Product Specifications

VC-6000 Monitoring System
Monitoring Module – SM-610-A06
User-Defined: up to 11x Vibration inputs, up to 2x Axial position, up to 2x Phase Reference/Speed with 8x DC Outputs and 2x Relays

The VC-6000 Monitoring System hardware is used for both stand-alone safety monitoring and condition monitoring using the Compass 6000 monitoring software modules and database. The VC-6000 offers various standard monitoring modules, power supply modules and communication modules. This Product Specification describes the SM-610-A06.

Applications

The SM-610 series of VC-6000 Monitoring Modules are designed to provide protective monitoring of various types of industrial machines. The SM-610-A06 is specifically designed as a "user-defined" monitoring module, where there are a number of selectable differential inputs and outputs. This is useful for monitoring machines with special applications, e.g. Hydro machines.

General Description

The features and functions common to all SM-610 Monitoring Modules are briefly listed below. Please refer to the VC-6000 Product Specification (BPS 0044) for more information.

- Interfacing with the CI-620 Communication Module
- High speed digital signal processor
- Relay outputs (logic controlled)
- DC outputs
- Module OK-relay status indication
- Extensive local LED indication
- Flash memory for storing settings and local logbook
- High speed reaction time
- Alarm limits with programmable hysteresis and response delay time
- Global trip multiply and override
- Extensive self-monitoring functions
- System bus interface to other modules
- Buffered input signal outputs

Inputs

- Up to 11 x vibration input channels– freely configurable with measurements
- 3 x binary input channels
- Up to 2 x axial position
- Up to 2 x speed inputs, with one dedicated for 1x Master [1] (central) trigger input signal
1 x Slave input channel
[1] Providing trigger signals to other SM-610-xxx modules.

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Measurements

The measurements available depend on the inputs selected. These can include up to:

- 2x speed/phase reference – rotation direction, zero speed, run up, coast down
- Bandpass – up to 11x single-point and/or up to 5x dual-point pairs with user-defined **ISO** (up to 11x) OR
  user defined variable (up to 6x) **HP** and **LP filters**
- Limit monitoring with up to 8* different sets of Alert and Danger limits according to 8 * definable machine states

Outputs

- 2 x relays (any combination of Alert and Danger). Selectable for any AC/DC measurement alarm limits. Relay logic operators AND, OR, NOT, and ( ) can be used in a user-defined voting logic with any combination of measurement alarm limits
- 8 x DC outputs freely assignable to any AC/DC measurement.

Input Channel Configuration Combinations

No.	Sum of Inputs	Channels/Measurements							Outputs	
		Variable Band-pass		ISO Filter		Axial Position	Speed/Phase Reference	Binary-Inputs	DC-out	Relays
		Dual-Point Vibr.[1]	Single-Point Vibr.[1]	Dual-Point Vibr.[1]	Single-Point Vibr.[1]					
1	9	6	-	-	-	-	3	8	2
2	10	5	-	1	1	3	8	2
3	11	5	2	1	-	3	8	2
4	11	5	1	2	-	3	8	2
5	11	4	1	1	2	3	8	2
6	11	4	2	1	1	3	8	2
7	11	4	-	2	2	3	8	2
8	12	4	4	1	-	3	8	2
9	12	4	3	2	-	3	8	2
10	12	3	5	-	1	3	8	2
11	12	3	4	-	2	3	8	2
12	13	3	4	2	1	3	8	2
13	13	3	7	-	-	3	8	2
14	13	3	3	2	2	3	8	2
15	13	2	7	-	1	3	8	2
16	13	2	6	-	2	3	8	2
17	14	3	6	2	-	3	8	2
18	14	2	9	-	-	3	8	2
19	14	2	6	2	1	3	8	2
20	14	2	5	2	2	3	8	2
21	15	2	8	2	-	3	8	2
22	15	0	11	1	-	3	8	2
23	15	0	11	-	1	3	8	2
24	15	1	8	1	2	3	8	2
25	15	1	8	2	1	3	8	2
26	15	1	7	2	2	3	8	2
27	15	0	10	1	1	3	8	2
28	15	0	10	2	-	3	8	2
29	15	0	10	-	2	3	8	2

[1] A dual-point band-pass measurement can alternatively be set up as two single-point measurements and vice versa.

