

# User Manual

# MR3000DMS

Firmware Version 2.0.x

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**CONTENTS**

- 1. INTRODUCTION.....5**
  - 1.1 Features.....6**
  - 1.2 Specifications.....6**
  - 1.3 Applications.....6**
  
- 2. HARDWARE.....7**
  - 2.1 Mechanical Drawing – Overview.....7**
  - 2.2 Connectors.....8**
    - 2.2.1. Power.....9
    - 2.2.2. LAN.....9
    - 2.2.3. GPS (optional).....9
    - 2.2.4. Relays.....9
  - 2.3 Status LEDs.....9**
    - 2.3.1. List of errors and warnings.....10
  - 2.4 Opening the Lid.....10**
    - 2.4.1. Internal display.....13
    - 2.4.2. MEMS acceleration sensor.....14
    - 2.4.3. SD Flash Card.....15
    - 2.4.4. Real-time clock with internal backup-battery.....15
    - 2.4.5. Battery.....16
    - 2.4.6. ST connectors.....16
    - 2.4.7. Device switch.....16
    - 2.4.8. Over-Voltage Protection (OVP).....17
    - 2.4.9. Relays.....17
    - 2.4.10. AC/DC converter.....18
    - 2.4.11. DC board.....18
    - 2.4.12. Terminal label.....19
    - 2.4.13. Axis orientation.....19
    - 2.4.14. Installation.....20
  
- 3. SET-UP of the MR3000DMS.....24**
  - 3.1 Connecting to the DMS for the first time (direct connection).....24**
    - 3.1.1. Wired connection via router.....24
    - 3.1.2. Wired connection without switch/router.....25
  - 3.2 Connecting to the MR3000DMS in the field (remote connection).....26**
  
- 4. OPERATING WITH THE MR3000DMS.....28**
  - 4.1 Preparing the DMS for field use.....28**
    - 4.1.1. Initial settings.....28
    - 4.1.2. Network settings.....30

- 4.1.3. Alerts..... 32
- 4.1.4. Measurements settings..... 33
- 4.1.5. Site installation..... 34
- 4.2 Power Options..... 35**
- 4.2.1. Internal Battery..... 35
- 4.2.2. AC Power..... 36
- 4.2.3. DC power..... 36
- 4.3 Additional services..... 36**
- 4.3.1. Embedded SFTP server..... 36
- 5. The Web User Interface (WebUI)..... 39**
- 5.1 Start..... 39**
- 5.1.1. Manual recording..... 39
- 5.1.2. Trigger recording..... 40
- 5.1.3. Timed recording..... 42
- 5.1.4. Background recording..... 43
- 5.2 Status..... 44**
- 5.3 System..... 45**
- 5.3.1. SD Card..... 46
- 5.3.2. Time..... 46
- 5.3.3. LAN..... 48
- 5.3.4. DDNS..... 49
- 5.3.5. OpenVPN..... 50
- 5.3.6. Mail ..... 51
- 5.3.7. FTP send..... 52
- 5.3.8. SCS Cloud..... 54
- 5.3.9. Authentication..... 55
- 5.3.10. Upgrade..... 56
- 5.3.11. Maintenance..... 57
- 5.3.12. Sensor..... 58
- 5.3.13. Monitoring..... 59
- 5.4 User Parameters..... 60**
- 5.4.1. General..... 60
- 5.4.2. Acquisition..... 60
- 5.4.3. Alarm..... 61
- 5.4.4. Notification..... 65
- 5.4.5. Daily message..... 68
- 5.4.6. Test Pulse..... 68
- 5.4.7. Relays..... 69
- 5.4.8. Advanced settings..... 69
- 5.5 VIEW..... 70**
- 5.5.1. Acquisition..... 70
- 5.5.2. Background..... 71

**5.6 Master functionality.....72**  
5.6.1. Config / Status and Master/slave configuration.....73  
5.6.2. Common Trigger.....73  
5.6.3. Common Alarm 1 and 2.....75  
**5.7 Recording List.....75**  
**5.8 System warning.....77**  
**5.9 Rest API.....78**  
  
**6. Available spare parts and accessories.....79**  
  
**Appendix A: SAFETY INSTRUCTIONS.....80**

## 1. INTRODUCTION

The MR3000 is a new family of compact vibration and motion measurement system. As such it meets all user expectations in a state-of-the-art device and thus is a highly reliable and efficient instrument for various application fields.

The main instrument is the MR3000C, which is the first system that has been developed and the most known among the customers all over the world. For this reason, in the user manual, its name will appear many times. The MR3000DMS keeps the best features of the MR3000C, with many new features, namely high-speed communication (FO), internal battery, relays and integrated terminals.

The MR3000DMS is dedicated to dams, but it can be used in other types of structures, like buildings, bridges and tunnels.

In the user manual, the name “DMS” will be used to indicate the MR3000DMS.

On the firmware side, the DMS has a built-in FTP-client (to push the data to a FTP server), a built-in SFTP-server (to retrieve the data in interactive mode) and a built-in Web server to configure the device via the WebUI (=Web based user interface).

In case the internet connection is available, it is possible to connect the MR3000DMS to the SCS cloud software ([scs.bartec-syscom.com](https://scs.bartec-syscom.com)), in order to visualize and post-process data coming from different devices. It is also possible to remotely change the most important parameters of the instruments. In this way, it is possible to manage many vibration surveys directly from the personal office.

No special hardware or software is needed to communicate with the DMS: any device with a Web browser and Internet connectivity (such as a Laptop or a Tablet) will do the job. The user can set-up the unit, download files via any type of network connection. Alarm messages can be automatically sent as E-Mail.

The memory storage capacity has been increased using industrial SD card. The data-storage is managed by a file-system.

The 3 orthogonally oriented MEMS sensors pick up the vibration and transform it into an electrical signal which is proportional to acceleration. The signals of the sensors are continuously digitized and stored in the ring-buffer memory. If the vibration exceeds the threshold level (trigger criteria are fulfilled), the contents of the ring-buffer memory is written to the internal SD Flash card.

The DMS may optionally be equipped with an external GPS antenna for a precise timing. By default, the internal clock is synchronized by an NTP time-server using the Internet connection.

The DMS can be interconnected in a network with other DMS. The Master provides additional network functionality, such as common trigger (simultaneous recording in all DMS in the network) and common alarm (alarm voting logic, e.g. 2 out of 4).

An internal rechargeable lead-acid 12Ah battery ensures continuous operation during power interruptions.

The DMS is very easy to operate and requires minimal maintenance. Routine maintenance and operation does not require specialized workforce.

## 1.1 Features

Main features are:

- Compact unit with integrated sensor, digital recorder, battery and wired connectivity
- ARM/DSP Technology
- Tri-axial MEMS accelerometers
- Removable 4 GB SD-Card storage (up to 32 GB)
- Internal battery
- 3 settable alarm relays
- Internal terminals and cable glands
- Internal Over-Voltage Protection device
- Integrated Web server
- Precise timing using NTP (Network Time Protocol), GPS as option
- Sampling rates up to 2000 Hz
- Simple installation
- Easy operation
- High reliability
- Low maintenance, no need of periodic calibration

## 1.2 Specifications

Operating Temperature: -20°C up to 50°C

Operating Humidity: up to 100% RH

## 1.3 Applications

- Structural monitoring
  - All types of dams
  - Buildings
  - Bridges
  - Tunnels
  - Big structures (stadiums, towers, ...)

## 2. HARDWARE

### 2.1 Mechanical Drawing – Overview

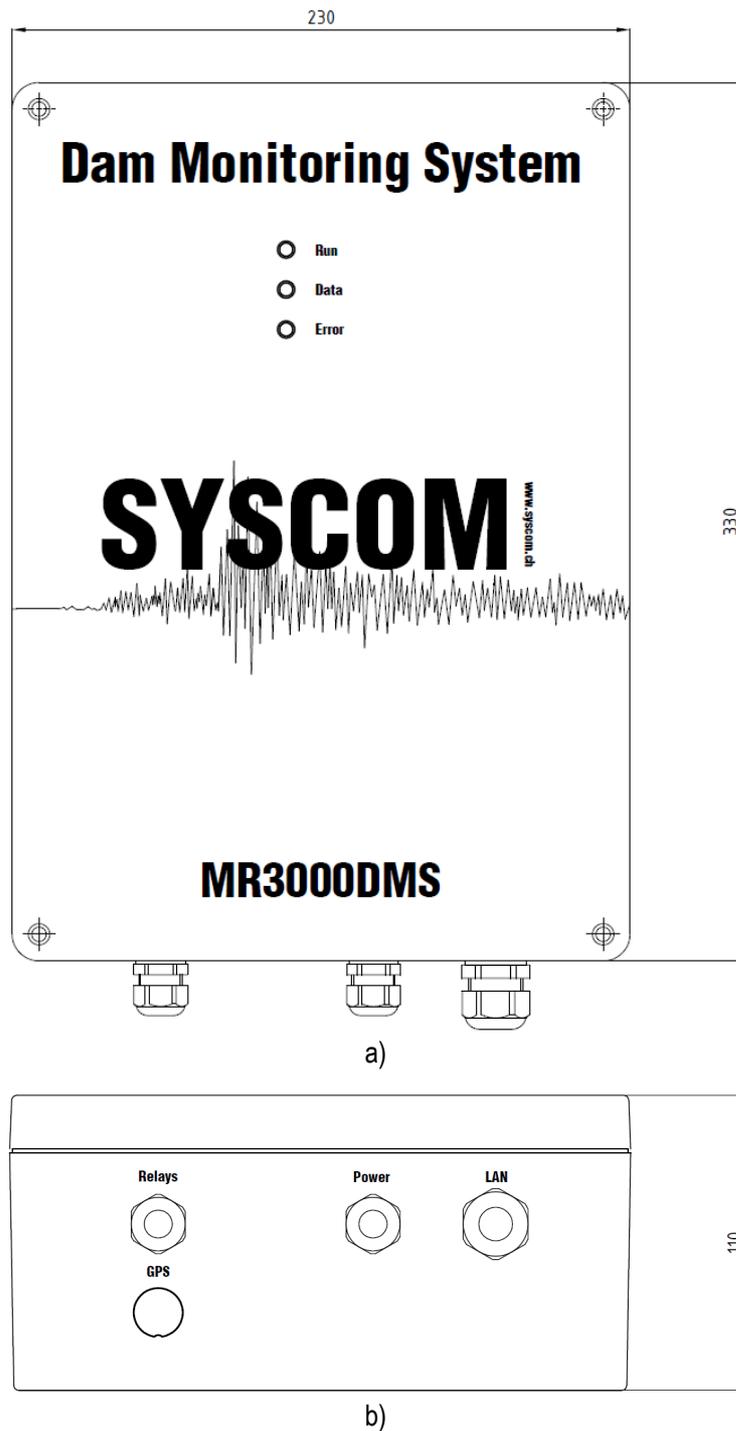


Figure 2.1.1. Mechanical drawings of them MR3000DMS: top view (a), front view (b).

