



Product Specifications

VC-6000 Monitoring System Monitoring Module – SM-610-A04

User-Defined: 6x single vibration / 3x dual-point vibration with 6x User-defined Band-pass (ISO or variable HP and LP), up to 4x Axial Position, 1x dual channel Relative Expansion, 4x Vector, 2x Speed, 1x Eccentricity. 3 Binary inputs and 6x DC Outputs and 10x 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-A04.

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-A04 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.

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

- 3 binary input channels
 - 6x input signals – freely configurable with measurements
 - 1x Master ¹ (central) trigger input signal
1x Slave input channel
- ¹ Providing trigger signals to other SM-610-xxx modules.

Measurements

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

- 2 x speed/phase reference
- Band-pass – 6x single-point or 3x dual-point pairs with user-defined **ISO OR** user defined variable **HP** and **LP filters**

- 4 x vector (2 x selectable 1n, 2n , Xn and Yn magnitude and phase, residual value (all vibration components except harmonics) or overall RMS) – 2 of each for DC-Out or Limits
- 4 x axial position
- 1x dual channel relative expansion, can be configured as 2 independent axial position measurements
- 1x shaft eccentricity

Outputs

- 6 x analogue DC outputs – selectable for any AC/DC measurement
- 10 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.

Note:

*It is possible to assign **more than one** measurement per input channel!*

Allowed filter combinations:

- ISO plus variable Band-pass
- Variable Band-pass plus variable Band-pass

It is NOT possible to combine two ISO filters!

Input Channel Configuration Combinations

Channel Types							
No.	Case / Shaft Vibr. var. Band-pass ¹	Case / Shaft Vibr. ISO-Band-pass ¹	Axial Pos. / Relative Expansion ^{4,7}	Speed / Phase reference. ^{2,3}	Eccentricity	Vector (RDA) ^{5,6}	Binary Inputs
1	6	0	2	0	0	0	3
2	5	1	3	0	0	0	3
3	5	1	2	1	0	0	3
4	5	1	2	0	1	0	3
5	5	1	0	1	1	0	3
6	5	0	1	1	1	0	3
7	4	2	3	0	0	0	3
8	4	2	2	1	0	1	3
9	4	2	2	0	1	0	3
10	4	2	1	2	0	0	3
11	4	2	1	1	1	0	3
12	4	2	0	2	1	0	3
13	4	2	0	1	1	1	3
14	4	2	0	1	0	2	3
15	4	1	2	1	0	2	3
16	4	1	1	1	1	1	3
17	4	0	4	0	0	0	3
18	4	0	3	1	0	2	3
19	4	0	3	0	1	0	3
20	4	0	2	2	0	1	3
21	4	0	2	1	1	2	3
22	4	0	2	1	0	3	3

Channel Types							
No.	Case / Shaft Vibr. var. Band-pass ¹	Case / Shaft Vibr. ISO-Band-pass ¹	Axial Pos. / Relative Expansion ^{4,7}	Speed / Phase reference. ^{2,3}	Eccentricity	Vector (RDA) ^{5,6}	Binary Inputs
23	4	0	1	2	1	0	3
24	3	3	3	0	0	0	3
25	3	3	2	1	0	3	3
26	3	3	2	0	1	0	3
27	3	3	1	2	0	2	3
28	3	3	1	1	1	3	3
29	3	3	1	1	0	4	3
30	3	3	0	2	1	1	3
31	3	2	1	2	0	3	3
32	3	2	0	2	1	2	3
33	3	2	0	1	1	4	3
34	3	1	4	0	0	0	3
35	3	1	3	1	0	2	3
36	3	1	3	0	1	0	3
37	3	1	2	2	0	2	3
38	3	1	2	1	1	2	3
39	3	1	1	2	1	2	3
40	3	1	0	2	1	3	3
41	3	1	0	2	0	4	3
42	2	4	2	0	0	0	3
43	2	4	1	1	0	4	3
44	2	4	1	0	1	0	3
45	2	4	0	2	0	4	3
46	2	4	0	1	1	4	3
47	2	3	1	2	0	3	3
48	2	3	0	2	1	3	3
49	2	2	4	0	0	0	3
50	2	2	3	1	0	2	3
51	2	2	3	0	1	0	3
52	2	2	2	2	0	2	3
53	2	2	2	1	1	2	3
54	2	2	1	2	1	2	3
55	2	0	5	0	0	0	3
56	2	0	4	1	0	1	3
57	2	0	4	0	1	0	3
58	2	0	3	2	0	1	3
59	2	0	3	1	1	1	3
60	2	0	2	2	1	1	3
61	1	5	1	0	0	0	3

