INSTALLATION AND OPERATING INSTRUCTIONS FOR THE

MODULAR SONOR MONITORING SYSTEM

RBV and TBV

MECASON®

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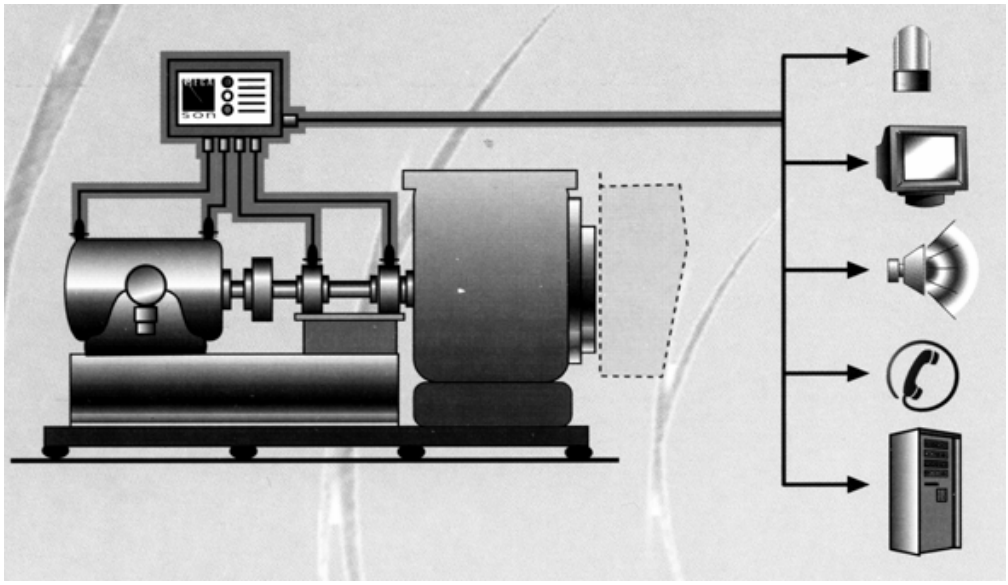

- PREAMBULE -

Thank you for choosing to install a device of surveillance *MECASON*! If you meet in the installation, or later, any difficulty, do not hesitate to contact us, your total satisfaction is our first objective.

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I - SYSTEM OVERVIEW

Just as other *MECASON* products, the modular sonar monitoring system is designed to monitor the evolution of machine internal noise level, via the *MECASON* sensor, the first point of measurement chain.

The designer's intention being to offer an equipment capable of reproducing, with an enhanced performance, the technique used by experienced mechanics, whereby the mechanic "listen" to the noise of his machine with screwdriver or stethoscope.

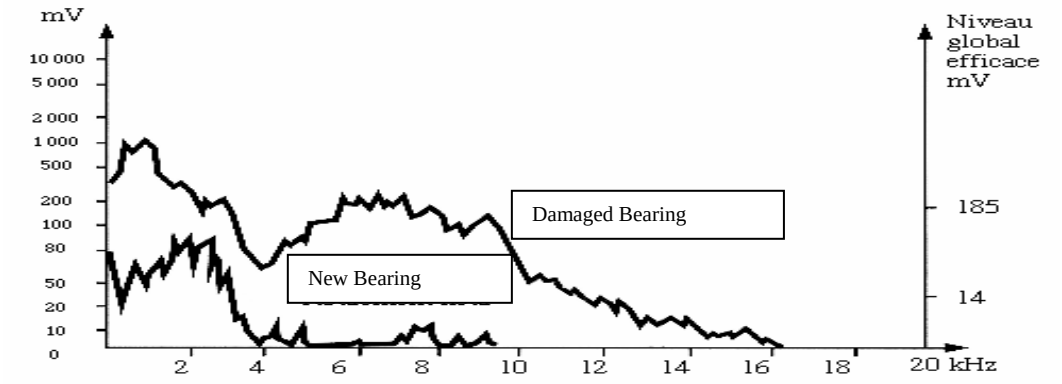
With sensors and electronics being installed permanently on the machine to be monitored, the system sounds an alarm and/or stops the machine in the event that the noise levels emitted by a mechanical component increase significantly; sign of certain changes in the mechanical characteristics.