Table 1: Input channel combinations

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Signal Flow Diagrams

User Definable Measurement Channel Inputs (maximum subject to overall input allocation).
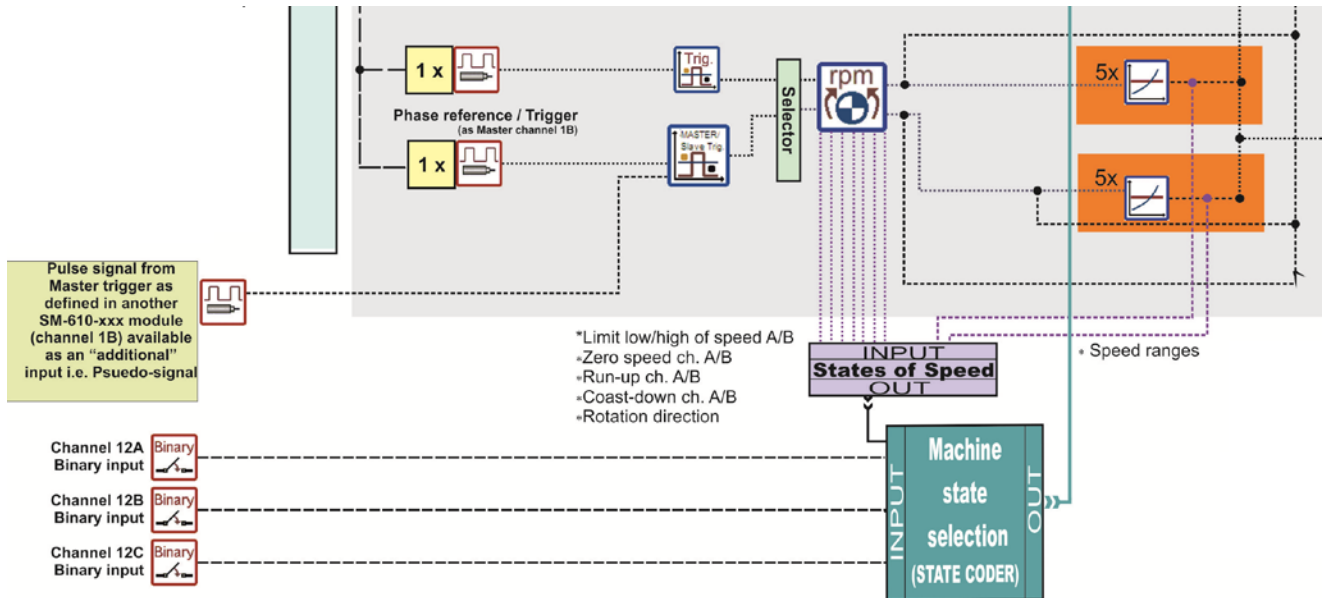

Figure 1. Speed reference sensor input (selectable in 2 channels), alternatively the Master Trigger signal of another SM-610-xxx module can be chosen. Channel 1B can be designated as a master speed/phase reference channel for distribution to other SM-610-xxx modules in up to 4 racks.
The three binary input channels together with the digital status signals of the Dual Speed measurement and/or definable speed ranges are the input signals for the Machine State selection, which defines up to 8* different machine states. For each machine state a different limit set of Alert and Danger values can be set up.
*Please note: Together with Compass 6000 a maximum of 6 machine states are available. The machine state coder in the 7126/7123 software shows a Compass 6000 compatibility marker!
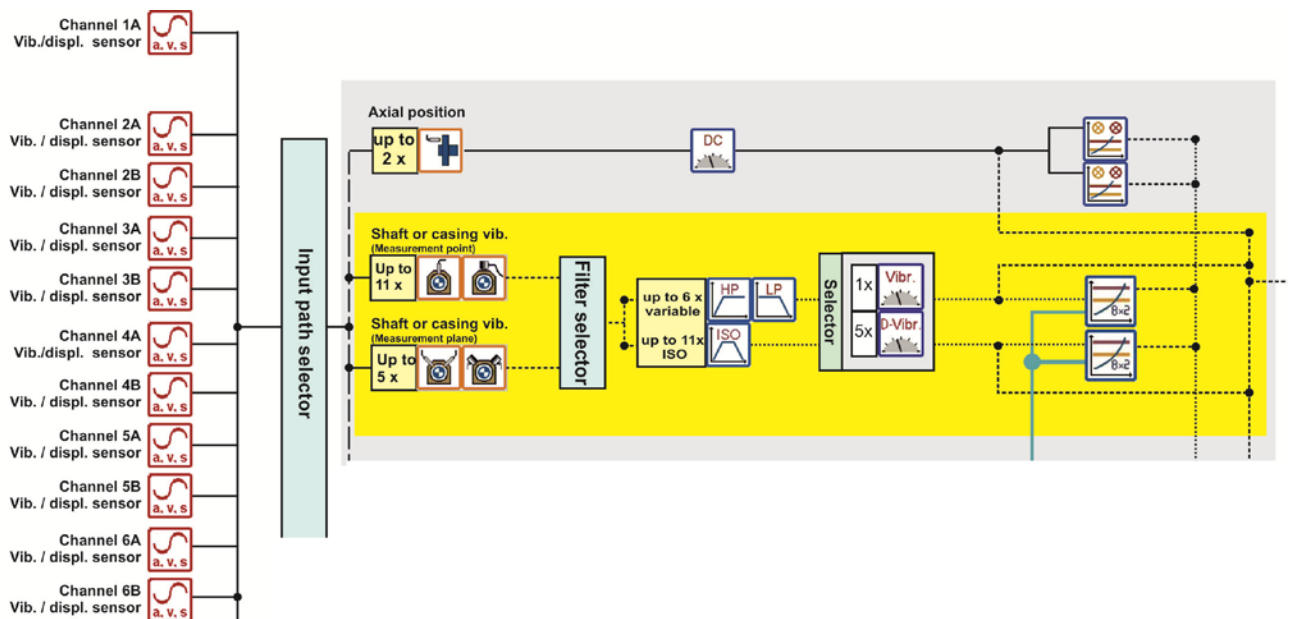

