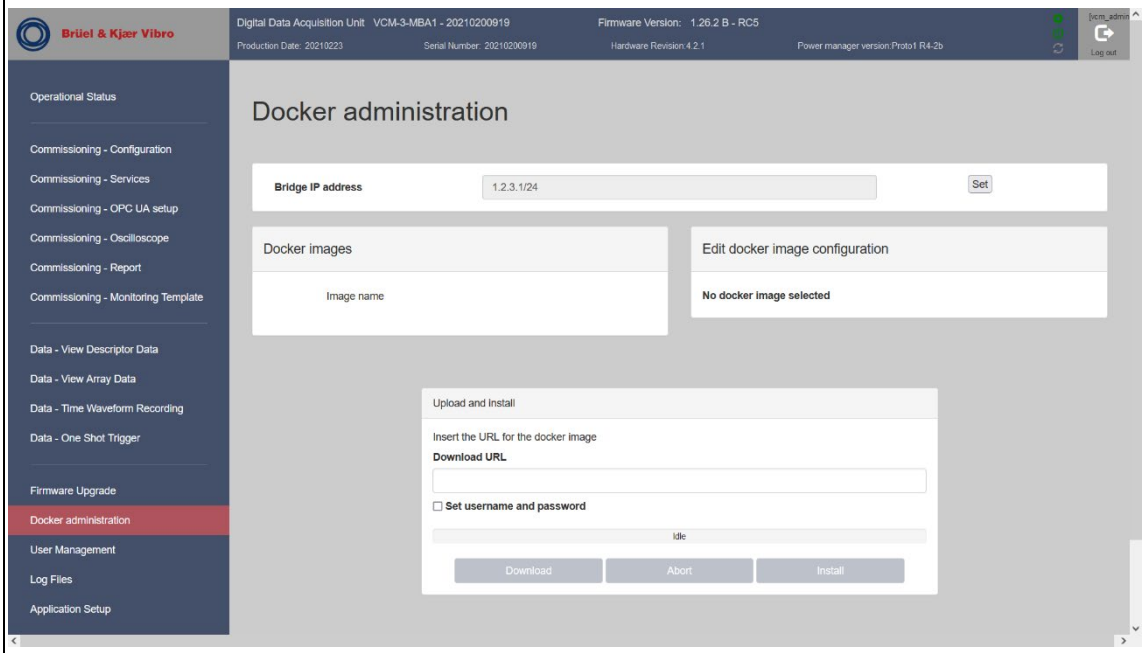
Starting with firmware version 1.26.3, the VCM-3 allows the execution of docker images.

12.14.1 Docker Installation

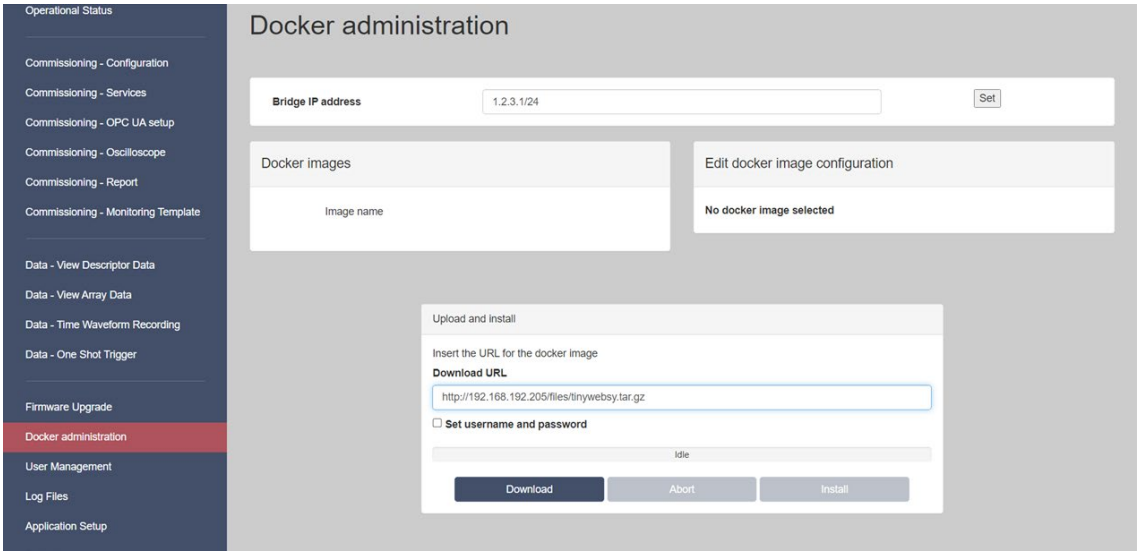
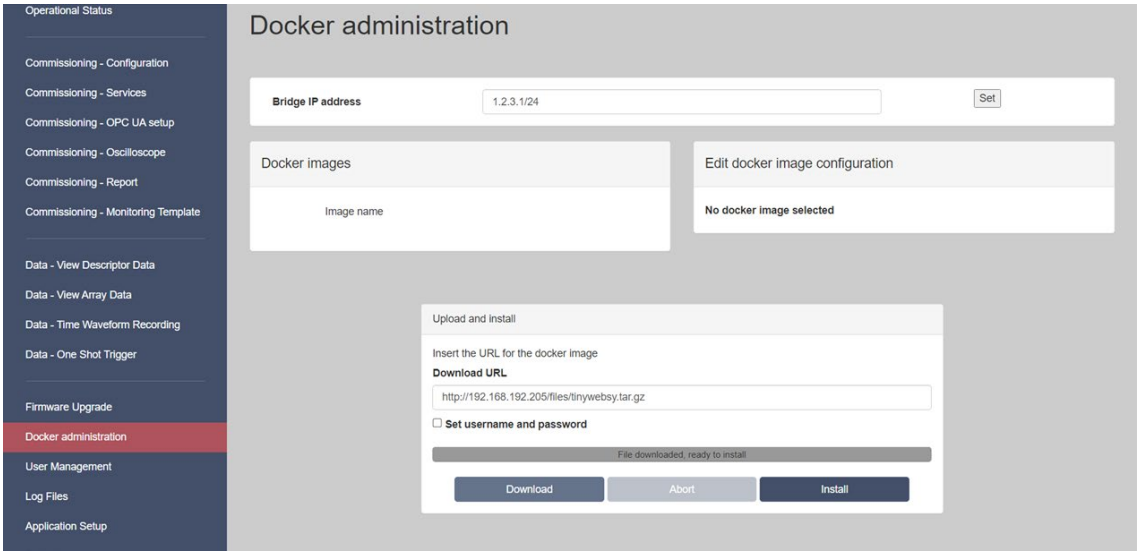
> **INFO**
>
> The VCM-3 comes with an invalid IP address range (254.254.254.0/24). This prevents the docker system from running before it is changed - but it will also protect the VCM-3 from duplicating an IP address already present on the network it is installed into. Changing this IP range should be the first thing done in a docker setup. A reboot is required the first time it is changed due to the docker system being disabled.

