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CMS Condition Monitoring System

Condition Monitor for Large Rotating Machinery

VM-7 Series

The perfect monitor for critical rotating machinery

VM-7

SHINKAWA

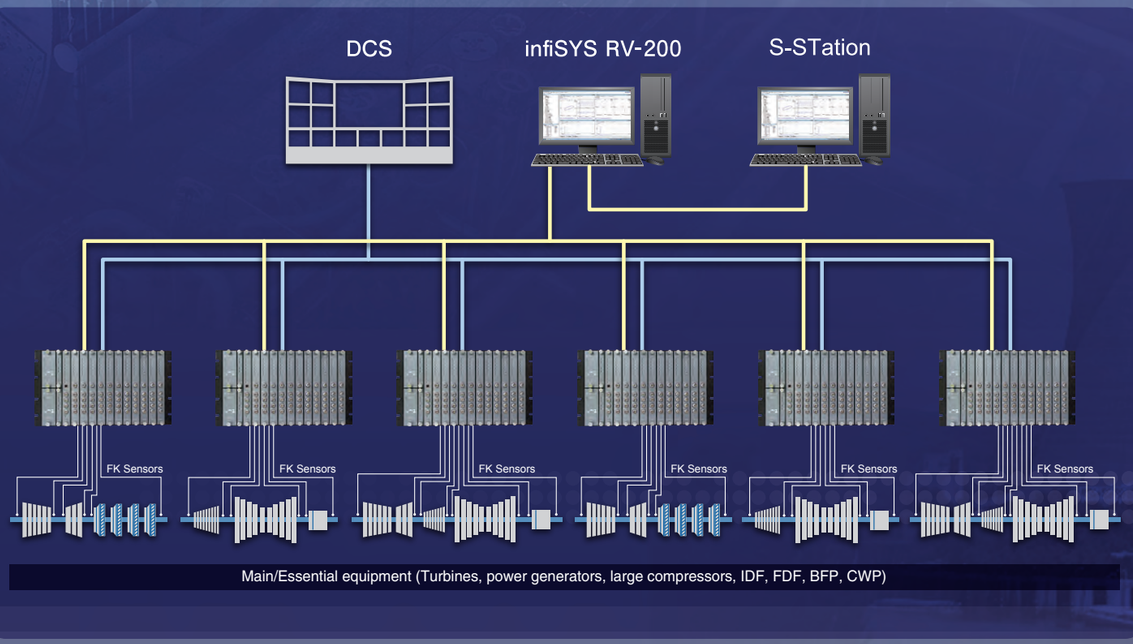
A condition monitor that can be flexibly configured to fit to the size of rotating machinery.

- Designed in accordance with the API* standard 670 -

VM-7 series monitors are optimized for condition monitoring of critical rotating machinery in petrochemical or power plants, including turbines and compressors.

* API: American Petroleum Institute

System Configuration Example



The perfect monitor for critical rotating machinery

VM-7

Features

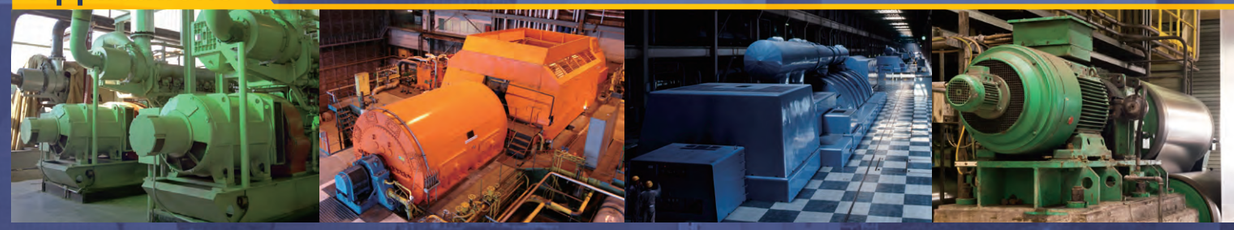
1. Conformity with the API Standard 670
2. Connection to Analysis and Diagnostic System
3. Reliability and Maintainability
4. High Network Robustness (Achilles* Level 2)
5. User Customizable System
6. Configurable Alarm Relays

* Achilles is a registered trade mark of GE Digital.

