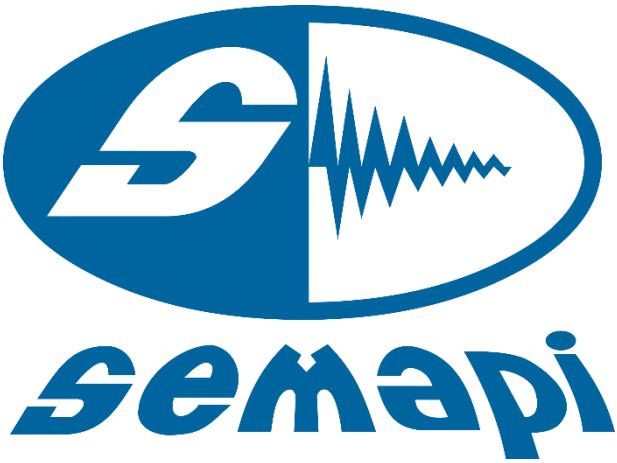

User's Manual

Tiny Remote Monitor

Version.: 1.0

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INTRODUCCIÓN:

Phrases Tiny Remote Monitor and DSP Machinery Control® are trademarks by SEMAPI.

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Tiny Remote Monitor system is used for continuous measurement of a wide variety of rotating industrial plant machines. It can be configured in standalone mode through a cell phone or tablet, or also through the DSP Machinery Control software.

DSP Machinery Control software allows you to manage measurements transmitted by hardware connected to online monitoring system, regardless of the family of machine it controls. All hardware associated and connected to network will be managed by software.

Creation of database and subsequent analysis of measurements will be task of software system.

Mounting:

Only technicians who are familiar with and able to comply with technical terms, warnings and instructions in the manual should connect the module.

If there is any doubt about correct connection of module, please contact our local distributor or, alternatively, SEMAPI | www.semapi.com.

Assembly and connection of module should comply with national legislation for the assembly of electrical materials, in relation to the section of cable, protective fuse and location. Input/output connection descriptions are shown on block diagram and on side label.

The following applies to modules connected to dangerous fixed voltages:

Maximum protection of fuse will be 10 A and, like the power switch, it should be easily accessible and close to module. Power switch should be marked with a label, indicating the way to disconnect module.

UL Installation conditions:

Use only copper conductors 60/75 °C.

Use only in pollution class Level 2 or better.

Environmental Temperature máx.60 ºC

Cable Max Size AWG 26-14

File Number ULE231911

Normal Operation:

Operators are the only ones allowed to adjust and operate modules that are securely installed in cabinets, etc., to avoid bodily injury and module damage hazards. This means that there are no dangerous electrical shocks and that module is easily accessible.

RESPONSABILITY:

To the extent that instructions in this manual are not strictly followed, client cannot demand SEMAPI and its distributors conditions that it normally offers in established sales agreements.

GENERAL CHARACTERISTICS:

- Measurement of mechanical vibrations up to 2 channels.
- Analysis of vibration spectra up to 2 channels.
- Vibration monitor and other industrial variables, it can be configured from a web interface via wi-fi/ethernet connection for standalone work mode or

from DSP Machinery Control software to generate control database and measurement history.

- Remote and continuous vibration monitor, transmitting measurements via LAN.

1) Inputs:
   Combination of:
   a. 2 (dos) accelerometers from 30-50-70-100-500 mV/g IPC type.
   b. 2 CC inputs.
   c. Optical Phase Sensor.
2) Outputs:
   a. 2 Relays (dos) per channel,1 & 2 threshold level.
   b. Up to 8 configurable 4..20 mA outputs
   c. Electrical security Relay.
3) Memoria: Micro SD.
4) Communication:
   a. USB 2.0
   b. Ethernet 10 base T/ 100 base-TX Ethernet communication port.
   c. Modbus TCP for PLC/SCADA communication.
   d. BNC outputs of each channel for reading with data collector.

Ideal for applications:

- Critical or semi-critical/auxiliary machines in both safe and dangerous areas, Monitoring of recurring failures
- Complementary measurement routes by taking data on BNC outputs.

- Remote monitoring via INTERNET.
- Machines in motion.
- Monitoring of end of life of components (for example, Bearings)

Measurements:

- Spectrum: Acceleration, Velocity, Displacement, Envelope.
- Spectral resolution in lines: 400, 800, 1600, 3200 and 6400.
- Windowing: Rectangular, Hanning and Flat top.
- Waveform: Acceleration, Velocity, Displacement and Envelope.
- Scalar values: RMS, 0-Peak, Peak-Peak.
- Maximum freq: 10 Hz, 20 Hz, 50 Hz, 100 Hz, 200 Hz, 500 Hz, 1k Hz, 2k Hz, 5 kHz, 10 kHz, 15 kHz.

Environmental:

- Temperature: -10 ºC a 55 ºC
- Humidity 95% without condensation.

LEDS:

Equipment consists of 4 leds, namely:

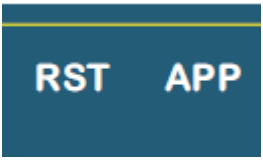
1) POWER (red), indicates that the equipment is energized
2) DATA (green), indicates that channels are receiving information.
3) Status of RELAY 1 (red), on if the relay is energized
4) RELAY 2 status (red), on if the relay is energized

BUTTONS:

The equipment has 2 operation buttons

1) RST (Reset) – Used to restart the computer.
2) APP – no current functionality.

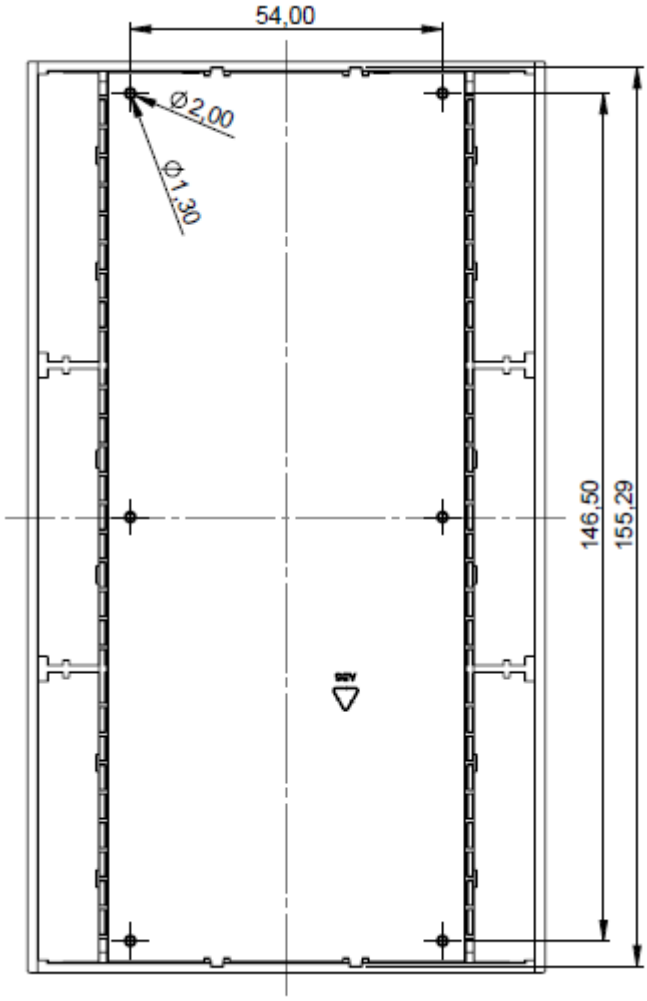
It is located on the front of the equipment, below power indicator.



