Condition Monitor for Large Rotating Machinery

VM-7 Series

The perfect monitor for critical rotating machinery

VM-7
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
Real-time monitoring of the machine condition. The immediate alarm output protects the rotating machinery.

Features

1. Conformity with the API Standard 670
2. Connection to Analysis and Diagnostic System
3. Reliability and Maintainability
4. High Density
5. User Customizable System
6. Configurable Alarm Relays

Advantages

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 temperature, but also differential expansion, valve position and eccentricity, etc., required for a Turbine Supervisory Instrument (TSI) for large turbines used for power generation.

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**1.

(**1 VM-772B Device Config is required.)

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 wirings at the back.
**High Density**

One 19” rack can hold up to 44 vibration/displacement acquisition channels (11 x 4 channel cards), or 66 temperature channels (11 x 6 channel cards), or a combination of the two.

**Connectin 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 Large Rotating Machinery Analyzing System, allowing for direct analysis of defects from virtually any computer.

**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.
Hardware

- **VM-76B**  
  **Instrument Rack**  
  The VM-76B 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-75B**  
  **Power Supply Module**  
  The VM-75B is a power supply module.  
  Rated voltage types:  
  VM-751B: 100 - 240 VAC  
  VM-753B: 24 VDC  
  VM-754B: VM110 - 220 VDC  
  Up to two power supply modules can be mounted on a rack for power supply redundancy.

- **VM-741B**  
  **Local Communication & Phase Marker Module**  
  The VM-741B transmits data from the back 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**  
  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)*3 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*3 and waveform data*3 are output via dedicated Ethernet. A second communication module can be fitted to provide redundancy.  
  (*3 Available with the optional analysis boards installed on vibration monitor modules.)
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.

<table>
<thead>
<tr>
<th></th>
<th>VM-721B</th>
<th>VM-722B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of outputs</td>
<td>18</td>
<td>9</td>
</tr>
<tr>
<td>Number of logic elements (per alarm relay)</td>
<td>255 max.</td>
<td>1023 max.</td>
</tr>
<tr>
<td>Number of modules installed in a rack</td>
<td>1</td>
<td>up to 10</td>
</tr>
</tbody>
</table>

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.

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). 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 corresponding to the inputs are provided through the rear panel of the instrument rack. There are 6 relays for which the 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. It 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 corresponding to the inputs are provided through the rear panel of the instrument rack. There are 6 relays for which the 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-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 corresponding to the inputs are provided through the rear panel of the instrument rack. There are 6 relays for which the 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.

### Monitoring Parameters

<table>
<thead>
<tr>
<th>Monitor Module</th>
<th>Monitoring Parameter</th>
<th>Number of Inputs</th>
<th>Number of Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>VM-701B Vibration / Displacement Monitor Module</td>
<td>Displacement Vibration</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Velocity Vibration</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Acceleration Vibration</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Dual Path Vibration</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Thrust Position</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Differential Expansion (Single Input)</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Ramp Differential Expansion</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Complementary Input Differential Expansion</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Case Expansion/Complementary Expansion</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Case Expansion</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Valve Position</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

| VM-702B Absolute Vibration Monitor Module | Shaft Relative Vibration and Shaft Absolute Vibration or Casing Vibration | 4 | 4 |

| VM-703B Tachometer & Eccentricity Monitor Module | Rotor Speed | 2 | 2 |
| CH1 & CH2 | Rotor Acceleration | 0 | 1 |
| CH2 | Reverse Rotation | 2 | 2 |
| CH1 & CH2 | Eccentricity | 1 | 2 |
| CH3 | Temperature | 6 | 6 |
| VM-704B Temperature Monitor Module | Rod Drop | 4 | 4 |
| VM-706B Rod Drop Monitor Module | 1 (PM) |

*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

**VM-771B**

*Software*

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

**VM-772B**

*Device Config*

VM-772B allows users to configure the monitoring system in or out of the field. PC can be connected to the USB port of the rack.

**VM-773B**

*infiSYS Analysis View*

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 functions, i.e., VM-701B/PM/ALY or VM-702B/ALY.