## 2.2 Connectors

The MR3000DMS provides rugged cable glands and caps, as it is shown in Figure 2.2.1:

- **Power** for 100-240VAC power supply or DC/DC (10-36 VDC).
- **LAN**. In the version for fiber optic connection, a cable gland like in Figure 2.2.1 is provided. In case the LAN/Ethernet kit is ordered, there is an external RJ45 connector in which an Ethernet cable can be directly inserted, as shown in Figure 2.2.2.
- **GPS** to connect an external GPS antenna. If the GPS antenna is not ordered, then the connector is replaced by a cap, directly inserted in the red box.
- **Relays** for relay outputs.



Figure 2.2.1. Face of MR3000DMS showing the sockets for Relays, Power, LAN and GPS, in case of FO kit.



Figure 2.2.2. Face of MR3000DMS showing the sockets for Relays, Power, LAN and GPS, in case of LAN kit, with and without a cap on the RJ45 connector.

### 2.2.1. Power

Here you connect the MR3000DMS to:

- the main power (100-240VAC, 50-60 Hz) in case the AC version has been purchased
- to an external DC (10-36 VDC) source if the DC version has been purchased

### 2.2.2. LAN

Here you connect the Fiber optic cable – for further detail check chapter 3.1.1 and 3.1.2.

M20 cable gland 6-13 mm and ST connectors are used. The FO type that should be used is Multimode OM2 fiber with wavelength 1300 nm, 50/125 µm, Rx/Tx, ST connectors.

If the kit LAN has been ordered, the DMS interfaces to a standard 10/100-BASE LAN.

### 2.2.3. GPS (optional)

In case the GPS kit has been ordered, here you connect to an appropriate GPS module for time synchronization.

### 2.2.4. Relays

Here you connect a relay cable to the terminals. 3 available relays with NO, NC, COM wires (9 wires) and 1 ground. The cable gland referred to the relays are M16 cable gland 7-11 mm.

For further detail on the electric scheme check Section 2.4.9, while for the software settings please look at Section 5.4.7.

## 2.3 Status LEDs

There are three status LEDs.

The green **RUN** LED is on if the MR3000DMS is active and blinking while the unit is starting up.

The yellow **DATA** LED is on if the MR3000DMS is recording an event.

The red **ERROR** LED indicates if any error or warning occurs on the MR3000. If it blinks slowly, then a warning has been detected, if it is permanently ON (red colour) then an error has been detected.



Figure 2.3.1. Led panel on the MR3000DMS.

### 2.3.1. List of errors and warnings

In the following, a list of the warnings and errors is presented, corresponding to the activation of the Error LED.

#### SD card

- No SD card detected                      ERROR
- Capacity is less the 20%                WARNING
- No more free space                      ERROR
- Lifetime is less than 20%              WARNING
- Lifetime expired                        ERROR

#### Battery

- Battery is not powered                WARNING
- Voltage                                    Please refer to Section 5.3.13

#### Test pulse

- Test pulse did not succeeded        WARNING

## 2.4 Opening the Lid

### WARNING – Static Electricity

The MR3000DMS contains CMOS devices and, when serviced, care must be taken to prevent damage due to static electricity. For a security reason, first the MR3000DMS should be disconnected from the AC. Successively you can open the lid and disconnect the fuse in order to protect all the internal components from any wrong manipulations that might occur.

### AC VERSION

In Figure 2.4.1 the internal view of the MR3000DMS with AC power is shown.

### DC VERSION

In Figure 2.4.2 the internal view of the MR3000DMS with DC power is shown.

The most important components are:

- 1) Internal display
- 2) MEMS accelerometer (under the display)
- 3) SD-Card
- 4) Real-time clock with internal backup battery
- 5) Battery
- 6) ST connectors

- 7) Device switch (fuse)**
- 8) OverVoltage Protection (OVP)**
- 9) Relays terminals**
- 10) AC/DC converter**
- 11) DC board**

For the DC version, the AC/DC converter and the over-voltage protection are replaced by a dedicated board for an external DC power.

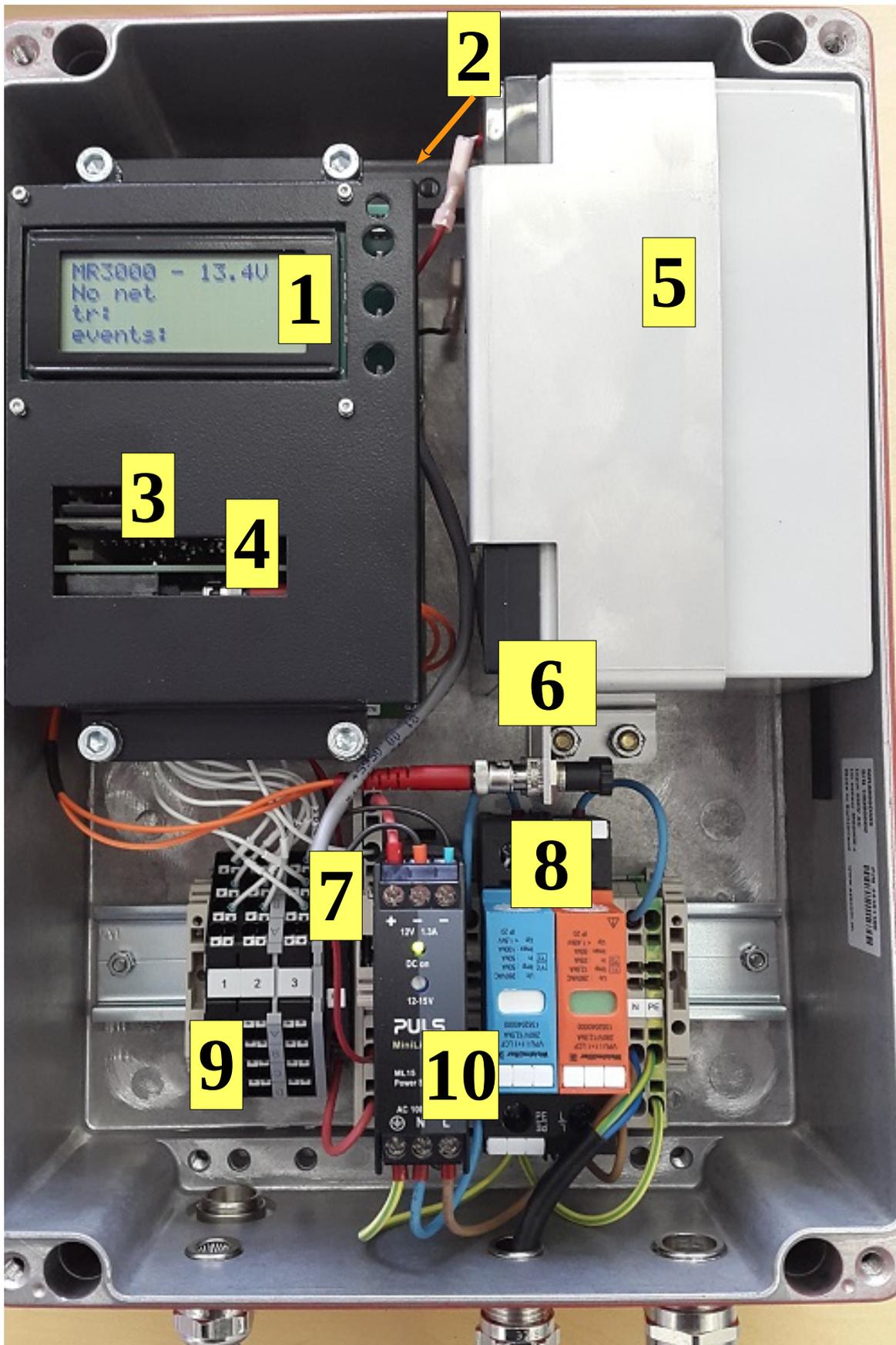


Figure 2.4.1. Internal view of the MR3000DMS with AC power.