Channel Types							
No.	Case / Shaft Vibr. var. Band-pass ¹	Case / Shaft Vibr. ISO-Band-pass ¹	Axial Pos. / Relative Expansion ^{4,7}	Speed / Phase reference. ^{2,3}	Eccentricity	Vector (RDA) ^{5, 6}	Binary Inputs
62	1	5	0	1	0	4	3
63	1	5	0	0	1	0	3
64	1	1	5	0	0	0	3
65	1	1	4	1	0	1	3
66	1	1	4	0	1	0	3
67	1	1	3	2	0	1	3
68	1	1	3	1	1	1	3
69	1	1	2	2	1	1	3
70	0	6	0	0	0	0	3
71	0	0	6	0	0	0	3
72	0	0	5	1	0	0	3
73	0	0	5	0	1	0	3
74	0	0	4	2	0	0	3
75	0	0	4	1	1	0	3
76	0	0	3	2	1	0	3

- ¹ A dual-point variable bandpass or ISO filter measurement can alternatively be set up as two single-point variable bandpass or ISO filter measurements, and vice versa. Any combination is possible as long as the total number of channels does not exceed the value given in the table.
- ² Speed measurements can be selected as being either locally from a tacho sensor attached to the module or designated as a slave trigger to a master from other modules or racks. A local speed measurement can act as a master trigger which can be distributed to up to all modules within the rack and 3 further racks for use as a phase reference.
- ³ When a slave trigger has been selected, then the entire measurement selection is available for the 6 input channels.
- ⁴ Relative expansion measurements can be performed in dual channel mode with or without measurement curve linearization. Alternatively the measurement channel pair may be configured as two independent position measurements.
- ⁵ Any 2 vector components per vibration signal input can be monitored to alarm limits, whereby the other vector values are subsequently available only for condition monitoring purposes.
- ⁶ The measurements which are phase reference triggered can be performed using a local trigger sensor signal or derived from a master or slave trigger respectively.
- ⁷ The number describes the sum of axial position and relative expansion measurements.

Signal Flow Diagrams

User Definable Measurement Channel Inputs (maximum subject to overall input allocation, with trip-multiply).

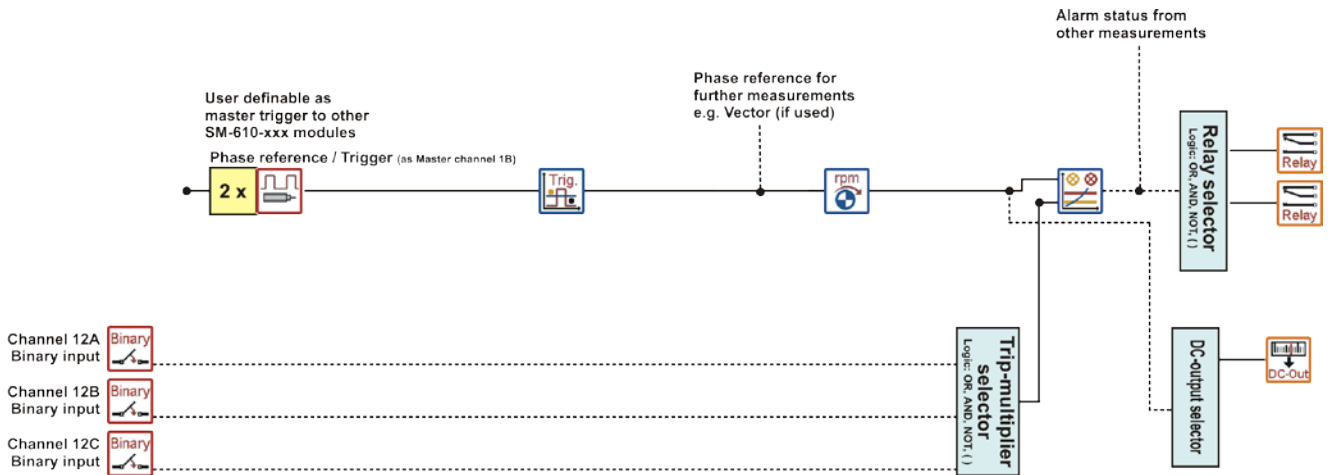


Figure 1. Phase/speed reference sensor input (up to 2 channels). The channel (only channel 1B) can be designated as a master speed/phase reference channel for distribution to other SM-610-xxx modules in up to 4 racks.

