



Product Specifications

VIBROCONTROL 6000 Monitoring System

Description of Functionality – Overview

The VIBROCONTROL 6000 Monitoring System is used for both stand-alone machine protection and condition monitoring using the Compass 6000 monitoring software modules and database. The VIBROCONTROL 6000 offers various flexible monitoring modules, power supply module and communication module. This document is an overview of the VIBROCONTROL 6000 system and its individual components.

Applications

The VIBROCONTROL 6000 (VC-6000) monitoring system is a modular 19" rack based system designed for continuous monitoring of machines using a wide range of permanently installed sensors.

The API 670 compliant protection system has voting logic programmable relay control with redundant power supply security. Cable redundant dual MODBUS can be used for process visualization and relay resetting. For commissioning and analyzing the extension of the configuration software **Safety Monitoring Workstation 7126** – the **Plus** functions help making a footprint of your machine.

For condition monitoring applications the **Compass 6000 Monitoring Software** - completely independent of the protective functions - accesses the VIBROCONTROL 6000 signals and time series for post-processing, analysis, monitoring and storage in a database.

The VIBROCONTROL 6000 is used in a number of industries worldwide such as **Oil & Gas, petrochemical, power and other heavy process industries**, including intrinsic-safety applications. It is scalable and can be used in a plant-wide monitoring application with a wide range of machines such as

- steam turbines
- gas turbines
- hydro turbines
- axial and centrifugal compressors
- reciprocating compressors
- motors
- generators
- pumps
- ventilators
- extruders
- agitators
- gearboxes, etc.



Features

- Modular design allows systems to be tailored specific to the application.
- Completely self-sufficient and independently operating monitoring modules each with up to 12 input channels
- Meets the important requirements in the details of all appropriate standards (**API 670, rev. 4; DIN ISO 10816; DIN ISO 7919**)
- 19" Module Housing in reduced height (3HE), suitable for installation into cabinets with 400 mm depth. Thus smaller machines can be efficiently monitored with instrumentation for up to 24 or 36 channels.
- Use of common control signals between multiple racks when the instrumentation is for larger machines with more than 48 channels.
- High level of system reliability through extensive self-monitoring and individual OK relays in the monitoring modules supplemented by a central OK relay for the complete monitoring rack.

- Processes signals from all commonly used sensors.
- Digital signal processor (DSP) allows multi-faceted and high-speed processing with high reliability through the use of fewer components.
- Flexible monitoring functions with extensive performance limits for special applications; *minimum reaction times of typically 10 ms*.
- Potential-free relay outputs for alarms and messaging to external electronics; relays can also be selectively controlled by logic selection to maximise the reliability of machine shutdown.
- "Fail-safe" operation guarantees optimum machine protection in the case of system disturbances or sensor faults.
- Wide range AC and DC power combined in a standard power supply.
- For additional operational security, a number of power supply modules can be redundantly connected together.
- Complete plant-wide system integration with **Compass 6000** is possible with numerous communication interfaces (RS-232, RS-485 and 1Gbit Ethernet).
- OPC-interface for optional connection with an MS-Windows PC (for process visualization, data export, data storage or plant-wide system integration).
- Optional interface for MODBUS RTU and cable dual MODBUS RTU.

System Description

Self-sufficient monitoring modules

All monitoring modules in the VIBROCONTROL 6000 operate completely independently of one another. Self-contained functions include real-time signal processing of the permanently installed measurement channels, monitoring with reference to alarm limits, relay signaling to peripheral equipment, extensive self-monitoring and the individual control of a built-in OK relay. The modules are hot-swappable – in case of exchanges.

Digital signal processing (DSP)

DSP technology requires considerably fewer electronic components than comparable expensive analogue systems with the same performance. This markedly increases the reliability of all electronic functional component groups as measured by the failure rate or the mean time between failures (MTBF).

Over-range recognition and sensor OK monitoring

Detectors at all inputs prevent false alarms due to sudden, short-term spikes on the input signals or cable faults. An over-range is registered in the event of a faulty input signal. An alarm is activated more than once only if the violating signal remains for more than 10s. Programmable input ranges allow the system to be adapted to practically all commercially available sensors. This heightens the level of monitoring functionality.