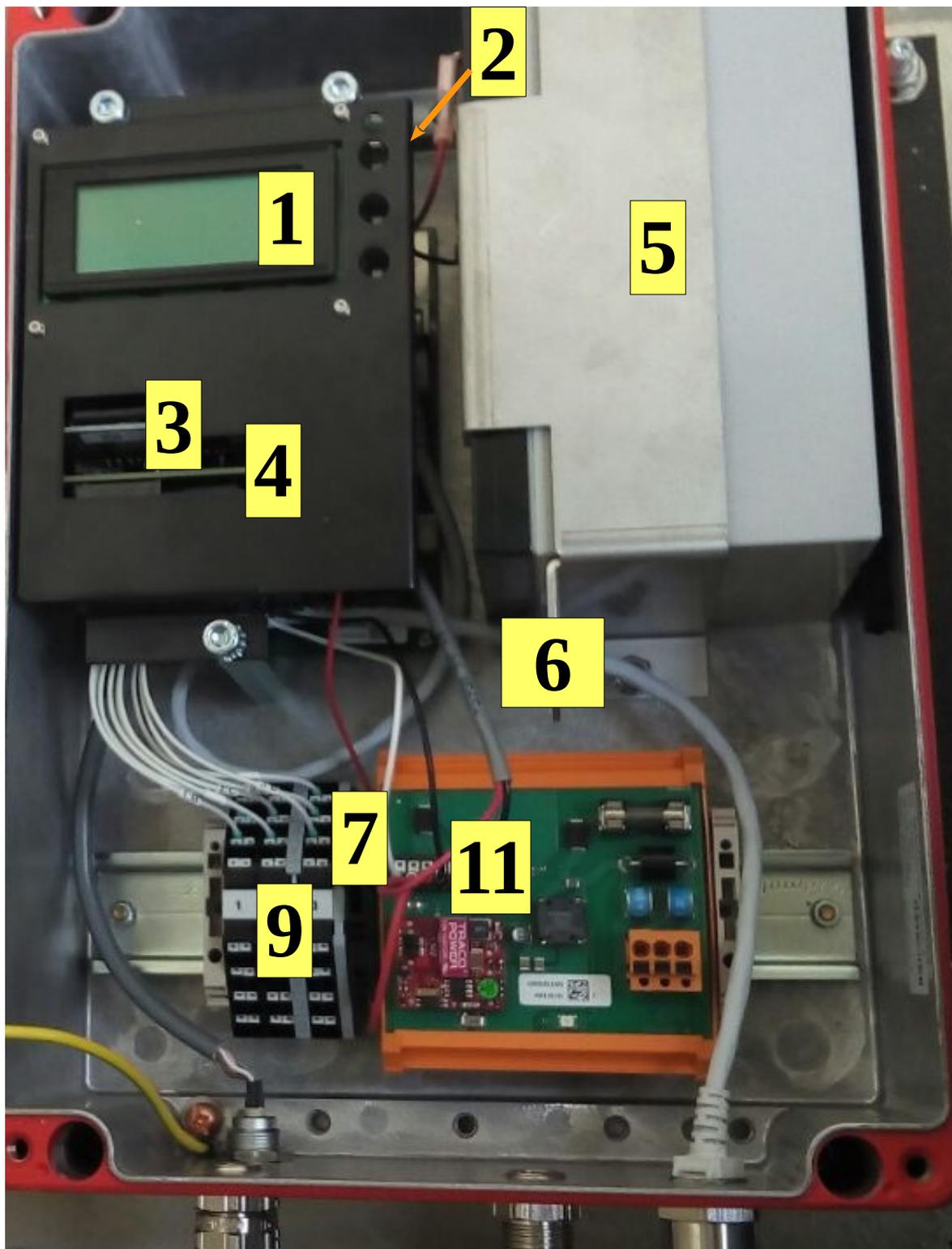


Figure 2.4.2. Internal view of the MR3000DMS with DC power.

#### 2.4.1. Internal display

The LCD of the MR3000DMS shows the most important settings and parameters. In particular, there are two types of screen, that are changing constantly. The first one, as can be seen in Figure 2.4.3a, indicates general parameters related to the MR3000DMS:

LINE 1. Typology of the instrument, together with the battery voltage

- LINE 2. IP address of the instrument.
- LINE 3. Values set for the trigger on the three axes. When trigger is 'disabled' or its mode is 'STA/LTA', this is clearly shown on the LCD display
- LINE 4. Number of events recorded on the SD card.



Figure 2.4.3. First (a) and second (b) screen of the internal display of the MR3000DMS.

The second screen (Figure 2.4.3b) shows the information related to the last event:

- LINE 1. Day and time of the event
- LINE 2. Vibration values on the three axes. "A" means amplitude (in mg)
- LINE 3. Dominant frequency calculated on the three axes. "F" means frequency (Hz)

The first screen last 10 seconds while the second screen lasts 15 seconds.

## 2.4.2. MEMS acceleration sensor

The MR3000DMS is equipped with an internal acceleration MEMS sensor MS2008+. It is placed in the zone under the display.

The main characteristics of the sensor are:

- Measuring range:  $\pm 4$  g
- Dynamic range: typ. 100 dB (@100 Hz BW)
- Frequency range: Frequency response DC to 600Hz
- Sensitivity: 1.25 V/g (differential)
- Noise: typ. 7 $\mu$ g/sqrt(Hz)

It does not require to be periodically re-calibrated since MEMS sensors are very stable during all their lifetime.

### 2.4.3. SD Flash Card

The MR3000DMS contains an SD-card slot. The SD Flash Card in this slot is used to store the recordings. To remove the card, you have to push it down, it will then pop-up.

NOTE: Ensure the MR3000DMS is turned off before removing and re-inserting the SD Card.

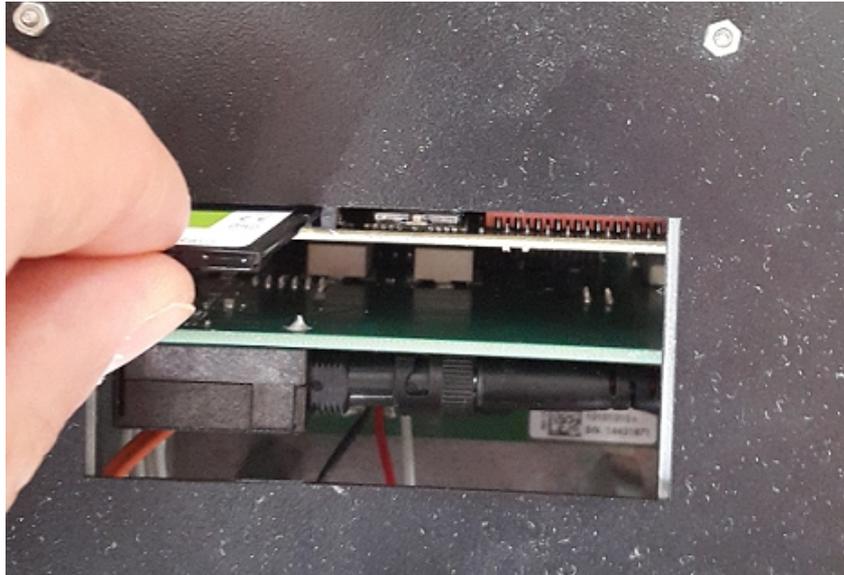


Figure 2.4.4. Inserting the SD Card from the MR3000DMS.

Inserting the SD Card in the card-reader of your PC allows you a fast access to all the data of the DMS. If you have copied all the data, you can format the SD Card.

### 2.4.4. Real-time clock with internal backup-battery

The DMS is equipped with a real-time clock with back-up battery, located on the main board at the lower right end. Even if the DMS is switched off, the clock continues working.



Figure 2.4.5. The internal Lithium battery. Replacement by the user is possible without any special tool.

#### 2.4.5. Battery

In the DMS, an internal battery is present, in order to guarantee about 40 hours of autonomy. It is a 12 V battery, 12 Ah.

#### 2.4.6. ST connectors

In the case the standard FO version is ordered, then a cable with ST connectors is connected to the point 6 in Figure 2.4.1.

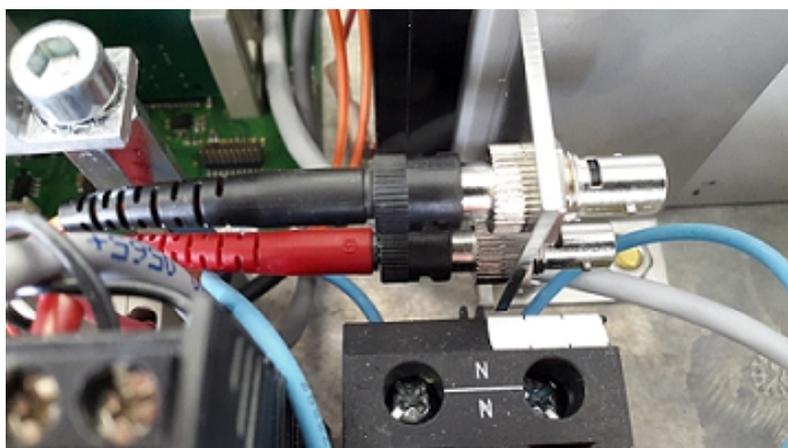


Figure 2.4.6. St connectors in case of FO kit.

#### 2.4.7. Device switch

Between the relay terminals and the AC/DC converter, a fuse can be used simply to turn on and turn off the MR3000DMS. It is indicated with F1. It is a 1.6 AT /250 V fuse, with dimensions 5×20 mm.

When you open the MR3000DMS for the first time, you have to put it back in place, because it is provided as opened, such that the DMS is not powered.



Figure 2.4.7. Device switch.

## 2.4.8. Over-Voltage Protection (OVP)

The over-voltage protection (OVP) has the following characteristics:

- Tested according to IEC 61643-11 for Type I and II surge protection
- Pluggable arrester. If it is red instead of green the arrester should be changed.



Figure 2.4.8. OverVoltage Protection.