II - SYSTEM FUNCTION

II.A - PRINCIPLES OF OPERATION

Relative movements, particularly those with metal to metal contact, produce via very small chocs, deformations, adhesions sound waves, whose intensity increase with the deterioration of the mechanical environment

If we analyse the noise of different bearings and observe the spectrums, we observe, with the deterioration, a general increase in the noise levels; particularly in the audible frequency range 50Hz to 15KHz heard by the mechanic. (note:these spectrum represent the signal transmitted by the sensor and therefore include the influence of the sensor connection as well as the pass band of electronics.



The sensor is not influence by the acoustic noise ever present in industrial installations.
The sensor and elctronics filter all noises with frequencies below 100Hz and thus any false alarm due to structural vibrations or stray noise.

For specific applications low pass filters up to 2,5 KHz can be supplied upon demand.

The intention of the unit is therefore:
- detect the noise produced by the machinery
- amplify the incoming sensor signal
- filter them when necessary
- calculate the effective value of the signal (RMS)
- compare this effective value with predetermined user selectable limits and if the limits are exceeded, sound an alarm and/or shut down the machine.

II.B - SYSTEM COMPONENTS

The system consist of:
- one or more sensors
- a filtered and regulated power supply (ABW)
- one or more RBV or TBV units (one per sensor)

The RBV units conduct the signal treatment, monitors the levels in comparison with the preset limits and generate the necessary alarms.

The TBV unit conduct the same signal treatment as te RBV, but convert the measured effective level into a 4-20 mA signal for remote transmission or manipulation by an automatic logic controller.

An audio amplifier in a separate housing allows the connection of a headset so as to listen directly to the noises emitted by the machine.

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III - TECHNICAL SPECIFICATIONS

POWER SUPPLY UNIT (ABW):

- power	8 VA
- Maximum number of units supported	8
- screw terminals	2,5 mm^2
- input voltage	
- standard	230 V 50Hz
- others upon demand	127, 48, 24 VAC, 24 VDC
- circuit protection	fuses 5X20 and varistor
- operating temperature	-10°C to +50°C
- dimensions	110X76X90 mm
- weight	500g
- polyamide 6,6 housing with polycarbonate, mounting on DIN rails	

RELAIS MODULE RBV:

- Power supply input	12VDC regulated
- alarm indication via	LED 3 mm
- alarm time-delay	approx 1 sec
- analogue control point	0 to 1V banana 2mm
- screw terminals, removable	2,5 mm^2
˙ potential free, relay output	
- maximum switching voltage	125 VDC
- maximum switching current	1 A
- maximum switching power	60 VAC, 50 W DC
- operating temperature	-10°C to +50°C
- dimensions	70X20X90 mm
- weight	100g
- polyamide 6,6 housing, mounting on DIN rails	

MODULES TBV:

- Power supply input	12VDC regulated
- maximum resistive load output 4-20 mA	400 Ohms
- analogue control point	0 to 1V banana 2mm
- screw terminals, removable	2,5 mm^2
- operating temperature	-10°C to +50°C
- dimensions	70X20X90 mm
- weight	100g
- polyamide 6,6 housing, mounting on DIN rails	

SENSORS:

- pass band (sensor+electronic)	100 to 12000 Hz
- operating temperature	-10°C to +50°C
- protection rating	IP 65
upon demand	IP 67, 5 bar
- sensor mounting	washer with 2 screws CHC Ø5mm
- weight (excluding wire)	50 g
- wire shielded, flexible	0,22 mm^2 PVC
- material (shaft)	stainless steel 316 L

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IV - MECHANICAL INSTALLATION

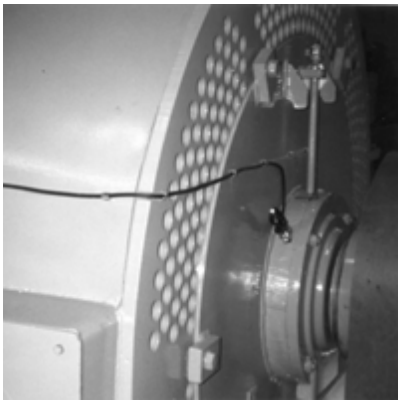
IV.A - ELECTRONIC UNIT INSTALLATION

Easily installed on DIN rails (symmetric or not). In the case of non symmetric rails, position the wilde flange towerd the bottom. If rails are already installed and cannot be easily removed, the housing can be easily opened so as to change the orientation of the click-on mechanism.

IV.B - SENSORS INSTALLATION

The sensors should be placed on the surface of the machine as close as possible to the component to be monitored. As close as possible meaning, the position on the surface of the machine allowing the shortest noise propagation path through metal and which possesses the least number of discontinuities. The orientation of the sensor itself is not very important.