Advantages

Real-time monitoring of the machine condition.
The immediate alarm output protects the rotating machinery.

Applications



- Steam turbines
- Gas turbines
- Electric generators
- Feed pumps
- Fans
- Blowers
- Compressors
- Rotating equipment critical to your facility

Conformity with the API Standard 670

Designed to meet the requirements specified in the API Standard. It supports not only monitoring parameters specified in the API Standard, such as shaft vibration, casing vibration, axial position, rotation speed and bearing temperatures, but also differential expansion, valve position and eccentricity, etc., required for a Turbine Supervisory Instrument (TSI) for large turbines used for power generation.

High Network robustness (Achilles Level 2)

Communication modules have been tested and certified by Achilles, an industry leading benchmark for secure communication network of industrial devices. It provides cyber security solutions for cyber-attacks through internet as well as terminal devices, and this addition to our monitoring system will benefit our customers for stable operation of critical infrastructure such as petrochemical plants and power stations.

Reliability and Maintainability

The power supply, network communication with the host network or analysis data communication with the infiSYS View Station can be supplied with redundancy to dramatically reduce the risks of monitoring disruption due to power failure or communication network failure. All modules can be installed/removed from the front which allows for the hot swap of modules without having to connect/disconnect wiring at the rack.

Configurable Alarm Relays

Each monitor module has 6 relays for users to set up AND/OR and special alarm logic on the desired channels of the monitor modules within the rack.
For a system that requires more contact outputs, one VM-721B 18-Channel Relay Module, or several VM-722B 9-Channel Relay Modules can be installed per rack.

User Customizable System

The VM-701B Vibration/Displacement Monitor Module can be configured to take 11 different types of measurements, including vibration, thrust, differential expansion, etc., covering all elements of condition monitoring of rotating machinery. Users can configure the modules to meet their monitoring needs*.
(* VM-772B Device Config is required.)

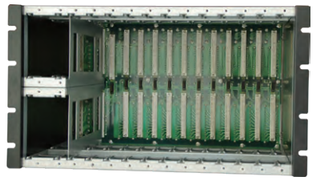
Connection to Analysis and Diagnostic System

To protect critical rotating machinery such as turbines and compressors, there is an increasing need for acquisition, analysis and diagnostics of vibration at machine startup/shutdown (transient data), as well as vibration analysis at rated operation. The VM-742B Network Communication Module connects directly to the infiSYS RV-200 Rotating Machinery Analyzing System, allowing for direct analysis of defects from virtually any computer.

Hardware

VM-76□B

Instrument Rack



The VM-76□B is a 6U, 19-inch rack.
Dimensions: 482.6 (W) x 265.9 (H) x 350 (D) mm
VM-761B: European I/O terminal type
VM-762B: D-sub I/O connector type

VM-75□B

Power Supply Module

The VM-75□B is a power supply module.
Rated voltage types
VM-751B: 100 - 240VAC
VM-753B: 24VDC
VM-754B: 110 - 220VDC
Up to two power supply modules can be mounted on a rack for power supply redundancy.

VM-741B

Local Communication & Phase Marker Module

Achilles* certificated module
VM-741B2

The VM-741B transmits data from the rack communication port to a local display PC via dedicated Ethernet to display bar graphs of measured values and alarm status.
(Requires VM-771B MCL View installed on display PC.)

Also, communicates with a service PC via front USB port for the configuration of a monitor module.
(Requires VM-772B Device Config installed on service PC.)

VM-742B

Network Communication Module

Achilles* certificated module
VM-742B2-□-2

The VM-742B communicates data between the VM-7 Monitoring System and DCS, PLC or to almost any control system. It also provides a direct communication with the infiSYS View Station for data analysis.
For DCS, measured values, analysis data (0.5X, 1X, 2X, Not-1X)* and alarm status are output via Ethernet using Modbus/TCP protocol or RS-485 using Modbus/RTU. For the infiSYS View Station, measured values, analysis data* and waveform data* are output via dedicated Ethernet. A second communication module can be fitted to provide redundancy.
(* Available with the optional analysis boards installed on vibration monitor modules.)

