

User manual
nmas
Simple



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General

nmas® is a registered trademark of Nome LTD. nmas® is an abbreviation of Nome Monitoring and Analyzing System.

This manual describes the usage of nmas hardware on unit. More info can be found at <http://nmas.nome.fi>.

Version:

1.0	24.05.2016
1.1	05.08.2016
1.2	11.10.2016
1.3	16.12.2016
1.4	27.7.2017

Product description

Nmas is an on-line condition monitoring system. Nmas can be used to monitor different sensors and signals. System can be used as an individual signal converter or as a collector and data analyzer.

Safety information

Information in this manual should be followed carefully to avoid electric hazards and dangerous situations. Misuse of hardware may lead to equipment or human damage. Wrong settings can lead to false signal scaling, disinformation or might cause machine failures. Please use professionals for configuration changes.

Manufacturer recommends twisted and shielded pair cable or other sensor manufacturer's recommended cable for all the sensor connections.

Do not install the sensor cables near high voltage cables.

Unconnect the sensors from the cables when welding or other high voltage operations are occurring near the sensors. Make sure that high voltage operations near the sensors do not damage the sensors.

Manufacturer is not responsible for damages made during installations.

If sensor is not connected, set the channel off to avoid any false diagnosis.

Intended use

Nmas is a condition monitoring device. It has multiple different features so usage may vary. Nmas should not be used as security device without consulting the manufacturer.

Support / Manufacturer

Please contact your local distributor for support. Manuals and user info can be found from manufacturer site <http://nmas.nome.fi>. Manufacturer of the nmas software and hardware is:

Nome LTD.

Lummintie 9

90460 Oulunsalo

Finland

www.nome.fi



Terminology

Measurement interface (MI)

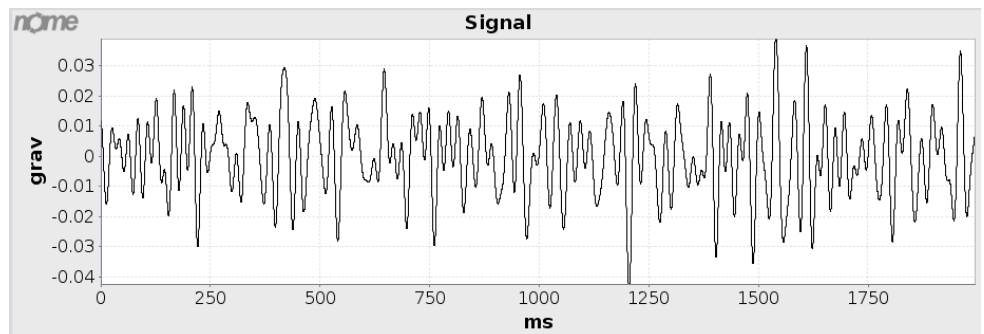
Nmas supports multiple signal and sensor connections. Some of these are sensors but nmas has no limitation of the input type. All data entered to nmas comes from *Measurement Interface*.

Examples of *measurement interfaces*:

- acceleration sensor (IEPE type)
- pulse sensor
- pressure sensor
- oil particle counter
- modbus interface
- digital sensor

Signal

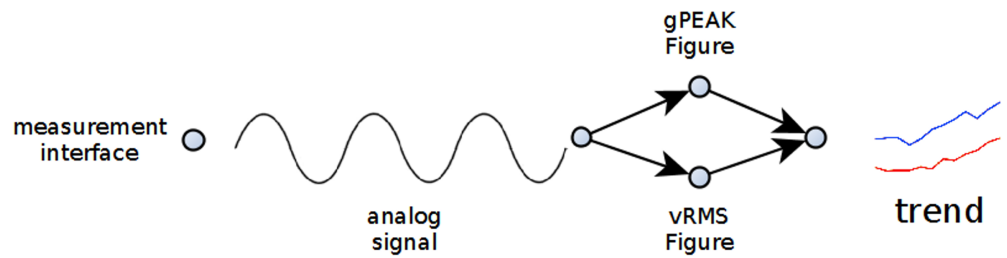
Some *measurement interfaces* provide timebase data. This data is described as *signal* in nmas. *Signal* is sample of data during limited time frame. *Signal* is used for further analysis and can be stored for later analysis. *Signal* is typical for acceleration and voltage inputs.



Picture 1: Signal from acceleration sensor.

Figure

All trend data is handled as *figures*. *Figures* are single number values representing data from measurement interface. User can attach multiple *figures* to same *signal*. Typically *figures* have relation to physical quantities. At least one *figure* should be linked to every *measurement interface*. *Figure* names are used in data views and reporting.



Picture 2: Figures

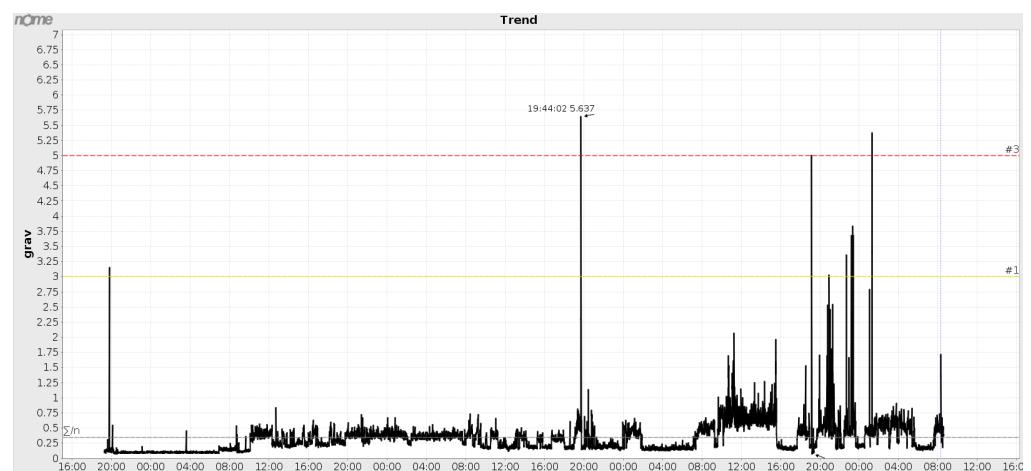
Nmas supports *figure* calculations in two levels. Levels are defined as *hardware level* and *software level*. Difference between levels is that calculation of *hardware level figures* are done immediately when data is measured. *Software level figures* are calculated when data is stored to database. *Software level figures* can also be calculated anytime after data has been stored.

Nmas *hardware level figures* can be related to peak, mean or rms values of relating data. *Software level figures* have no limitations. Data in nmas storage can be manipulated, recalculated and associated to other signals as desired. Please note that some *software level figures* have to be specially added to nmas and are not included in standard user interfaces.

Warning and Alarm

Nmas warnings and alarms are always related to figures. All figures can have individual warnings and alarms. As in figures nmas supports two levels of warnings and alarms. Levels are defined as hardware level and software level. When using warnings and alarms it is important to notice that only hardware level warnings and alarms are calculated immediately when data is measured. When warning or alarm information demand immediate actions they should be configured as hardware level warnings and alarms.

Nmas hardware level warnings and alarms can be related to peak, mean or rms values of data.



Picture 3: Trend data with warning and alarm limit.

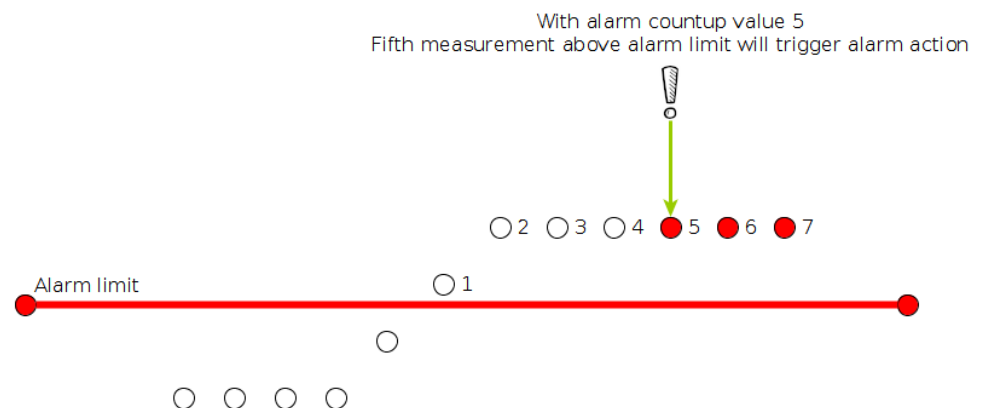
Warning and Alarm Configurations

Warning and alarm configuration allows user to define how warnings and alarms are treated in measurement hardware and software. Common to all "warnings and alarms" is that they have multiple triggering levels. Basic set up of levels is two. These two levels can be understood as warning and alarm level.