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**Software**

- **VM-771B**
  - MCL View
    - Bar Graph Screen (Current Value Display)

- **VM-772B**
  - Device Config
    - Device Config Screen

- **VM-773B**
  - infiSYS Analysis View
    - infiSYS View Station Screen

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**Typical System Configuration**

[Diagram of system configuration with labels for various components such as network, local communication, device config, etc.]
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

<table>
<thead>
<tr>
<th>Modules</th>
<th>Slot Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>VM-75□B Power Supply Module</td>
<td>P1 P2 C1 C2</td>
</tr>
<tr>
<td>VM-742B Network Communication Module</td>
<td></td>
</tr>
<tr>
<td>VM-741B Local Communication &amp; Phase Marker Module</td>
<td></td>
</tr>
<tr>
<td>VM-701B Vibration/Displacement Monitor Module</td>
<td></td>
</tr>
<tr>
<td>VM-702B Absolute Vibration Monitor Module</td>
<td></td>
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<td>VM-706B Rod Drop Monitor Module</td>
<td></td>
</tr>
<tr>
<td>VM-721B 18-Channel Relay Module</td>
<td></td>
</tr>
<tr>
<td>VM-722B 9-Channel Relay Module</td>
<td></td>
</tr>
<tr>
<td>VZ-71 30mm (W) Blank Panel</td>
<td></td>
</tr>
<tr>
<td>VZ-75 20mm (W) Blank Panel</td>
<td></td>
</tr>
<tr>
<td>VZ-76 50mm (W) Blank Panel</td>
<td></td>
</tr>
</tbody>
</table>

*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) \( \times \) 265.9 (H) \( \times \) 350.0 (D) mm
Max. number of Mountable Modules | • Power Supply Module - 2 | • Local Communication & Phase Marker Module - 1
 | • Network Communication Module - 2 | • Monitor Module - 1
 | • 18-Channel Relay Module - 1 | • 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 \( \times \) 4 channels
Communication Port | Front USB \( \times \) 1 (for service and maintenance purpose)
 | Rear Ethernet 100 Base-TX \( \times \) 1 (for PC for permanent display)

**Software Screen View** | **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
 | **Cursor function**

**Monitor Module** | **Digital Display Accuracy** (on Display Software for PC) | Vibration/displacement/eccentricity \( \pm 1.0\% \) of F.S. at 25 °C \( \pm 2.0\% \) of F.S. at 0 to 65 °C
 | Rotation speed \( \pm (0.003\% \) of rdg. + 1 digit) at 25 °C \( \pm (0.03\% \) of F.S. + 1°C) at 0 to 65 °C
 | Temperature \( \pm (1.0\% \) of F.S. + 1°C) at 25 °C \( \pm (2.0\% \) of F.S. + 1°C) at 0 to 65 °C

**Recorder Output** (4 to 20 mA or 1 to 5 V)
 | Vibration/displacement/eccentricity | Rotation speed \( \pm 1.0\% \) of F.S. at 25 °C \( \pm 2.0\% \) of F.S. at 0 to 65 °C
 | Temperature \( \pm (1.0\% \) of F.S. + 1°C) at 25 °C \( \pm (2.0\% \) of F.S. + 1°C) at 0 to 65 °C

**Number of Alarm Contact Outputs** | SPDT \( \times \) 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.
Amplitude: 0.5X, 1X, 2X, nx1*, nx2*, nx3*, nx4*
Phase: 0.5X, 1X, 2X, nx1*, nx2*, nx3*, nx4*

**Analysis data (available with analysis board installed): amplitude and phase of 0.5X, 1X and 2X and amplitude of Not-1X**

**18-Channel Relay Module** | Number of Alarm Contact Outputs | SPST \( \times \) 18 points
Number of Logic Elements | 255

**9-Channel Relay Module** | Number of Alarm Contact Outputs | SPST \( \times \) 9 points
Number of Logic Elements | 1023

**Network Communication Module (Redundancy connection available)** | **Communication Protocol** | Modbus/TCP
 | Modbus/RTU

**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

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**Rack Dimensions**

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**VM-76** B Instrument Rack Frontpanel View

*For module and mountable slot number, refer to the chart on page 6, "MOUNTABLE MODULE SLOT NUMBER".*