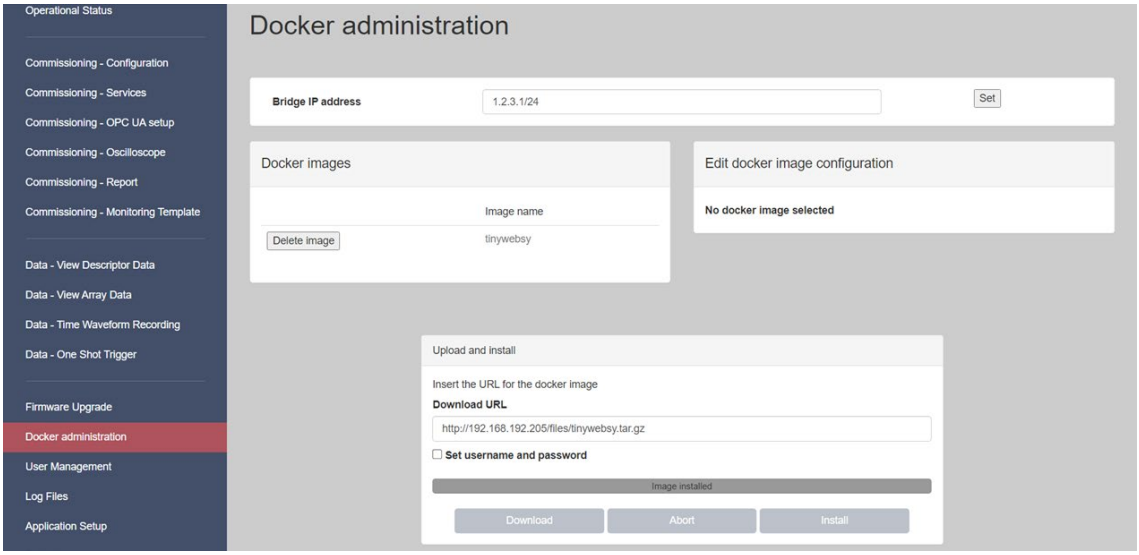
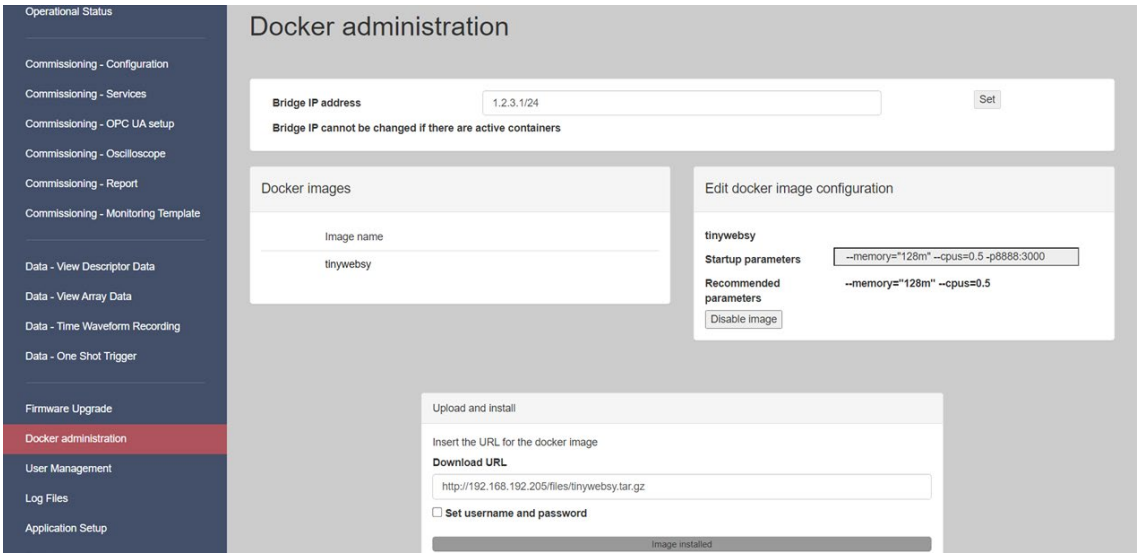
Set Bridge IP address

1



Before you can install or run any docker image, you must set up the docker's bridge IP address and the range of IP addresses it can use. To do that change the "Bridge IP address" field (format IP/range, for example 1.2.3.1/24). After providing the IP range, click the **Set** button. If it is the first time you change this, you must reboot the VCM-3.