Differences in the length of the noise path are compensated for by the sensor input gain adjustments made during installation. However, one must take care not to approach other noise sources as the noise path becomes longer. If two or more noise sources (components to be monitored) are at equal distances to the sensor, the sensor will measure the sum of the individual noise levels. If all components are producing roughly the same noise intensities, one sensor can be used to monitor several components in the case above, but the sensitivity of the monitoring for each component will be somewhat reduced

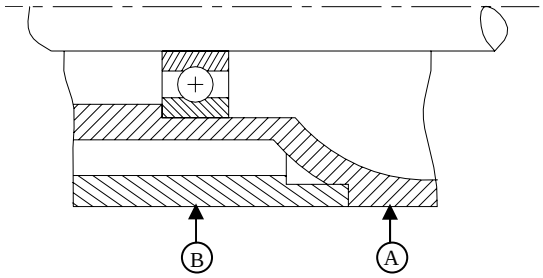


In cases where the speeds of rotation are very low (30 or 40 rpm), it is best to place the sensor on the side of the bearing mount carrying the load, with an orientation parallel to the load direction.

In the example below, the sensor should be placed at position A. At position B, even though physically closer to the noise source, the attenuation of the noise caused by the discontinuity makes this choice less desirable.

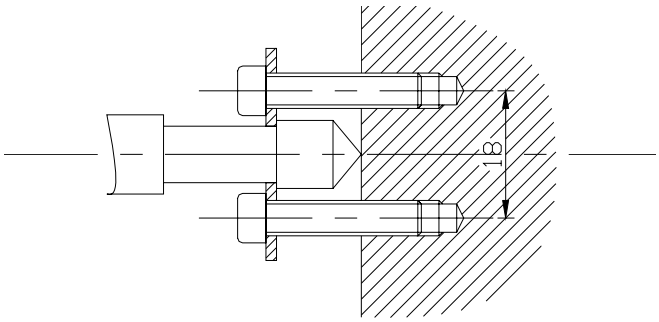
A good guide in deciding where to place a sensor is to imagine a mechanic listening to a bearing with a screw drive in contact with the machine surface and the handle against his ear. How the mechanic chooses the listening position is analogous to the placement of *MECASON* sensors. In case of doubt, feel free to consult your *MECASON* representative.

NOTE: In placing the sensor on the machine, don't overlook the fact that a sensor mounted horizontally is a potential foothold for personnel. To minimise the possibility of sensor breakage place the sensor in a protected area or with cable end slanting downward.



To install a sensor outfitted with a sliding washer, 2 screws CHC 5x20 and 2 holes M5 place at 18 mm centre to centre and tapped to a depth of 7mm minimum are needed. With a hammer and point or with a drill, create a light indentation at the point where the sensor tip touches the machine, so as to remove any unstable material and provide a solid contact with the machine surface.

To prevent loosening of the sensor mounting, apply a drop of "LOCTITE" to the screws and tighten them until the washer flexes slightly.



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To protect the fragile point where the cable is attached to the sensor, the cable must be fixed with a plastic collier to the sensor body. We suggest to protect the cable with a hose like "Capriplast".

To install the probe on the opposite side of the coupling up on engine with external fan, it will generally be necessary to realize a bight in the crankcase of the fan.