It reflects the state of operation in the following three states (in this order of priority):

- Fast and continuous flashing: indicates that there is an error in the communication with the DSP.
- 3 short flashes, repeated every 4 seconds: indicates that there is no connection with the service that records the measurements.
- 1 short flash, repeated every 2 seconds: indicates that everything is working correctly.

Hardware Cabinet Dimensions:



Electrical requirements:

General concepts:

It consists of taking measures to protect people against dangers that may result from contact with parts normally under voltage.

Protection by isolation by remoteness or by means of obstruction of live parts:

None of the parts of an installation that is normally live must be accessible to contact with people. Protection must be achieved by adequate isolation of parts (which can only be rendered ineffective by destroying it using tools or, when technically feasible, by placing parts out of reach by means of suitable obstacles: sheets, bars, or other mechanical protection. Said protection elements must have sufficient mechanical rigidity to prevent electrical contact from being established with live parts due to blows or pressure. If protections are perforated plates or bars, the impossibility of reaching parts under tension, making the size of holes comply with conditions established by IP2X degree of IRAM 2444 Standard.

NOTE:

All mechanical obstacles must be electrically connected to each other and to protective conductor in order to ensure their grounding.

Complementary protection with circuit breaker for differential leakage current (IRAM 2301))

Use of differential switch is intended to complement classic measures of protection against direct contacts.

Nominal operating current of differential switch must not exceed 30 mA to ensure complementary protection in

the event of failure of other protection measures against direct contact or imprudence of users, causing disconnection of the affected part of facilities, from establishment of a ground fault current.

Use of such a device is not recognized as a complete protection measure and, therefore, does not in any way exempt use of the rest of security measures listed in paragraph 3.1.2, since, for example, this method does not prevent accidents caused by simultaneous contact with two active conductive parts of different potentials.

It should be noted that such a solution facilitates protection against indirect contacts, while allowing technically and economically feasible grounding conditions and has the additional advantage, from a fire protection point of view, of permanently monitoring insulation of live parts.

Protection against indirect contacts:

General concepts:

It consists of taking all the necessary measures to protect people against dangers that may result from contact with metallic parts (masses) accidentally put under tension as a result of an insulation failure.

Ground definition:

Set of metal parts of appliances, equipment and electrical conduits and their accessories (boxes, cabinets, etc.) that, under normal conditions, are insulated from live parts, but that can be electrically connected to latter by consequence of a failure.

Protection by automatic power disconnection:

This protection system consists of a grounding system and a protection device. Coordinated action of protection device with grounding system, allows that, in the event of an insulation failure of installation, separation of faulty part of the circuit occurs automatically, in such a way that accessible metal parts do not acquire a contact voltage greater than 24 V permanently.

Grounding:

Ground connection is made up of set of devices that allow protective conductor to be connected to ground. This capture must be made by means of electrodes, dispersers, plates, cables or wires whose configuration and materials must comply with respective IRAM Standards.

It is recommended to install ground connection in a place close to main panel.

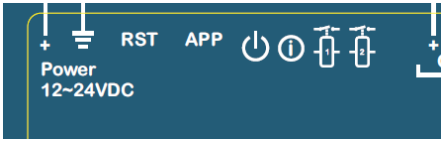
Power supply:

Equipment must be powered in interval of 12 -24 VDC

Specification Range. -20 °C a +60 °C

S / N Range..... Min 60 dB (0... 100 kHz)

Environmental temperature..... 60 °C



Vibration sensors:

The Tiny Remote Monitor equipment allows, in vibration inputs to connect active piezoelectric accelerometer sensors, called ICP.

ICP, is a registered PCB trademark that means "Integrated Circuit - Piezoelectric" and identifies sensors that incorporate integrated PCB, electronic signal conditioning.

Built-in electronics convert high impedance charge signal that is generated by the piezoelectric sensing element into a usable low impedance voltage signal that is easily transmitted over two-wire or coaxial cables.

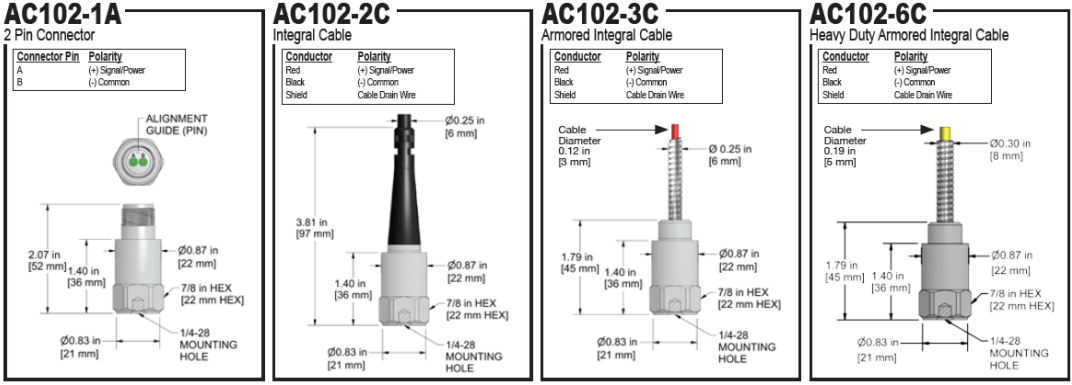
Low impedance signal can be transmitted over long cable distances and used in field or factory environments.

Electronic components within the ICP accelerometers require excitation power from a regulated constant current source, direct current voltage. Tiny Remote Monitor system has these sources, suitable for operation of all installed sensors.

Sensor type:

Multipurpose*:*

AC102 Multipurpose vibration sensor.



Specifications	Standard	Metric
Part number	AC102	M/AC102
Sensibility (±10%)	100 mV/g	
Response Frequency (±3dB)	30-900.000 CPM	0,5-15.000 Hz
Response Frequency (±10%)	120-600.000 CPM	2,0-10.000 Hz
Dynamic range	± 50 g, peak	
Electrical		
Stabilization time	<2.5 sec	
Source voltage	18-30 V CC	
Constant Current Excitation	2-10 mA	
Spectral noise @ 10 Hz	14 µg/√Hz	
Spectral noise @ 100 Hz	2.3 µg/√Hz	
Spectral noise @ 1000 Hz	2 µg/√Hz	
Output impedance	<100 Ohm	
Bias Output Voltage	10-14 V CC	
Isolation case	>108 ohm	

Specifications	Standard	Metric
Environmental		
Temperature Range	(-58 a 250) °F	(-50 a 121) °C
Maximum protection against shocks	5.000 g, peak	
Electromagnetic Sensitivity	CE	
Seal	Welded, Hermetic	
Submersible depth (AC102-2C/3C)	200 ft	60 m
Physical		
Detection element	PZT Ceramically	
Detection element	Shear mode	
Peso	3,2 oz	90 gr
Box material	SS 316L	
Mounting	01/04/2028	
Connector (not included)	2 Pin MIL-C-5015	
Resonant frequency	1.380.000 CPM	23000 Hz
Torque Mount	2 a 5 ft. lbs.	2,7 a 6,8 Nm
Mounting hardware	1/4-28 Stud	M6x1 Stud adapter