* Achilles is a registered trade mark of GE Digital.

Hardware

VM-721B
18-Channel
Relay Module

VM-722B
9-Channel
Relay Module

The VM-721B and the VM-722B are relay modules that have independently programmable alarm relays. Users can program AND/OR or 2 out of 3 logic with any channels of any modules within the rack.

	VM-721B	VM-722B
Number of outputs	18	9
Number of logic elements (per alarm relay)	255 max.	1023 max.
Number of modules installed in a rack	1	up to 10

VM-701B
Vibration /
Displacement
Monitor Module

The VM-701B monitors various vibration and displacement parameters, including shaft vibration, casing vibration, axial position and differential expansion between the rotor and the casing. It accepts up to 4 channels of input, and as an option, one phase marker input is also available.
Recorder and contact outputs corresponding to the inputs are provided through the rear panel of the instrument rack.
There are 6 relays for which logic can be set using the status of the monitor module/channel within the rack and AND/OR logical settings.
The number of logic elements is 63 per alarm relay.

VM-702B
Absolute
Vibration
Monitor Module

The VM-702B is designed to concurrently monitor the shaft relative vibration and the absolute vibration or the seismic vibration on rotating machinery. It accepts two systems of inputs (relative vibration: 2 channels, seismic vibration: 2 channels).
Recorder and contact outputs for each input are provided through the rear panel of the instrument rack.
There are 6 relays for which logic can be set using the status of the monitor module/channel within the rack and AND/OR logical settings.
The number of logic elements is 63 per alarm relay.

VM-703B
Tachometer &
Eccentricity
Monitor Module

The VM-703B has functions that monitor speed, acceleration, direction of the shaft rotation and shaft eccentricity due to a bend in the shaft.
This module accepts up to 2 channels for rotation signals and 1 channel of eccentricity signal.
Recorder and contact outputs for each input are provided through the rear panel of the instrument rack.
There are 6 relays for which logic can be set using the status of the monitor module/channel within the rack and AND/OR logical settings.
The number of logic elements is 63 per alarm relay.

VM-704B
Temperature
Monitor Module

The VM-704B monitors the temperature of any part of the machinery. I accepts up to 6 channels, i.e., the temperature of 6 areas can be monitored with one monitor module. Inputs from thermocouples or 3 and 4 wire resistance temperature sensors are supported.
Recorder and contact outputs for each input are provided through the rear panel of the instrument rack.
There are 6 relays for which logic can be set using the status of the monitor module/channel within the rack and AND/OR logical settings.
The number of logic elements is 63 per alarm relay.

VM-705B
18-Channel
Temperature
Monitor Module

The VM-705B monitors the temperature of any part of the machinery. I accepts up to 18 channels, i.e., the temperature of 18 areas can be monitored with one monitor module. Inputs from thermocouples or 3 and 4 wire resistance temperature sensors are supported.
It don't have Recorder output. Modbus/TCP protocol are provided through the rear panel of the instrument rack. Contact output of each input are provided through the VM-721B or VM-722B relay module.

Note) VM-7A1B is necessary to use VM-705B.

Hardware

VM-706B
Rod Drop
Monitor Module

The VM-706B is used for measurement and monitoring of wear of the rider band (ring) of reciprocating compressors.
This module accepts up to 4 channels of input.
Recorder and contact outputs for each input are provided through the rear panel of the instrument rack.
There are 6 relays for which logic can be set using the status of the monitor module/channel within the rack and AND/OR logical settings.
The number of logic elements is 63 per alarm relay.

VM-707B
Aeroderivative
Gas Turbine
Monitor Module

Aeroderivative Gas Turbine Monitor Module monitors the casing vibration of an aeroderivative gas turbine and takes inputs of up to 4 channels. 3 types of measurement methods - overall, band-pass filter, and 1X tracking filter - are available. It measures and sets off alerts in accordance with the 2 methods selected per channel. 1 of the 2 selected measurements is sent for recorder output. Recorder outputs and contact outputs are sent to external equipment through the rear panel of the instrument rack.