## 2.4.9. Relays

The relays can be configured in the software (see section 4.4.7). For an accurate electric scheme, look Figure 2.4.9.



a)

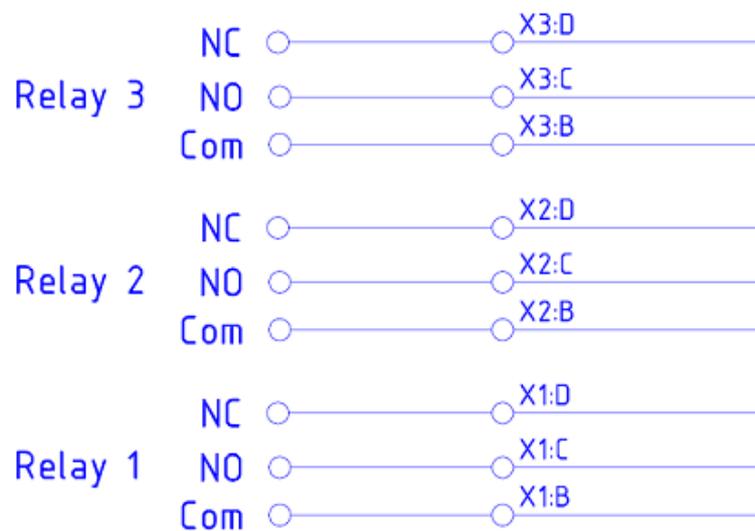


Figure 2.4.9. Terminal for relays and electric scheme.

### 2.4.10. AC/DC converter

In Figure 2.4.10 it is possible to see the hardware structure and terminals related to the AC/DC converter. If an external fuse is necessary or utilized, minimum requirements need to be considered to avoid nuisance tripping of the circuit breaker. A minimum value of 10A B- or 6A C-Characteristic breaker should be used.

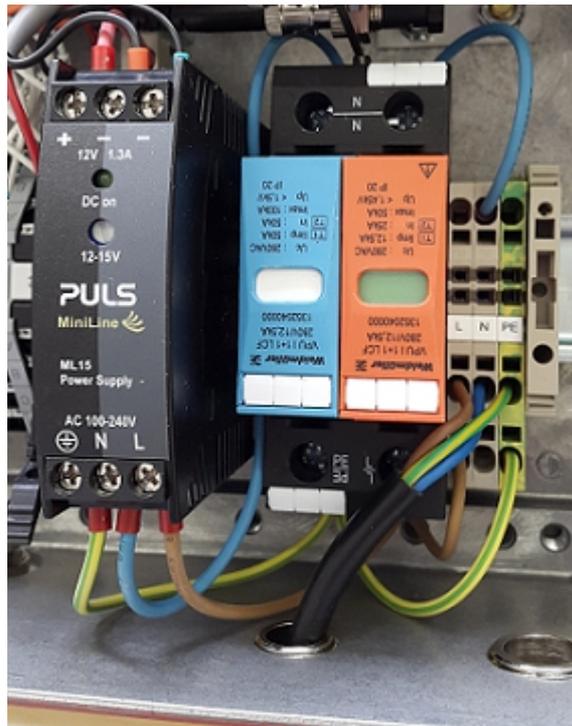


Figure 2.4.10. AC/DC converter and terminals.

### 2.4.11. DC board

In case of DC version, the AC/DC converter and the over-voltage protection are replaced by a dedicated board for an external DC power (see Figure 2.4.11).

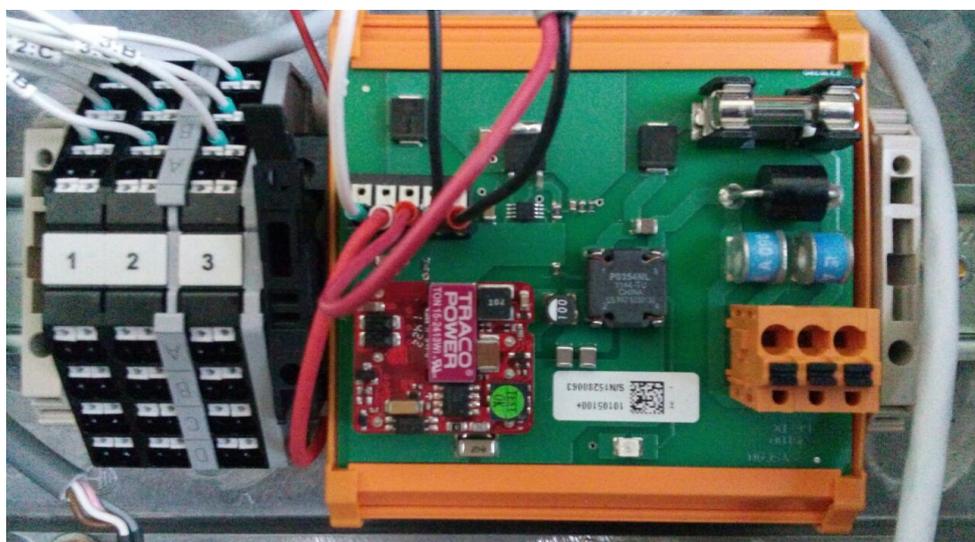


Figure 2.4.11. DC board.

### 2.4.12. Terminal label

To better understand the terminals and the electric connection of the relays and the AC power, a label with this information has been placed on the cover of the MR3000DMS. It is also represented in Figure 2.4.12.

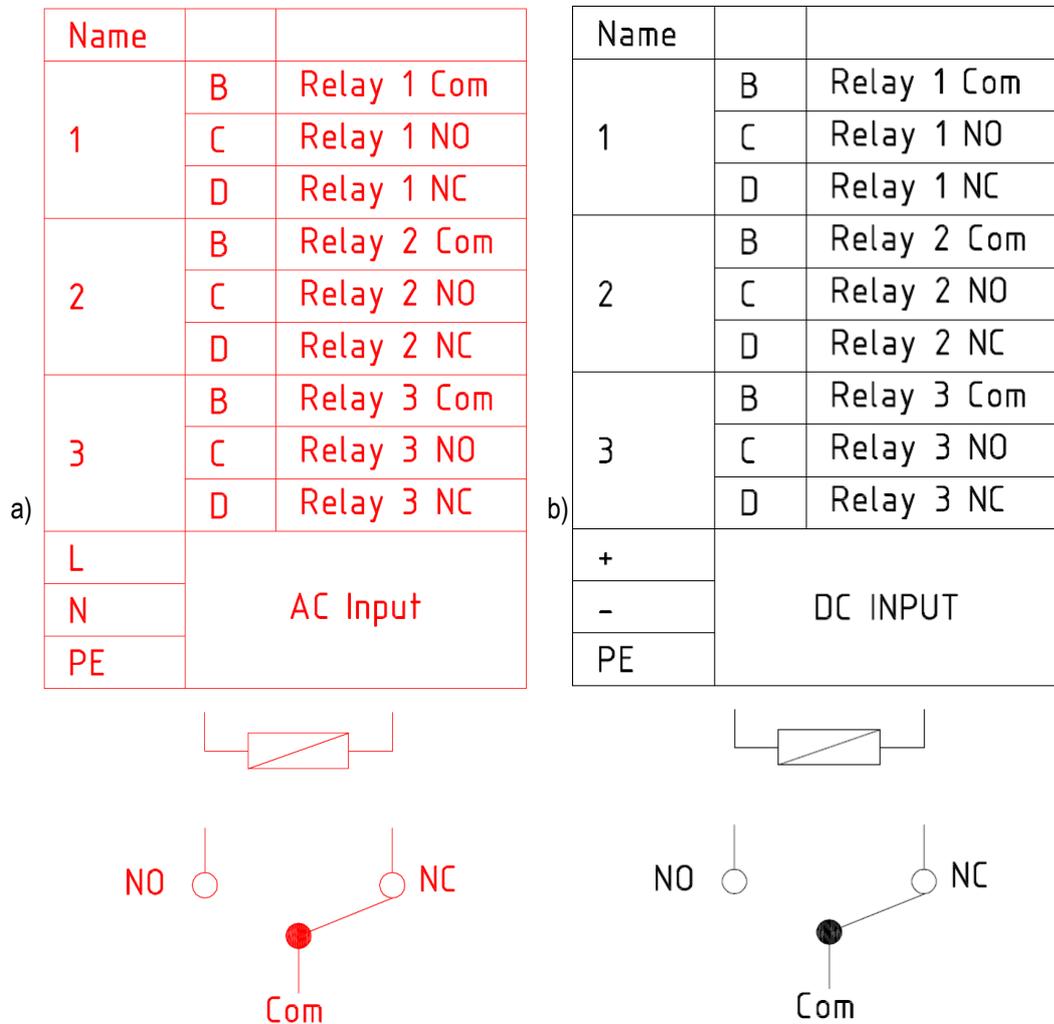


Figure 2.4.12. Label with information on the terminals of relay and power for: a) MR3000DMS with AC power; b) MR3000DMS with DC power.

### 2.4.13. Axis orientation

The axis orientation of the MR3000DMS depends if the installation is vertical (against a wall) or horizontal (on the ground). In the Figure 2.4.13 the different configurations are shown.

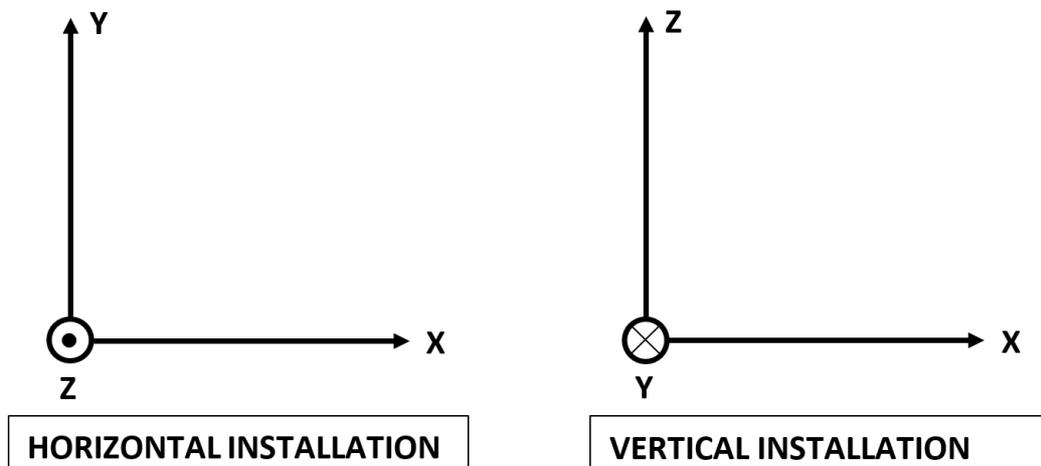


Figure 2.4.13. Axis orientation in case of horizontal and vertical installation.