Mounting:

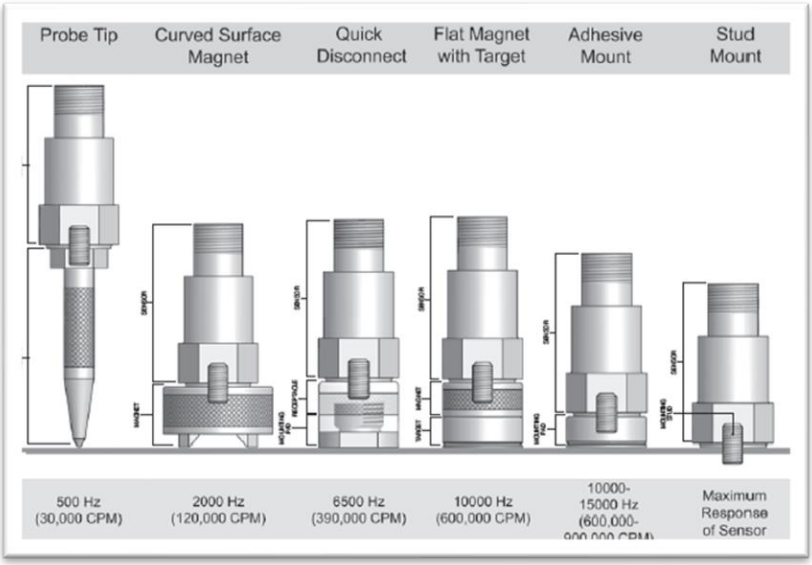
A vibration sensor must be installed correctly to guarantee quality of data that will be acquired. Installation includes mounting options for sensor (adhesive, magnet, permanent, etc.), as well as proper connection between sensor and meter hardware.

Frequency Response / Mounting Techniques

Accuracy of response at high frequencies is directly affected by mounting technique that you select for sensor.

In general, the greater the surface contact between the sensor and machine surface, more accurate the high-frequency response will be.

Following table offers a general guide to full range of mounting techniques available, and the correspondingly high frequency response expectations.

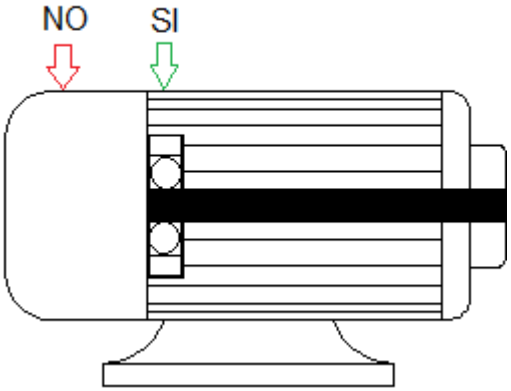


Sensor's location on machine:

Vibration sensor should be placed as close to bearing as possible, with solid metal between bearing and sensor. Placement on thin metal bearing covers should be avoided.

If possible, locations should be selected in such a way that there are no joints between metal and metal, between bearing and sensor.

In general, it has been found that for motors under around 50 HP one test point is sufficient, but for motors over 50 HP each bearing should have its own vibration sensor. In machines sensitive to bearing damage and where bearing problems should be detected as early as possible, each bearing should have its own sensor as well.



Sensor has a threaded stud-type mounting accessory that must be previously placed in selected location for vibration measurement. Sensor must support its entire base in selected place, this must be clean for its best measurement.

In addition to cleaning, it is recommended that surface be flat or that it be rectified so that entire sensor base makes contact with equipment to be measured.

Accelerometer should be held firmly in place with no chance of it moving. Any movement of sensor will add noise to signal, usually broadband, but sometimes speed harmonics. Accelerometer is sensitive to rapid changes in temperature. If a cold sensor is mounted on a hot surface, data will be false for the time necessary to reach an equilibrium temperature. This will take form of low frequency noise, with a steep upward slope, in lower range.

If an accelerometer is continually exposed to a temperature higher than what it has been calibrated for, its internal electronics will be damaged and data it will collect since then will be worthless. Tiny Remote Monitor's accelerometers operate in temperatures up to 120 °C (250 °F), exceeding this will cause damage.

Care must be taken not to drop accelerometer on a hard surface and damage the piezoelectric element. If the element is cracked, stiffness of internal assembly will decrease and reduce resonant frequency of accelerometer and this can significantly change its sensitivity to high frequencies.

Vibration Sensors Orientation:

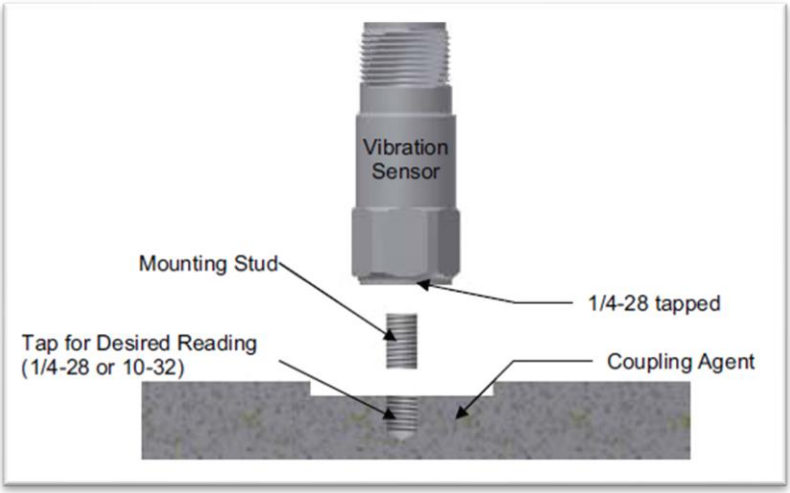
In any machine monitoring program, the fact that data is collected in exactly same way each time a measurement is made is extremely important. This ensures that data can be repeated and that a trend can be established over time.

It is advisable to place vibration sensors in direction of greatest stress, if unknown, in two radial directions,

perpendicular to each other and one axial direction on thrust bearing.

Prepare a 6 mm deep hole in middle of the point defined as measurement for mounting the prisoner. Thread a ¼ x 28 thread tap three times recommended for complete set.

Once threaded hole is finished, glue the stud with a liquid thread lock type product.



Mounting Probe for Electric Motor Vane / Installation Path:

1. Prepare the cooling fins on engine by cleaning any paint or debris between cooling fins.

2. Clean mounting area with a non-residue degreasing spray.

3. Mix adhesive.

4. Apply adhesive to the sides and bottom of probe body.

5. Place mounting piece between motor fins in the desired location.
Probe should be located between motor fins, and bottom of probe should contact motor casing. as close to as possible.