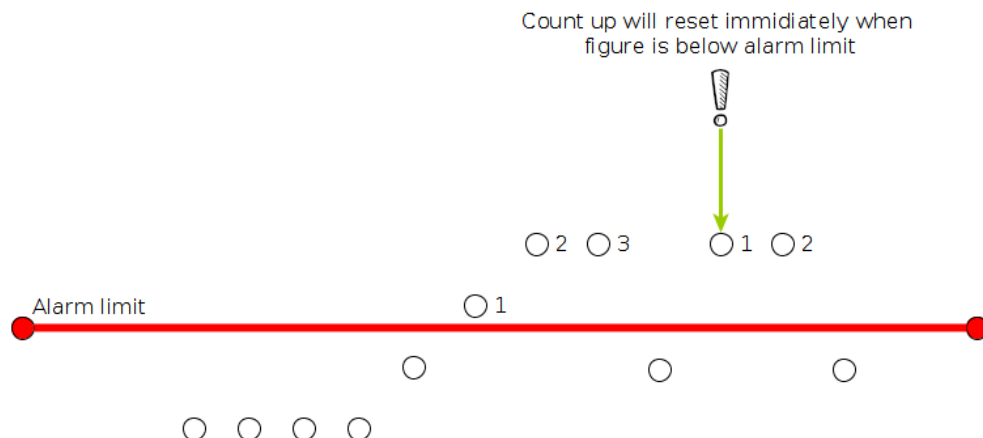
Passing "hardware level warnings and alarms" always triggers data storage. If action is related to "figure" calculated from "signal" all related data is also automatically stored. With this operation user can always verify the reason for alarm action.

Nmas can be configured to react on every "figure" level passing. This is usually not desired since it can lead to very high amount of data storage. Usually at least one direction of level passing should be set to values higher than 10. In typical condition monitoring situation both passing counter values should have values higher than 10. Due to this behavior data in trend can be higher than warning or alarm limit without any triggered warning or alarm actions.

Reacting on level passings is controlled with configuration parameters count-up and countdown. Count-up defines how many times figure value has to be higher than level before level actions are triggered. Countdown amount defines how many times figure value has to be lower than set level before level actions are triggered.



Picture 4: Figure is higher than alarm level in five subsequent measurements and alarm is triggered with count-up value of five.



Picture 5: Figure is higher than alarm level in three subsequent measurements and alarm is not triggered with count-up value of five.

Nmas Hardware

nmas Simple

In nmas Simple hardware components Sensor Unit (SU) and Local Data (LD) are combined in one housing. Other hardware components can be added as external units.

Nmas Hardware Components

SU (Sensor Unit)

Sensor Unit (nmas SU) is used to measure data from different kinds of sensors. Data can be vibration sensor data or data from any other sensor providing signal between 0 - 30 VDC. Data can be processed inside unit to enable characteristic value outputs. SU uses Ethernet or radio for communication. Unit can be configured for different measurements. Configuration is stored in LD.

LD (Local Data)

Local Data (nmas LD) is a unit to locally store and display measurement data. LD can store up to 500 MB of measurement data. This is usually more than six months of measurements.

Data samples from nmas SU are stored as raw signals. Also selected characteristic values are stored for faster analysis. All raw signals can be downloaded and processed for more accurate analysis afterwards.

When database is coming to it's size limitations cleaner activates and removes parts of oldest data.

nmas LD communicates to nmas SU with wired Ethernet or wireless radio (special orders).

LD can be equipped for remote connections and analysis. Remote connection can be made via wired or wireless Ethernet.

LD is used as a cloud server for measurement data and software components in local network.

RD (Remote Display)

Remote Display (nmas RD) is unit to display data in local network. Typical usage is to present data in control rooms. RD units do not store data. All visible data is downloaded from nmas-cloud. Data clouds can be in nmas server or nmas LD. Remote Display can show data from multiple nmas-clouds.

WR (Wireless Router)

Wireless Router (nmas WR) is used for routing data in wireless nmas-network. Routing can be a combination of Ethernet, wlan or gsm data transfer.

Server

All nmas units can operate individually. Nmas server can be used for central data storage, long time data storage, remote access, database manipulation and big data analysis. In small installations nmas server is usually not needed.

Nmas Software

All nmas softwares need Java 7 or higher to run.

nmas Simple software

nmas Simple is shipped with “LD View” and “View” software. nmas Simple unit is used for hosting “View” software in local network.

nmas RD software

nmas RD is shipped with “View” software.

nmas Server software

Server is used for hosting all software components.

Nmas Software Components

LD View

nmas LD view software is used to display latest results on small displays. Most typically LD view software is used on nmas LD unit. Software allows user to view latest results as a list and a trend. LD View user interface also allows user to change some values related to measurements.

View

nmas View software is used for viewing data. It can be used for viewing data in different formats. Basic view is to follow measurements as trend data. nmas

Trend can display also actual signals if they are stored to a database.

Read nmas View manual for more information.

Analysator

nmas Analysator software is used for data analysis. nmas Analysator software has a wide range of tools for performing analysis for different signals. Analysator software has been built mainly for analyzing vibration data but can be used for viewing other time based signals also.

Read nmas Analysator manual for more information.

Configurator

nmas Configurator software is used for configuring measurements by user.

Read nmas Configurator manual for more information.

Signal processing

Analog-to-digital converter

Nmas uses AD-converters to convert analog sensor signal to digital format. Analog-to-digital conversion is done in nmas SU (Sensor Unit). Nmas uses different conversion rates for high and low frequency signals.

All high frequency signals in one unit are measured at the same time. When using tacho it is also measured simultaneously with signals.

All high frequency signals are also measured continuously in all channels. Continuous measurement gives the possibility to trace all phenomena in device under measurement.

For low frequency signals analog to digital conversion is done channel by channel. This is generally described as multiplexed measurements. This means that data from different channels have small difference in time domain.

High and low frequency signals are measured with different AD-converters.

Digital signal processing can be done in hardware and software levels. Hardware level signal processing is done immediately after the signal is measured. See chapters “figures” and “warnings and alarms” for more information.

Typical high frequency signals are vibration, acoustic emission and proximity signals.

Typical low frequency measurements are temperature and pressure.

High frequency measurement AD-converter

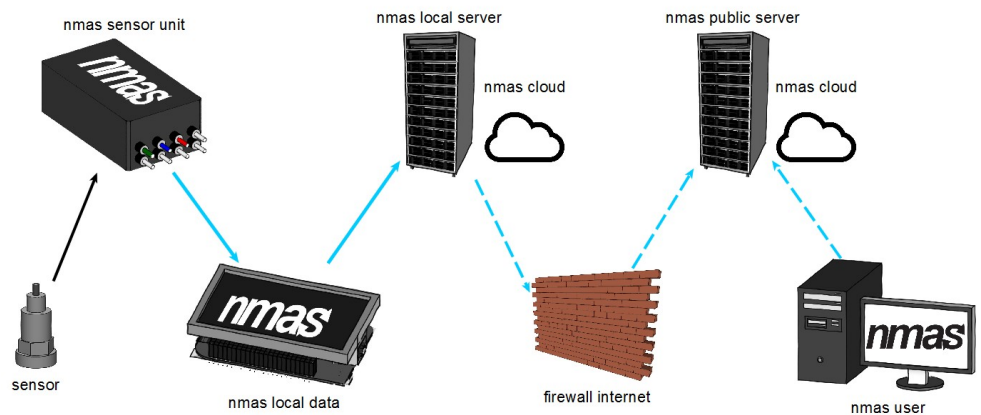
- max number of ADC Inputs: 8

- max conversion Rate: 10 KSPs
- resolution: 24 bit
- SNR: 111 dB
- maximum operating temperature: + 105 C

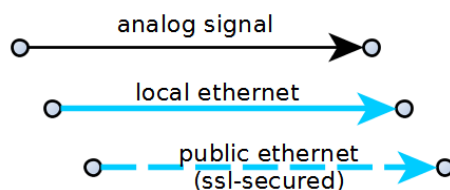
Low frequency measurement AD-converter

- max number of ADC Inputs: 8 multiplexed channels
- max conversion Rate: Software control
- resolution: 12 bit
- maximum operating temperature: + 105 C

nmas Data Management



Picture 6: Data management in nmas system.