#### 2.4.14. Installation

For a fixed installation of the DMS, it is possible to directly fix the DMS or to use a mounting plate.

In the first case, the holes (number 1 in the Figures 2.4.14 and 2.4.15) close to the screws (number 2 in the same figures) can be used. The screws are used to fix the cover to the box containing all the electronics of the DMS.



Figure 2.4.14. Cover part of the DMS, from an internal point of view.

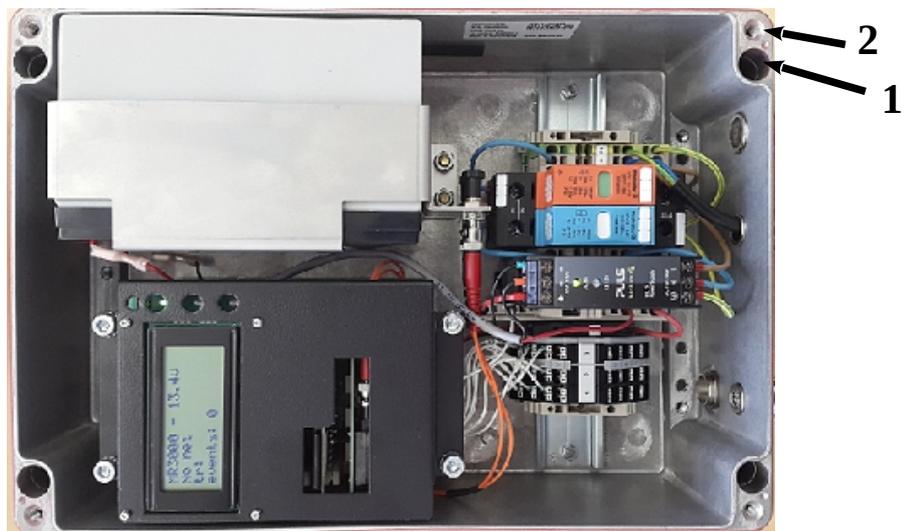


Figure 2.4.15. Internal view of the DMS.

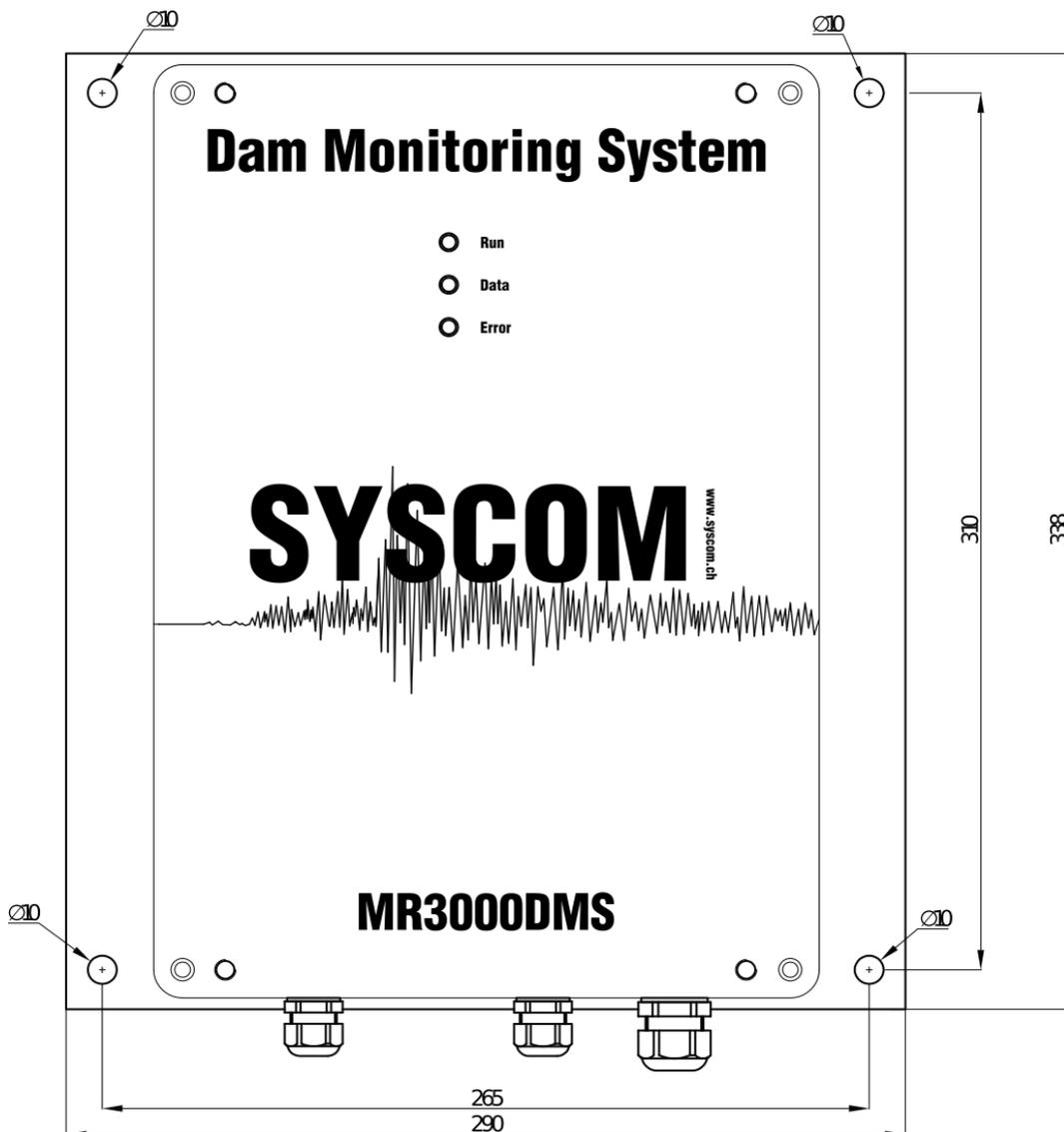


Figure 2.4.16. Drawing of the DMS together with its mounting plate. The values are in mm.

In case of a mounting platform, the same holes are used to fix it to the MR3000DMS. This application must be preferred in cases where the surface of installation is not perfectly smooth. In Figures 2.4.16 and 2.4.17 it is possible to have all the information about the distances.

Syscom provides 8 screws M8 in the kit with the mounting plate. The tools can be seen in Figure 2.4.18.

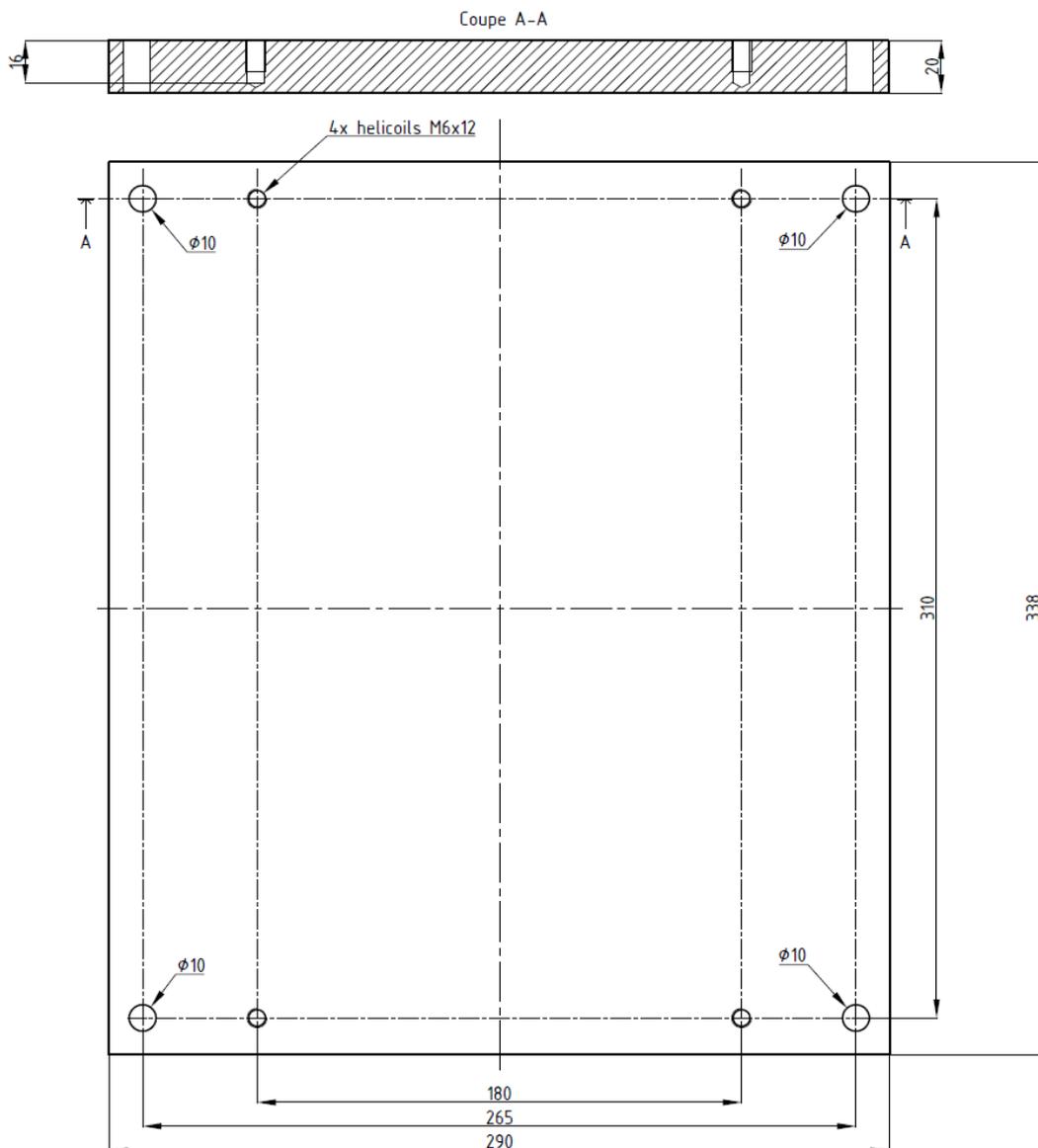


Figure 2.4.17. Drawing of the mounting plate related to the MR3000DMS. The values are in mm.