Over-voltage protection

All inputs and outputs are secured against voltages of ± 35 V and higher. This protects the hardware against damage due to installation errors.

Power supply monitoring

The supply voltage, supply current and all internal operating voltages are continuously monitored to certain limits and tolerances. In the event of a fault, the power is automatically switched off.

Redundant power supply

To increase the system availability VIBROCONTROL 6000 can be powered by a number of power supplies. All power supply voltages are connected to each individual monitoring module, which automatically selects and monitors its own power source.

"Watchdog" function

This function eliminates false alarms due to the possibility of faults in a monitoring module. If the signal processor does not set an interval-timer back after a preset count, a hardware reset is implemented for it.

Differential inputs

Noise can often cause problems in vibration measurements limiting the amount of measurable information. Therefore most input channels of the VIBROCONTROL 6000 are laid out as differential inputs. This collectively suppresses common-mode interferences such as ground loops or cable noise.

System Configuration

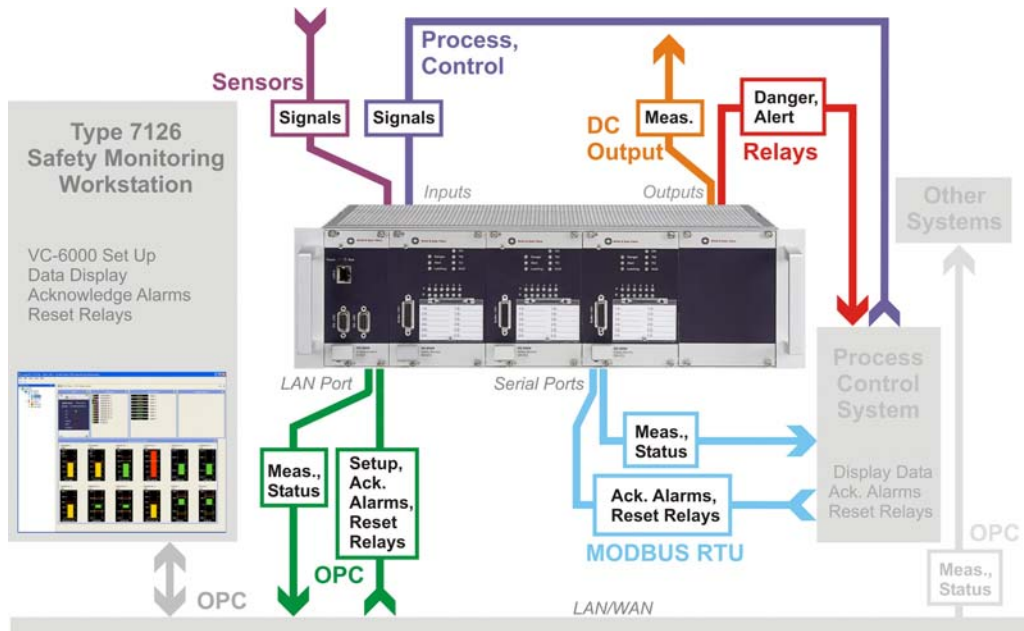


Figure 1: VIBROCONTROL 6000 configuration as a machine protection system.