6. Press firmly on mounting probe, ensuring that there are no gaps.
It should be as flat as possible against motor housing. (Figure 2)

7. Fill the remaining gaps with adhesive to ensure that probe is fixed in place.

8. Allow full cure for adhesive prior to sensor installation.

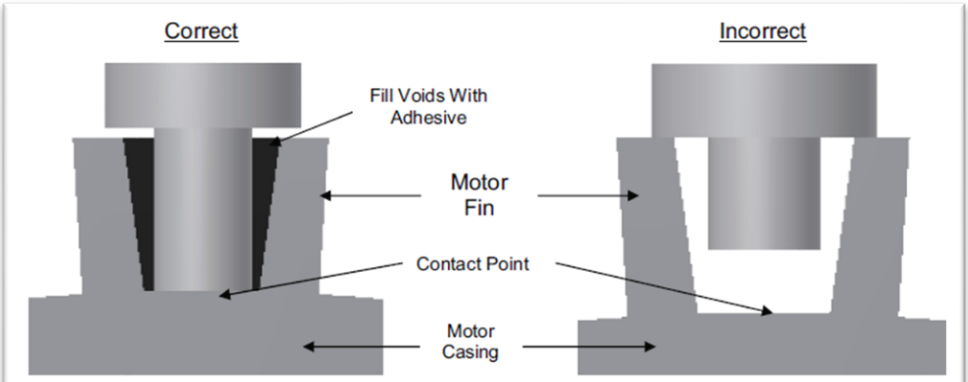
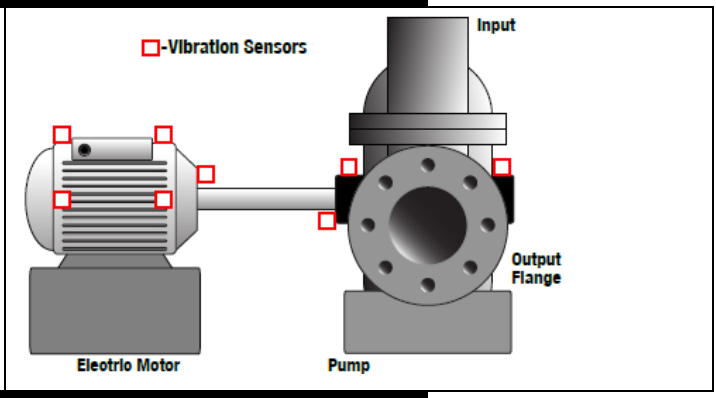


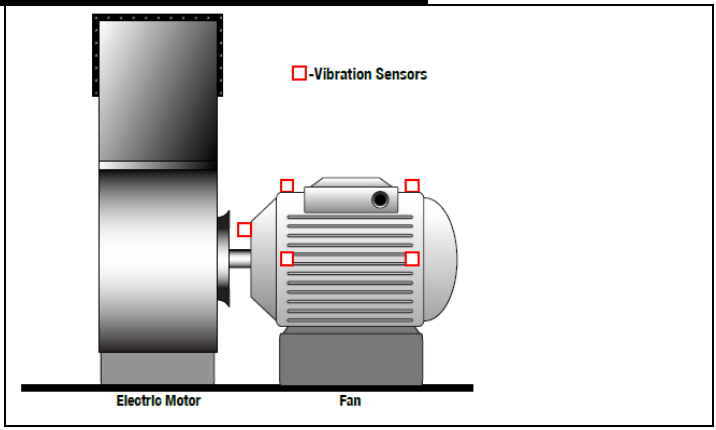
Figure 2. Installation of Motor Fin Mounts

Typical checkpoints by machines type:

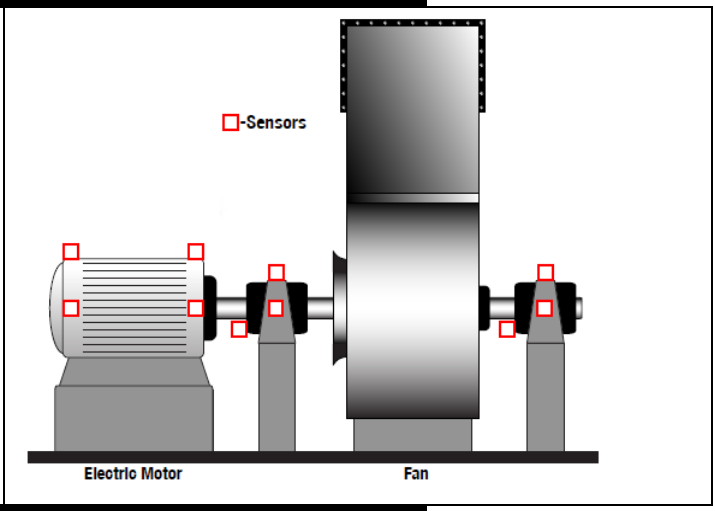
Boiler feed pumps



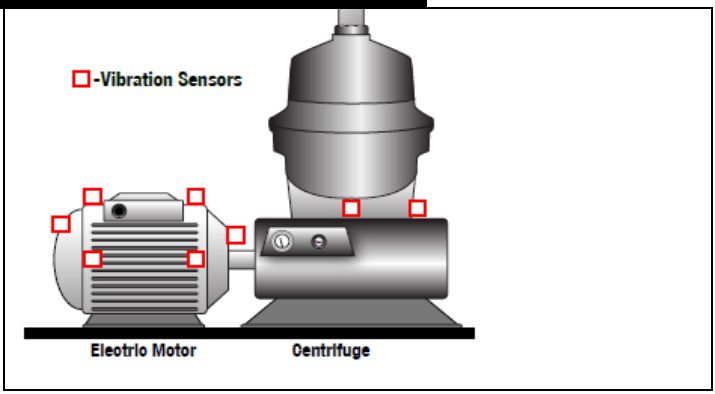
Direct fans



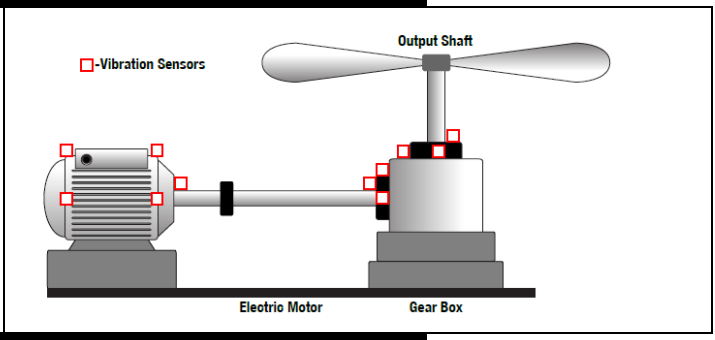
Fans



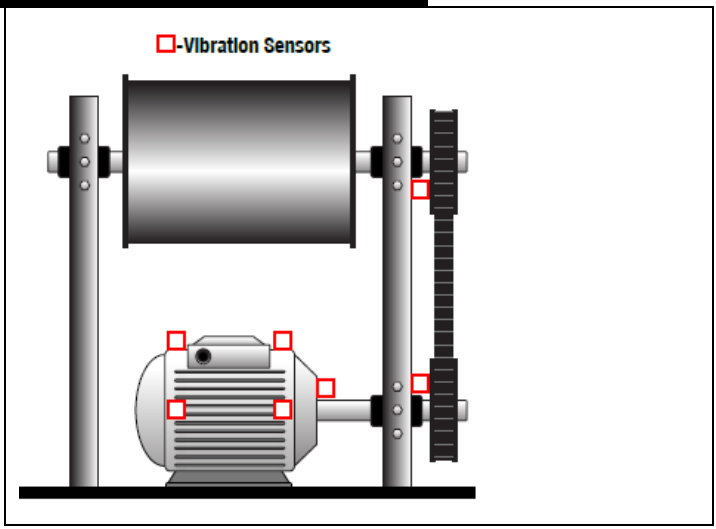
Industrial centrifuges



Cooling towers

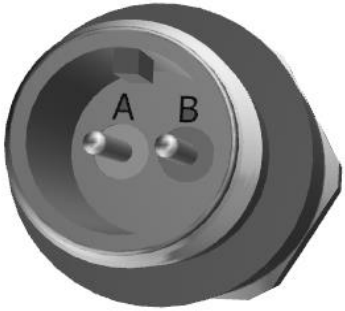


Belts



Accelerometer sensor output connector:

Multipurpose accelerometer



Cable:

Cable length:

The capacitance present between both conductors, which is proportional to their length, must be such that the attenuation represented by said load at sensor output for high frequencies is negligible.

Behavior at high frequencies and for large amplitudes is also limited by current delivery capacity of source that polarizes sensor to charge that capacity formed between conductors.

Cable routing:

Route cables as far as possible from radio transmitters, motors, generators, transformers, and other sources of electromagnetic interference (EMI).).

Avoid areas prone to electrostatic discharge (ESD).

Never route a sensor cable in parallel with a power line. If you have to cross it, do so at a right angle.

Use shielded and high-quality cables, in case of making splices (which is not recommended) screen must be preserved in this region.

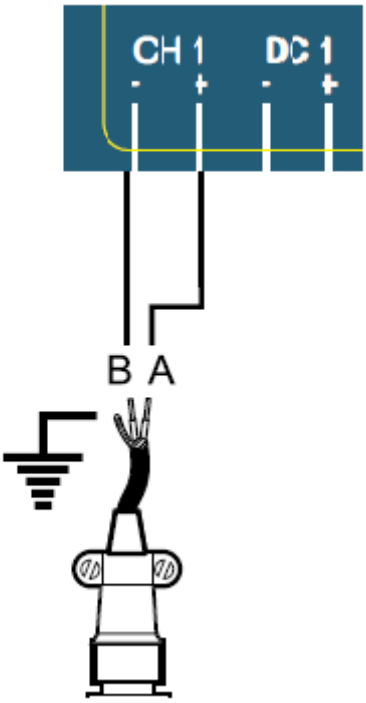
Accelerometer input for vibration measurement:

Equipment has 2 channels suitable for connectivity of accelerometer sensors, ICP type, these vibration acceleration input channels are suitable for digital integration and display from acceleration, velocity and displacement of vibration.

Supported Sensor Features:

Excitation voltage	18 a 28 V CC
Constant Current Excitation	2 a 20 mA
Output impedance	<150 Ohm
Bias voltage output	8 a 12 V CC
Sensitivity	1-1000 mV/g

Accelerometer sensor connection diagram:



Cable holder:

Once sensor is connected, cable must be fastened to surface of machine with a clamp, in order to avoid possible stresses at the end of cable, but still allowing free movement of accelerometer.

Shielded cables:

They are used to prevent high-power, high-frequency signals from being coupled to low-level analog signals

through parasitic capacitances and inductances. If guard (or screen) is correctly connected, these spurious signals will be absorbed by it and not by conductors.

Another advantage is that shield reduces input capacitance of circuit, since undesirable capacitances are formed with respect to shield and not conductors.

Tachometer:

Measurement equipment has 1 (one) trigger input, intended mainly for measuring RPM of machine.

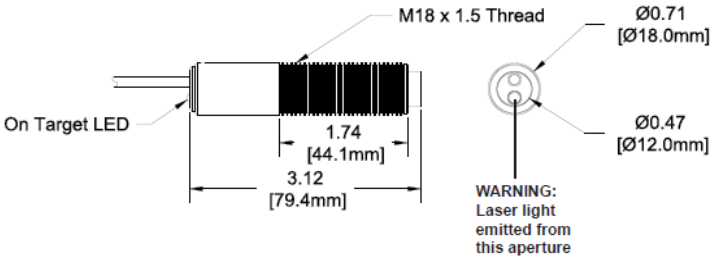
There are different types of sensors to measure RPM of a machine, and appropriate one must be selected taking into account the distance from target, shaft material, light to which the monitored equipment is exposed, and environment in which it works.

Laser sensor:

Laser optical remote sensor has a visible red light laser light source and a green LED indicator for operation or reading.

Laser acts as the aiming device during installation and can accurately measure speeds from 1-250,000 RPM from a distance of up to 7 meters with a maximum deflection angle of 60 degrees to rotating object.

Sensor is housed in a stainless-steel threaded body and is supplied with a mounting bracket, nuts and an eight-foot shielded cable. ROLS24-W.



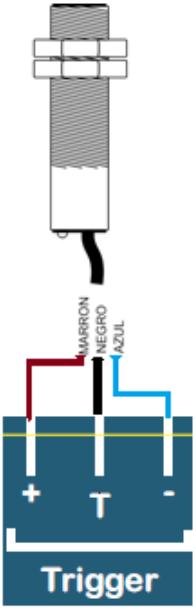
Speed range: 1-250,000 RPM
Lightning: Visible Red Laser, class 2
Laser specifications: Class 2 (by IEC 60825-1 Ed. 1.2 2001-8)
Complies with FDA performance standards for laser products except for deviations found in Laser Notice N.º. 50, July 26, 2001.
Max Laser Output: 1mW
Pulse Duration: Continuous
Laser wavelength: 650 nm
On-Target indicator: Green LED on cable ends cap.
Operating range: up to 25 ft [7.6 m] y 60º diff from objective.
Required Power: 9 - 24 V CC, 0.13W
Output: positive pulse with objective – Output voltage = Supply voltage
Optional – Open collector or TTL pulse, Negative pulse (Contact the factory)
Working Temperature: 14 °F a 158 ºF [-10 °C a 70° C]
Humidity: Max relative humidity of 80%: for temperatures above 88 °F [31 °C] decreasing linearly until 50 %.
Connection: Tin wires

Cable Length: 8 ft [2.4 m]
Material: 303 SS supplied with two M18 Lock Nuts and mounting bracket

Installation:

ROLS24-W must be mounted (with aluminum mounting bracket and nuts) and optically aligned to illuminate on target. It is recommended that optical sensor be placed at a small angle (15 degrees) from perpendicular so that the sensor receives pulses only from the reflective marker.

Laser sensor connection diagram:



Output Signals:

Relays:

Hardware has 2 physical Relays mounted on its connectivity board. These Relays have dry contacts, NO (normal open) and NC (normal closed).

There are high-density slim mount type Relays and complies with Bellcore and FCC Part 68 specifications.

