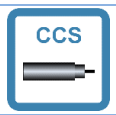
Product specification
VCM-3 Master Monitoring Template – S01 Standard

Overview

The VCM-3 provides an easy-to-implement vibration condition monitoring solution to detect potential failure modes of your production assets that could, if not checked, result in a catastrophic failure, downtime, and production loss. The fault detection measurements in this template offer an "Early Warning System" that brings go/no-go decisions directly into the control room as part of regular plant operations. In addition to actionable information, The VCM-3 instantly also feeds filtered and refined vibration health data to the historian, DCS and/or SCADA systems for subsequent analysis.

The mission of the standard template is to detect potential machine problems via a few simple machine fault indicators. One does not need to find the root cause of the vibration problem to make decisions about asset operation. This simple approach prevents DCS or SCADA systems from being flooded with information that can mask other issues. The fast 24/7 reaction of the VCM-3 provides the right information, when and where it is needed, without the shortcomings of data gaps or low-quality data of alternate periodic monitoring strategies.

Product features			
	Rolling Element Bearing Fault Detection		Severity assessment of vibration level according to ISO 10816
	12 CCS Accelerometer input channels		Condition Monitoring Alarms System Alarms to notify about faulty sensors
	Display of Spectra on VCM-3 Homepage		Export of time waveforms for subsequent detailed analysis and root cause investigation
	Templates available with results and alarm limits scaled in SI units or Imperial units.		Should the condition monitoring requirements change over time the VCM-3 can be upgraded via the network connection with more advanced monitoring features

Interfaces		
OSIsoft.	OPC UA	Modbus
The B&K Vibro SETPOINT® Adapter offers interface to the PI Vision™ dashboard as well as a unique option for analysing time waveforms stored in the PI database using the B&K Vibro SETPOINT® CMS software. Refer also to the application section of this document.	True IIoT and on-premise interface solutions are offered by the OPC UA server embedded in the VCM-3. No further external hardware is. The OPC UA implementation in VCM-3 supports the OPC UA cybersecurity features and OPC UA historical data access.	The well proven Modbus protocol is fully supported by VCM-3. The Modbus server embedded in the VCM-3 supports Modbus TCP/IP.

Application

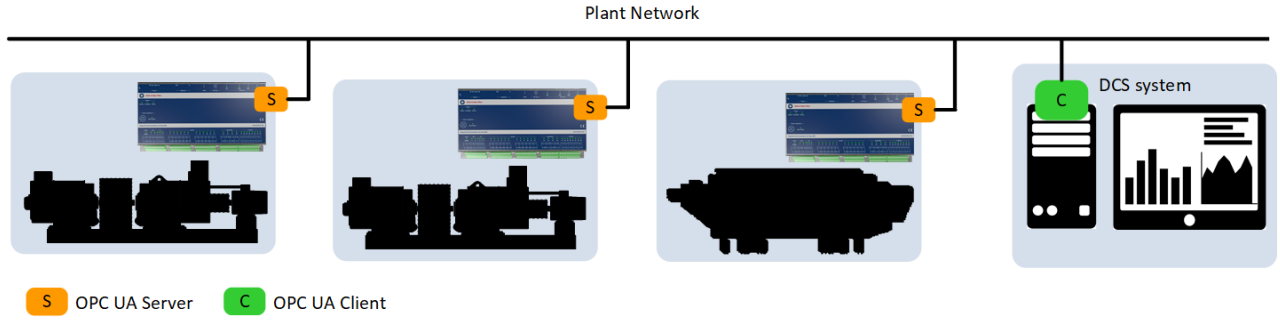
Application of the S01 Template
This template detects the presence of machine faults of the following kinds: • Unbalance / Misalignment / Looseness / Shaft bow / Coupling faults • Rolling element bearing defects/Rolling element bearing loose on shaft or in housing • Blade/Impellor faults/Cavitation/Turbulence • Gear wear /Gear eccentricity or misalignment /Cracked or broken tooth

Fault Detection Methods	
Rolling element bearings fault detection	Early detection of bearing faults using ECU Descriptor based on envelope technology.
Generic machine fault detection	Severity assessment of vibration level according to ISO 20816. **Class II**: Individual parts of engines and machines, integrally connected to the complete machine in its normal operating condition. Machines up to 15kW (Approximately 20hp).
Generic machine fault detection based on low and high frequency measurements.	Detection of machine faults expressed by vibrations in the high and low frequency range are covered.