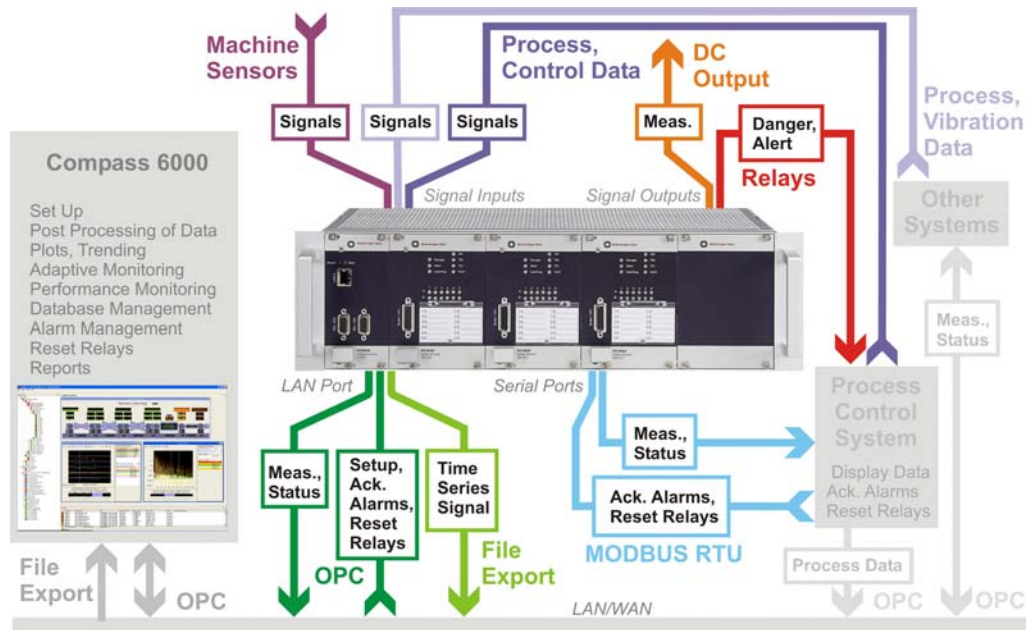


Figure 2: VIBROCONTROL 6000 configuration as a combined protection and condition monitoring system.

System Components

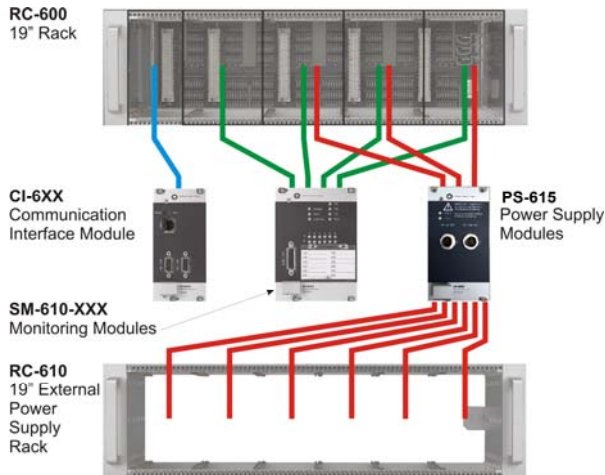


Figure 3: VIBROCONTROL 6000 system components

Monitoring Modules – SM-610-xxx



There are a number of SM-610 Monitoring Modules available, each one operating completely independently for a specific monitoring task. A combination of various add-on input/output hardware modules and firmware make each SM-610-xxx Monitoring Module unique. Each SM-610-xxx is responsible for measurement data acquisition, alarm activation, relay control and time stamping of events that occur.

See the SM-610-xxx Product Specification for more information about each module.

Setup and Data Display Software – Type 7126



The **Type 7126** is the basic software used for setting up the monitoring hardware and communication of the VIBROCONTROL 6000. The Windows®-based software can be used as a control room user-interface for displaying measurement data and for acknowledging alarms from any number of VIBROCONTROL 6000 monitors. During machine commissioning, all measurements can be stored at regular intervals in a file for baseline documentation.

See the 7126 Product Specification (lit. no. BPS0056) for more information.

Power supply Module – PS-615



This module provides power to a fully equipped RC-600 rack with up to 48 inputs and a number of DC outputs and relay outputs.

See the PS-615 Product Specification for more information.

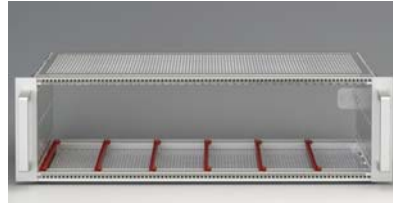
Communication Interface Modules – CI-6xx



The CI-6xx module handles all communication data of the SM-610-xxx Monitoring Modules for setup, visualisation, post-processing and storage using an OPC interface, MODBUS and LAN.

See the CI-6xx Product Specification for more information.

• RC-610 – Power supply rack:

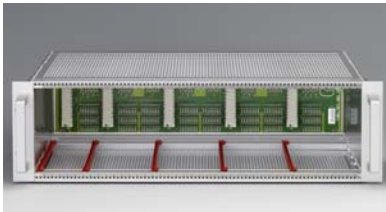


The **RC-610 rack** holds up to six PS-610 Power Supply Modules for powering up to six racks containing SM-610-xxx Monitoring Modules.