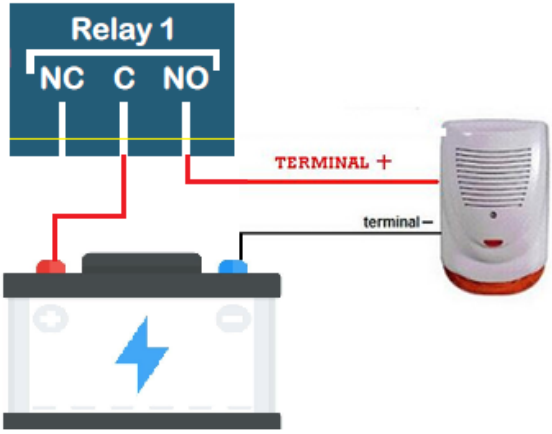
- Dielectric strength 1,500 VAC between coil and contacts
- Force arises 2,500 V between coil and contacts (between the 2 x10 s surge wave)
- Maximum switching capacity of I – 4.2 A, 700 VAC with high sensitivity and low power consumption
- Sealed plastic type

Versatility of relays allows us to connect them directly to an acoustic alarm (siren), a light command, drive, etc. or directly to auxiliary connection of a contactor for automatic command of monitored equipment.

Configuration of these relays is controlled from WEB application or through the DSP MC, from there relays can be actuated according to events found during monitoring time.

Relay connection diagram:

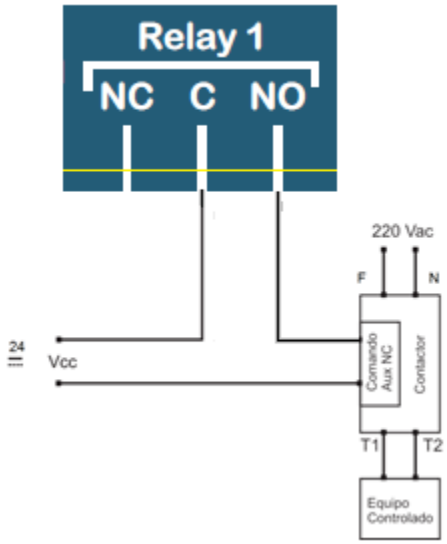
Trip sound signal connection:



For conditions where triggering of Relays must define the operation of a machine, its outputs can be connected to a contact.

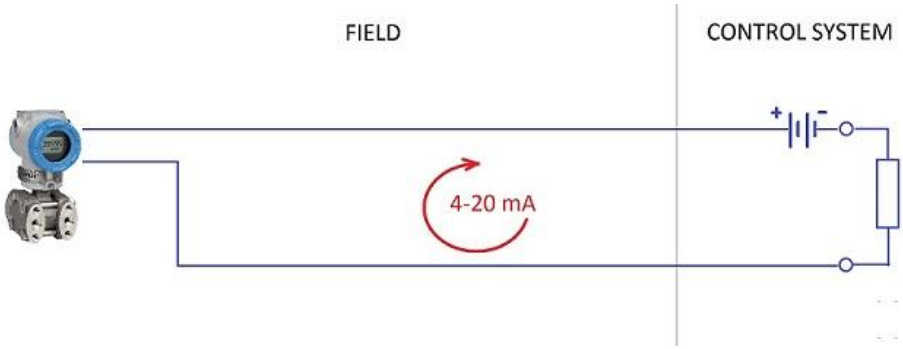
For this option, parameters that will command activation of Relays must be precisely defined, from web configuration page or from DSP Machinery control software.

Relay connection to a contactor:

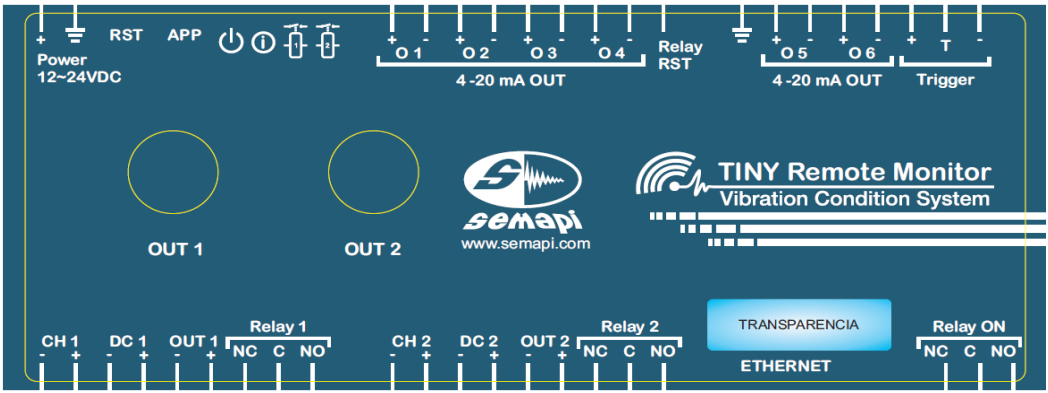


Analog 4..20 mA Output

Tiny Remote Monitor outputs are of “passive” type, so the equipment connected to them must supply necessary voltage.



Schematic plans of connections, inputs and outputs:



Configuration

Tiny Remote Monitor equipment can be configured through the built-in web page or through DSP Machinery Control software. If latter is used, spectral measurements can be analyzed with all tools available for this purpose.

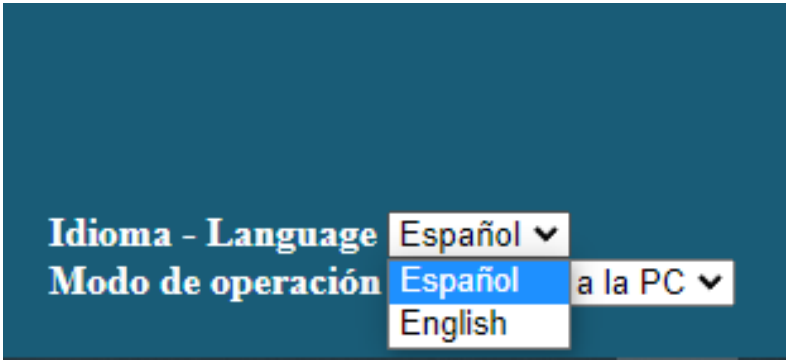
To access the page, device and PC/Phone or Tablet must be on same network

Using the name supplied by SEMAPI (e.g., TR100-0014), open your web browser and enter it as address (http:\\TR100-0014)

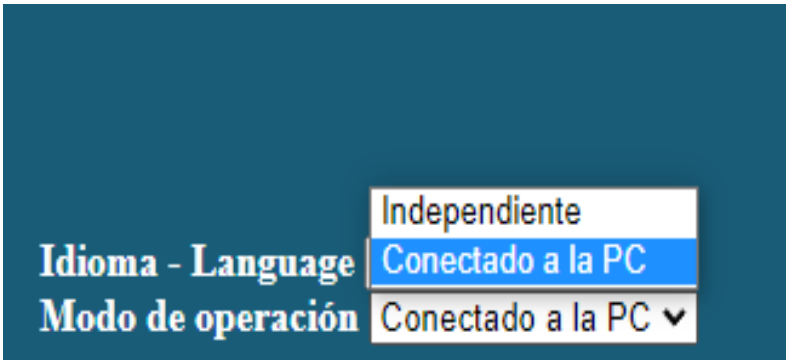
The equipment's home page will open.

In it we will have access to all configurations of the equipment and follow-up of measurements. We can also configure:

Language:



Operational Mode:



Independent:

In this mode configuration is done through web page.