Application Examples

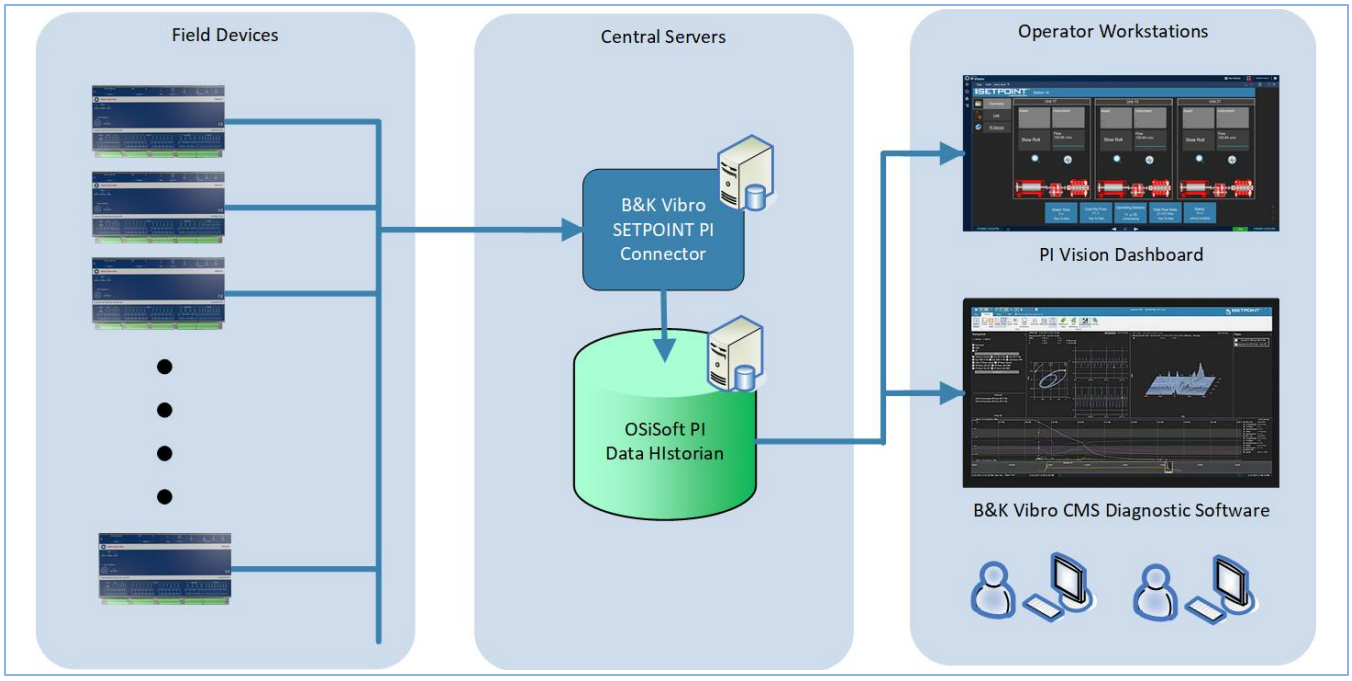
Transfer of Data to DCS System via VCM-3 OPC UA Server

The DCS OPC UA client reads process data from all the VCM-3 OPC UA servers on the network for display on the DCS terminal



Transfer of Data to OSIsoft PI Historian via B&K Vibro SETPOINT Connector

Data from the VCM-3 field devices are stored in the OSIsoft PI Data Historian via the B&K Vibro Setpoint PI Connector. The PI Connector allows seamless configuration of the descriptors from the VCM-3 as PI Tags in the asset framework. Descriptors used for vibration supervision can be displayed in the PI Vision dashboard and as unique feature of the PI Connector time waveforms from the VCM-3 devices can be stored in the data historian as PI Tags. These time waveforms can be used for detailed analysis and root cause investigations once a supervision alarm occurs.



Technical Specifications

In this section you will find information about:

- Descriptors implemented in this template
- Descriptor alarms
- Display of Spectra on the VCM-3 Homepage
- System Integration - OPC UA Specifications
- System Integration - Modbus TCP/IP
- Information for Commissioning
- Hardware specifications of VCM-3 relevant for the S01 template

Descriptors implemented in this template

A descriptor is a data item derived from the raw data received from the sensor. Descriptors are created in VCM-3 by extracting various types of information from the raw sensor signal. Each type of information is converted into a simple value and a time stamp. These values indicate at any time the state of the various components and failure modes of the monitored machine and is very well suited for indicating anomalies when watching the descriptors over a period of time.

Descriptors on each channel

The mission of vibration control is to detect potential machine problems via a few simple descriptors. The intention of the descriptors is not to find the root cause of the vibration problem, only to indicate severity of machine damage using a few descriptors in order to support decisions about continued asset operation.
Please Note. If required by the application, you can change descriptor names and descriptor frequency ranges using the VCM-3 Editor. The set of descriptors listed below is repeated on each of the twelve input channels. If frequency ranges are changed alarm limits for the descriptors shall be reconsidered.