Picture 7: Signal explanations.

Nmas can manage and acquire data on multiple levels. For analog signals first processing is usually done in nmas sensor unit. Unprocessed analog signal is usually also send periodically for database storage. Stored values can be used for analyzing and post-processing.

Digital sensors or serial communication data can be acquired from nmas local data or nmas server units. Data in nmas cloud can be viewed and recalculated by user. nmas always stored unprocessed signal. This allows user to use any recalculation methods available. Server level big data analysis can be performed in nmas LD and nmas Servers.

Nmas Simple components

- 1 piece carrying case
- 1 piece nmas Simple unit
- 1 piece nmas Simple power cord
- 4 pieces acceleration sensors (IEPE 100mV/g)
- 4 pieces acceleration sensor cables
- 4 pieces magnets for acceleration sensors
- 1 piece tachometer with cable
- 1 piece adjustable magnetic base for tachometer
- 1 piece “nmas user manual”
- 1 piece “nmas View user manual”

Carrying case

Carrying case is used to carry and storage all the components of the nmas devide. Carrying case is water proof and has custom fitted foams to protect all the components. It has lockable cliplocks and soft grip handle to carry.



Picture 8: nmas carrying case

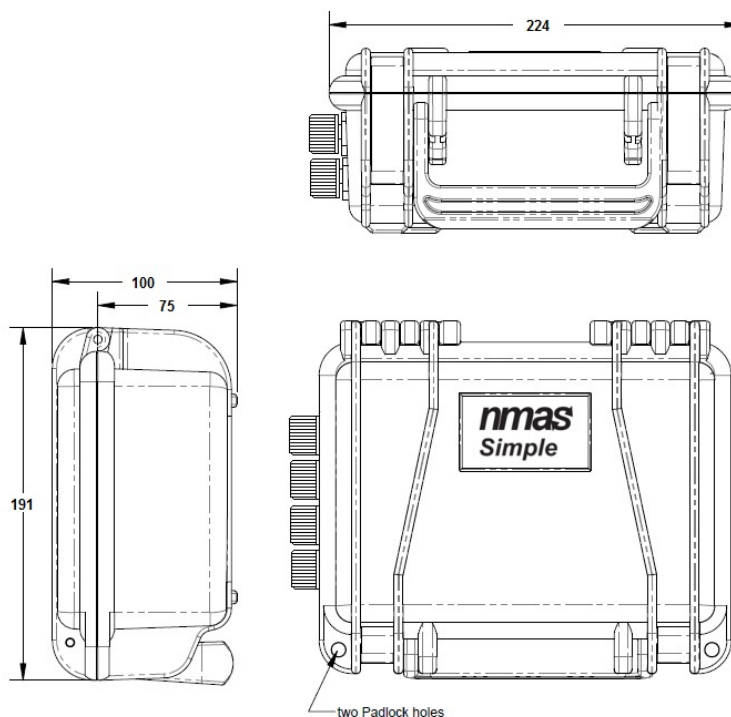
IP rating	IP 67
Exterior dimensions (L x W x D)	569 x 425 x 215 (22.4" x 16.73" x 8.46")

nmas Simple unit

Small and easy to carry waterproof case with IP 67 rating.



Picture 9: nmas simple unit

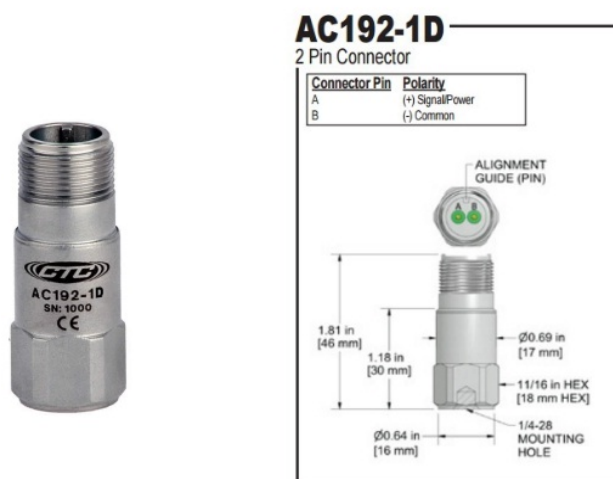


Picture 10: nmas simple unit dimensions

Acceleration sensors

Acceleration sensors provided with nmas device are high quality sensors.

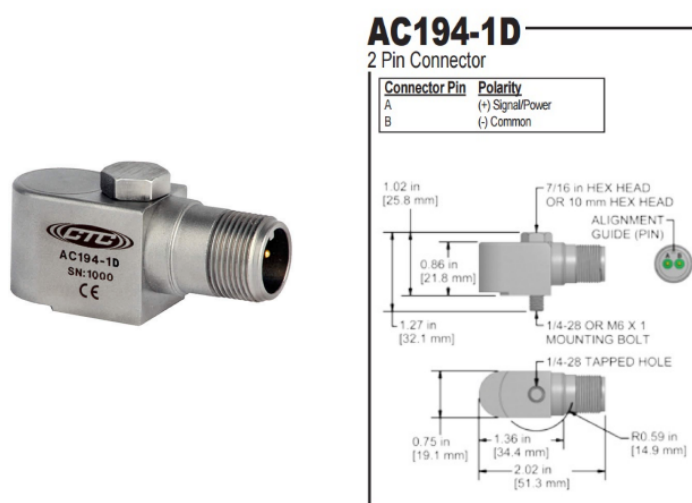
With top exit connector (AC192)



Picture 11: Accelerometer with top exit connector

With top exit connector (AC192)	
Sensitivity:	100 mV/g
Dynamic range:	± 80 g, peak
Voltage source:	18-30 VDC

With side exit connector (AC194)

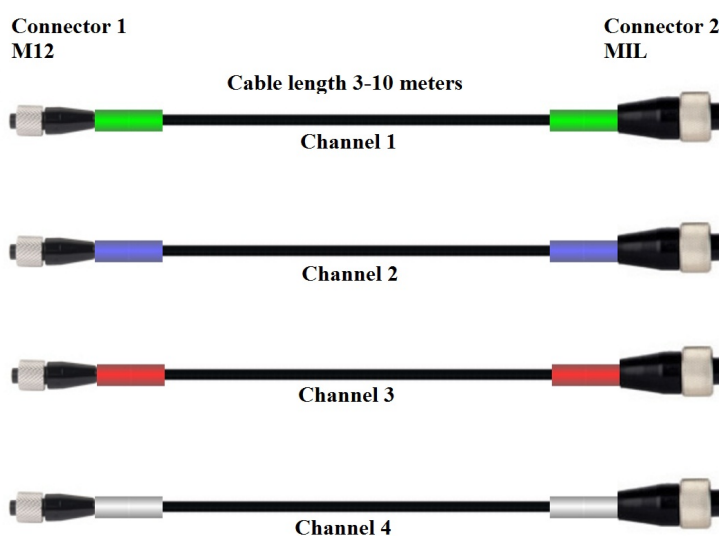


Picture 12: Accelerometer with side exit connector

With side exit connector (AC194)	
Sensitivity:	100 mV/g
Dynamic range:	± 80 g, peak
Voltage source:	18-30 VDC

Acceleration sensor cables

All cables provided with nmas device are high quality cables. Cables are color coded for easy installation.