Connected to PC:

In this mode configuration is done by DSP Machinery Control software. According to measurement frequency, signals will be sent and all available analysis tools can be used.

From main page we have different options for configuration and monitoring.

Status:

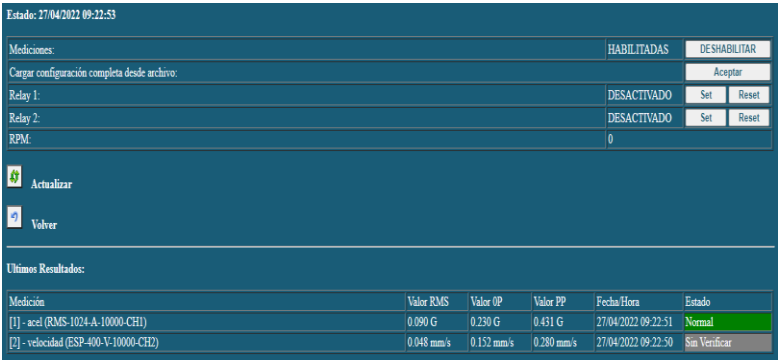
On this screen you can enable and disable measurements, load the modifications made to input signals, configuration of relays and output signals, verify status of relays and have RPM reading (if trigger sensor is connected).

Status of measurements will also be displayed, indicating the configuration of each measurement (RMS, 0-P and P-P values of the same, Date/Time of

measurement and status, which will depend on whether or not mask is applied).

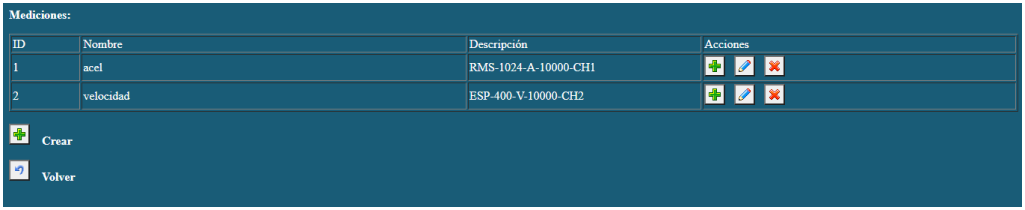
Modifications loading:

Once measurements are generated (or modifications are made to them), it is necessary to tell the system to reload them. To do this, you must press “Accept” button to the re-load.



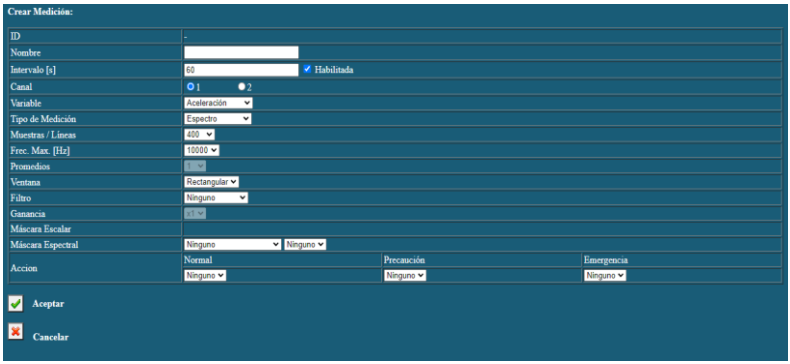
Measurements:

In this window, measurements that equipment will carry out are configured.



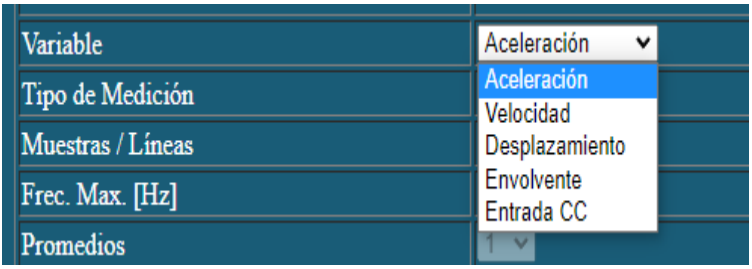
Create:

This button opens a new window for configuration of measurement



Must enter:

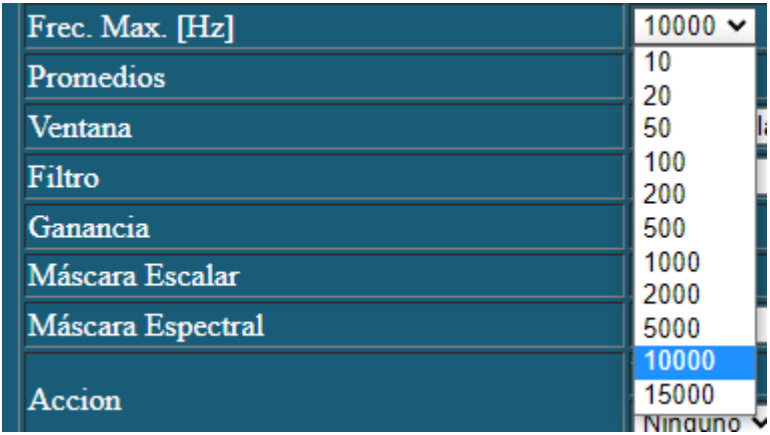
1. Name
2. 2. Measurement interval [Seg]
3. Channel used
4. Variable



5. Type

6. Number of lines

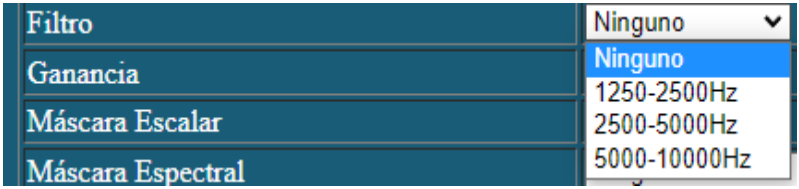
7. F Max



8. Averages

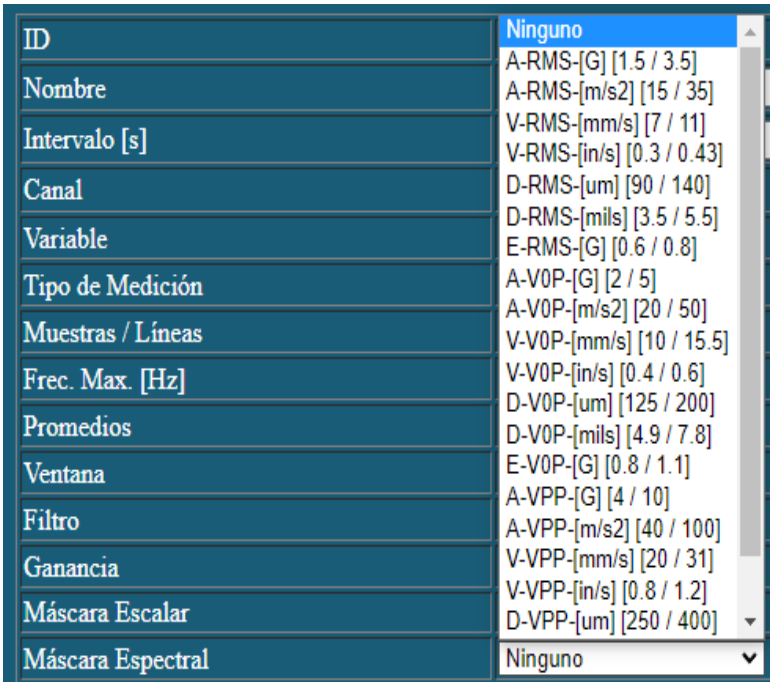
9. Window

10. Filter



11. Gain

12. Spectral mask (all configured masks will be displayed)



13. Action: Here it is configured if one or both relays will be associated to this measurement. State will depend on the chosen Mask

14. Once measurement is configured, confirm with ACCEPT button.

You can continue to configure other measurements, if necessary.