Descriptor Name	Description	Comment
Sensor Condition.vavg	Sensor Bias voltage	Is used to check if sensor is OK
LF Condition.rms	Bandpass Velocity [1-10]	Detects turbulence
HF Condition.rms	Bandpass Acceleration [1000-10000]	Detects bearing faults and cavitation in pumps

ISO Condition.rms	Bandpass Velocity [10-1000]	Detects rotor problems, Coupling faults, Gear faults, Pump Faults
Bearing Condition.rms	Broadband Envelope [1000-10000], [10-500]	Early detection of bearing faults
Status	Sensor status based on Sensor Condition	0 = Good Sensor, 1 = Faulty sensor or no connection
LF Condition.rms.Alarm	Alarm Status	0 = No alarm, 1 = Warning, 2 = Alarm
HF Condition.rms.Alarm	Alarm Status	0 = No alarm, 1 = Warning, 2 = Alarm
ISO Condition.rms.Alarm	Alarm Status	0 = No alarm, 1 = Warning, 2 = Alarm
Bearing Condition.rms.Alarm	Alarm Status	0 = No alarm, 1 = Warning, 2 = Alarm

Alarms

In order to enable a quick start on your monitoring program all descriptors defined in the template have preset alarm limits. These limits are based partly on ISO 10816-3 standard and partly by experience in cases where the standard does not cover. Please note that these alarm limits are only guidelines and vibration levels may vary depending upon the application, sensor mounting technique and operating conditions.

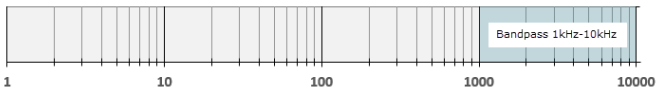
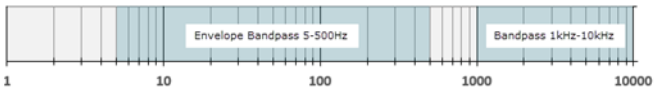
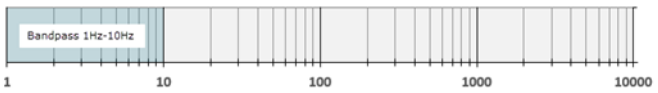
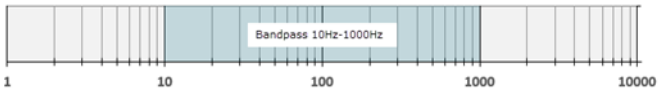
The limits specified for the ISO descriptors corresponds to Class II machines as categorized in the ISO10816 standard. That is,

- Medium sized machines (power 15kW to 300kW) with flexible foundation support
- Large machines (power 300kW to 50MW) with rigid foundation support
- Pumps > 15kW with integrated driver with flexible foundation support
- Pumps > 15kW with external driver with rigid foundation support

Please consult the ISO10816 series of standard as well as its replacement ISO20816 for adapting the preset alarm limits to other types of machinery.

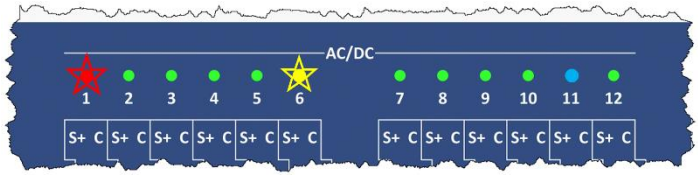
Please Note: The alarm levels configured in the template provides a standardized starting point for the alarm evaluation. The application, the mounting technique for sensors and the operating environment and conditions may cause a change in the initial alarm levels. The initial alarm levels can be fine-tuned using the VCM-3 Editor.

Alarm Specification

Descriptor			Frequency Range (Log Axis)
HF Condition (Acceleration)	Danger	58.8 m/s²- 6 g	
	Alert	24.5 m/s²- 2.5 g	
	Ref.	14.7 m/s²- 1.5 g	
Bearing Condition (Acceleration)	Danger	3 m/s²- 0.31 g	
	Alert	1.5 m/s²- 0.15 g	
	Ref.	1 m/s²- 0.1 g	
LF Condition (velocity)	Danger	6.4 mm/s- 0.25 in/s	
	Alert	4.1 mm/s- 0.16 in/s	
	Ref.	2.1 mm/s- 0.08 in/s	
ISO Condition Velocity	Danger	7.1 mm/s- 0.28 in/s	
	Alert	4.5 mm/s- 0.18 in/s	
	Ref.	2.3 mm/s- 0.09 in/s	

Alarm Status indication on the front panel LED's

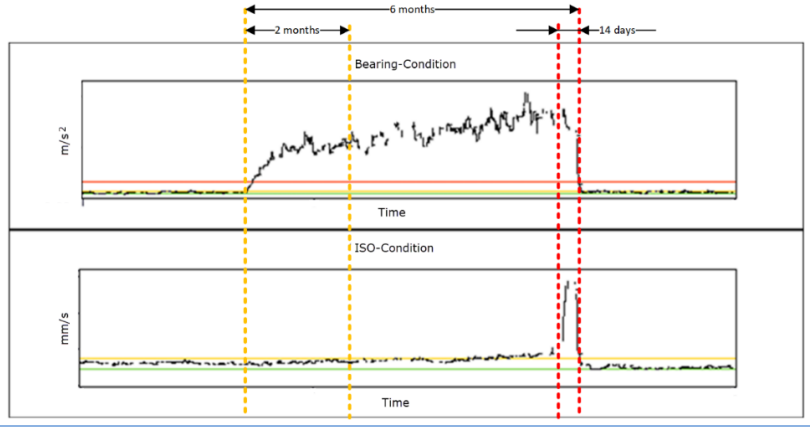
Alarm Status on individual channels is shown on the channel LEDs on the VCM-3 front panel:



Update rate	Every 10 seconds	
Danger State value	2 – Unacceptable	Channel LED flashing Red
Alert State value	1 – Unsatisfactory	Channel LED flashing Yellow
OK State value	0 – Good/Satisfactory	Channel LED steady Green
System Alarm State value	1 – Not OK	Channel LED steady Blue

About the Descriptors: Bearing Condition and ISO Condition (ISO 10816)

The figure below illustrates that the choice of descriptor for fault detection is an important factor for estimating the remaining useful life. The lead time indicated by the envelope based descriptor Bearing-Conditions shows differences in months towards the ISO Condition descriptor. The figure also illustrates that the choice of descriptor type can be used to express the criticality of the fault. When the Bearing Condition descriptor starts to develop the fault is far from critical. First observation of criticality is when the ISO Condition starts to increase, this is an indication that the overall vibration level is increasing, now repair shall be planned. When the overall vibration severity becomes unacceptable the risk of failure is high and failure may be imminent.

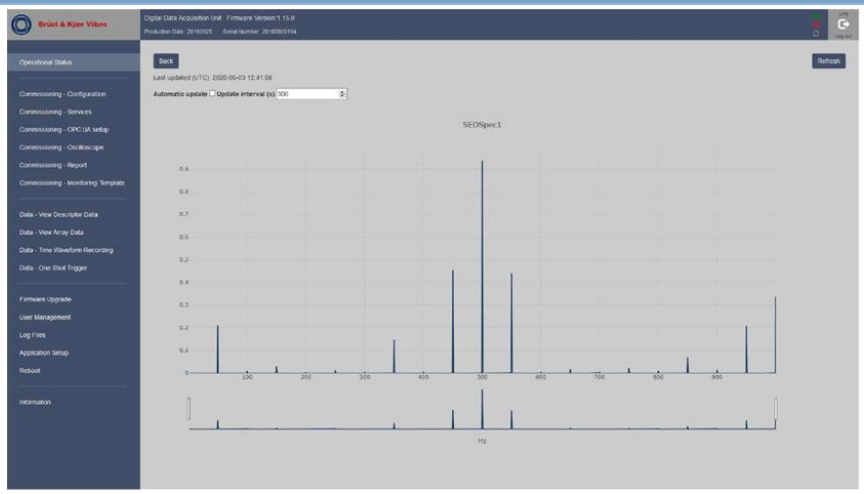


Display of Spectra on the VCM-3 Homepage

Three different vibration spectrum measurements are configured on each channel. The application of these spectra is mainly for the initial commissioning to check if signals are plausible. However, they can also be used to check the vibration pattern in case of an alarm.

Type	Lower Frequency	Upper Frequency	Envelope filter	No. of lines
Power spectrum (Acceleration)	5Hz	20000Hz		6400
Envelope spectrum	1Hz	1000Hz	1000-1000Hz	1600
Power spectrum (Velocity)	1Hz	1000Hz		1600

Example of Envelope Spectrum on VCM-3 Homepage



System Integration - OPC UA Specifications

OPC Server

Supported data types	Scalar data	
	Array data as complete objects such as Autospectra, Envelope spectra	
Supported functions	Read	Values in the VCM-3 output register
	Readhistory	Scalar as well as array data. Buffer size is configured in the VCM-3 monitoring template
Data retrieval	By polling from an OPC UA client	
	By subscription from an OPC UA client.	
Data refresh rate	Once every 5 seconds	
Client support	Supports simultaneous sessions from one or several clients. Max. number of simultaneous sessions = 50	
Configuration	The OPC server name space is configured via the VCM-3 monitoring template.	