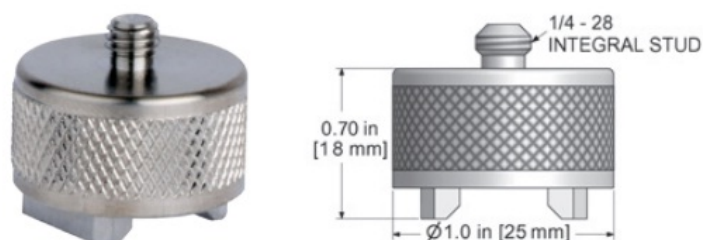
Picture 13: Accelerometer sensor cables

Cable material:	Black Polyurethane
Max temperature:	121°C (250°F)
Cable diameter:	6 mm (.245 in)
Connector 1:	M12-style molded connector with 2 live sockets
Connector 2:	MIL-style molded 2 socket connector

Magnetic base for accelerometers

All the magnetic bases provided with nmas device are high quality rare earth magnetic bases. Magnetic bases are designed to be used in flat or curved surfaces.

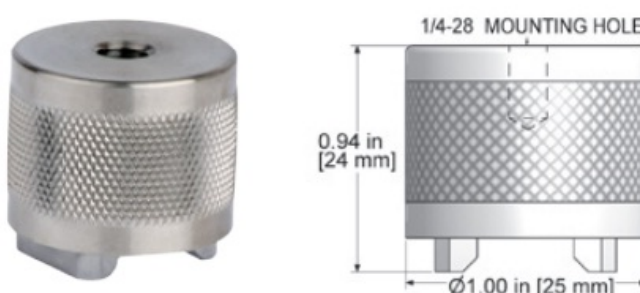
Magnetic base for top exit accelerometer (MH112)



Picture 14: Magnetic base for top exit accelerometer

Base for top exit accelerometer (MH112)	
Pull strength:	14 kg (30 lbs.)
Mounting:	1/4 – 28 integral stud
Max temperature:	80°C (176°F)

Magnetic base for side exit accelerometer (MH128)

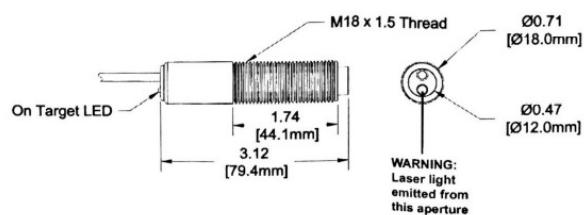


Picture 15: Magnetic base for side exit accelerometer

Base for side exit accelerometer (MH128)	
Pull strength:	14 kg (30 lbs.)
Mounting:	1/4 – 28 mounting hole
Max temperature:	80°C (176°F)

Tachometer (Speed sensor)

Provided tachometer is heavy duty, high quality optical laser sensor. Tacho comes with a mounting bracket and reflective tape stripes.



Picture 16: Tachometer

Illumination:	Visible Red Laser, Class 2
On target indicator:	Green led on wire end cap
Operating range:	Up to 7.6 meters (25 feet)
Power requirements:	3-15 VDC
Operating temperature:	-10°C to 70°C (14°F to 158°F)

Magnetic base stand for tachometer

With magnetic base stand – user can adjust the right height and angle for the tachometer. Magnetic base stand has ON/OFF switch to switch the magnet on or off.



Picture 17: Magnetic base stand for tachometer

Holding power:	60 kg
Base size:	60 x 50 x 55 mm
Weight:	1,4 kg
Vertical arm:	12 mm dia x 170 mm long
Adjustable arm:	10 mm dia x 150 mm long

Preparing for use nmas Simple

Overview

nmas Simple is designed for simple startup and operation. This means unit is fully functional after connecting sensor and power cables. All cables are marked with number or color codes for easy installation. Identifier codes are marked on nmas Simple connection points and both ends of the cables.

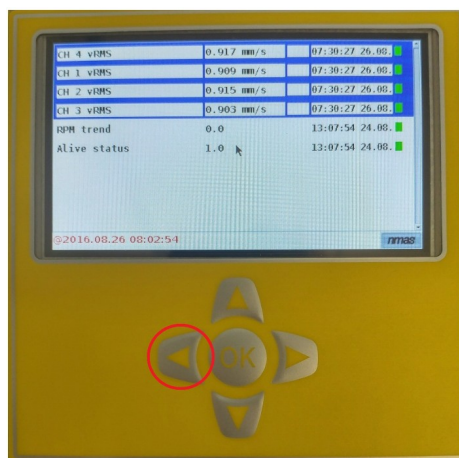
Typical ways to access nmas:

- local display (no configuration)
- local nmas_network (no configuration)
- local network (network configuration required)
- remote connection (no configuration)
- nmas-cloud (no configuration)

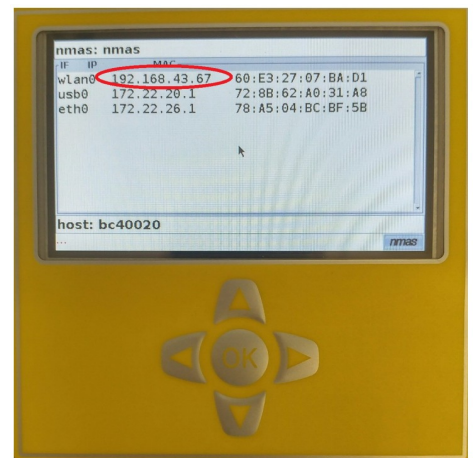
Running nmas software does not require admin privileges if Java and Java webstart support is installed. All software is downloaded and run from nmas-cloud without local installation.

Fast start:

1. Power on nmas Simple, modem and PC
2. Check **nmas-Simple IP-address** on local display by pressing left button (wlan0 ip-address)
3. Connect PC to wireless "nmas_network" with password "NMAS_Secrets"
4. User web browser on PC to access **http://nmas-simple IP-address**



Picture 18: nmas local display



Picture 19: nmas-Simple IP-address

Local display

User can access measurements through nmas Simple local display. In local

display user can access:

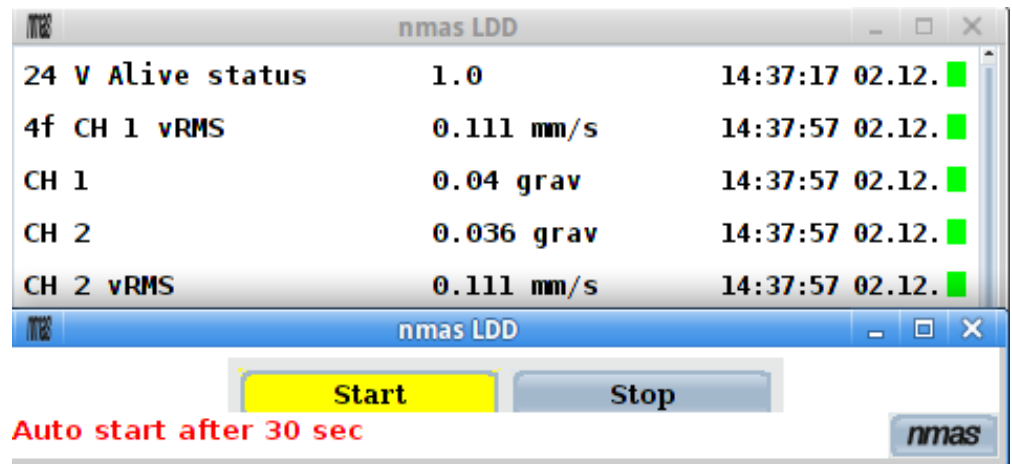
- all the indicators (measurement points) and latest measured values
- trend
- configurations
- network connections

Push buttons are used to navigate in screen. Basic button functions are:

- up/down = move
- left in the main screen = connections information
- left in the nmas connetions screen = nmas name
- right in the main screen = trend
- right in the trend screen = warning and alarm limit configurations
- OK = Select

Start / Stop

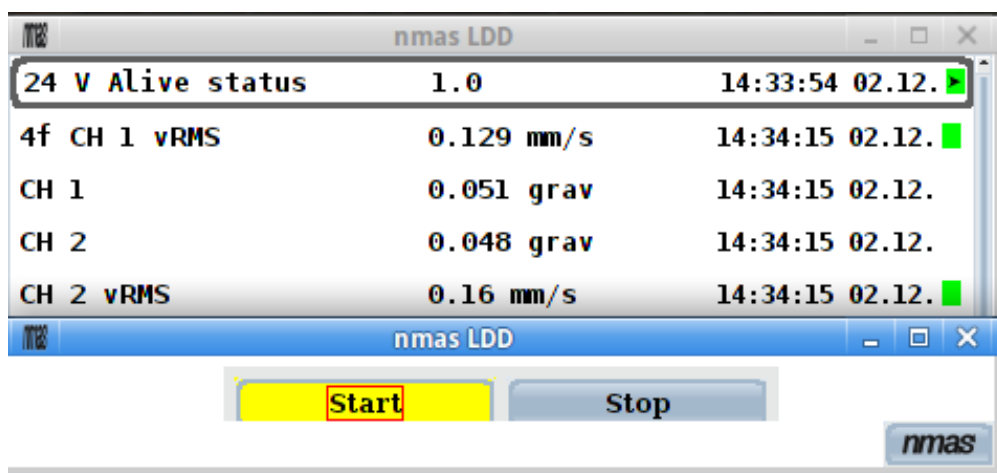
When control display is visible and measurements are started automatically after 30 seconds unless one press of **Stop** - display button. Measurements can also be started by pressing **Start** - display button. Press right or left arrow on the keyboard to choose between **Start** and **Stop** - display buttons.