Figure 2.4.18. Screws for the installation of the MR3000DMS.

The typical installation on a dam is done on a concrete block, for a good coupling with the ground, and with the protection of a cabinet, as shown in Figure 2.4.19.



Figure 2.4.19. Typical installation in a dam, with the MR3000DMS inserted in a protective cabinet, above a concrete block.

### **3. SET-UP of the MR3000DMS**

First of all, please connect the MR3000DMS to the main power or to a DC power, depending on the version purchased. In case no power is provided, the internal battery can guarantee an autonomy of about 40 hours.

You have to open the MR3000DMS and close the fuse (F1), in order to switch on the device.

All 3 LEDs (green, yellow, red) are on and the 1<sup>st</sup> and 3<sup>rd</sup> line of the LCD become black during start-up of the DMS. Then all the 3 LEDs go off. The green LED is blinking while the DMS updates the database of the files on the SD card.

Once the unit is started, only the green POWER LED remains on. Now you can establish communication with the DMS using any of the 2 methods described below.

#### **3.1 Connecting to the DMS for the first time (direct connection)**

To communicate with the DMS you do not need any special software: any Web browser is sufficient. There are 2 methods for direct connection:

- Wired connection via router: This method offers the most possibilities and needs no configuration at start-up, but you need a router. If the router has access to the Internet, you can do everything with your MR3000DMS, including firmware upgrades. You can attach many DMS to the router and communicate to all of them simultaneously. The disadvantage of this method is that you need an additional device.
- Direct wired connection: If the MR3000DMS ordered has LAN interface and there is no router involved, you will have to adjust the network settings of the PC. Obviously, you can communicate only to one MR3000DMS at a time. This is not possible if the MR3000DMS has fiber optic interface, since a converter is needed to communicate with the PC.

Depending on the method you choose, the IP address of the DMS will be different. The following paragraphs describe these methods in details.

##### **3.1.1. Wired connection via router**

Depending of the MR3000DMS model (FO or LAN), you will have to use either a standard router/switch or a switch/router with FO ST connectors.

In case you have the LAN version, please use an Ethernet cable to connect the DMS to one of the LAN ports of your switch. Your PC needs a connection to the same switch (wired). Make sure to disable any other LAN connections on your PC.

In case you have the FO version, use a FO ST cable to connect directly to the FO switch. (see Fig. 3.1.1).



Figure 3.1.1. FO cables with ST connectors.

After connecting all the DMS in the network to a router, after few seconds the switch assigns an IP address to all the MR3000DMS.

The DHCP feature of the router makes sure your PC has acquired an IP address in the same subnet and communication between MR3000DMS and PC is possible. Now, you can simply enter the IP address displayed on the LCD of the MR3000DMS (inside the red box) in your Web browser.

Generally your workshop router should have the following features:

- DHCP (DHCP = Dynamic Host Configuration Protocol – i.e. the router assigns the IP addresses) feature
- 1 port to have Internet access (optional, but recommended e.g. for firmware upgrades), WLAN or wired

### **3.1.2. Wired connection without switch/router**

If you have a MR3000DMS with LAN interface and you connect it directly to your computer, you must then configure the IP address of your computer. The default IP address of the MR3000DMS is 192.168.1.2. Therefore you must assign a static IP address to the LAN port of your computer, on the same sub-network as the DMS. For example, 192.168.1.3.

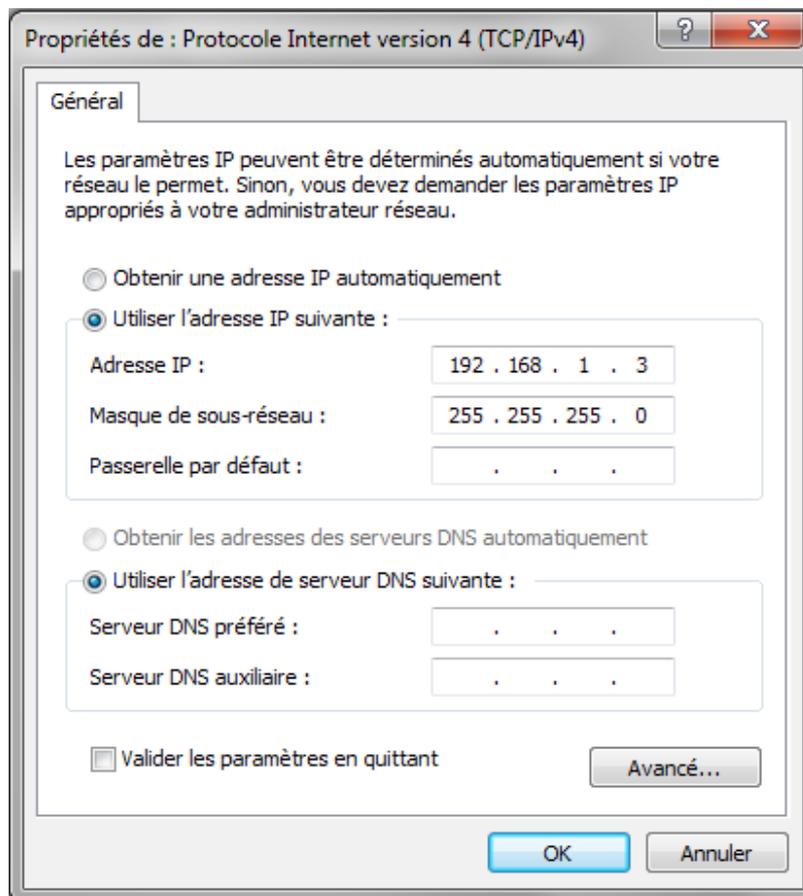


Figure 3.1.2. Settings of the LAN port on the personal PC.

### 3.2 Connecting to the MR3000DMS in the field (remote connection)

For a remote connection (from your office to the DMS at site) you need Internet access and you have to enable the OpenVPN or DDNS service.

You can use an existing Internet access point at site (DSL, cable TV line, ...) and you simply connect the MR3000DMS with the router using the LAN/FO cable – as you would do in your office. If the router has the DHCP feature enabled – and you have enabled it in the DMS as well, the router will assign an IP address to the DMS. You may check the Internet connectivity with the PING feature (see Section 5.3.10).

As the DMS is not accessible through the IP address, you will have to enable the DDNS or the OpenVPN service to communicate to your DMS through the WebUI. To establish communication with the MR3000DMS you have to enter the Domain Name (DDNS) or the virtual address (OpenVPN) in the Web browser. For OpenVPN you have to install the OpenVPN client on your PC (or smartphone) with the appropriate certificates, as well. To communicate with the DMS, you have to start the VPN service on the PC.

For a remote connection (from the control room to the DMS at site location), you need to be connected to the same intranet network. Then, with the intranet IP addresses you can easily remotely connect to any DMS devices in the same intranet.

**SCS cloud software**

The SCS (Syscom Cloud Software) allows to change the most important parameters of the MR without requiring any additional services like OpenVPN or DDNS. The procedure is the following:

1. Log in the SCS at [scs.bartec-syscom.com](https://scs.bartec-syscom.com)
2. Create a project
3. Link the MR3000 in one project
4. Click on the recorder name to access its setting

More details can be found at [scs.bartec-syscom.com](https://scs.bartec-syscom.com) or at the dedicated [webpage](#) on the Bartec Syscom website.

Please contact [support@bartec-syscom.com](mailto:support@bartec-syscom.com) for any additional information.

## 4. OPERATING WITH THE MR3000DMS

### 4.1 Preparing the DMS for field use

Before entering in details about the WebUI (Web User Interface), the configuration of the DMS for a monitoring session is explained.

It is recommended to set-up the MR3000DMS in the office for the use in the field. Depending on the measurement task, you may consider the different power options. It is recommended to erase any obsolete files on the SD card before you use the DMS for a specific measurement. Moreover, it is also recommended to collect all the data once the measurement is finished.

Be sure that the fuse (F1) is off when the DMS is not in the monitoring phase (for example during transportation). You will switch on the device when you will start to use the MR3000DMS.

#### 4.1.1. Initial settings

For the vibration monitoring of a dam, several DMS are necessary, depending on the dam dimension and typology. To be more informed about the requirements, please refer to Syscom guidelines for the dam vibration monitoring.

AC power is normally available at all the sites, and the internal battery ensures monitoring continuity if power is lost. Otherwise, the DC version can be used to connect external power sources, like solar panels.

First make sure to enable communication with MR3000DMS before installation in the field. For this reason, please follow what has been described in chapter 3.1. To access the device firmware, it is possible to connect the personal laptop directly to the device or to the nearest Ethernet switch.

Successively, the communication with the unit is needed, for example to change the trigger level or to adjust the alarm scheme (e.g. add a person to the contacts or change a threshold level).