Figure 2: 11 vibration input channels can be configured as Smax, Max X/Y or single measurements (RMS, Peak, Peak-Peak). Up to 6 of these measurements can be configured with variable band-pass.
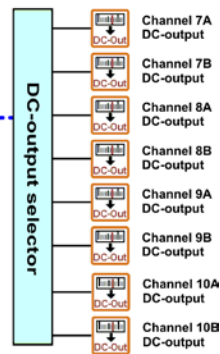*– Please have a look at table 1: "Input channel combinations"*

Figure 3. 8 DC-output channels can be freely assigned to any AC/DC measurement within the SM-610-A06 module.
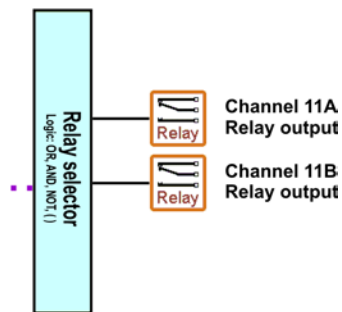

Figure 4. 2 output relays can be assigned with a free assignable voting logic to any limit within the SM-610-A06 module.

Defining Machine states

There are various possibilities to define the different machine states for the Safety monitor module SM-610-A06.

1. Using the three binary-inputs to define over bit pattern a maximum of 8 different machine states. The input signals could be signals of the DCS system, that indicate different machine states like pumping state or generating state of the hydro machine.

2. Using the speed signals in addition to the binary inputs. Out of the speed signal various logic signals can be detected, like zero speed, run-up, coast down or rotation direction.

3. Machine states can also be defined by different speed ranges.

Please note: *The configuration software allows setting "Compass 6000 compatibility mode". Then only a maximum of 6 different machine states are possible!*

Technical Specifications

The specifications given below are specific for the SM-610-A06 Monitoring Module. See the VC-6000 Product Specifications for features and functions common to all SM-610 Monitoring modules.

AC/DC Vibration Sensor Inputs

Input voltage range .... −21.5V to −1V

Input frequency range:
    Accelerometer/velocity sensor............1Hz to 20kHz
    Displacement sensor ....DC to 20kHz

Input impedance:
    Accelerometer...>800kΩ
    Velocity sensor 50kΩ
    Displacement sensor ....>800kΩ

Gain:
    Accelerometer sensor:
        No integration .... 1 to 80
        Analogue integration............................... 1 to 80
    Velocity sensor .... 1 to 80
    Displacement[1] sensor... 1

Sensitivity:
    Accelerometer.................adjustable (e.g. 100mV/g)
    Velocity sensor ....adjustable (e.g. 100mV/mm/s)
    Displacement sensor ....adjustable (e.g. 8mV/μm)

Common mode rejection:
    DC to 30kHz ....typically 90dB
    30kHz to 100kHz ....typically 85dB

Maximum accelerometer input signal (100mV/g):
    No integration .... 1.25g to 80g peak
    Analogue integration....12.5mm/s to 150mm/s peak

Sensor power:
    Sensor supply.................................. −24VDC ±2%
    Maximum current..30mA

Speed/Phase Reference Sensor Inputs

Input voltage range .... −21.5V to −1V
Input frequency range.............................DC to 20kHz
Input impedance ....>800kΩ
Gain 1

Common mode rejection:
    DC to 10kHz ....typically 90dB
    10kHz to 100kHz ....typically 85dB

Sensor power:
    Sensor supply .... −24VDC ±2%
    Maximum current...30mA

Binary Inputs

Input impedance 3.3kΩ
Accuracy ....response time 5ms
Minimum current load 5mA
Maximum contact voltage ....±50V

Signal status LOW:
    Nominal input voltage 0V
    Input voltage range........................... −50V to 6.6V
    Maximum input current 2mA