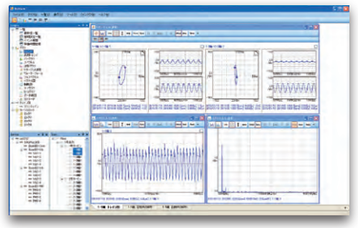
Software

VM-771B
MCL View

Bar Graph Screen (Current Value Display)

The VM-771B displays measurement values, monitoring status and the configuration of each module.

VM-773B
infiSYS
Analysis View



infiSYS View Station Screen

The VM-773B displays measured values, analysis plots and diagnostic results.

Note; An optional analysis board must be specified when ordering to obtain analysis and diagnostic function, i.e.,
VM-701B/PM□/ALY or VM-702B/ALY

VM-772B
Device Config

Device Config Screen

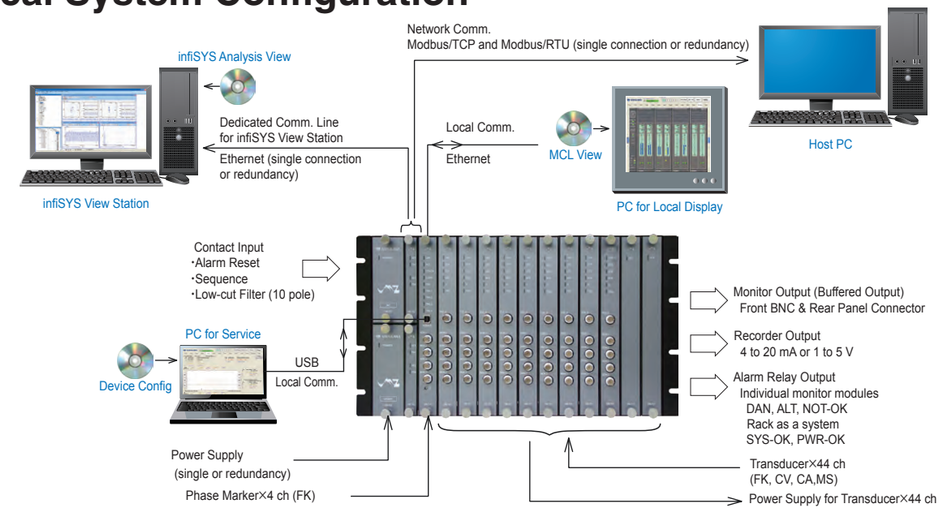
The VM-772B allows users to configure the monitoring system on site by directly connecting the PC to the rack, or from a remote place via the Ethernet.

Monitoring Parameters

Monitor Module		Monitoring Parameter	Number of Inputs	Number of Outputs
VM-701B Vibration / Displacement Monitor Module*1		Displacement Vibration	4	4
		Velocity Vibration	4	4
		Acceleration Vibration	4	4
		Dual Path Vibration	2	4
		Thrust Position	4	4
		Differential Expansion (Single Input)	4	4
		Ramp Differential Expansion	4	2
		Complementary Input Differential Expansion	4	2
		Case Expansion/Complementary Expansion	3	3
		Case Expansion	4	4
		Valve Position	4	4
VM-702B Absolute Vibration Monitor Module		Shaft Relative Vibration and Shaft Absolute Vibration or Casing Vibration	4*2	4*2
VM-703B Temperature & Eccentricity Monitor Module	CH1&CH2	Rotor Speed	2	2
	CH2	Rotor Acceleration	0	1
	CH1&CH2	Reverse Rotation	2	2
	CH3	Eccentricity	1	2
VM-704B Temperature Monitor Module		Temperature	6	6
VM-705B 18-Channel Temperature Monitor Module		Temperature	18	-
VM-706B Rod Drop Monitor Module		Rod Drop	4 1 (PM)	4
VM-707B Aeroderivative Gas Turbine Monitor Module		Casing Vibration (overall or band-pass filter or and 1X tracking filter)	4	4