Picture 20: Start / Stop - display buttons after system boot up

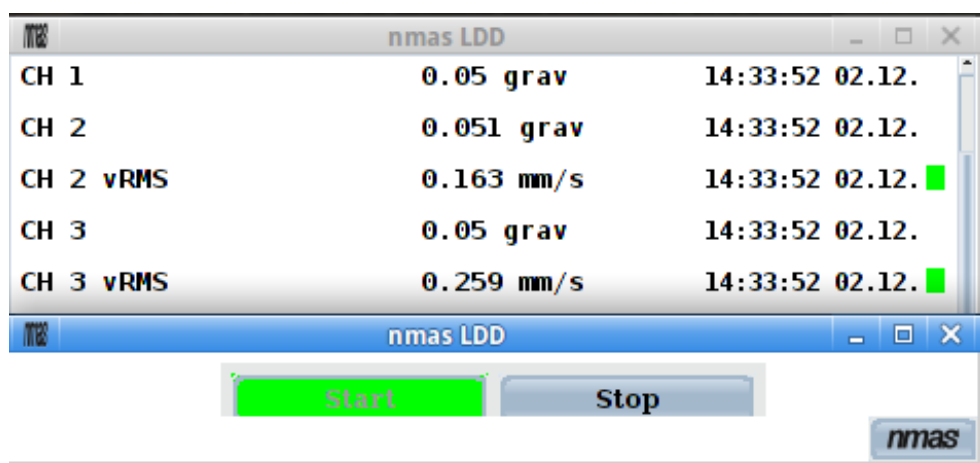
Control display can be set visible by pressing **OK** button on the keyboard and hide by pressing **arrow down** on keyboard.

Start - display button can be pressed when color is yellow.



Picture 21: Press Start - display button to start measurements

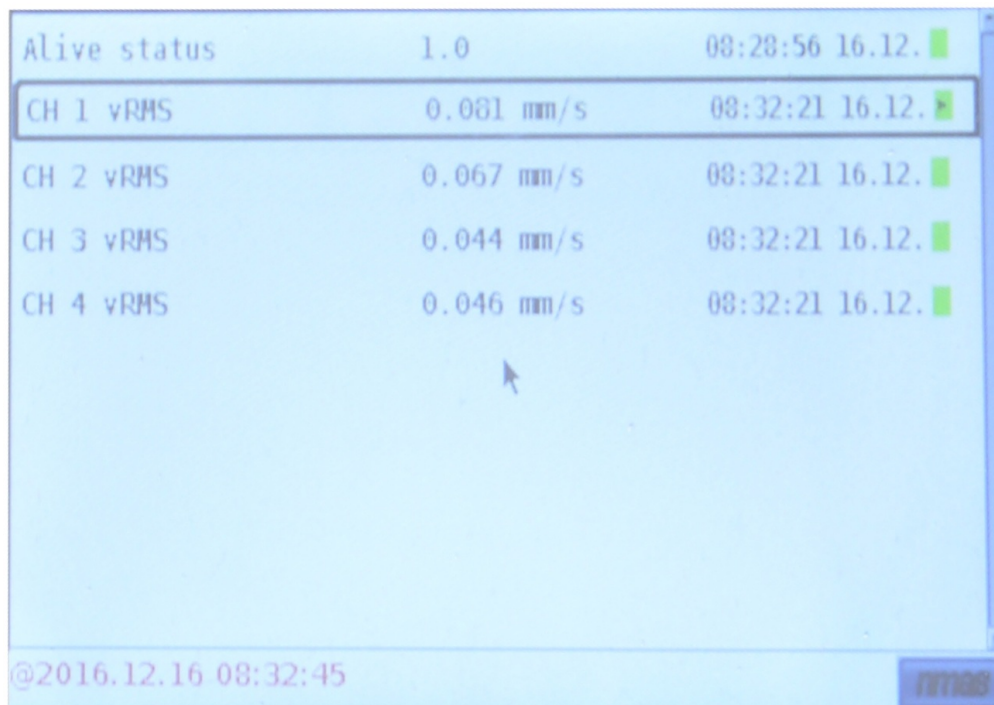
Start - display button color is green when measurements are ongoing.



Picture 22: Ongoing measurements when Start - display button is green

Result list




Main screen of the local display is the result list. It displays names of the channels, values of latest results and time of the measurement.



Picture 23: Result list in the local display

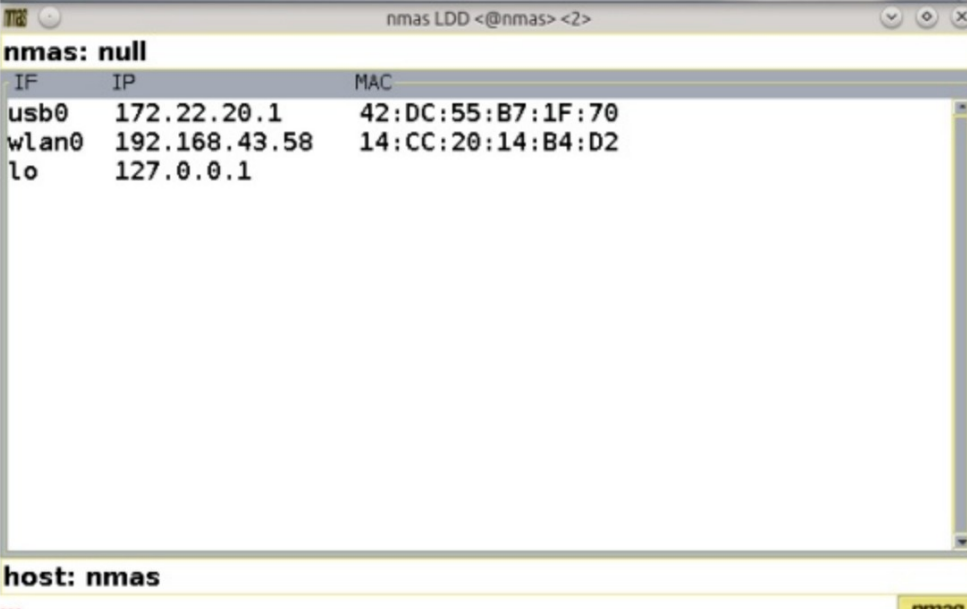
Background colors (yellow, red and blue) indicate warning and alarm status and if sensor is connected.

Color markings (green, yellow and red) indicate warning- and alarm level passings.

Color	Meaning
	Measuremet is between limits
	Warning limit passing
	Alarm limit passing
Background color	Warning
Background color	Alarm
Background color	Sensor not connected/sensor fault

Connection information

Pushing left button in the result list (main screen) will display system info. This screen shows connection information. Unit can be accessed with **wlan0** addresses in local network. In *Picture 24* the ip address is **http://192.168.43.58**.



The screenshot shows a terminal window titled "nmas LDD <@nmas> <2>". The prompt is "nmas: null". Below the prompt is a table with three columns: "IF", "IP", and "MAC". The table contains three rows of data: "usb0" with IP "172.22.20.1" and MAC "42:DC:55:B7:1F:70", "wlan0" with IP "192.168.43.58" and MAC "14:CC:20:14:B4:D2", and "lo" with IP "127.0.0.1". At the bottom of the terminal, the prompt "host: nmas" is visible.