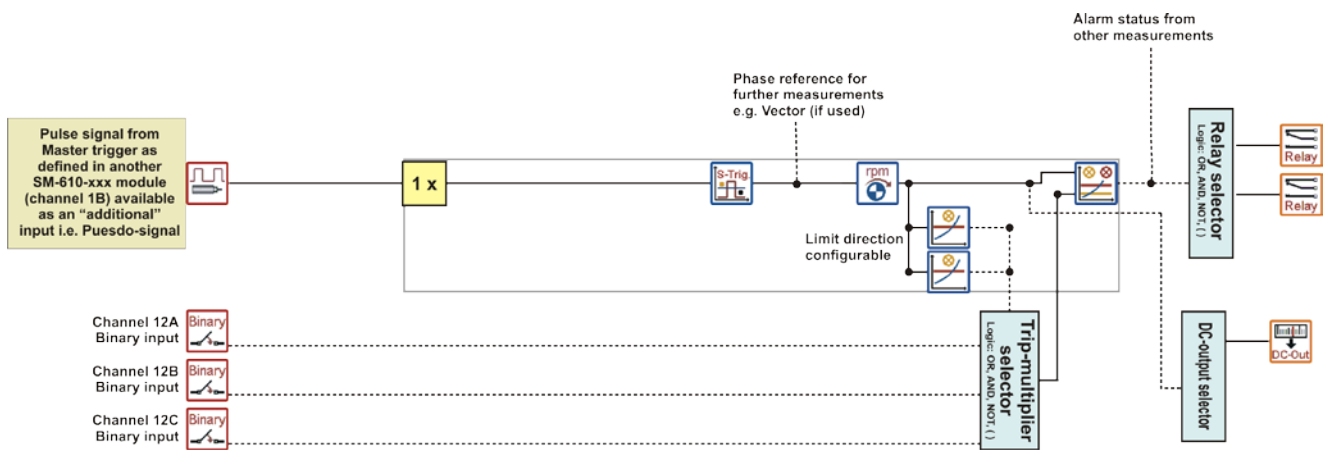


Figure 2. Speed/phase reference slave input responding to a master trigger specified in another SM-610-xxx module.