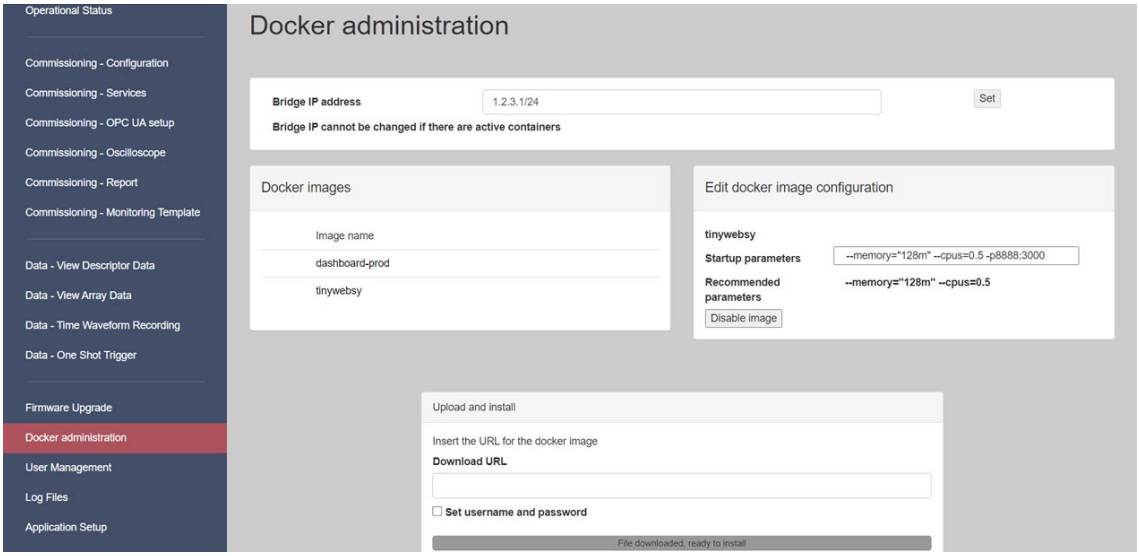
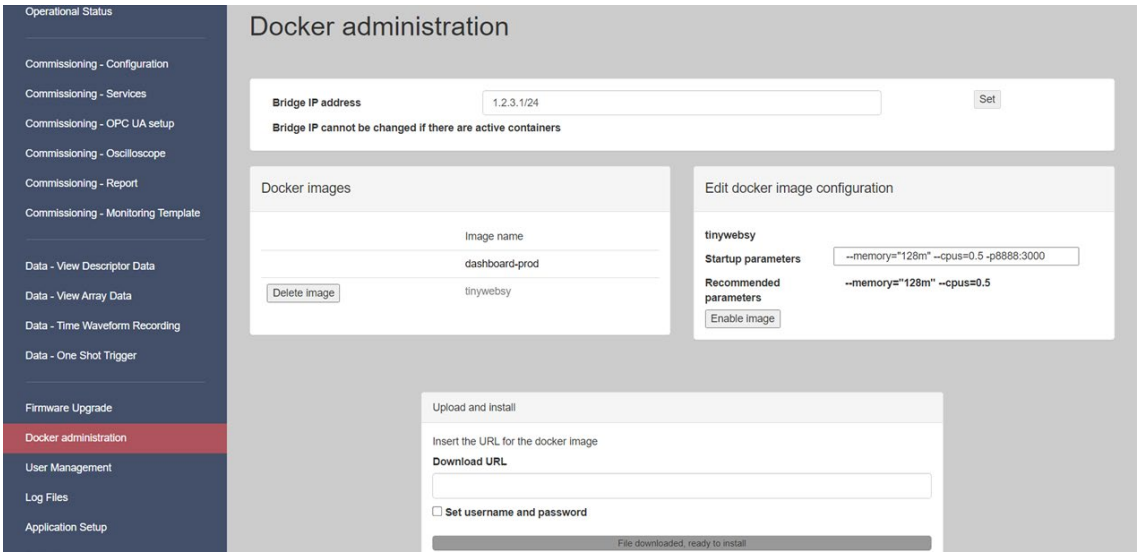
Install Docker image	
1	 To install docker images provide the URL in the “Download URL” field, then click **Download**.
2	 Click **Install** when it is ready.

Install Docker image	
3	 The installation will take a while, depending on the size of the image. After a successful installation it will be listed in the **Docker images** panel. If not, the installation has failed. In this case, please contact Brüel & Kjær Vibro Technical Support.
4	 Next select the installed Docker image under **Docker images**. On the right under you will see recommended or already set startup parameters. Check with your Docker image provider to get recommended parameters. Next click **Enable image** to activate the image. You should now be able to use your Docker application.

INFO

You may want to install more than one docker image. Be aware that each docker image requires resources (CPU, memory, ...) and may influence the performance of the whole system.

12.14.2 Docker Deletion

Delete Docker image	
1	 To remove a Docker image, you must disable it first. To stop a Docker image, click on **Disable image**.
2	 Click on **Delete image**.