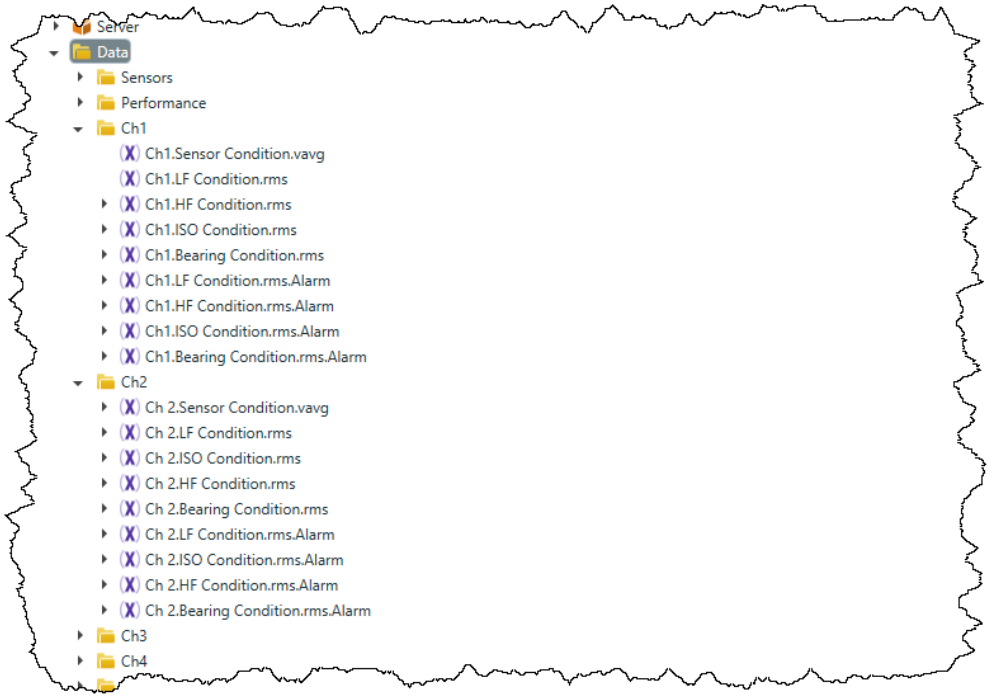
IT Integration – OPC UA Standardized Security Model

As a direct result of the standardized security model, OPC UA allows for easy integration into pre-existing IT networks which limits the configuration costs. Through this standardization, OPC UA can connect securely over a VPN and through firewalls to allow seamless, remote client-to-server connectivity. OPC UA uses standard web technologies to implement security, this includes digital certificates authentication and encryption capabilities. The VCM-3 OPC UA Interface supports several combinations of Security policy, Security Mode and User Token

Security Options	Security Policy – Encryption	Security Modes	User Token
	None, Basic 256, Basic128Rsa15, Basic256Sha256, Aes128Sha256RsaOaep Aes256Sha256RsaPss	None Sign SignAndEncrypt	Anonymous UserName
Configuration	OPC UA security options are configured in the VCM-3 monitoring template		
OPC UA Port	4840 - this is the standard OPC UA communication port.		
Certificates	Trust between OPC UA Client and Servers are established via certificate exchange.		
	VCM-3 OPC UA Client write to OPC UA server:	Download VCM-3 public certificate via VCM-3 Homepage	
	VCM-3 OPC UA Client read from OPC UA server:	Upload 3rd part OPC Server certificate via VCM-3 Homepage	
	VCM-3 OPC UA Server:	Download VCM-3 public certificate via VCM-3 Homepage	
	VCM-3 OPC UA Server	Accept/reject 3rd party client certificates via VCM-3 Homepage	

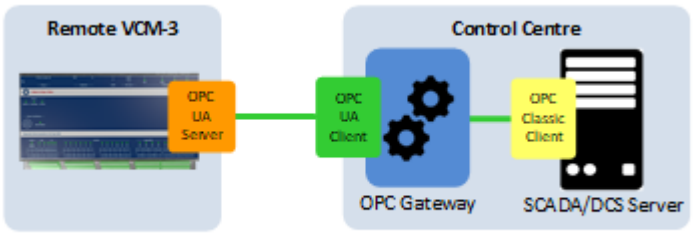
OPC Namespace Layout

The OPC UA namespace for this template is organized as a simple tree structure under the main object “Data”. The node “Sensors” contains the sensor status, the “Performance” node contains all VCM-3 performance parameters and each channel has its own node with descriptor values and alarm status.



Compatibility – Interface to Legacy OPC Classic DA Servers and Clients

Because of the shift in data communication technology where a standardized security model is used, the OPC UA protocol is not inherently backwards compatible with Classic OPC data access (DA) models. To interface legacy OPC components to the new OPC UA components an OPC gateway is required. Many vendors of SCADA and DCS systems supply their own gateways. However, generic gateways which supports the conversion from OPC Classic to OPC UA and OPC UA to OPC Classic is available on the market. A good example is the Cogent DataHub OPC Gateway.



DCS/SCADA OPC Classic client reads data from the DDAU3 OPC UA Server

System Integration - Modbus TCP/IP

The Modbus TCP/IP server layout is a simple layout with Modbus address staring at address 1000. Each group of descriptors has a register offset for ease of reference. Please refer to the table below.

Port Number	Format	Device Unit	Datatypes (all registers)	Function Code (all registers)
502	Little Endian	1	Float32 (2 reg)	4

