

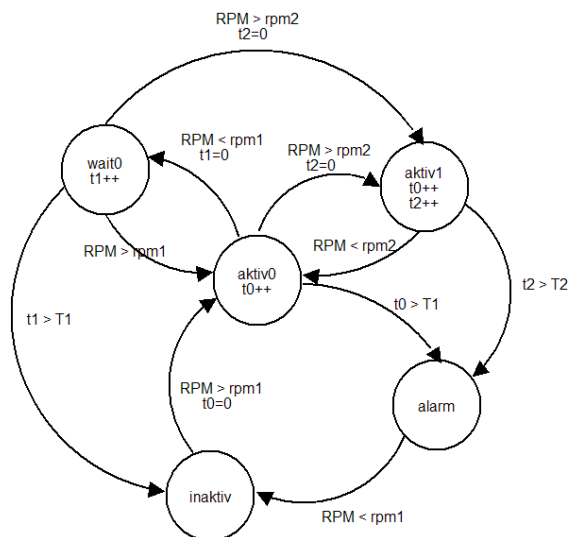
- **Advanced Low Speed Monitoring Unit**
- **RPM Input**
- **Four Versatile Vibration Guards**
- **Fastest Possible Response Time**
- **Relay and Level Output**
- **Motion Pattern Analysis**

Overview

The Gram & Juhl DAM-LMU sensor is an intelligent sensor with built-in digital signal analysis that offers advanced Structural and Revolution (RPM) monitoring facilities. Applications include monitoring and analysis of structures, such as wind turbines, bridges, towers, cranes, and buildings combined with RPM monitoring where applicable. Since the DAM-LMU is a self-contained digital device there is no risk of damaging an external sensor and cabling is straightforward. This makes the DAM-LMU most reliable for critical systems.

LMU Monitor

The following state diagram depicts the functionality of the LMU monitor. "RPM" represent the actual revolution per minute and "T1" and "T2" are time constants in seconds. In the alarm state the relay is activated (if enabled). The Relay is sticky i.e. after an alarm it needs a power down/up cycle to reset (Normally closed i.e. no alarm). The analogue output can be used to monitor the actual RPM.



Structural Vibration Monitoring SVM

The DAM-LMU, with its DC coupling, is well suited to measure low frequencies simultaneously in X and Y direction. This is used for calculating the motion of the structure onto which the sensor is mounted. When narrowed in bandwidth, e.g. around

a resonance frequency, this converges to an ellipsis showing orientation and maximum deflection, i.e. Motion patterns.

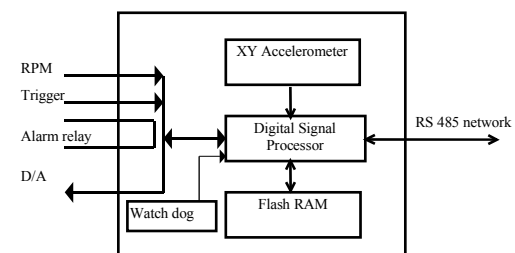
Continuous Vibration Guards

The sensor has four continuously running vibration guards. The guards are independently configured regarding direction(s), frequency band, level, and response time. Alarms are signalled via a relay switch and an analogue voltage. Further, all alarm events are stored internally in non-volatile memory. The vibrations guards are optimised to provide the fastest possible response time.



The Sensor

The DAM-LMU has an internal two-axial accelerometer. Further, the unit has input for tachometer pulses or triggers, solid-state relay and an analogue output (0-5Volt). Thus, motions can be related to machine operation as expressed via RPM, which allows for advanced monitoring.



Stand-alone or Internet operation

The DAM-LMU works on its own or on a network. When operating with a host e.g. the hardware front end, the M-System, in the TCM® System, monitoring results are communicated via a RS485 multi-drop serial bus. The host can be connected to as many as 32 DAM units on a single DAM network. The DAM network protocol is open so any controller with a serial port may interface to the DAM network. The DAM-LMU can be applied to remote monitoring using the TCM® WEB software.