Signal status HIGH:
    Nominal input voltage 24V
    Input voltage range........................... 16.5V to 50V
    Maximum input current 5mA

Buffered Outputs

Minimum output load 100kΩ
Output gain ....1 (±2%)
Cross-talk....................... typically −90dB (up to 50kHz)
Inherent noise (1Hz to 50kHz) ......typically 10mV RMS
Output impedance .... <100Ω
Frequency range......... DC to 50kHz (phase shift <5%)
Output offset ....≤ ±13mV

Analogue DC Outputs

Current output:
    Current range.......... 0mA to 20mA or 4mA to 20mA
    Maximum output load 500Ω
    Accuracy ...max. deviation 2.4% of measured value
    Offset ....<20μA

Voltage output:
    Voltage range .... 0V to 10V or 2V to 10V
    Minimum output load 1kΩ
    Accuracy ...max. deviation 1.3% of measured value
    Offset ....<9.5mV

Relay Outputs

Nominal working voltage.......................................24V
Maximum current 100mA

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Measurements

Meas. Name	Frequency Range	Measuring Time	Detection	Alarm Limits	Measuring Range	Units[1]	Accuracy (25°C, 80Hz, 0-Peak)
Bandpass (ISO 10816)	HP: 1Hz to 10Hz (-1dB) LP: 1kHz (-1dB) 18dB/Octave (ISO 2954)	Adjustable 100ms to 100s in steps of 100ms	RMS, Peak, Peak-Peak	1x Alert, 1x Danger	80g	g	±(0.08g + 0.75% of measured value)
					150mm/s [2]	mm/s	±(0.6mm/s + 2.75% of measured value)
					100mm/s	mm/s	±(0.1mm/s + 0.75% of measured value)
Bandpass (ISO 7919)	HP: 1Hz to 10Hz (-1dB) LP: 1kHz (-1dB) 18dB/Octave (ISO 2954)	Adjustable 100ms to 100s in steps of 100ms	RMS, Peak, Peak-Peak	1x Alert, 1x Danger	2000µm	µm	±(10.0µm + 1.0% of measured value)
S_{max}	HP: 1Hz to 16kHz (-1dB) LP: 1.25Hz to 20kHz (-1dB) 18dB/Octave (ISO 2954)	Adjustable 100ms to 100s in steps of 100ms	Peak	1x Alert, 1x Danger	2000µm	µm	±(10.0µm + 1.0% of measured value)
$X\text{-}Y_{max}$	HP: 1Hz to 16kHz (-1dB) LP: 1.25Hz to 20kHz (-1dB) 18dB/Octave (ISO 2954)	Adjustable 100ms to 100s in steps of 100ms	RMS, Peak, Peak-Peak	1x Alert, 1x Danger	80g	g	±(0.08g + 0.75% of measured value)
					150mm/s [2]	mm/s	±(0.6mm/s + 2.75% of measured value)
					100mm/s	mm/s	±(0.1mm/s + 0.75% of measured value)
					2000µm	µm	±(10.0µm + 1.0% of measured value)
Variable bandpass	HP: 1Hz to 16kHz (-1dB) LP: 1.25Hz to 20kHz (-1dB) 18dB/Octave (ISO 2954)	Adjustable 100ms to 100s in steps of 100ms	RMS, Peak, Peak-Peak	1x Alert, 1x Danger	80g	g	±(0.08g + 0.75% of measured value)
					150mm/s [2]	mm/s	±(0.6mm/s + 2.75% of measured value)
					100mm/s	mm/s	±(0.1mm/s + 0.75% of measured value)
					2000µm	µm	±(10.0µm + 1.0% of measured value)
DC (axial)	-	Adjustable 10ms to 100s	-	2x Alert, 2x Danger	2000µm	µm	±(10.0µm + 1.0% of measured value)
DC (gap voltage) [3]	-	-	-	-	22.0 V	V	±(16.0mV + 1.0% of measured value)
RPM	Signal slope: +/- Trigger level (manual or automatic): -1.0V to – 21.5V; adjustable in steps of 0.1V Hysteresis: 0 to 25V; adjustable in steps of 0.1V	Adjustable 10ms to 100s	RPM	1x Alert, 1x Danger	0.06 to > 1500000 RPM RPM multiplier and divider adjustable from 1 to 99999	RPM	Speed >10000rpm: ±0.01% of measured value Speed 100 to10000 rpm: ±1 rpm Speed < 100 rpm: ±0.1 rpm (one pulse per revolution)

[1] Metric and imperial units can be used; Metric units are shown only as an example.

[2] One analogue integration is possible. An additional integration can be done with ISO filter settings, but this will result in loss of accuracy.

[3] Only available for displacement sensor measurements e.g. vibration displacement, axial etc.

Please note:
For Condition Monitoring all kinds of adapted measurement are possible.

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

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