Modbus Map

Register	Descriptor Name	Unit	Comment
100	Ch1.Sensor-Condition.vavg	V	
102	Ch1.LF-Condition.rms	mm/s	
104	Ch1.ISO-Condition.rms	mm/s	
106	Ch1.HF-Condition.rms	m/s2	
108	Ch1.Bearing-Condition.rms	m/s2	
110	Ch1.Sensor-OK	-	
112	Ch1.ISO-Condition.rms.Alarm	-	
114	Ch1.HF-Condition.rms.Alarm	-	
116	Ch1.Bearing-Condition.rms.Alarm	-	
118	Ch1.LF-Condition.rms.Alarm	-	
200	Ch2.Sensor-Condition.vavg	V	
202	Ch2.LF-Condition.rms	mm/s	
204	Ch2.ISO-Condition.rms	mm/s	
206	Ch2.HF-Condition.rms	m/s2	
208	Ch2.Bearing-Condition.rms	m/s2	
210	Ch2.Sensor-OK	-	
212	Ch2.ISO-Condition.rms.Alarm	-	
214	Ch2.HF-Condition.rms.Alarm	-	
216	Ch2.Bearing-Condition.rms.Alarm	-	
218	Ch2.LF-Condition.rms.Alarm	-	
300	Ch3.Sensor-Condition.vavg	V	
302	Ch3.LF-Condition.rms	mm/s	

Register	Descriptor Name	Unit	Comment
304	Ch3.ISO-Condition.rms	mm/s	
306	Ch3.HF-Condition.rms	m/s2	
308	Ch3.Bearing-Condition.rms	m/s2	
310	Ch3.Sensor-OK	-	
312	Ch3.ISO-Condition.rms.Alarm	-	
314	Ch3.HF-Condition.rms.Alarm	-	
316	Ch3.Bearing-Condition.rms.Alarm	-	
318	Ch3.LF-Condition.rms.Alarm	-	
400	Ch4.Sensor-Condition.vavg	V	
402	Ch4.LF-Condition.rms	mm/s	
404	Ch4.ISO-Condition.rms	mm/s	
406	Ch4.HF-Condition.rms	m/s2	
408	Ch4.Bearing-Condition.rms	m/s2	
410	Ch4.Sensor-OK	-	
412	Ch4.ISO-Condition.rms.Alarm	-	
414	Ch4.HF-Condition.rms.Alarm	-	
416	Ch4.Bearing-Condition.rms.Alarm	-	
418	Ch4.LF-Condition.rms.Alarm	-	
500	Ch5.Sensor-Condition.vavg	V	
502	Ch5.LF-Condition.rms	mm/s	
504	Ch5.ISO-Condition.rms	mm/s	
506	Ch5.HF-Condition.rms	m/s2	
508	Ch5.Bearing-Condition.rms	m/s2	
510	Ch5.Sensor-OK	-	
512	Ch5.ISO-Condition.rms.Alarm	-	
514	Ch5.HF-Condition.rms.Alarm	-	
516	Ch5.Bearing-Condition.rms.Alarm	-	
518	Ch5.LF-Condition.rms.Alarm	-	
600	Ch6.Sensor-Condition.vavg	V	
602	Ch6.LF-Condition.rms	mm/s	
604	Ch6.ISO-Condition.rms	mm/s	
606	Ch6.HF-Condition.rms	m/s2	
608	Ch6.Bearing-Condition.rms	m/s2	
610	Ch6.Sensor-OK	-	
612	Ch6.ISO-Condition.rms.Alarm	-	
614	Ch6.HF-Condition.rms.Alarm	-	
616	Ch6.Bearing-Condition.rms.Alarm	-	
618	Ch6.LF-Condition.rms.Alarm	-	
700	Ch7.Sensor-Condition.vavg	V	
702	Ch7.LF-Condition.rms	mm/s	
704	Ch7.ISO-Condition.rms	mm/s	
706	Ch7.HF-Condition.rms	m/s2	
708	Ch7.Bearing-Condition.rms	m/s2	
710	Ch7.Sensor-OK	-	
712	Ch7.ISO-Condition.rms.Alarm	-	

Register	Descriptor Name	Unit	Comment
714	Ch7.HF-Condition.rms.Alarm	-	
716	Ch7.Bearing-Condition.rms.Alarm	-	
718	Ch7.LF-Condition.rms.Alarm	-	
800	Ch8.Sensor-Condition.vavg	V	
802	Ch8.LF-Condition.rms	mm/s	
804	Ch8.ISO-Condition.rms	mm/s	
806	Ch8.HF-Condition.rms	m/s2	
808	Ch8.Bearing-Condition.rms	m/s2	
810	Ch8.Sensor-OK	-	
812	Ch8.ISO-Condition.rms.Alarm	-	
814	Ch8.HF-Condition.rms.Alarm	-	
816	Ch8.Bearing-Condition.rms.Alarm	-	
818	Ch8.LF-Condition.rms.Alarm	-	
900	Ch9.Sensor-Condition.vavg	V	
902	Ch9.LF-Condition.rms	mm/s	
904	Ch9.ISO-Condition.rms	mm/s	
906	Ch9.HF-Condition.rms	m/s2	
908	Ch9.Bearing-Condition.rms	m/s2	
910	Ch9.Sensor-OK	-	
912	Ch9.ISO-Condition.rms.Alarm	-	
914	Ch9.HF-Condition.rms.Alarm	-	
916	Ch9.Bearing-Condition.rms.Alarm	-	
918	Ch9.LF-Condition.rms.Alarm	-	
1000	Ch10.Sensor-Condition.vavg	V	
1002	Ch10.LF-Condition.rms	mm/s	
1004	Ch10.ISO-Condition.rms	mm/s	
1006	Ch10.HF-Condition.rms	m/s2	
1008	Ch10.Bearing-Condition.rms	m/s2	
1010	Ch10.Sensor-OK	-	
1012	Ch10.ISO-Condition.rms.Alarm	-	
1014	Ch10.HF-Condition.rms.Alarm	-	
1016	Ch10.Bearing-Condition.rms.Alarm	-	
1018	Ch10.LF-Condition.rms.Alarm	-	
1100	Ch11.Sensor-Condition.vavg	V	
1102	Ch11.LF-Condition.rms	mm/s	
1104	Ch11.ISO-Condition.rms	mm/s	
1106	Ch11.HF-Condition.rms	m/s2	
1108	Ch11.Bearing-Condition.rms	m/s2	
1110	Ch11.Sensor-OK	-	
1112	Ch11.ISO-Condition.rms.Alarm	-	
1114	Ch11.HF-Condition.rms.Alarm	-	
1116	Ch11.Bearing-Condition.rms.Alarm	-	
1118	Ch11.LF-Condition.rms.Alarm	-	
1200	Ch12.Sensor-Condition.vavg	V	
1202	Ch12.LF-Condition.rms	mm/s	