IF	IP	MAC
usb0	172.22.20.1	42:DC:55:B7:1F:70
wlan0	192.168.43.58	14:CC:20:14:B4:D2
lo	127.0.0.1	

host: nmas

Picture 24: nmas connections in local display

Device name

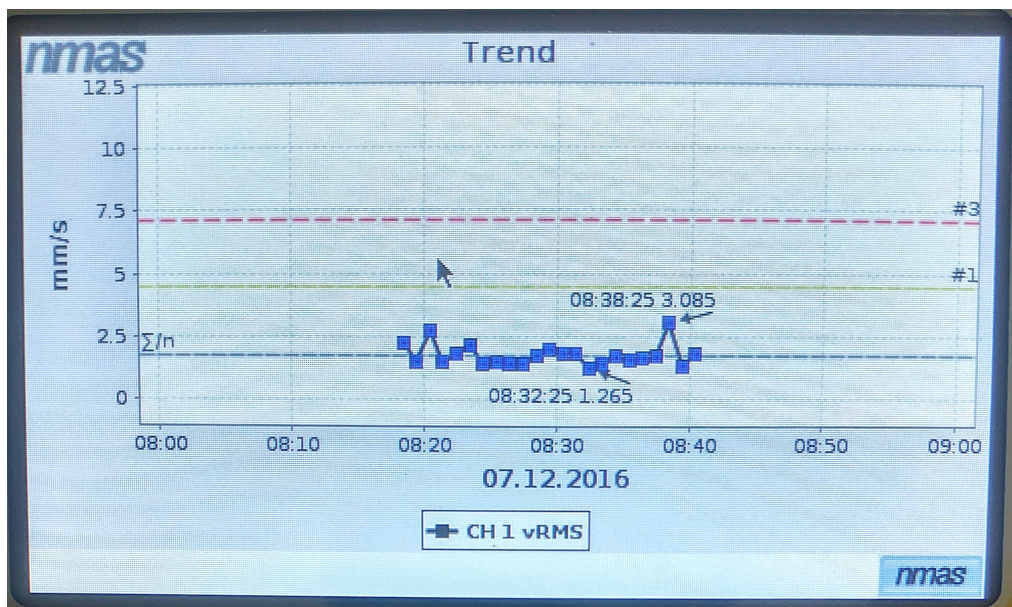
By pushing left button in the connections screen displays nmas name screen. User can change the name of the nmas device in this screen.



Picture 25: nmas name screen in the local display

Trend

Pushing right button in the main screen displays selected channels trend. Local displays trend screen displays trend chart with limits and the average line.



Picture 26: Trend screen in local display

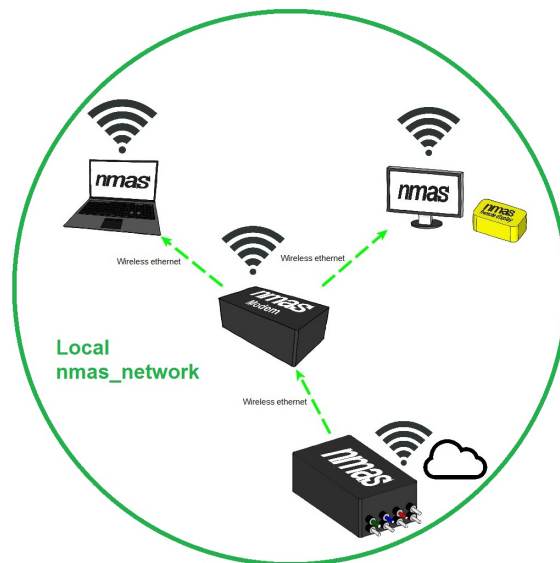
Pushing right button in the trend screen displays configuration screen. In the configuration screen user can change the scale of the trend and limits of trend.



Picture 27: nmas configuration screen in the local display

Connection possibilities

Local nmas_network



Picture 28: Local nmas_network

nmas Simple can connect to a wireless network. Unit connects automatically as a client to predefined "nmas-wireless" network "nmas_network". This connection is used for the remote display or remote connections.

nmas-wireless creates local wireless network. Wireless network is used for:

- Viewing data from PC
- Viewing data in control room from nmas remote display
- Changing configurations

- Used for remote connection access point
- Nmas-cloud-service connection

Nmas LD host a cloud service. nmas LD can be accessed with web browser on local network.

Factory settings for connecting parameters:

SSID: nmas_network

Password: NMAS_Secrets

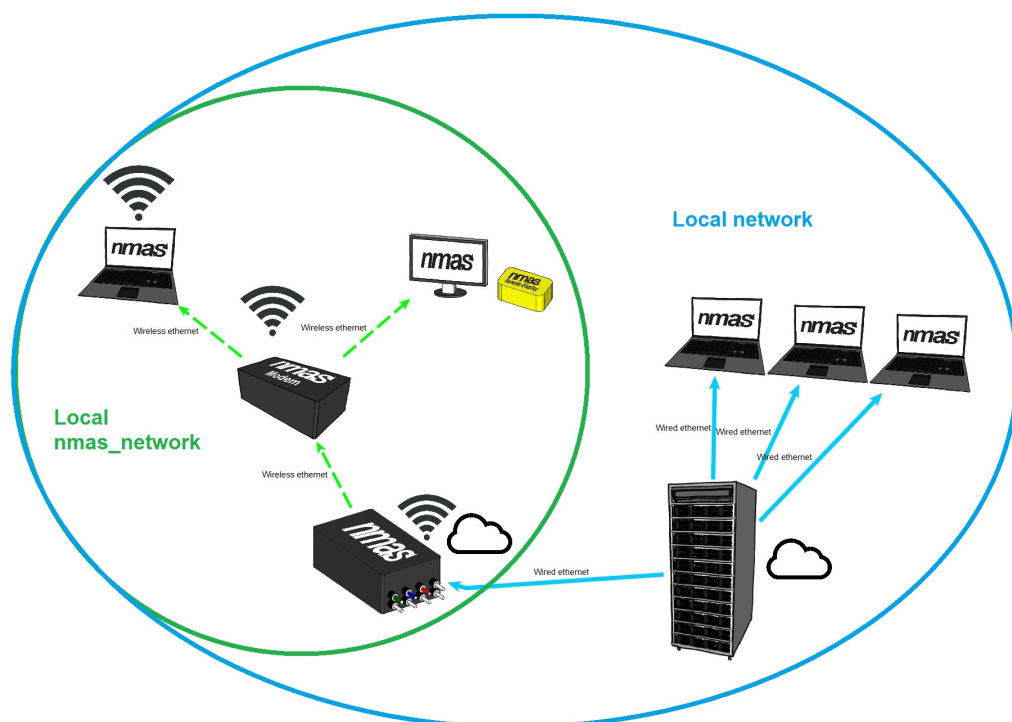
Security: WPA/WPA2

For accessing data on nmas LD, user has to be on same network. Easiest way to do this is to use wireless "nmas_network". **nmas LD unit connects automatically to this network if it is properly set-up.** Pre-configured nmas-wireless creates this network automatically.

Nmas-wireless units can be:

- Mobile phone
- Wireless 3G/4G modem
- Customer wlan (need configuration)
- Special access method (wired-to-wireless)

Local network



Picture 29: Local network

Nmás can be connected to local network in multiple ways. Connection method depends on customers network configuration. Typically this installation requires local IT-support and firewall configurations.

Local network is used in larger measurement network. Larger network is usually equipped with nmás-server for data and configuration management.

Nmás-server hosts a cloud service. Depending on network configurations, server can be accessed on any PC on client network.