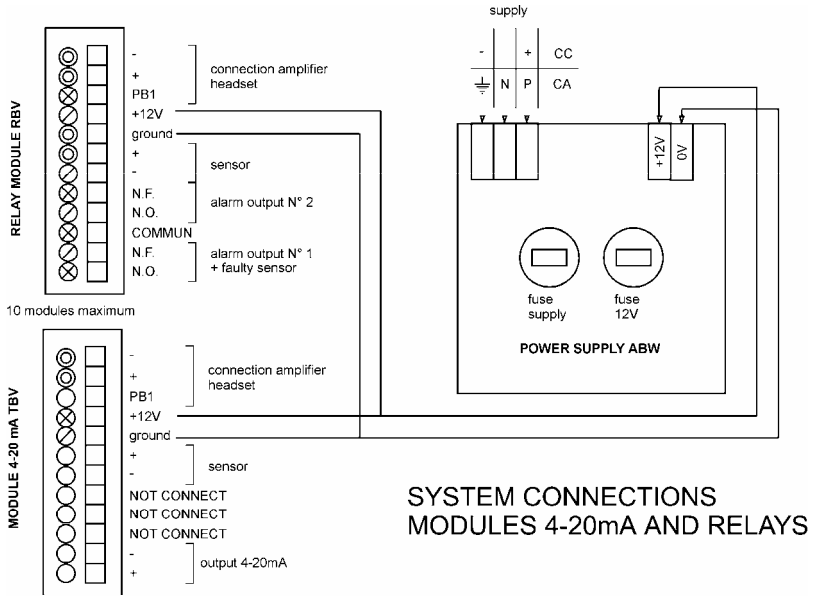
V - CONNECTION AND ADJUSTEMENTS

V.A - INTERCONNECTIONS

The terminal used for wire connections are screw type terminals. To facilitate the installation, the terminal blocks are removable (MINICONNEC de Phoenix-Contact).

Being that the incoming sensor signals are very low voltage, it is best to avoid intermediate terminal junctions along the transmission path. For this reason, MECASON sensors can be ordered with the desired cable length. However, should one wish to use junction boxes with longer cable wire ends so as to provide the best contact possible.

To assure a quality of monitoring, the incoming sensor signal integrity must be confirmed by listening via the headset to the quality of the noise picked up by the sensor. The noise must be recognizable as being of mechanical origin. If you do not have a headset, shut down the machine and confirm that the noise level indicated at the analogue control output drops under the "defective sensor limit". If this is not the case, the signal to noise ratio is not satisfactory. In case of doubt, contact us.



Annex 1

ANTICIPATION & MAINTENANCE – 8 chemin du Jas de Valèze – 13124 PEYPIN
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V.B - CIRCUIT PROTECTION

To protect the circuit from damage cause b line faults the following components are used:

- a 160 mA slow burn fuse (230V AC supply)
- a secondary rapid burn fuse 1.0 A
- a varistor to protect against over voltage (V250L20 for 230V AC)

V.C - SYSTEM ADJUSTEMENTS

To offer a compact and low cost solution, a display is not incorporated in the module. To display the level while making system adjustments; a digital multi-meter must be used with the range set to 2V DC and connected to the analogue control output available on the module front panel (gold plated banana 2mm). See fig annex 2 and 3.

Included with the modules are necessary connectors and wires (male banana plugs Ø2 and 4mm) a screwdriver Ø3 is also included.

The gain adjustment (RV1) has to be done with the machine running, in optimised operation (lubrication, alignment, well bolted…).

V.C.1 - RELAY MODULE RBV

Four leds are used to show the unit status:

- LED D+ module correctly connected
- LED DS3 second level alarm limit exceeded
- LED DS2 first level alarm limit exceeded
- LED DS1 incoming sensor signal is above minimum level (i.e. sensor is functioning well)

Relay output interpretation (annex 4)

To produce a product which takes up a very small space, the module has only two relays to insure these three functions:

- Minimum required signal
- First level alarm limit excited
- Second level alarm limit excited

One relay is used for first level alarm (yellow led) and minimum required signal (green led). It was in activated state in normal operating conditions, and unactivated when first level alarm limit is exeed or minimum required signal isn't reached. It has one second delay before changing state from activated to unactivated.

The other one is used for the second alarm level. It could be adjusted with the RV3 potentionmeter. It has one second delay before changing state from unactivated to activated.