See the RC-610 Product Specification for more information.

19” Racks – RC-6xx

• RC-600 – System rack:



The **RC-600 rack** holds up to four SM-610-xxx Monitoring Modules, up to three PS-610 Power Supply Modules and a CI-6xx Communication Interface Module for mounting to a 19” cabinet frame. The rear panel of the rack has connecting plugs for all inputs and outputs and includes a system bus.

See the RC-600 Product Specification for more information.

System Reliability Assessment

Contact Brüel & Kjær Vibro for Safety and Reliability Assessment Specifications that describe the mean time to failure (MTTF) for each individual VIBROCONTROL 6000 module.

Product Specifications - VC-6000 Monitoring System

SM-610-xxx	No. of physical sensor inputs	Input Channel Types										Additional Measurements			Output ch. types	
		Two Point vibration (ISO)	One point Vibration (ISO)	Axial Position	Speed	DC In	Rod Drop	Relative Expansion	Eccentricity	Binary In	Direct Temp.	Vector	Variable Bandpass	Tracking Bandpass	DC OUT	Relay
107	8 Vibr. + 2 Axial			2						3				6	6	
108	8 Vibr.	4	8											8	8	
109	2 x Tacho + 6 Vibr.		6		2					3				8	6	
112	1 x Tacho + 3 x Axial + 4 x Process			3	1	4								8	8	
113	12 Vibr.		12											12		
115	10 Vibr.	5	10							6					10	
138	1x Tacho + 4x Vibr.	4			1					3		4 ⁵		8	8	
139	4 x Tacho + 4 x Vibr.				4		4							8	8	
140	3 x Tacho + 6x Vibr.				3		6			3				12		
145	3x Axial + 1x Tacho + 6x Vibr.	4	2	3	1					3		4 ⁵		8	4	
153	1x Tacho + 2x Axial + 4x Vibr.	4 ³		2	1							4 ⁶		7	8	
160	2x Tacho + 2x Vibr.				2					3		2	2	6	8	
168	1x Tacho + 2x Axial + 4x Vibr.	4 ³		2	1							4 ⁶		7	8	
A01 ⁷ /A02	2x Tacho + 8x Vibr. + 2x Process	Up to 4 ⁸	Up to 8 ⁸	Up to 2 ⁴	2	2		Up to 1 ⁴		1		Up to 4 ^{8,7}	Up to 4 ⁵	Up to 2	Up to 8	
A03	2x Tacho + 8x Vibr. + 2x Process	Up to 4 ⁸	Up to 8 ⁸	Up to 2 ⁴	2	2		Up to 1 ⁴		1		Up to 4 ^{8,7}	Up to 4 ⁵	Up to 8	Up to 2	
A04	6x Vibr.	Up to 3 ⁹	Up to 6 ⁹	Up to 4 ⁹	2 ⁹			Up to 1 ⁹		3		Up to 4 ^{8,7}	Up to 6 ⁹	Up to 6	Up to 10	
A05	2x Vibr. 10x Process		Up to 2		Up to 2	10				9				Up to 6	Up to 6	
A06	12 x Vibr.	Up to 5 ¹⁰	Up to 11 ¹⁰	Up to 1 ¹¹	Up to 2					3			Up to 2	Up to 8	Up to 2	
A07	12x Vibr.	Up to 5 ¹⁰	Up to 11 ¹⁰	Up to 12	Up to 2	Up to 12 ¹¹				6		Up to 4	Up to 2		Up to 8	
T01	12x PT100/PT1000										12				12	
1	Accelerometers only (constant current supply)															
2	SM-610-A01 has single-ended inputs. SM-610-A02 has differential inputs as the other SM-610 modules															
3	The Smax/Max(X-Y) is for condition monitoring only, they are not monitored to alarm limits. The X and Y bandpass values are monitored to alarm limits															
4	There is a maximum of 8 vibration inputs, but several combinations are possible															
5	All vector values (1n, 2n, Jn, Kn magnitude and phase, residual values, and overall RMS) are for condition monitoring purposes only															
6	Only 1n magnitude is monitored to alarm limits, the other vector values (1n phase, 2n, Jn, Kn magnitude and phase, residual values, and overall RMS) are for condition monitoring only															
7	Only 1n magnitude is monitored to alarm limits, the other vector values (1n phase, 2n magnitude and phase, residual values, and overall RMS) are for export only															
8	Slave Trigger input possible: Pulse signal from Master trigger as defined in another SM-610-xxx module (channel 1B) Available as an "additional" input i.e. Pseudo-signal															
9	There is a maximum of 6 vibration inputs, but several combinations are possible															
10	There is a maximum of 11 vibration inputs, but several combinations are possible															
11	One channel of the 11 vibration inputs is configurable for axial position.															