INFO

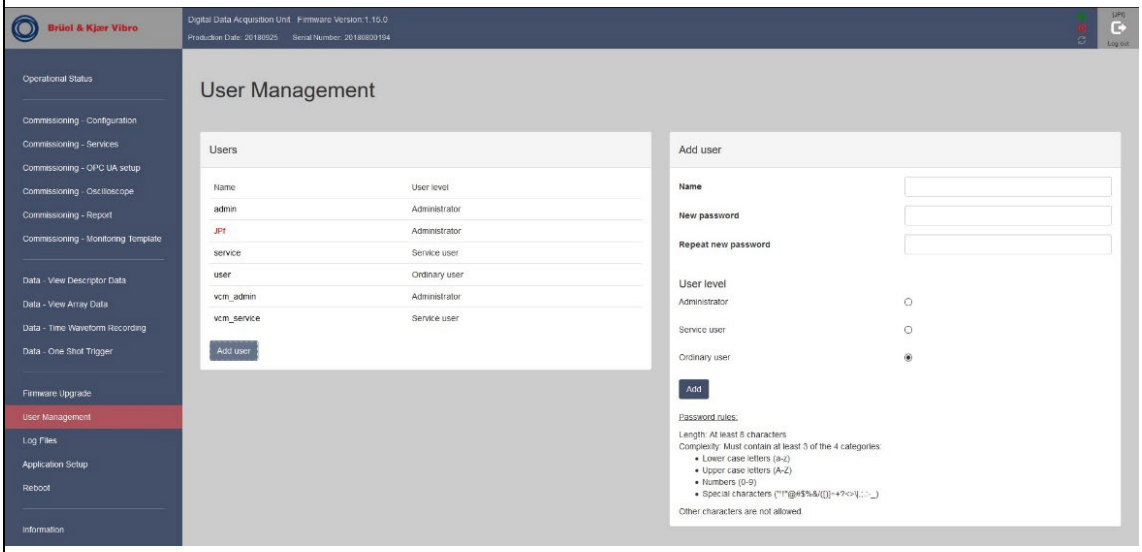
For further information of how to install and use Docker images please contact Brüel & Kjær Vibro Technical Support.

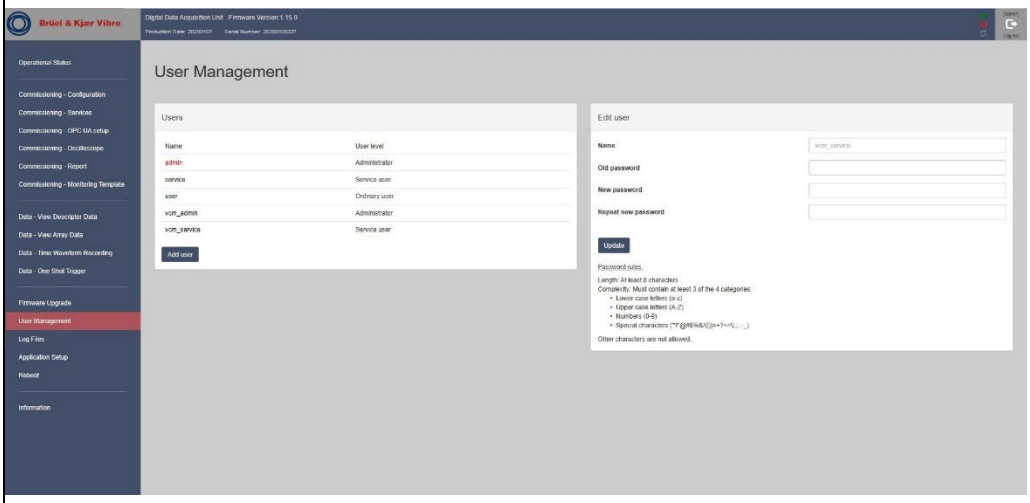
12.15 VCM-3 – User Management

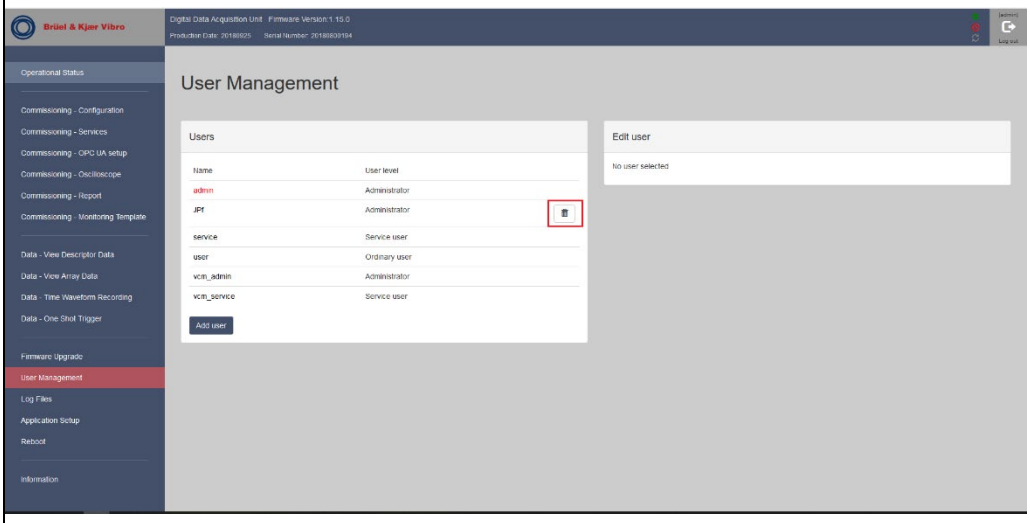
You can define three user levels for the VCM-3 Homepage. You can add/update/delete a user if you have Administrator rights.

- **Administrator** has access to all functionality on the VCM-3 Homepage
- **Service user** has access to all functionality except user management
- **Ordinary user** (a guest user) can only read the content of the WEB pages including making the tap test.

You can add new users, update credentials for an existing user, and delete a user.