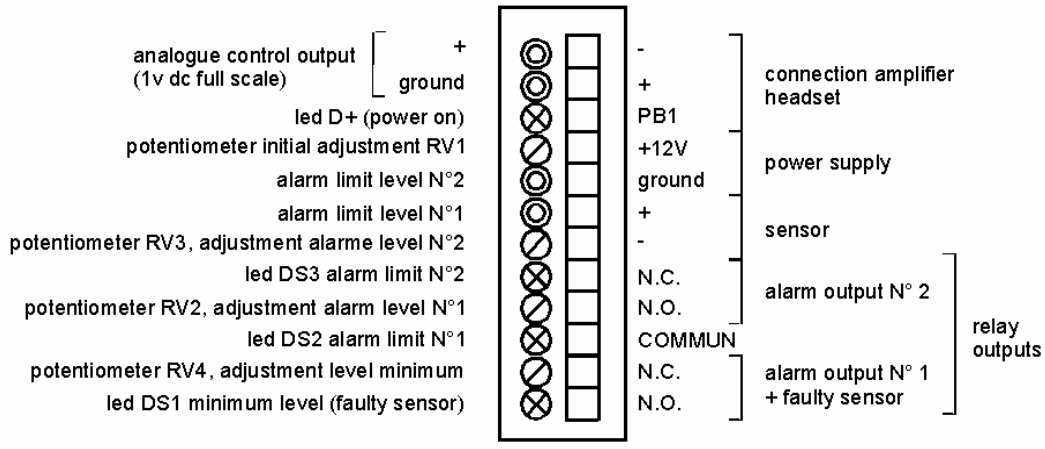
System adjustments

The first adjustment necessary is the incoming sensor signal gain, so as to establish a point of departure for the monitoring within the range 0.0 to 1.0 V at the analog control output. To leave a sufficient range for the evolution of the signal (i.e increase), we suggest adjusting the input gain so as to have 200mV at the control point mentioned above. This adjustment is made after system installation and with the machine running.

Assuming this initial gain adjustment will be made to 200mV the following alarm limits are pre-adjusted at the factory:

- defective sensor limit: 100mV (potentiometer RV4)
- alarm limit level 1: 500mV (RV2)
- alarm limit level 2: 800mV (RV3)

If you wish set the high alarm level limits differently, you may adjust them with RV2 or RV3. You know the value on the two gold plated bananas 2mm, with on of the wires connected on ground.



Annex 2

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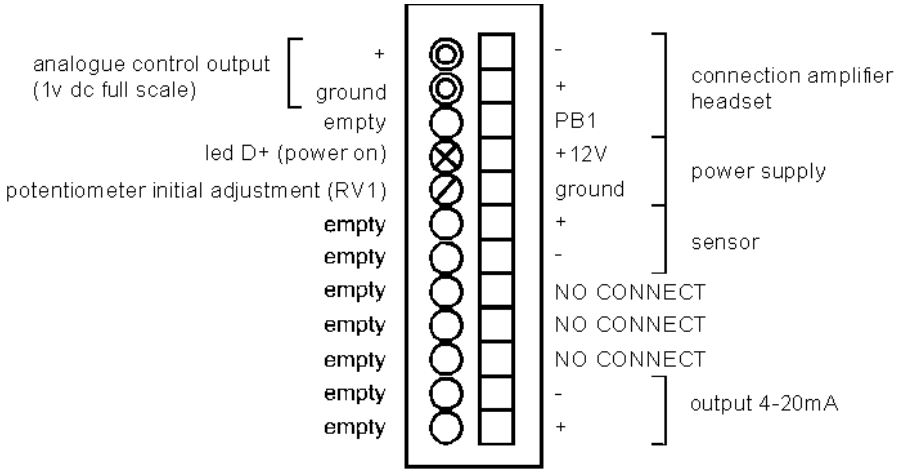
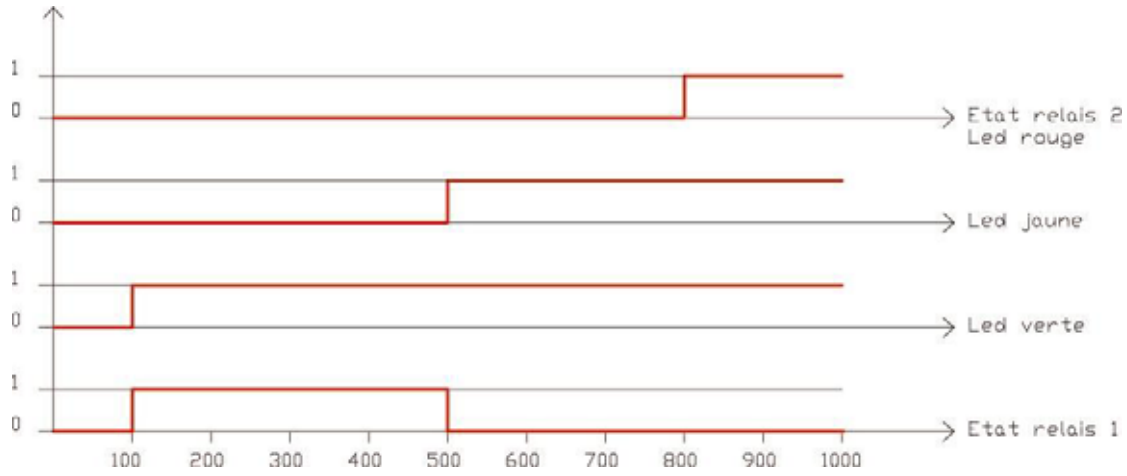
V.C.2 - ANALOGIC MODULE TBV

The only adjustment necessary is the incoming sensor signal gain, so as to establish a point of departure for the monitoring within the range 0.0 to 1.0 V at the analog control output. To leave a sufficient range for the evolution of the signal (i.e increase), we suggest adjusting the input gain so as to have 200mV at the control point mentioned above. This adjustment is made after system installation and with the machine running.