Register	Descriptor Name	Unit	Comment
1204	Ch12.ISO-Condition.rms	mm/s	
1206	Ch12.HF-Condition.rms	m/s2	
1208	Ch12.Bearing-Condition.rms	m/s2	
1210	Ch12.Sensor-OK	-	
1212	Ch12.ISO-Condition.rms.Alarm	-	
1214	Ch12.HF-Condition.rms.Alarm	-	
1216	Ch12.Bearing-Condition.rms.Alarm	-	
1218	Ch12.LF-Condition.rms.Alarm	-	
3000	performance.time-max	usec	Displays the max. execution time of the real time processing system
3002	performance.time-avg	usec	Displays the average execution time of the real time processing system
3004	performance.mem-max	-	Displays the maximum memory usage by the real time processing system (in Kbyte)
3006	performance.mem-avg	-	Displays the average memory usage by the real time processing system (in Kbyte)
3008	performance.mem-cur	-	Displays the current memory usage by the real time processing system (in Kbyte)
3010	performance.load-max	-	Displays the maximum system load
3012	performance.load-avg	-	Displays the average system load
3014	performance.board-temperature	C	Displays the circuit board temperature of VCM-3
3016	performance.core-temperature	C	Displays the processor core temperature
3018	status.time-synch-error	-	Displays whether time is synchronized
3020	Spectra_Performance	sec	Execution time (in sec.) of the last run of the spectrum calculation module
3022	Spectra_Performance.max	sec	Max. execution time (in sec) of the spectrum module since startup
3024	Spectra_Performance.avg	sec	Avg. execution time (in sec) of the spectrum module since startup
3026	Alarms_Performance	sec	Execution time (in sec) of the last run of the alarm module
3028	Alarms_Performance.max	sec	Max. execution time (in sec) of the alarm module since startup
3030	Alarms_Performance.avg	sec	Avg.. execution time (in sec) of the alarm module since startup
3032	Status_Performance	sec	Execution time (in sec) of the last run of the sensor status module
3034	Status_Performance.max	sec	Max. execution time (in sec) of the sensor status module since startup
3036	Status_Performance.avg	sec	Avg.. execution time (in sec) of the sensor status module since startup

Information for Commissioning

Once the S=1 template has been loaded to the VCM-3 you can check the VCM_3 device by inspecting the LEDs on the front panel. The picture shown below assumes that you have configured the VCM-3 via the VCM-3 WEB interface as specified in the commissioning instructions.
The picture below assumes that you user RJ45 port 4 for your network cable and an accelerometer is mounted on each of the 12 AC/DC inputs. If no accelerometer is mounted on an AC/DC input the channel LED will show blue light.

Hardware specifications of VCM-3 relevant for the S01 template	
12, AC/DC Analog Input Channels	
Sampling Frequency	204.8kHz synchronous on all channels
Analysis Frequency Range	DC-80kHz
Input Type	Differential, bipolar (-25.5V to +25.5V)
Dynamic Range	> 100dB at 1kHz, > 94dB at 0.1kHz
Channel Interference	>-100dB
AC Amplitude Accuracy	±0.5dB
DC Amplitude Accuracy	1% relative of full scale with ±40mV Offset.
Total Harmonic Distortion	< 0.01%/250Hz/4Vpp
Input Impedance	>100kΩ
Common Mode Rejection	>50dB at 50Hz
Phase Match Between Channels	<0.3° at 80kHz
Sensor Power Supply	10mA/+24 Volt/ -24 Volt(external)
Internal Storage	
Internal Storage	4GB
SD Card storage	Original Size SD. microSD via an adaptor. No limit to storage capacity, depends on card size File system formats: Windows compatible FAT32. Linux compatible: Ext3 and Ext4
USB Flash Disk (USB 2.0)	No limit on storage capacity. Depends upon Flash disk. File system formats: Windows compatible FAT32. Linux compatible: Ext3 and Ext4
Storage Interval	Can be configured for each individual descriptor or array measurement
Buffer Size	No. of days in buffer is specified for individual descriptors and array measurements