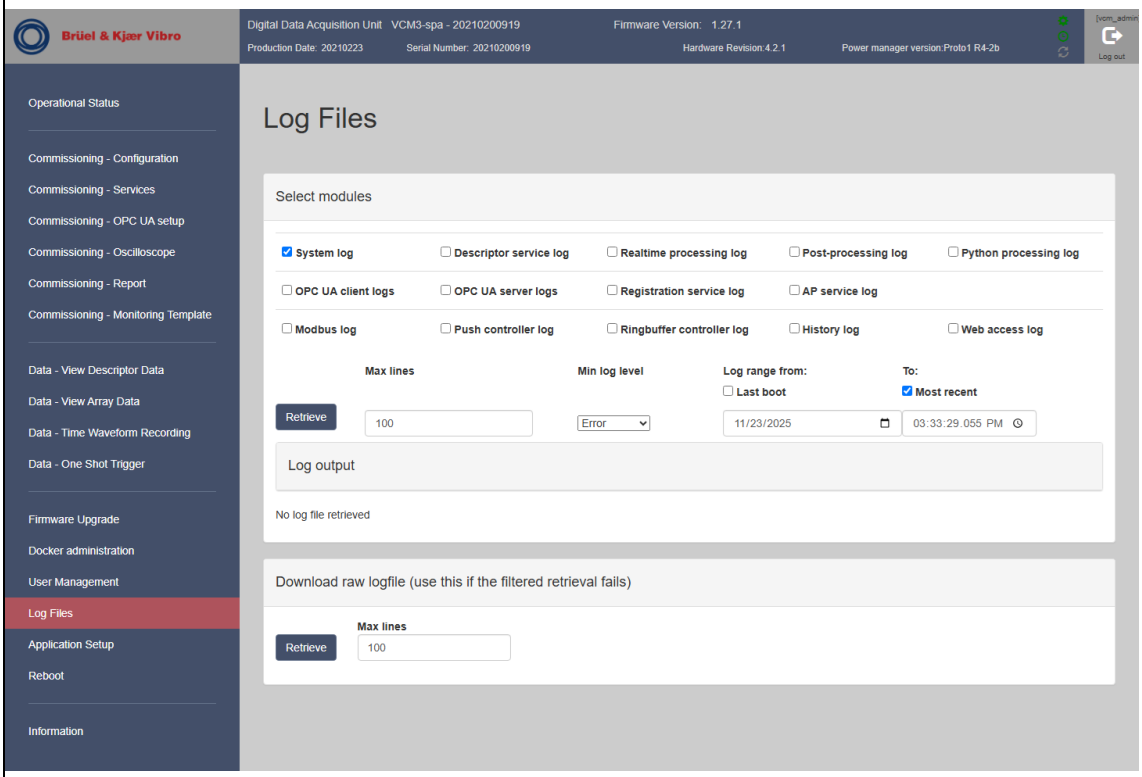
How to add a user	
1	 Click **Add User** to add a new user.
2	Specify username and password. The password must fulfill the rules specified in the **Password rules** section of the page.
3	Select user level for the user.
4	Click **Add** when all fields have been specified.

How to update a user	
1	 Click the line with the user to be edited.
2	Change **Name** and/or **Password** for the user. You cannot change user level. Observe the Password rules when defining the new password.
3	Click **Update**

How to delete a user	
1	 Click the wastebasket sign in the line with the user to be deleted. **INFO** You cannot delete the predefined users **admin**, **service**, **vcm_admin**, **vcm_service**, and **user**. You can only update their password. The active user is highlighted red.
2	Confirm the action when you are prompted.

12.16 VCM-3 – Log Files

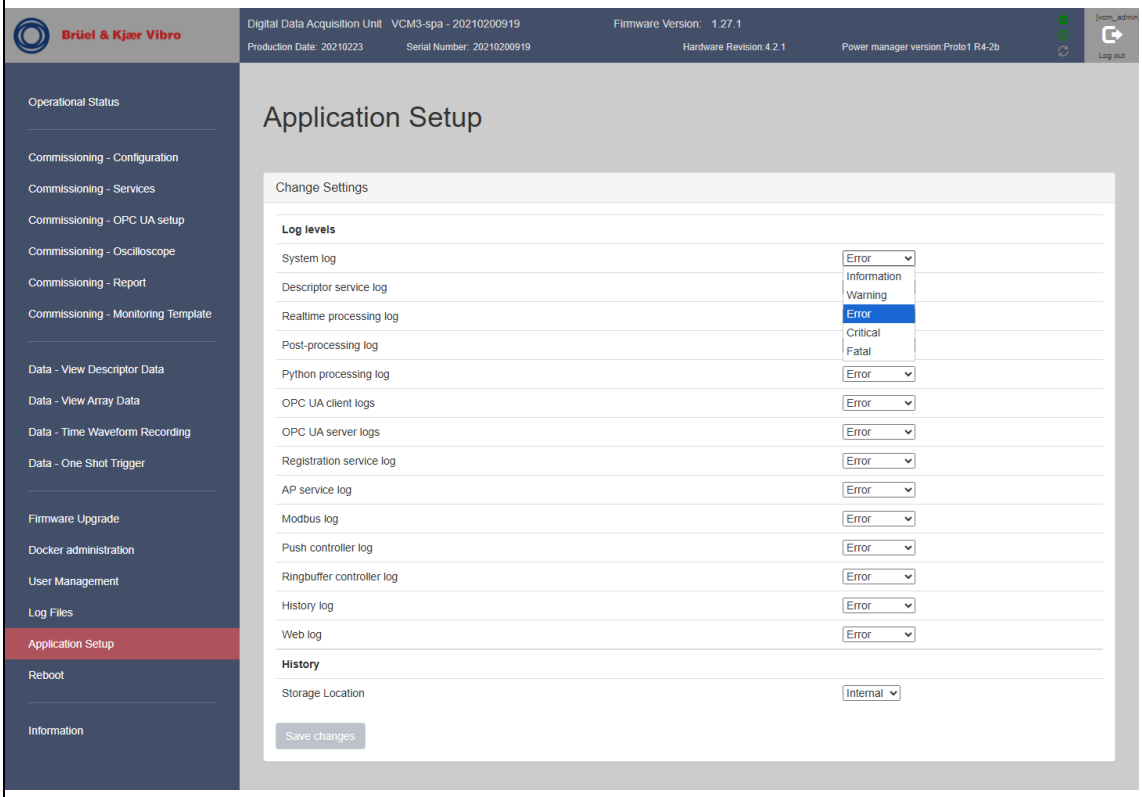
In case of functional problems with the VCM-3 the log file system can be consulted. VCM-3 has several log files each related to a particular subject. Check the log files which you suspect may relate to the problem. E.g., if you have problems with the Modbus communication then consult the Modbus controller log.
Often the information in the log indicates a problem which shall be reported to Brüel & Kjær Vibro.
You can download the log file to your PC and send it to Brüel & Kjær Vibro Technical Support: techsupport@bkvibro.com

How to view and download Log Files	
1	 Select a log file to display it in the **Log output** window.
2	Click **Download** to download the selected log file to the PC running the browser. Attach the log file to an E-mail and send it to Brüel & Kjær Vibro Technical Support techsupport@bkvibro.com with a description of the problem you have encountered.