In case all the DMS are connected on the same local network, it is advisable to assign an IP address to each device. Since the default IP address is 192.168.1.2 for every MR3000DMS, you need to change it for every DMS, except one, which can remain with the default address. It is important to change only the last number of the address to remain in the same subdomain. For example, valid addresses are:

192.168.1.3

192.168.1.4

192.168.1.9

Wrong addresses are:

192.168.5.2

192.163.1.2

199.168.1.2

To do that, first set up a valid IP address on the LAN port of your laptop/PC, as in Figure 4.1.1. Then, connect one DMS to a switch, change the address, disconnect the device and then connect a new device to the switch and repeat the procedure (see Figure 4.1.2).

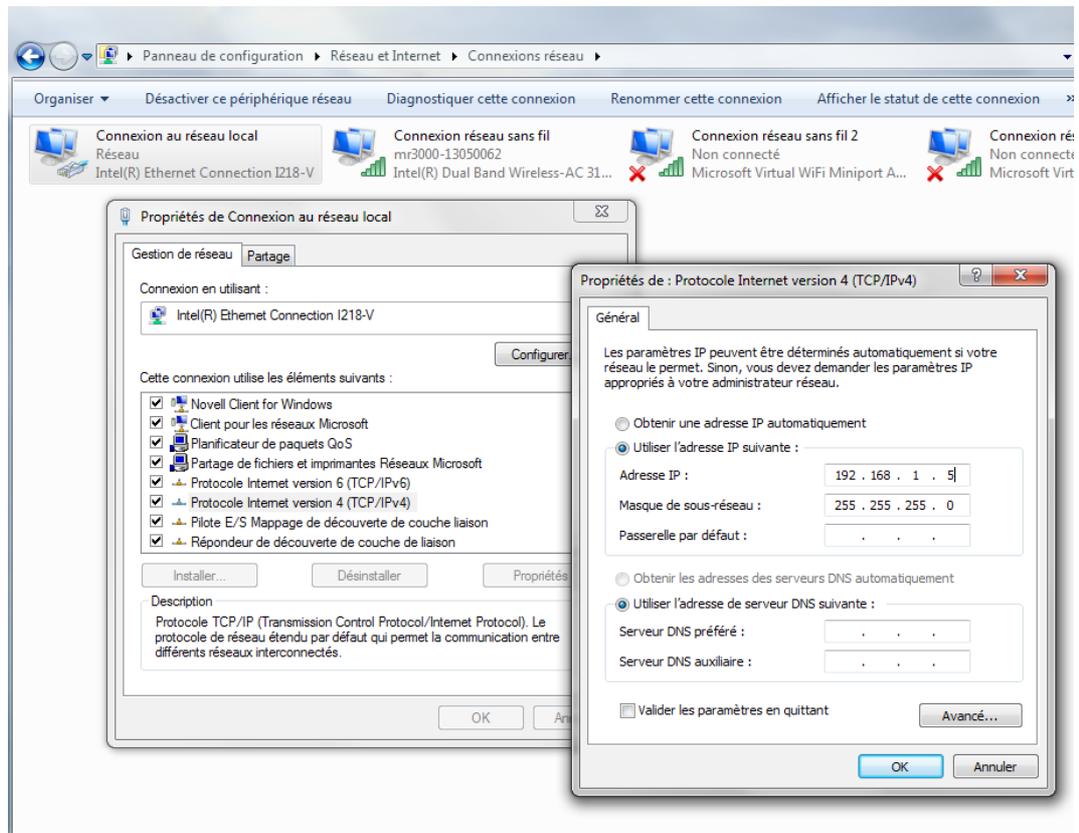


Figure 4.1.1. Setting of a fix IP address on a personal PC or laptop.

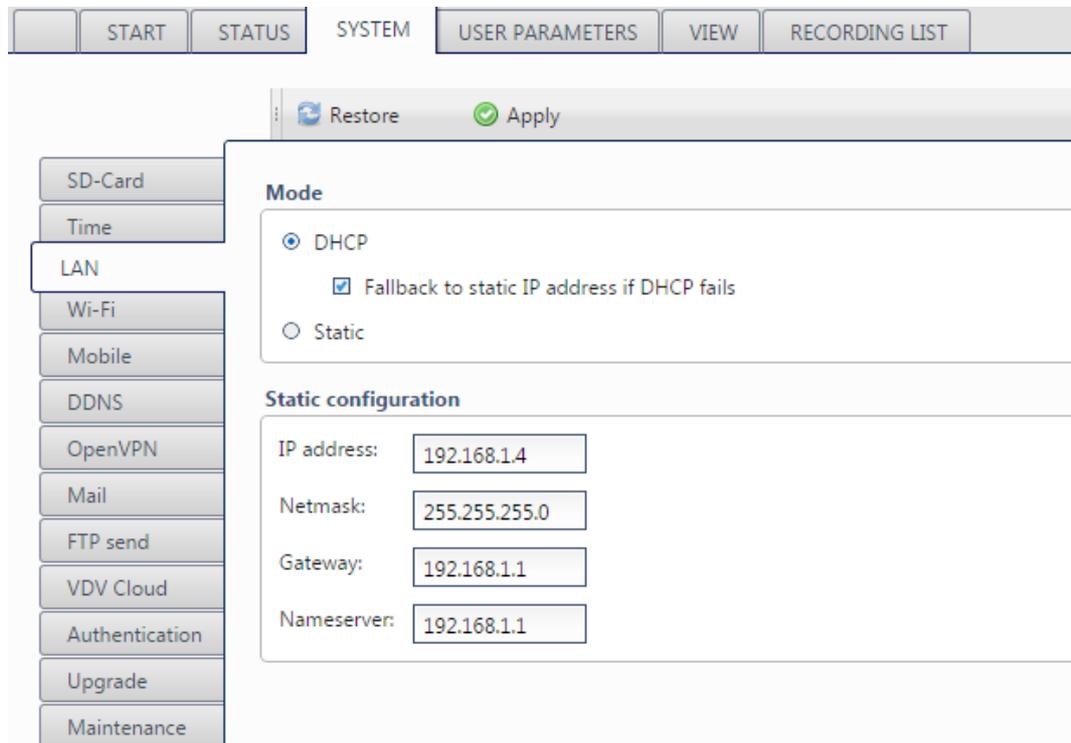


Figure 4.1.2. Assignment of the IP address to a MR3000DMS, in case of a local network.

#### 4.1.2. Network settings

One of the most important features is the setting of the network, since in a dam multiple recording units must be installed. To do this, it is necessary to enable the Master option in the Master / Config/status section. The other instruments are Slaves. Communication in the network is handled by the Master. In this way, it is possible to perform common sampling, common trigger and common alarm. All the details are given in Section 5.6. Please contact Syscom at [info@bartec-syscom.com](mailto:info@bartec-syscom.com) to have an application note dedicated to the preparation of a local network with the MR3000DMS.

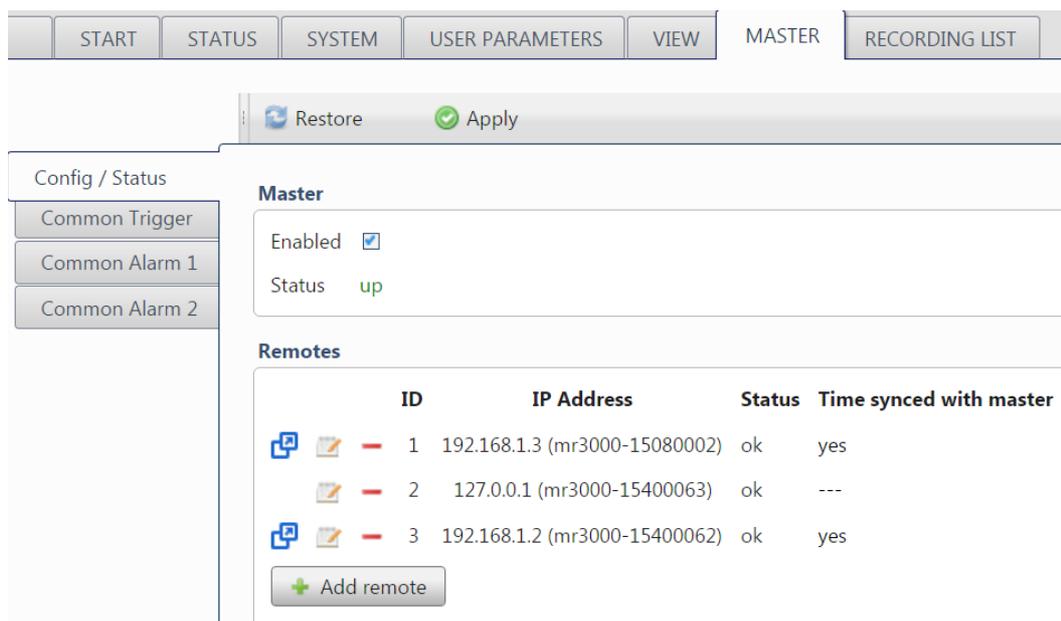


Figure 4.1.3. Subsection dedicated to the configuration of the network.

Here you define which MRs are part of the network. Simply **add** the IP-address of the MR. The Master itself *must* be included (simply check the **itself** box). The IP address of the Master could be shown as 127.0.0.1 (localhost) or as its own IP address (Figure 4.1.3).

The column **status** should show ok after a few seconds: this means the Master is able to communicate with the Slaves. The column **Time synced with master** should show **yes**. This means the time difference in the corresponding MR is less than 3 seconds compared to the Master. This is usually the case if all MRs have access to a NTP server in the Internet or if a specific MR in the network is acting as time server. If you have an MR as internal time server, configure all other MRs to use the IP address of this MR as NTP server (see chapter 5.3.2). Otherwise, in case of GPS, you need to put the IP address of the MR3000DMS which is connected to the GPS.