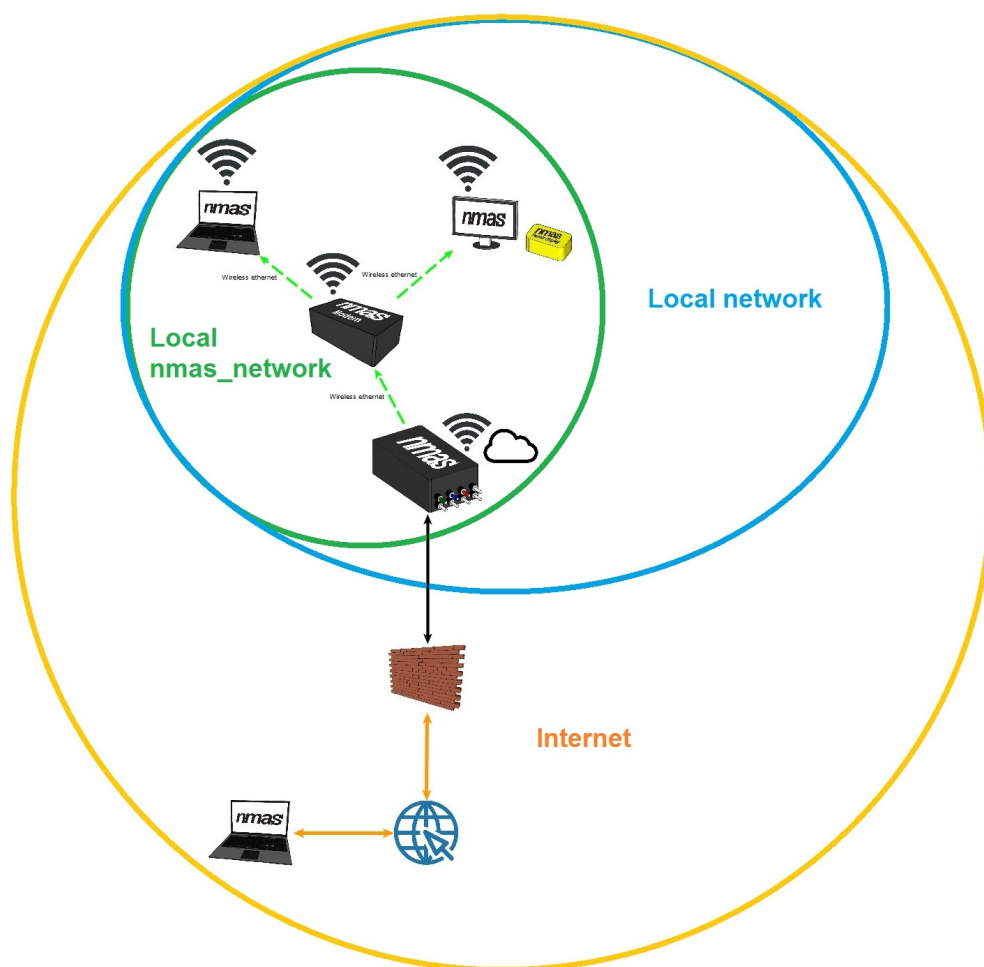
Factory settings for connecting parameters:

SSID: nmás_network

Password: NMAS_Secrets

Security: WPA/WPA2

Remote connection



Picture 30: Remote connection

Remote connection allows measurements on nmas Simple to be accessed by any computer on Internet. All connections are ssh-encrypted and require a user-name and a passwords.

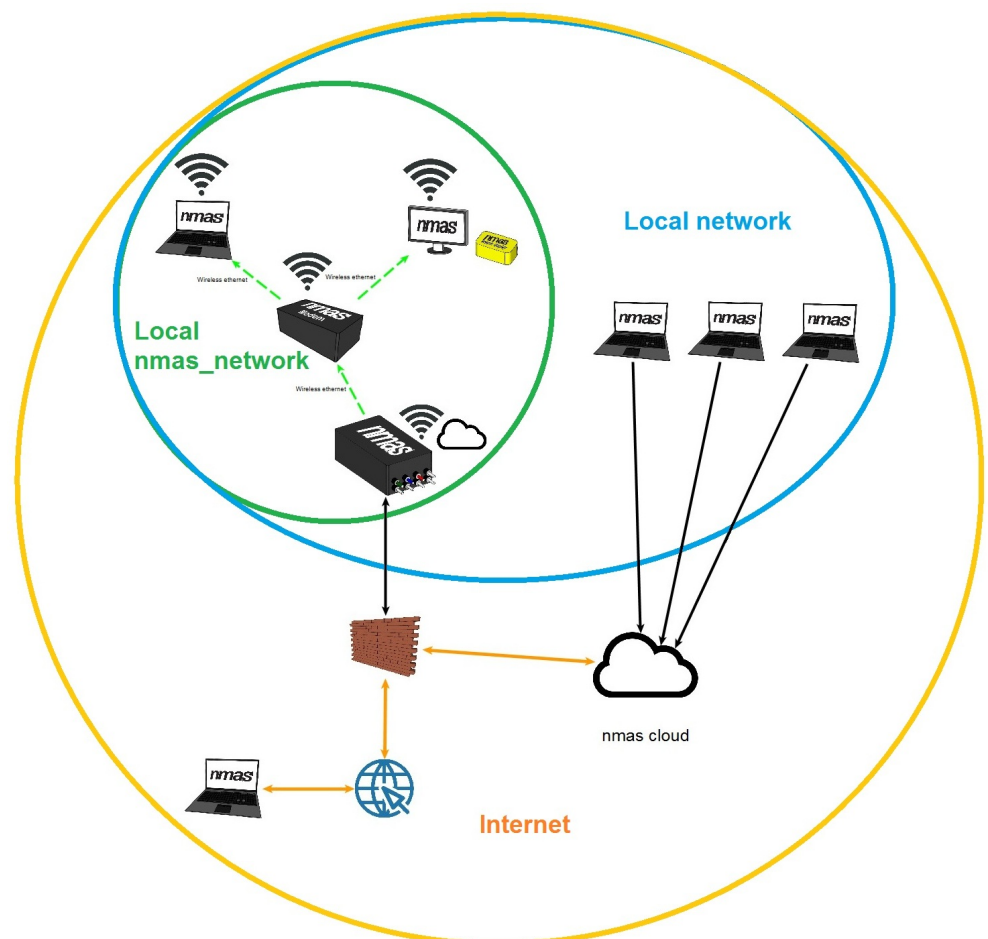
nmas can be configured to provide remote access to nmas LD. Secure connection is established to nmas-server which will then provide route to nmas LD on customer network. All data is encrypted and access is password protected. All units have individual access parameters. Connection parameters are set by nmas distributor.

Customer specified web page is created for all remote connections. This page has direct links and related information for accessing remote units.

Requirements for remote connection are:

- Wireless "nmas_network" with access to Internet.
- Agreement to access the nmas-server hosted by Nome.

Cloud service



Picture 31: nmas cloud service

Nmas-cloud service is a simple way for customer to access measurement data. Cloud service does not require any configuration on customer side. Measurement data is uploaded automatically by nmas-wireless to nmas-cloud.

Customer can access data with any PC connected to internet. Nmas-cloud can manage multiple nmas LD units on multiple locations. All data transfer is encrypted and password protected. Customer specified access page is created for easy access.

Default configurations of nmas Simple

Factory settings for nmas Simple measurements are:

- Unit identifier = Unit mac-address
- Figure names = green signal, green vRMS, green BIAS
- Figure names = blue signal, blue vRMS, blue BIAS
- Figure names = red signal, red vRMS, red BIAS
- Figure names = white signal, white vRMS, white BIAS
- Sample length = 1,6 seconds (sample rate 10 kHz)
- Visibility level of figures = signal=1 ; vRMS=1 ; BIAS=3
- Warning level = 4,5 mm/s for vRMS
- Alarm level = 11,0 mm/s for vRMS

Warning and alarm limits are based to ISO10816-3. These are general guide rules and do not apply to all machinery. Please change warning and alarm limits based to the machinery.

Configuring nmas Simple

nmas Simple unit can be configured from local display. Local display allows user to change:

- unit identifier
- figure names
- sample length
- visibility level of figures
- warning and alarm limits.

On local display:

1. Select desired figure on display by pressing Up/Down
2. Press Right to view trend
3. Press Right again to access configuration displayed
4. Use on-board keyboard to change values

Visibility setting is used to define in which nmas softwares figure is visible.

Please see “nmas Configurator manual” for detailed information about configurations.