12.17 VCM-3 – Application Setup

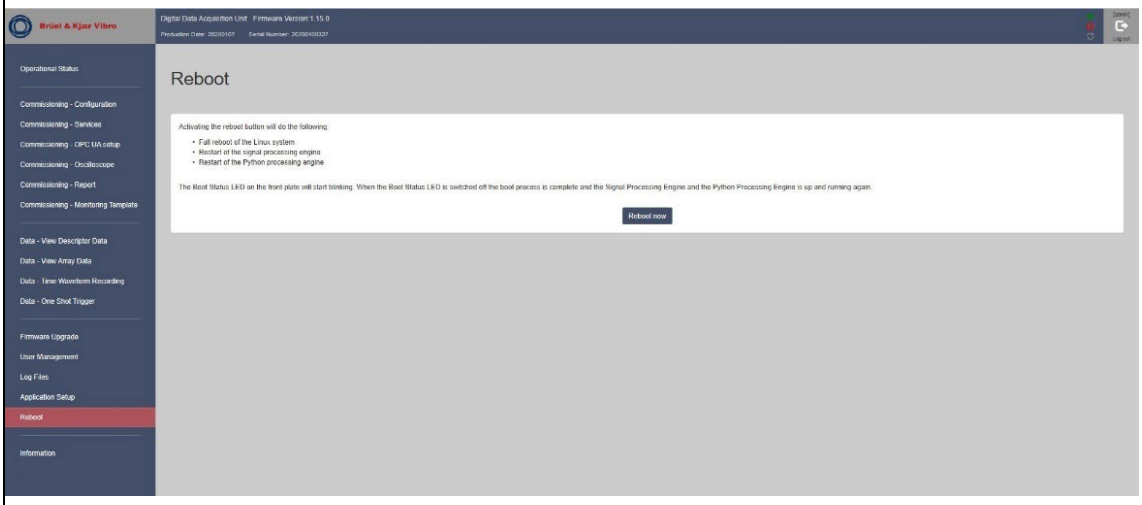
This page allows the user to configure various settings for the VCM-3.

- **Log level:** This setting specifies the amount of information in the log files. In case of functional problems select a log level with more information. This may provide valuable debug information for the Brüel & Kjær Vibro technical support.

Select the information (Log) level for the log files within the Application Setup	
1	 Select the logging level for VCM-3. Select between various log levels, such as: **Information, Warning, Error, Critical, Fatal**
2	Save the new setting by clicking **Save Changes**.

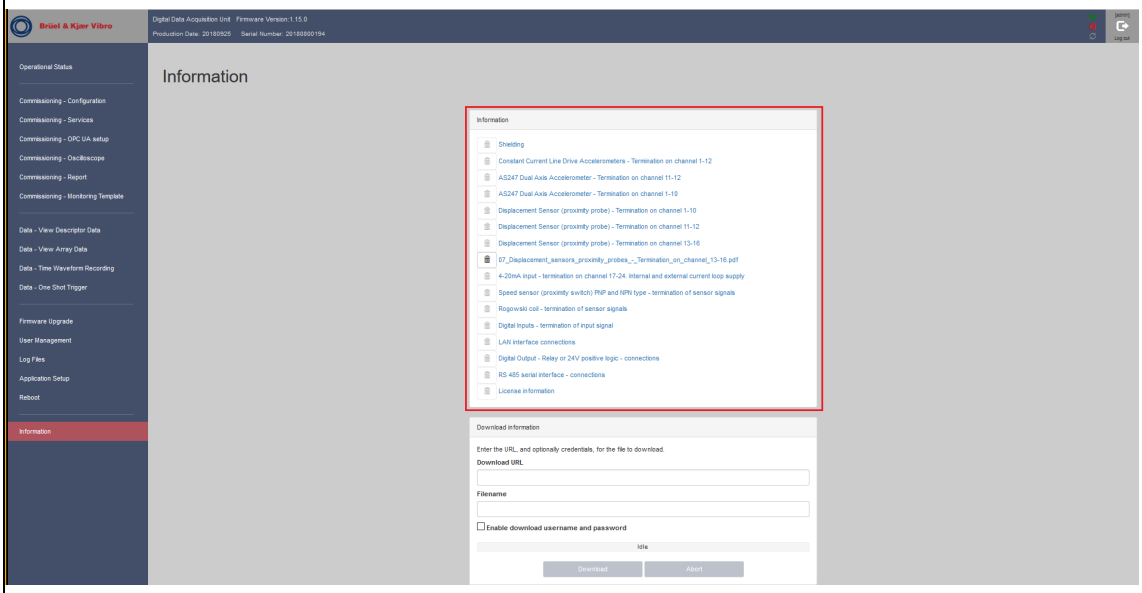
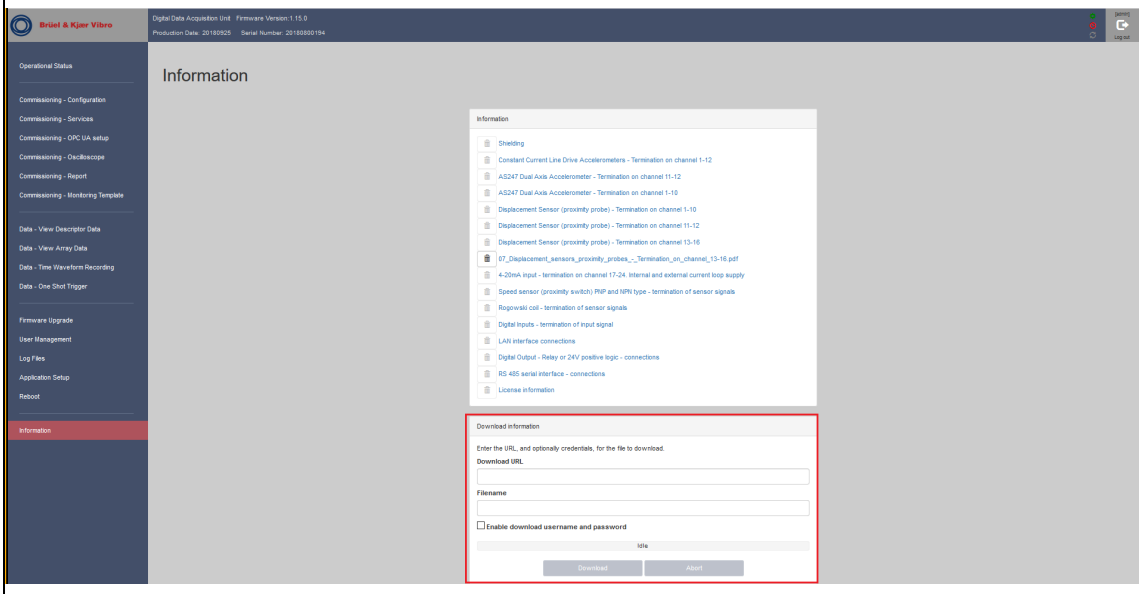
- **Storage location:** This setting allows the user to specify whether the VCM-3 internal memory (4 GB) or external memory – SD card or USB memory stick shall be used. In this case the size of the history buffer only depends upon the capacity of the external storage media.
  Refer to Appendix 2:
  Internal and External Storage Devices for VCM-3, for more detailed information about external storage media.