Annex 3



Annex 4

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VI - INTERPRETATIONS : LEVEL CHANGES AND ALARMS

	Symptoms	Analysis	When,... action
1	level dropping	Most probably a result of machine run-in.	Listen to sensor signal with headset. Re-adjust the individual reference level so as to allow a common alarm level limit
2	Level risen slightly (+ 30 to + 50%).	Change in machines operating condition or possible approaching insufficient lubrication. Keep in mind that a worn ball bearing can produce levels15 to 40 times higher than the same well greased ball bearing in good condition	Apply grease to bearing Wait for any further level increase.
3	Level continues to rise and the Alarm 1 has been tripped	Most probably an insufficient lubrication.	- Apply grease, top off oil level - Check for contaminants in the bearing housing, - Inspect the machine for other obvious external problem sources in the machines direct vicinity.
4	In spite of application of lubricants, the alarm level rests constant See § 6 and 6b below.	The lubrication was not the cause of the alarm. The ball bearing is most likely showing signs of wear.	If the machinery is complex vibrations measurement may be justified. If the machine is simple, divide the level by 2 using the corresponding individual input gain adjustment potentiometers RV1 to RV8. Do not forget to note this adjustment! With wear, a ball bearing tends to need more and more frequent grease applications
5	After grease application the alarm 1 is tripped again in the following weeks.	Possible grease destruction or loss due to temperature peaks	Apply grease again
6	After grease application the alarm 1 is tripped before the standard greasing interval has completely lapsed.	The ball bearing is slightly worn and now has a shorter greasing interval.	Apply grease with the alarm 1 condition. The greasing interval will continue to shorten with the passage of time until an application of grease no longer can prevent an increase in the noise level
6 b	After an application of grease the level drops then regains its previous level in the following hour	The ball bearing is most likely in poor mechanical condition assuming that the bearing does not have too much play (see §9 below).	Follow and further level developments
7	In spite of assuring proper lubrication and having verified the non-existence of external causes (fixation, other machines,...) the measured level continues to rise progressively.	You are witnessing the slow deterioration in the bearings mechanical condition.	Level factor 3 over new is not alarming but certainly serious. We suggest re-adjusting the gain of the input (as in §4) to halve the level. Note the date of the adjustment. If the time between double-increases shortens consistently, change the bearing or at least take a diagnostic vibrations measurement to establish the bearing's condition.
8	Alarm level 2 is tripped before being able to react to alarm level 1	Sign of mechanical breakage (ruptured cage etc.) or radical changes in the lubrication of the bearing (grease destruction, absence of oil, contamination etc°.	Listen to the sensor signal with the headset to have an idea of the type of problem. Where source is not obvious after having assured proper lubrication, arrange a vibrations measurement immediately or shut down the machine and open the bearing housing

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9	Significant, repetitive and rapid fluctuations of noise levels.	- Poor connection sensor/electronics unit - Machine in question.	Listen to the signal with the headset. If you hear static in the line you have a loose or corroded sensor connection, the sensor is not in firm contact with the machine, or the sensor/ cable connection has been damaged. We had the opportunity to notice such phenomenons on bearings working with an excessive clearance (C3 clearance roll bearing without adjustable system). There are two possible solutions : reducing the clearance, place a preload. using a higther performance grease (we can help you in this choice).
10	After grease application the noise level increases.	Most probably a de-stabilised cage	Easily recognisable with headset. Should disappear after a couple minutes. Apply grease more slowly the next time.

VII - CHECK PROCEDURE

As all appliances insuring a safety function, it is suitable to periodically check the good performance of the MECASON chain.

The operation has to be done with the machine running.

- Signal quality :

Listen with the headphone the signal quality. Verify that you recognize a mechanical noise. In case of doubt, you may hit the steel body part of the sensor with a screw driver or other small metallic tool. You have to perceive a clear noise. The measure must move.

- General operation :

When you disconnect the sensor, the measure has to lower. On a RBV module, the relay "faulty sensor + alarm N°1" must get down to off position.

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