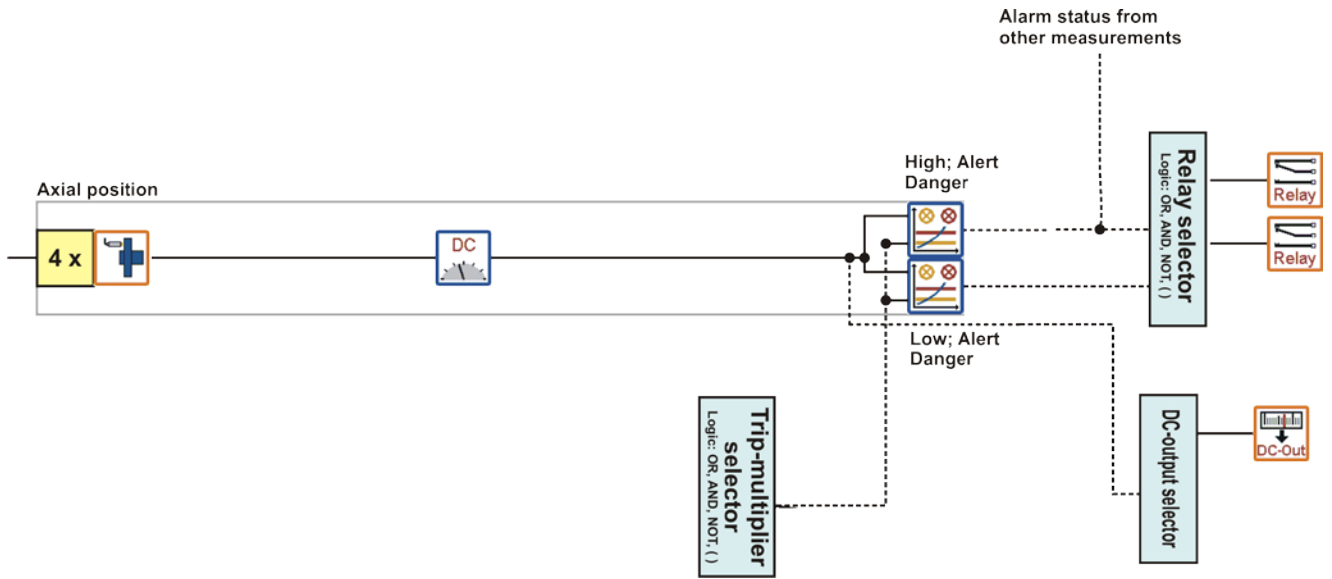


Figure 3. Axial position input (up to 4 channels).

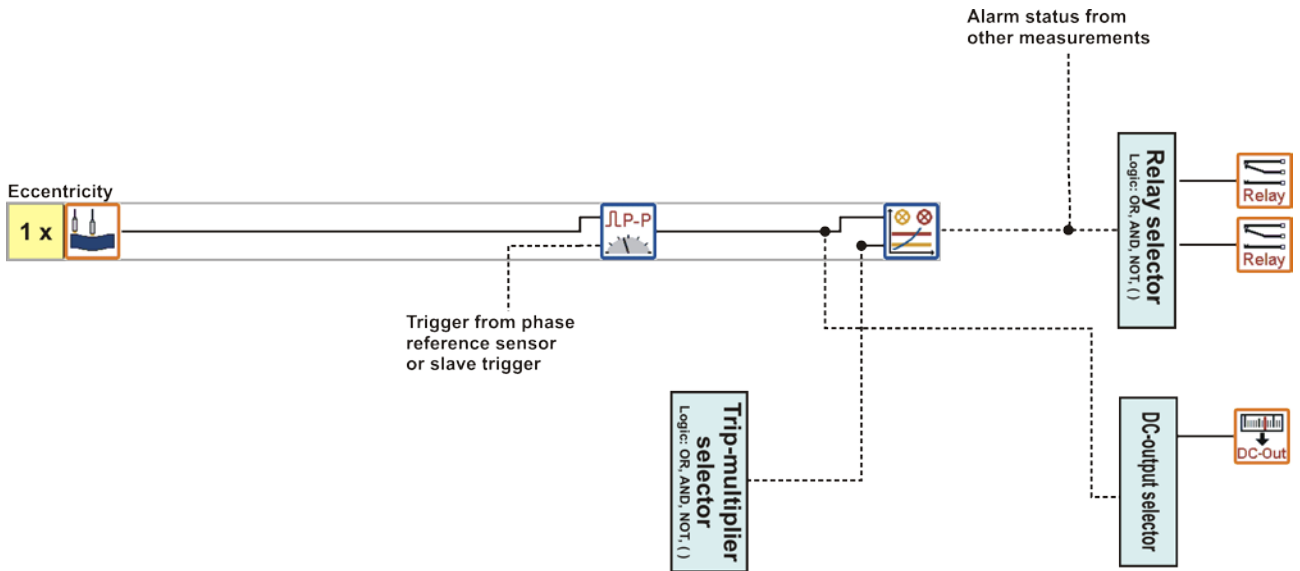


Figure 4. Shaft eccentricity (1 channel in conjunction with phase reference signal).