Once all the settings have been made, return button returns to main page.

In order for new configuration (or modification of current configurations) to be updated, file must be loaded as explained in Modifications loading:

Edit:

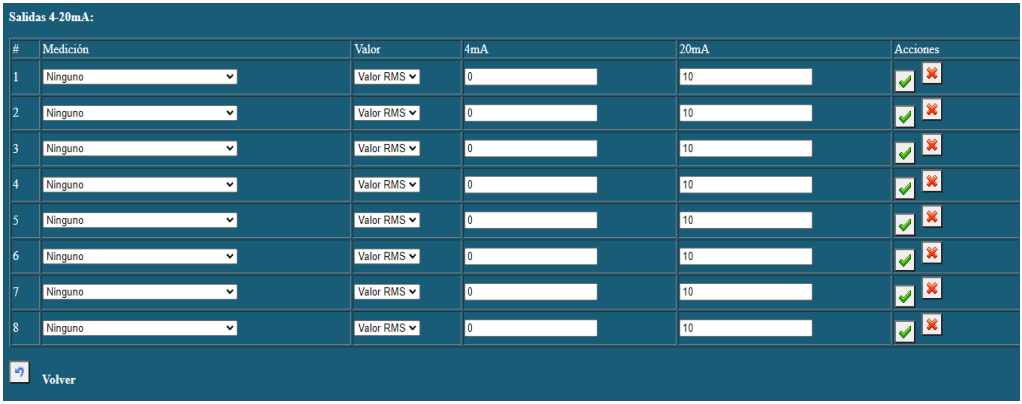
It allows modification of parameters and characteristics of each Measurement. To update values, the configuration file must be reloaded according to Modifications loading:

Delete:

Allows you to delete a measurement. Configuration file must be reloaded according to Modifications loading:

4..20 mA Output

This section allows the configuration of any of 8 of 4..20 mA outputs.



For each output, following must be indicated:

i. Select which measurement it corresponds to
ii. Selection of measurement value to be replicated, selection between:
    1. RMS value
    2. 0P value
    3. PP value
    4. RPM value
iii. Select value that will correspond to 4 mA output
iv. Select value that will correspond to 20 mA output
v. Once settings have been made, the configuration file must be reloaded as indicated in Modifications loading:

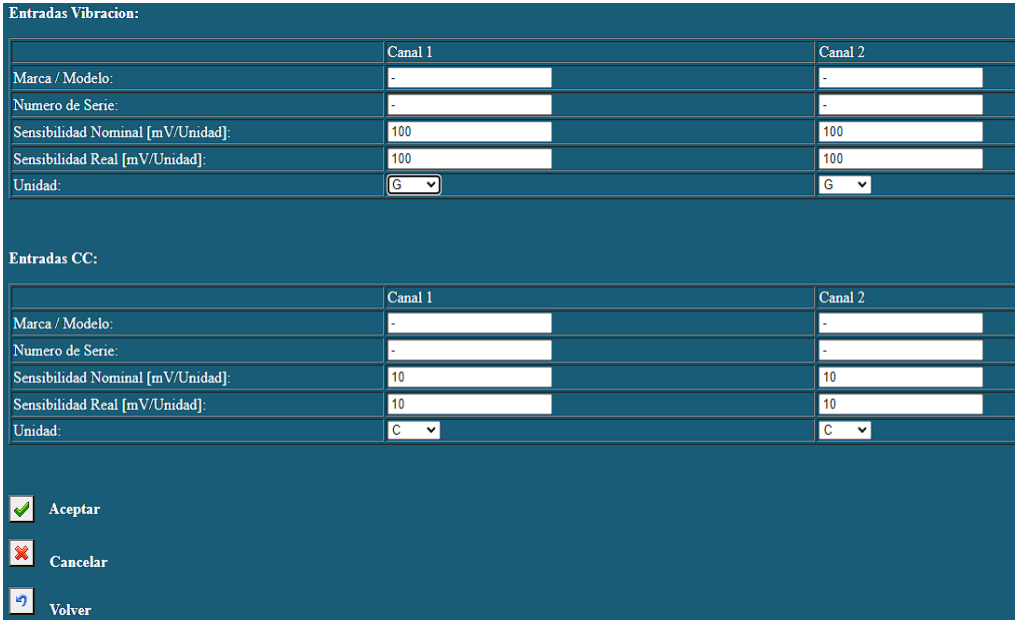
Communications

Here you can configure ethernet connectivity with equipment, either by wired connection or by Wi-Fi

In the event that a Reset is needed, either from wired connection or from Wi-Fi connection, there are specific buttons to do so.

System:

Here it will be possible to carry out: Configuration of both accelerometers and DC sensors for each channel



For each item, you must enter Brand/Model of sensor. It is very important to note that Real Sensitivity field must be completed exactly with data provided by sensor manufacturer, since correct calibration of corresponding point measurement depends on this data. Finally, indicate in which unit's sensor provides information.

Channel Calibration:

If necessary, channels can be calibrated against a calibration standard

Calibración de Canales:

Canal	Configuracion Actual			Parametros de Calibracion		Acciones
	Sensibilidad Real	Factor	Ultima Medición	Patrón	Sensibilidad Real	
A1	0.1	1.13742545163877	0.0000	1	0.1	
A2	0.1	1	0.0000	1	0.1	
CC1	0.01	1	0.0000	1	0.01	
CC2	0.01	1	0.0000	1	0.01	

Mask management

To create, modify or delete alarm masks

Máscaras:

ID	Nombre	Tipo	Variable	Descripción	Acciones
1	A-RMS-[G]	Valor RMS	Aceleración	Precaución: 1.5G Emergencia: 3.5G	
2	A-RMS-[m/s2]	Valor RMS	Aceleración	Precaución: 15m/s2 Emergencia: 35m/s2	
3	V-RMS-[mm/s]	Valor RMS	Velocidad	Precaución: 7mm/s Emergencia: 11mm/s	
4	V-RMS-[in/s]	Valor RMS	Velocidad	Precaución: 0.3in/s Emergencia: 0.43in/s	

You must enter a name that is representative and then define whether mask is for a scalar value or a spectrum, then define variable, unit system and finally values chosen for level of caution and level of emergency.

If mask is scalar, values can be defined for RMS, 0-Peak, Peak-Peak, Crest Factor or even RPM measurements.

If a mask is to be generated for a spectrum, precautionary and emergency values must be defined for different frequency steps, always defining cut-off frequency of each step. It is important to note that last designated frequency step must coincide with selected maximum frequency