Table 1: Channel input and output configuration for the various SM-610 Monitoring Modules.

There are more SM-610-xxx modules available for special purposes like monitoring of special gas turbines – please contact Brüel & Kjær Vibro for support.

Technical Specifications

Technical Specifications are given for VIBROCONTROL 6000 accessories in this document. See the respective Production Specification for the individual SM-610-xxx Monitoring Modules, CI-6xx Communication Modules, PS-610 Power Supply Modules, RC-6xx 19"-Racks and the Type 7126 Setup and Data Display Software. Technical Specifications for condition monitoring applications of the VIBROCONTROL 6000 can be found in the respective Compass 6000 Product Specifications.

Conformance with standards



The CE mark verifies conformance with EC guideline 89/336/EEG and the low-voltage guideline 73/23/EEC

Safety

EN 61010-1 (2002-08) "Safety requirements for electrical equipment for measurement, control and laboratory use".

EMC interference emission and interference immunity

DIN EN 61326 (2006-10) "Electrical equipment for control and laboratory use – EMC requirements".

Temperature and humidity

DIN EN 60068-2-1 (1995-03): cold down to 0°C
DIN EN 60068-2-2 (1994-08): dry heat up to 65°C

Mechanical strain

DIN IEC 60068-2-6 (1996-05):vibration (sinusoidal)
DIN IEC 60068-2-27 (1995-03): shock
DIN IEC 60068-2-29 (1995-03): bump

Housing

IEC 60529 (2001), housing protection classIP-20



Standard:

UL 61010-1, 3rd Edition, 2012-05-11 (ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL, AND LABORATORY USE - Part 1: General Requirements)

CAN/CSA-C22.2 No. 61010-1, 3rd Edition, 2012-05, (ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL, AND LABORATORY USE - Part 1: General Requirements)

Certification Type:

Component Recognition

CCN: OGTK2, OGTK8
(Laboratory Use Electrical Equipment)

Accessories

Diagnostic Panel - AC-4605



Accesses raw AC/DC signals supplied from the SM-610-xxx Safety Monitor Modules for diagnostic evaluation using a portable measuring instrument.

Features

- Provides 12 BNC sockets
- Arranged for magnet mounting
- 1.5 m connection cable with 26-pol D-Sub plug

Mechanical

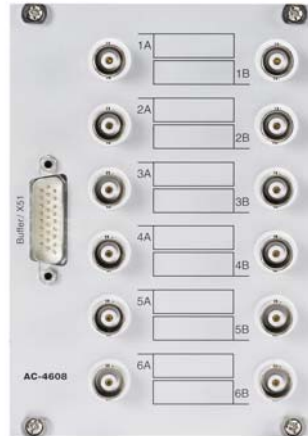
Aluminium housing with IP-20 protection:

Width	100mm
Height	160mm
Depth	42mm
Weight	approx. 2.5kg

Environmental

Operating temperature range..... 0 to +65°C
 Operating and storage humidity 95% RH non-cond.

Terminal Block for Diagnostic Access - AC-4608



Accesses raw AC/DC signals supplied from the SM-610-xxx Monitoring Modules for permanent wiring to peripheral equipment.

Features

- Provides terminals for 12 buffered raw signal outputs
- Mounts into the RC-600, RC-610
- Connection to SM-610 Safety Monitor module by HD-Sub socket

Mechanical

Width	73mm
Height	90mm
Depth	70mm
Weight	approx. 0.3kg

Environmental

Operating temperature range..... -40 to +85°C
 Operating and storage humidity 95% RH non-cond.

Product Specifications – VC-6000 Monitoring System

Brüel & Kjær Vibro reserves the right to change specifications without notice

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