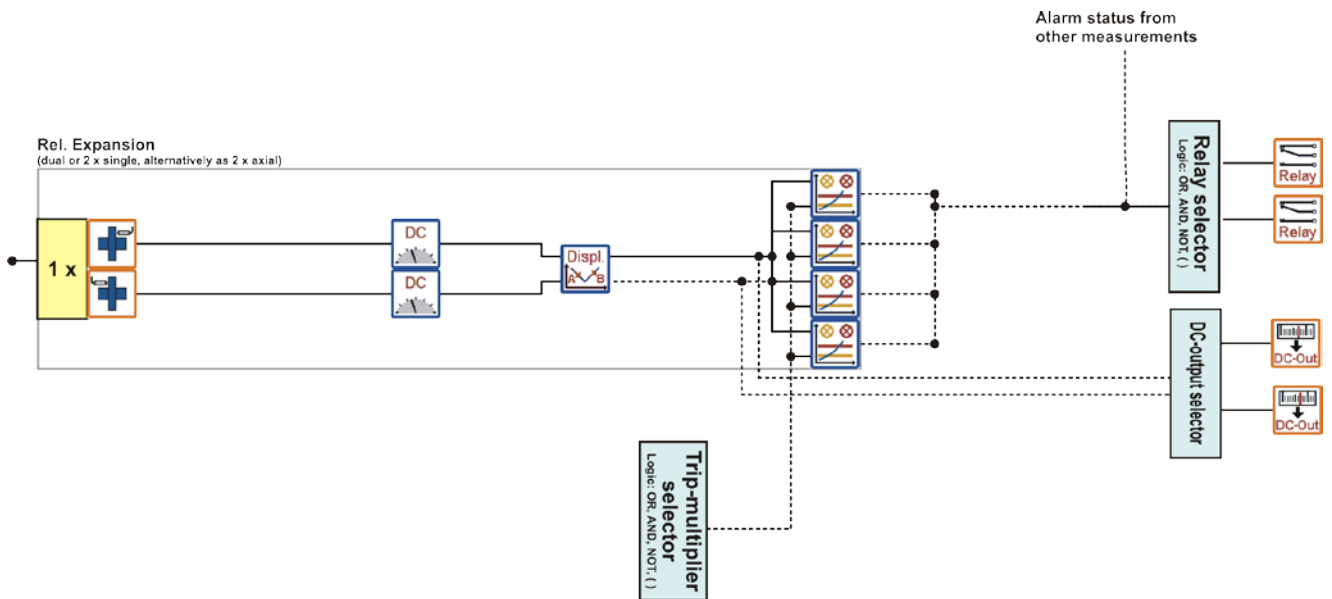


Figure 5. Relative expansion input (2 channels, (1-pair) for dual expansion measurement or individual as position measurements).