12.18 VCM-3 – Reboot

How to Reboot a VCM-3 device	
1	 Click **Reboot now** to reboot. This process will take approximately 30 seconds. Login again after the reboot.

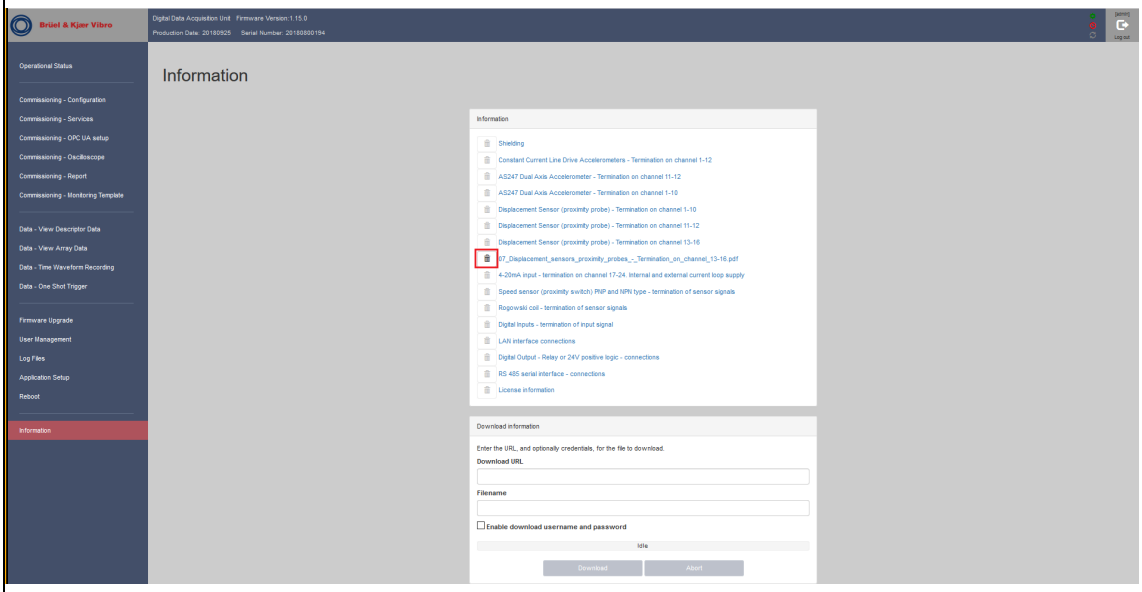
12.19 Information

In this section you can find a quick overview of the VCM-3 Homepage functionality. You may also upload your own information to service technicians.

View information	
1	 Click the link representing the information you want to view in the information field.
Download additional information	
1	 Fill in **Download URL** and **Filename**. If you want to view the file, it must be in .PDF format.
2	Click **Download**.

Remove information

1



Click waste bin basket in the line where you want the information to be removed.

13 Maintenance

CAUTION!

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. Input calibration has been done at the factory, and no further calibration is needed. 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.

14 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.