LED Indicators on the Front Panel	
SFP, RJ45	Green light indicates network activity
System	Green: Everything is OK. Red: Operating system malfunction.
Template	Green: Monitoring OK. Red: Monitoring not running, Yellow: Some descriptors not running
On-line	Green: If there is contact to backend server, Red if no contact. Checked at regular intervals.
Boot Status	Green when boot sequence is completed
RS485	Green flashes during data transfer
System Integration – General Networking	
Network Connections	3 RJ45, 1 optical SFP connector
Low level protocol	Ethernet TCP/IP. IPv4, prepared for IPv6.
Switch functionality	The 4 network ports have built-in switch functionality
RS485 Interface	The serial bus RS485 supports MODBUS RTU interface on VCM-3.
Cyber Security – Networking	
Firewalls	Restricts access by defining rules for control of incoming network traffic.
Secure protocols	Communication takes place through secure and encrypted protocols, such as Websockets, HTTPS, SCP.
Port configuration	All services using a TCP/IP port (e.g. https, default port 443) can be configured to use another port.
NERC Compliance	VCM-3 can be part of solutions complying with NERC CIP Standards. (North American Electric Reliability Corporation – Critical Infrastructure Protection).
Cyber Security – Operating System Level	
Operating System – Security Releases	Operating system is Linux. The operating system is maintained with new security releases as part of firmware update service.
Strong passwords	The use of strong passwords is enforced. Compliance with NIST SP800-118 – Guide to enterprise Password Management. Can be changed by user.
Activity logging	VCM-3 performs activity logging of users and services.
Environmental	
Ambient Temperature	In operation. -30 °C - 60 °C in accordance with EN/IEC 60068-2-2. Applies to device and to device mounted in cabinet. -40 °C with reduced accuracy - 70 °C with de-rated Mean Time Between Failures (MTBF).
Ambient Temperature	Storage. -40 °C - 85 °C in accordance with EN/IEC 60068-2-2.
Temperature Change	Operational during a temperature change rate of 1°C per minute in accordance with 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.
Salt Mist	In operation. According to EN/IEC 60068-2-52 when mounted in cabinet.
Random & Sine Vibration	According to EN/IEC 60068-2-6.
Rough Handling	Storage. According to EN/ IEC 60068-2-31.
EMC	According to EN/IEC 61326-1, EN/IEC 61000-6-2 and 61000-6-3
High Altitudes	According to EN/IEC 60068-2-13. Air pressure equivalent to 3500m altitude.
Inclination	According to IEC 60092-504.
Corrosion	According to ISO 9223 Class C3-medium when mounted in cabinet.
IP Rating	The device IP rating is IP20 according to EN/IEC 60529 without cabinet. In cabinet rating is IP66
CE Marking	In compliance with the EMC and RoHS 2011/65/EC directives.
HALT Test	Has been subject to HALT test. Excessive vibration and temperatures and combinations hereof
UL Certification	cULus certified
Hazardous Area Approval (Only available for VCM-3 Ex)	24V dc / max. 1,6 A / max. 30 W T4 T_{amb} -30 ° C to +60° C **UL Hazardloc Area Approval** Class I, Division 2, Groups A-D Class I, Zone 2, Group IIC 2 **IECEx Approval IECEx UL 20.0034X** Ex IIC ec T4 Gc

	ATEX Approval UL 20 ATEX 2467 X II 3G Ex IIC ec T4 Gc
Mechanical	
Dimensions	280 x 153.5 x 35 mm
Weight	1.5 kg
Mounting	DIN Rail Mounting or mounting plate
Power Supply	
Voltage/Power Consumption	Nominal 24V (SELV – Safety Extra Low Voltage) 18-26 V DC/10W + power consumption of each sensor. Worst case sensor current consumption: 48W (including network load) The VCM-3 is intended to be supplied from an isolated Limited Energy Source per UL61010-1, 3rd ed cl. 9.4 or Limited Power Source per UL60950-1 or Class 2 per NEC."
Fuses	Power supply inputs are fused to protect against over-voltage and fire
System	
Operating system	Linux
Python	Environment for calculating iDescriptors, array measurements and customizations
Watchdogs	Software: Software process monitoring. Hardware: Monitors the software watchdog and operating system
Logging	System Log, Measurement system log, Python user module log
Operational	
Fully remote operation	Upload of firmware updates and monitoring templates via network or modem connection
Device homepage	For remote or local service. Commissioning, view of trend and array data, view Log files, selection of Monitoring Templates
Calibration	Factory calibrated. No further calibration needed.
Service	No onsite service required. VCM-3 has no moving parts, or other parts which requires regular service
Design lifetime	20 years

Contact

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