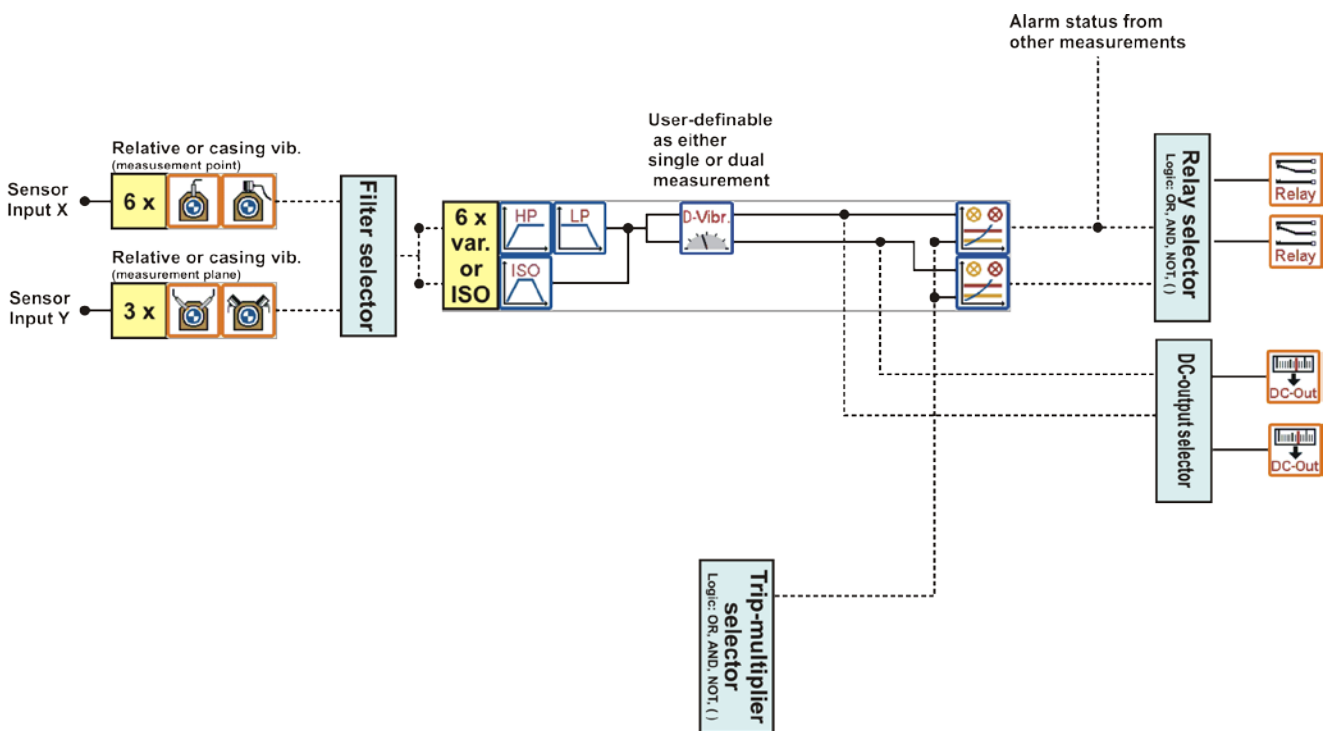


Figure 6. User-definable single or dual-point **variable bandpass filter or ISO filter measurement** input (up to 6 individual channels or 3 pairs).

Additional vibration measurements

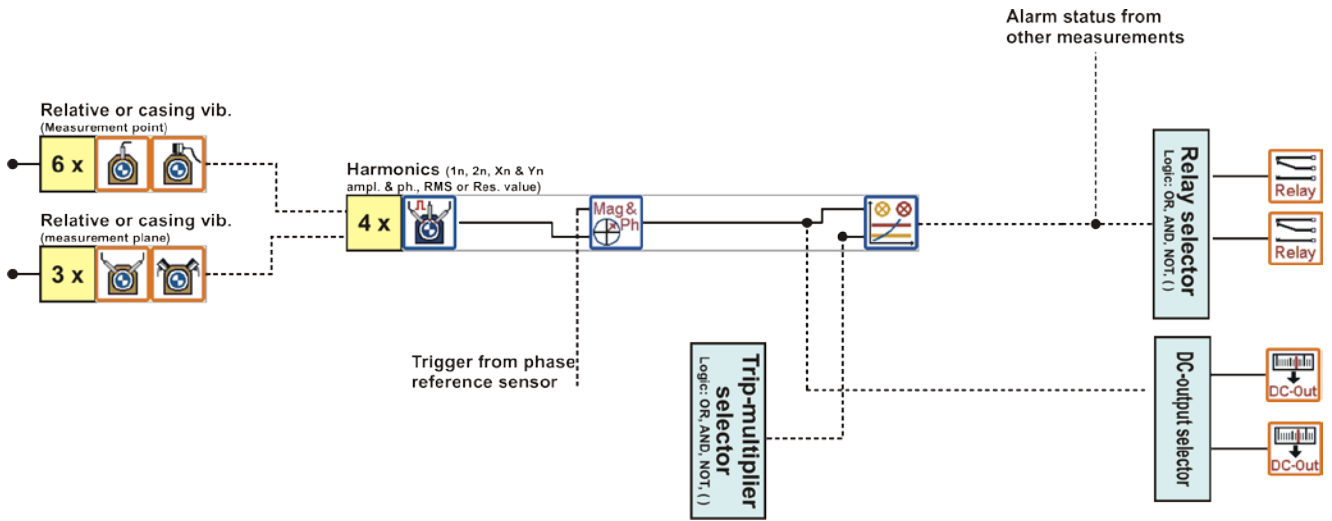


Figure 7. Vector measurement input (up to 4 channels). This measurement is available for a vibration input channel. Any 2 vector components (1n, 2n, Xn & Yn magnitude and phase, residual values, and overall RMS) per vibration signal input can be monitored to alarm limits, the other vector values are subsequently available only for condition monitoring purposes.