Connectors

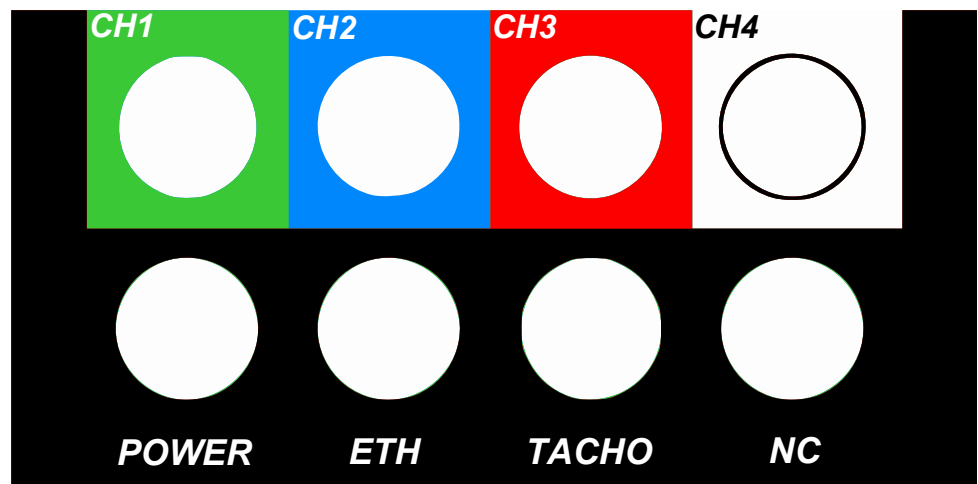
nmas Simple is equipped with eight pieces of 5-pin m12 connectors. Connectors are marked with numbers.

All the connectors in nmas Simple are M12 connectors. Connectors are located in the one side of the device. All the connectors have protection caps.

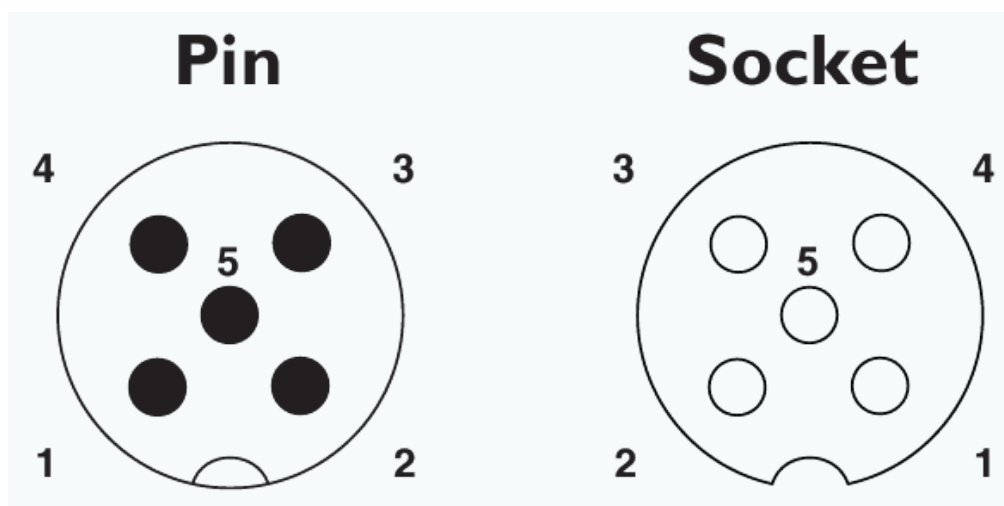
Sensor channels are color coded, and match with color coded cables.

Connector assignment:

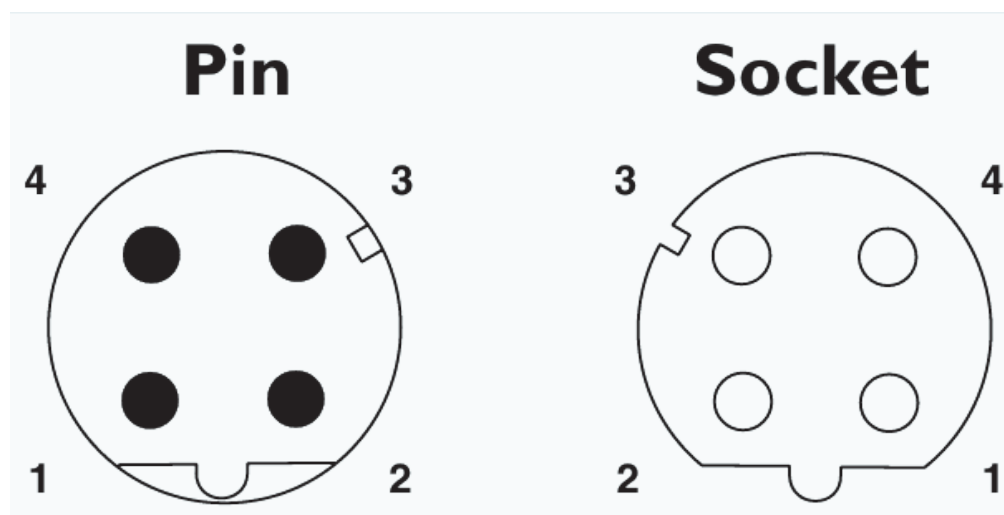
- Conn. 1 = m12 plug A-coded = Accelerometer/Voltage 1/CH 1/Green
- Conn. 2 = m12 plug A-coded = Accelerometer/Voltage 2/CH 2/Blue
- Conn. 3 = m12 plug A-coded = Accelerometer/Voltage 3/CH 3/Red
- Conn. 4 = m12 plug A-coded = Accelerometer/Voltage 4/CH 4/White
- Conn. 5 = m12 plug A-coded = Power supply/POWER
- Conn. 6 = m12 plug A-coded = Ethernet/ETH
- Conn. 7 = m12 plug A-coded = Tacho/TACHO
- Conn. 8 = m12 plug D-coded = Not Connected/NC



Picture 32: nmas Simple connectors



Picture 33: m12 A-coded pinout



Picture 34: m12 D-coded pinout

Connector pin-out

Power supply (m12 plug A-coded)

- Pin1 = GND
- Pin2 = GND
- Pin3 = 24 VDC IN
- Pin4 = 24 VDC IN
- Pin5 = Cable shield

Accelerometers/Voltage (m12 plug A-coded)

- Pin1 = Signal/IEPE
- Pin2 = GND
- Pin3 = 5 VDC Out
- Pin4 = 24 VDC Out

- Pin5 = Cable shield

Ethernet (m12 socket D-coded)

- Pin1 = TX+
- Pin2 = RX+
- Pin3 = TX-
- Pin4 = RX-
- Pin5 = Cable shield

Tacho (m12 plug A-coded)

- Pin1 = Tacho/NC
- Pin2 = GND
- Pin3 = 5 VDC Out
- Pin4 = 24 VDC Out
- Pin5 = Cable shield

Start measurements on nmas Simple

1. Attach unit to it's measurement location
2. Connect sensor cables. Match color codes on unit to cables
3. Place sensors to device under measurement
4. Connect tacho cable (optional)
5. Connect power supply
6. Measurements start after 30 seconds and new data is visible on nmas LD screen

Start remote connections on nmas WR (optional)

1. Attach unit to it's location.
2. Connect power supply.
3. Check connection status on nmas Simple by pressing left

For wireless connection nmas has scanning timer of five minutes. Connection will not be immediately visible on LD-trend display.

Configurating nmas Simple

On local display

1. Select desired figure on display by pressing Up/Down
2. Press Right to view trend

3. Press Right again to access configuration displayed
4. Use on-board keyboard to change values

Reset nmas Simple

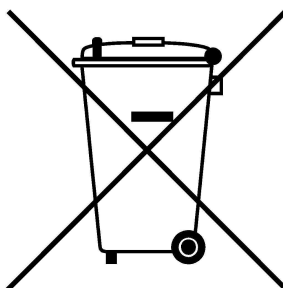
Reset nmas Simple by unplugging the power cable.

Taking out of service and disposal

Do not dispose of nmas hardware or associated components via domestic waste as they contain electronic components that must be disposed of in the proper manner.

Please dispose of the unit and individual components in accordance with local regulations at the authorised collection point.

Thank you for your contribution to environmental protection.



Contacts

nmas is a product of Nome Ltd.

Nome Ltd.

Lummintie 9

90460 Oulunsalo

Finland

www.nome.fi

More info and manuals can be found at <http://nmas.nome.fi>



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