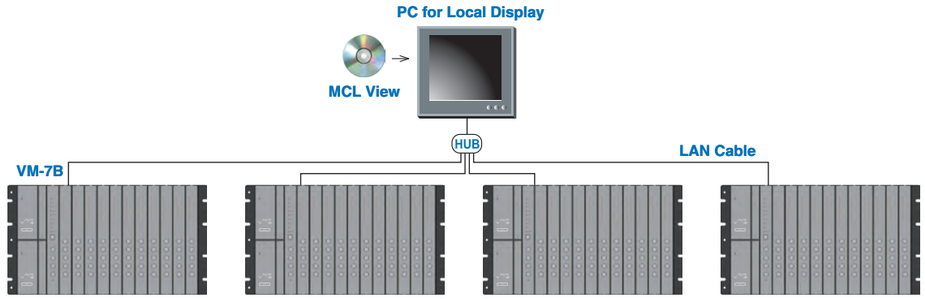
*1 One channel phase marker (PM) input is optionally available.
*2 Two channels of input are required per measurement point, i.e., four channels of input make measurements of two points.

Typical System Configuration

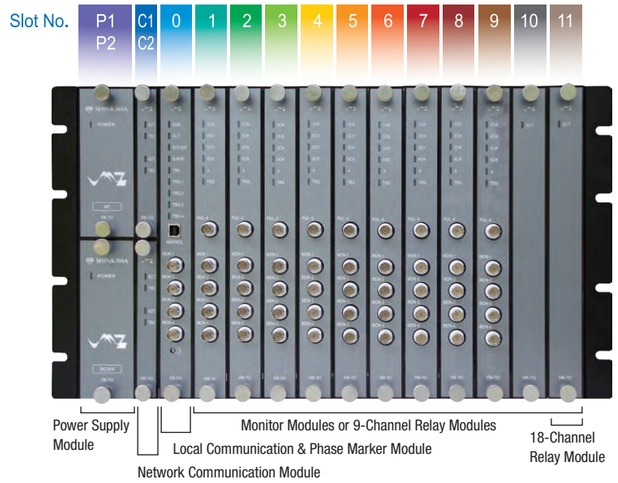


Local PC Connection

Up to 4 VM-76□B instrument racks can be connected to a local PC.
(MCL View software installation is required.)



Mountable Module Slot Number



Modules	Slot Number															
	P1	P2	C1	C2	0	1	2	3	4	5	6	7	8	9	10	11
VM-75□B Power Supply Module	●	●														
VM-742B Network Communication Module			●	●												
VM-741B Local Communication & Phase Marker Module					●											
VM-701B Vibration / Displacement Monitor Module						●	●	●	●	●	●	●	●	●	●	●
VM-702B Absolute Vibration Monitor Module						●	●	●	●	●	●	●	●	●	●	●
VM-703B Tachometer & Eccentricity Monitor Module						●	●	●	●	●	●	●	●	●	●	●
VM-704B Temperature Monitor Module						●	●	●	●	●	●	●	●	●	●	●
VM-705B 18-Channel Temperature Monitor Module						●	●	●	●	●	●	●	●	●	●	●
VM-706B Rod Drop Monitor Module						●	●	●	●	●	●	●	●	●	●	●
VM-707B Aeroderivative Gas Turbine Monitor Module						●	●	●	●	●	●	●	●	●	●	●
VM-721B 18-Channel Relay Module																●
VM-722B 9-Channel Relay Module						●	●	●	●	●	●	●	●	●	●	●
VZ-71 30mm (W) Blank Panel					– *1	●	●	●	●	●	●	●	●	●	●	●
VZ-75 20mm (W) Blank Panel			●	●												
VZ-76 50mm (W) Blank Panel	– *2	●														

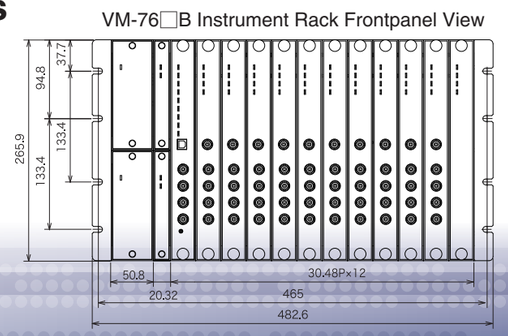
*1 Local Communication & Phase Marker Module is installed in slot 0 with any rack design.
*2 Primary power supply is installed in slot P1.