Measurements

RPM guard	
RPM alarm limits	2
Minimum latency	1ms
Individual latency for both alarm limits	
Sticky fail-safe relay signalling	
Vibration guards	
No. of independent guards	4
Sensing direction	X, Y or XY
Centre Frequency]0 Hz .. 49 Hz]
Bandwidth	>2% of Centre Frequency
Filter Response	Minimum Phase
Averaging	Exp. running mean
SVM and MCM measurements	
Motion pattern (Major axis, minor axis, orientation)	
Averaging on all measurements except time	
Configurable frequency span DC-50 Hz.	
Autospectrum with Zoom and Envelope. 400 lines within span.	
Configurable Overall.	
Time series 16384 samples at configurable sampling rate	

Vibration Sensor Specification

Dynamic range	> 70dB
Calibrated at	10 Hz (± 0.1 dB)
Frequency accuracy	30 ppm
Coupling	DC or AC (digital filter)
Full Scale Range	± 16 m/s ²
Nonlinearity	0.2% of Full Scale
Transverse sensitivity	$\pm 2\%$
Overload detection	
Sensitivity temperature drift	0.01%/K
Noise	250 μ G/ $\sqrt{\text{Hz}}$ rms

RPM / TRIGGER Input

RPM range	60000 RPM
Input Level high	>21 V, max 24V
Accuracy	0.4 ms
RPM divider	1..65535

Analogue Output

Bandwidth	100 Hz (2 nd order filter)
Range	0-5 Volt
Noise	1mVolt RMS

Alarm Output

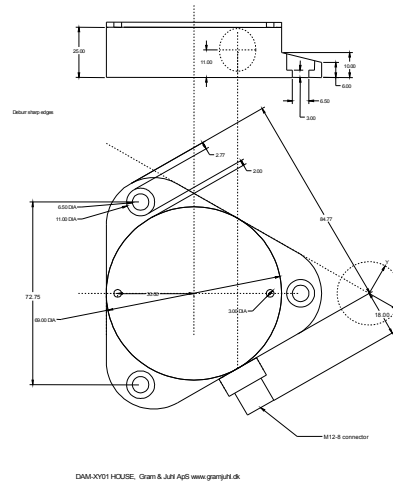
Type	Solid state non-polarized
Current	max 100 mA
Voltage	50 V DC
Voltage ripple	max 100 mVrms
State	(Normally Closed=No alarm)
Note: Relay alarm in LMU configuration is sticky and needs power off/on for reset or a reset command.	

Environmental

Operating temp.	-20 to 70 ° C
Sustained acceleration	<50 Grms
Storage temp.	-40° to +80 ° C
ESD and over-voltage protected (transients)	

Mechanics

Housing	Stainless steel (non corrosive)
Connector	M12-8, shielded connector male
Enclosure	IP68 to 5 bars
Mounting	3 holes, M6 bolts, see drawing
Weight	400g



Compliance with standards

CE (low voltage)
EN 50081-1, EN61000-6-3 (emission)
EN 50082-2, EN61000-6-2 (immunity)
Surge protected

Ordering Information

DAM-LMU [RPM1]/[T1] – [RPM2]/[T2] [Pulses per rev.]
See function diagram above
Shielded cable DIN 47250-6/01.83 or better

Software

Can be used in conjunction with the M-System as part of the TCM® System (no special software required).
Sensor firmware is on-site upgradeable and configurable.
Open communication protocol

Connector

Pin, Colour	Description	Connector
1, White	A RS485+	<p>Front View</p>
2, Brown	POWER +, 12-24 VDC	
3, Green	RPM / TRIG input	
4, Yellow	RELAY 2	
5, Grey	B RS485+	
6, Pink	RELAY 1	
7, Blue	POWER -, 0 VDC	
8, Red	0-5VOLT OUT	

Note: If communication pins are unused they should be interconnected with a 120 Ohm 0.25W resistor. Unused RPM input should be tied to ground.