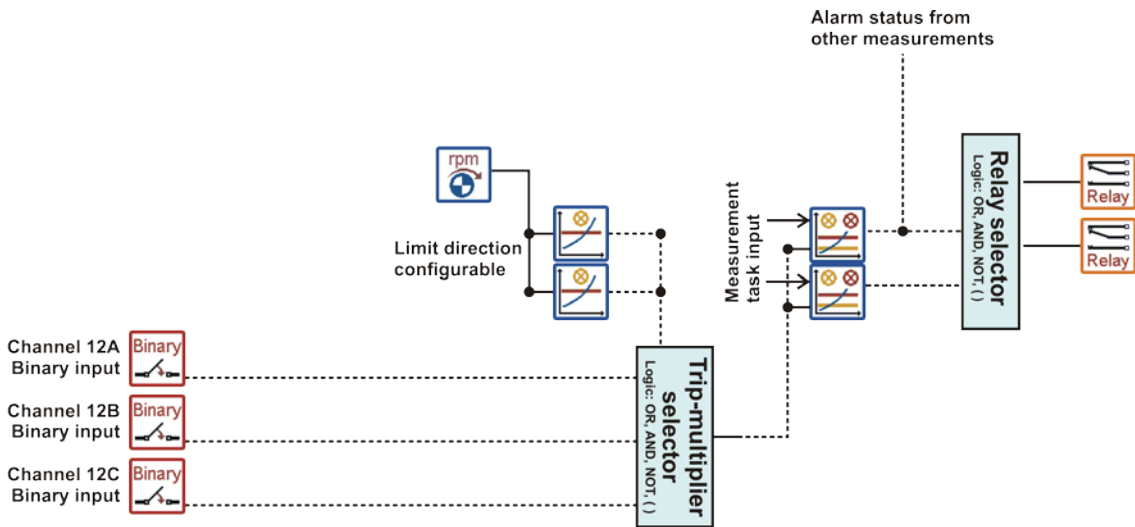


Figure 8. Trip-multiplier limit value control with a user-definable binary and speed input configuration.

Technical Specifications

The specifications given below are specific for the SM-610-A04 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 sensor 1

Sensitivity:

Accelerometer.....adjustable (e.g. 100mV/g)
 Velocity sensor adjustable (e.g. 100mV/mm/s)
 Displacement sensoradjustable (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 impedance3.3kΩ
 Accuracyresponse time 5ms
 Minimum current load5mA
 Maximum contact voltage±50V

Signal status LOW:

Nominal input voltage 0V
 Input voltage range -50V to 6.6V
 Maximum input current2mA

Signal status HIGH:

Nominal input voltage 24V
 Input voltage range 16.5V to 50V
 Maximum input current5mA

Buffered Outputs

Minimum output load 100kΩ
 Output gain1 (±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 load500Ω
 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

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-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)
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	2000µm	µm	±(10.0µm + 1.0% of measured value)
					80g	g	±(0.08g + 0.75% of measured value)
					150mm/s ⁴	mm/s	±(0.6mm/s + 2.75% of measured value)
DC (rad. static shaft position)	-	Adjustable 10ms to 100s	-	2x Alert, 2x Danger	100mm/s	mm/s	±(0.1mm/s + 0.75% of measured value)
					2000µm ⁴	µm	±(10.0µm + 1.0% 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 (relative exp.)	-	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)
Vector (1n, 2n, Xn Yn, RMS and Residual value)	Fundamental: 0.33Hz-1kHz Bandwidth: 22%, 11%, 6%, 3% 44% (fixed for residual value) Upper freq.:5kHz	Computed from bandwidth	RMS, Peak, Peak-Peak	1x Alert, 1x Danger (1n & 2n)	1n, 2n, Xn and Yn (magnitude and phase), RMS or residual value	g, mm/s, µm ⁴	Magnitude: <1% + 0.2% of measured value
							Phase 10 to 200Hz: <2°
							Phase to 500Hz: <4° Phase to 1000Hz: <10°
RPM	Signal slope: +/- Trigger level ⁵ (manual or automatic): -1.0V to -21.5V; adjustable in steps of 0.1V Hysteresis: 0 to 25; adjustable in steps of 0.1	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 to 10000 rpm: ±1 rpm Speed < 100 rpm: ±0.1 rpm (one pulse per revolution)
Eccentricity (cyclic DC P-P)	Trigger controlled 0.01Hz to 10 Hz		-	1x Alert, 1x Danger	2000µm	µm	±(10.0µm + 1.0% of measured value)

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

² One analogue integration is possible. An additional digital integration can be done, but this will result in loss accuracy.

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

⁴ Only analogue integration is possible

⁵ Please refer to the sensor input for the allowed input signal.

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

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