Primary Specifications

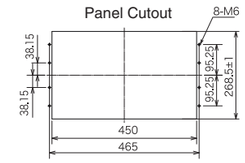
Module	Item	Specifications	
Instrument Rack	Size	482.6 (W) × 265.9 (H) × 350.0 (D) mm	
	Max. number of Mountable Modules	·Power Supply Module···2 ·Network Communication Module···2 ·18-Channel Relay Module···1 ·Local Communication & Phase Marker Module···1 ·Monitor Module···11 ·9-Channel Relay Module ···10 * For module and mountable slot number, refer to the chart on page 6, “MOUNTABLE MODULE SLOT NUMBER”.	
Power Supply Module (Redundancy module available)	Power (rating)	100-240 VAC / 110 -220 VDC / 24 VDC	
Local Communication & Phase Marker Module	Phase Marker Input	RD-05A or FK-202F Transducer × 4 channels	
	Communication Port	Front USB × 1 (for PC for service and maintenance purpose) Rear Ethernet 100 Base-TX × 1 (for PC for permanent display)	
	Software Screen View	* MCL View installation on PC required.	
		[Bar graph screen] (current value display)	Measured value (numeric and bar graph displays), GAP (bias) voltage indication, alarm setting value, alarm status, channel bypass status, danger bypass status, Power OK status, tag name, serial No., channel name
		[Train screen]	Machine train diagram, measured value, alarm setting value
		[Trend graph screen]	Cursor function
		[Relay status screen]	Relay status, relay logic
Monitor Module	Digital Display Accuracy (on Display Software for PC)	Vibration/displacement/eccentricity Rotation speed Temperature	±1.0% of F.S. at 25 ℃ ±(0.003% of rdg. + 1 digit) at 25 ℃ ±(1.0% of F.S. + 1℃) at 25 ℃
			±2.0% of F.S. at 0 to 65 ℃ ±(0.03% of rdg. + 1 digit) at 0 to 65 ℃ ±(2.0% of F.S. + 1℃) at 0 to 65 ℃
	Recorder Output (4 to 20 mA or 1 to 5 V)	Vibration/displacement/eccentricity Rotation speed Temperature	±1.0% of F.S. at 25 ℃ ±1.0% of F.S. at 25 ℃ ±(1.0% of F.S. + 1℃) at 25 ℃
			±2.0% of F.S. at 0 to 65 ℃ ±2.0% of F.S. at 0 to 65 ℃ ±(2.0% of F.S. + 1℃) at 0 to 65 ℃
	Number of Alarm Contact Outputs	SPDT × 6 points	
	Number of Logic Elements	63	
	Vibration Analysis Capability (Available with analysis board installed)	Number of points of vibration analysis	Up to 44 points* (vibration channels of VM-701B) * When 11 modules are installed.
		Analysis item	Amplitude : 0.5X, 1X, 2X, nX1*, nX2*, nX3*, nX4*, Not-1X, Sp-p max Phase : 0.5X, 1X, 2X, nX1*, nX2*, nX3*, nX4* * nX amplitude and phase can be monitored on the infiSYS View Station.
18-Channel Relay Module	Number of Alarm Contact Outputs	SPST × 18 points	
	Number of Logic Elements	255	
9-Channel Relay Module	Number of Alarm Contact Outputs	SPST × 9 points	
	Number of Logic Elements	1023	
Network Communication Module (Redundancy connection available)	Communication Protocol	Modbus/TCP Modbus/RTU	Ethernet 10 Base-T / 100 Base-TX (communication ports at rear side) RS-485
	Communication Item	·Measured value ·Gap voltage ·Danger alarm status ·Alert alarm status ·OK alarm status ·Danger Bypass status ·Danger & Alert Set value ·OK limits set value ·Alarm set multiplier status ·Low-cut filter (10 pole) ON/OFF status ·Power-OK status ·Analysis data (available with analysis board installed): amplitude and phase of 0.5X, 1X and 2X and amplitude of Not-1X	

Rack Dimensions

VM-76□B Instrument Rack Frontpanel View



Panel Cutout



Dimension : mm