WEEE Reg. No. DE 69572330

15 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.
The 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 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:

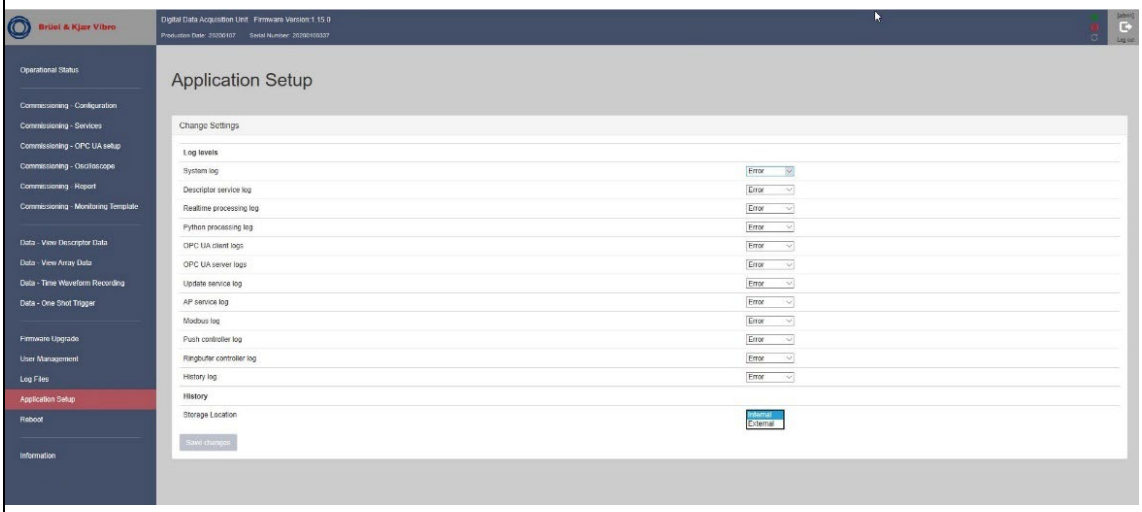
- The LAN-connection, wired or optical, is by design isolated to more than 125Vrms.
- The digital inputs are by design galvanic isolated to more than 125Vrms.
- The digital outputs are by design galvanic isolated to more than 125Vrms.

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.

16 Appendix 2: Internal and External Storage Devices for VCM-3

INFO

To save history data internal or external, this must be implemented in the Machine Monitoring Template.

Select storage location for the history buffer within the Application Setup	
1	 Select storage location: **Internal:** 4 GB of internal Flash memory **External:** SD card or USB memory stick
2	Save the new setting by clicking **Save Changes**.

Select "Storage Location -> External" to store history data on an external media.

Any external storage device to be used with the VCM-3 must be formatted with a compatible file system format and correct label type (see Label types).

Currently supported formats for the USB and SD ports are:

- FAT32, exFAT and ext4 filesystems

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

The VCM-3 supports and accepts 2 predefined labels for the storage device. If correctly labelled the storage device is ready for use when the storage device is fully inserted.

Label types	
HISTORY	A storage device with this label can be used for extra history buffer storage. The storage device must be inserted into the VCM-3 before the setup change is made. The external history storage is enabled via the VCM-3 Homepage by selecting Application Setup > History > Storage Location > External
EXT_STORAGE	A storage device with this label can be used for Time Waveform data storage if configured in the VCM-3 template. Device will be available on /mnt/ext_storage

It is possible to use a combination of SD and USB. A label can only be used once!

INFO

To avoid data loss on the storage device, the VCM-3 must be powered down before removing the storage device.

16.1 External Storage – SD Card

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

16.2 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 only storage devices or devices with a current consumption >500 mA are currently not supported. USB storage devices must be pre-labeled "EXT_STORAGE" or “HISTORY“ to be accepted by the VCM-3. It is possible to use a combination of SD and USB A label can only be used once!

17 Appendix 3: EU Declaration of Conformity

Brüel & Kjær Vibro
A member of the NSK Group

EU-Konformitätserklärung / *EU- Declaration of conformity*

Hiermit bescheinigt das Unternehmen / *The company*

Brüel & Kjær Vibro GmbH
Wittichstraße 6
64295 Darmstadt

CE

die Konformität des Produkts / *herewith declares conformity of the product*

VIBRO Condition Monitoring 3

Typ / *Type*

VCM-3, VCM-3 Ex

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

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

2011/65/EU + (EU) 2015/863 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*

2014/34/EU ATEX-Richtlinie / *ATEX-Directive* *(nur für /only for VCM-3 Ex)*

Angewendete harmonisierte Normen / *Harmonized standards applied*

EN IEC 61326-1: 2021
EN IEC 63000:2018
EN IEC 60079-0:2018, EN IEC 60079-7:2015+A1:2018 *(nur für /only for VCM-3 Ex)*

EG-Baumusterprüfung / *EC-Type-Examination Certificate*
UL 20 ATEX 2467X Ausgabe 3 / Rev. 3 erstellt von /*created from*
UL International Demko A/S (Nummer / Number 0539)

Die alleinige Verantwortung für die Ausstellung dieser Konformitätserklärung trägt der Hersteller. / *This declaration of conformity is issued under the sole responsibility of the manufacturer.*

Bereich / Division
Brüel & Kjær Vibro GmbH

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

Ort/*Place* **Darmstadt**
Datum / *Date* **12.12.2024**

i.A. (Niels Karg)

18 Appendix 4: Additional Documentation

Document type	Document title	Document no.
Product Specifications and Ordering Information	VIBRO Condition Monitoring 3 (VCM-3 / VCM-3 Ex)	C107757
	VIBRO Condition Monitoring 3 (VCM-3) – Reliability	C108080
	CM360-CG/VCM-3 Condition Monitoring System	C107897
	VCM-3 Monitoring Template – S01 Standard	C108041
	SETPOINT CMS Overview	S000029
Quickstart Guide	VCM-3	C108026
Instructions	VIBRO Condition Monitoring 3 (VCM-3 / VCM-3 Ex) – Safety	C107761
	VIBRO Condition Monitoring 3 (VCM-3 / VCM-3 Ex)	C108418
	CM360-CG/VCM-3	C107899
	VCM-3 Editor	C107762
	VCM-3 Firmware Update Tool	C108141
Troubleshooting Guide	VCM-3 Condition Monitoring Unit	C108291
Release Notes	VIBRO Condition Monitoring 3 Firmware	C107825

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Subject to technical changes