In the example proposed, three MRs are connected on the same local network, and the IP address has been changed manually.

After that, you can define the conditions for a common trigger, named recording in all MRs in the network. Each line contains a condition, the lines are logically OR combined. A condition might be a single MR or a group of different MRs. If more than 1 MR is defined, the trigger condition in the single MR must occur within 3 seconds.

Click on the **Add** button to set-up a new combination. Click in the **Edit combination** section the **select** box for the single MRs. In the column **Name** you may enter a mnemonic for this condition (e.g. MR in cellar). In the column **Selected** the logical combination of this condition is shown. The logical combination of all conditions is shown in the section **Logic function**.

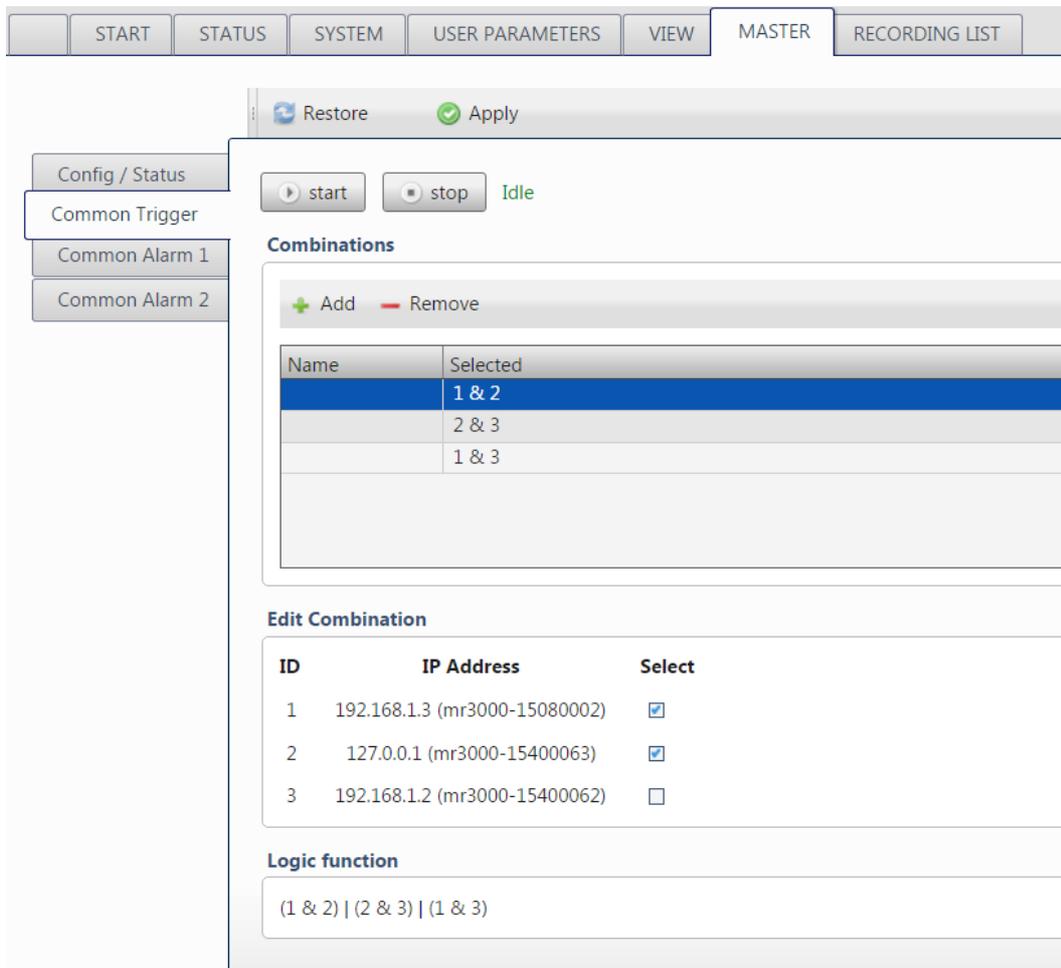


Figure 4.1.4. Subsection dedicated to the setting of the common trigger.

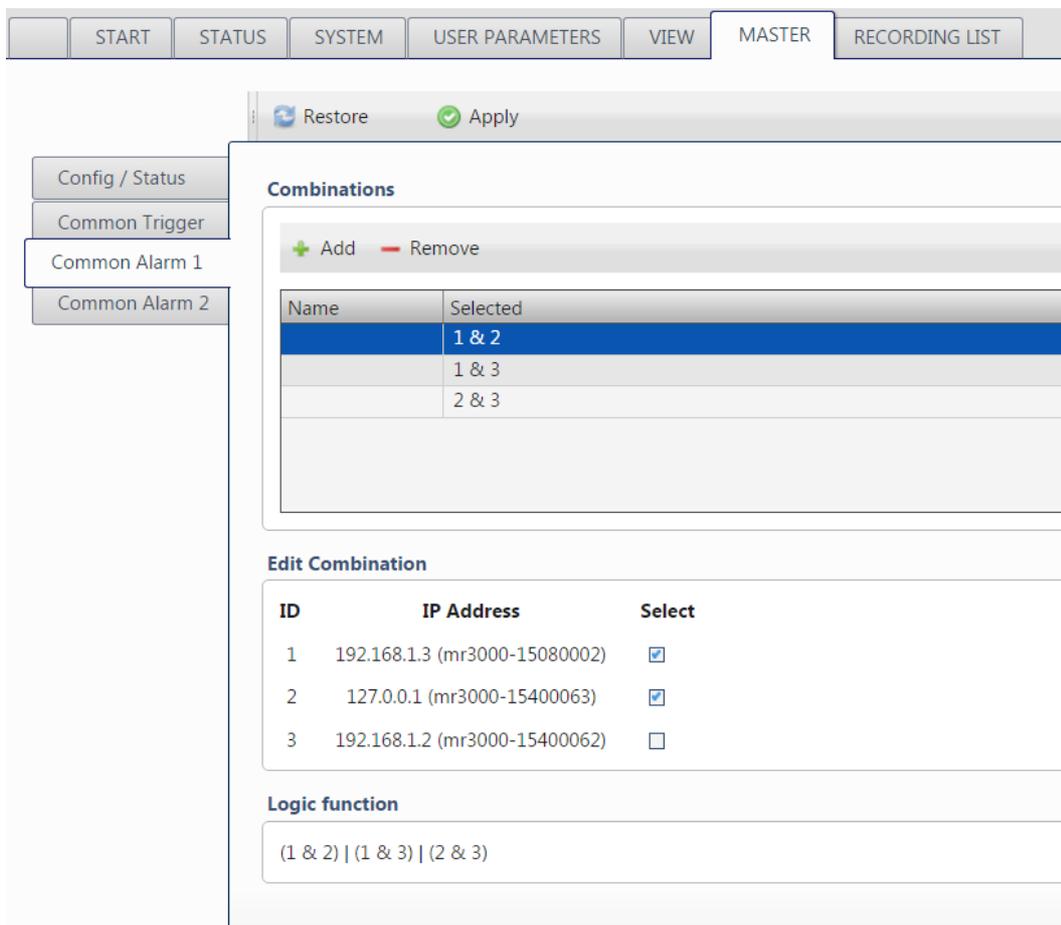


Figure 4.1.5. Subsection dedicated to the common alarms.

Successively, in the Common Alarm section, you define the conditions for the voting logic. The procedure is exactly the same as for the common trigger. Make sure to activate the **Common Alarm** in the tab Contacts to get a message if there is a common alarm.

### 4.1.3. Alerts

In case of Internet access, the alarm notification can be sent by e-mail to anybody. For further details, please look at Subsection 5.4.4.

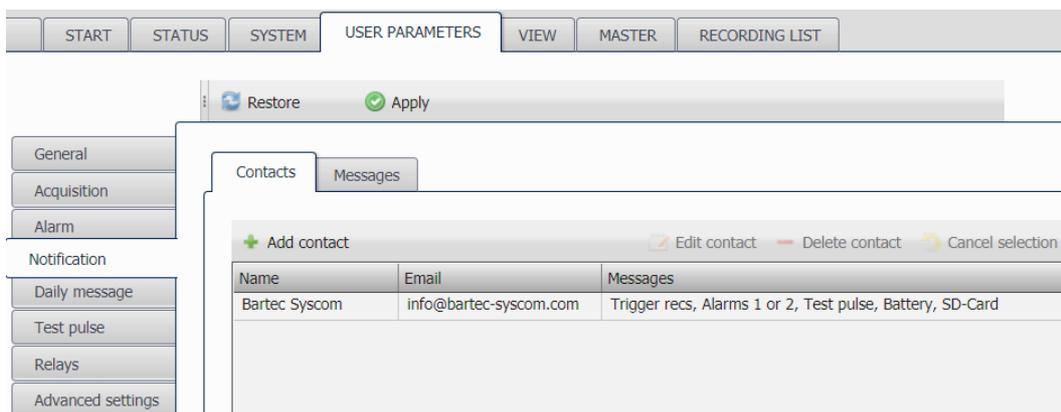


Figure 4.1.6. Set up of the mail sending.

### 4.1.4. Measurements settings

First the sampling frequency must be set up, then the trigger level. In the example, the trigger level is set at 10 mg on X and Y axes while 50 mg for the Z axis. The trigger is activated if one of the three axes exceed the respective threshold. The max (recording) length is limited to 120 seconds in order to make sure to receive the e-mail in a short time. The trigger increment is not activated for dam monitoring. For additional information, please look at Subsection 5.1.2.

The values used for the triggers cannot be defined *a priori*, but they must be chosen according to evaluation tests done at the site or the calculated response spectrum of the monitored location.

NOTE: There is a bandpass filter trigger between in the frequency range 0.5-15 Hz applied on the signal. Please refer to Subsection 5.1.2 for more details.

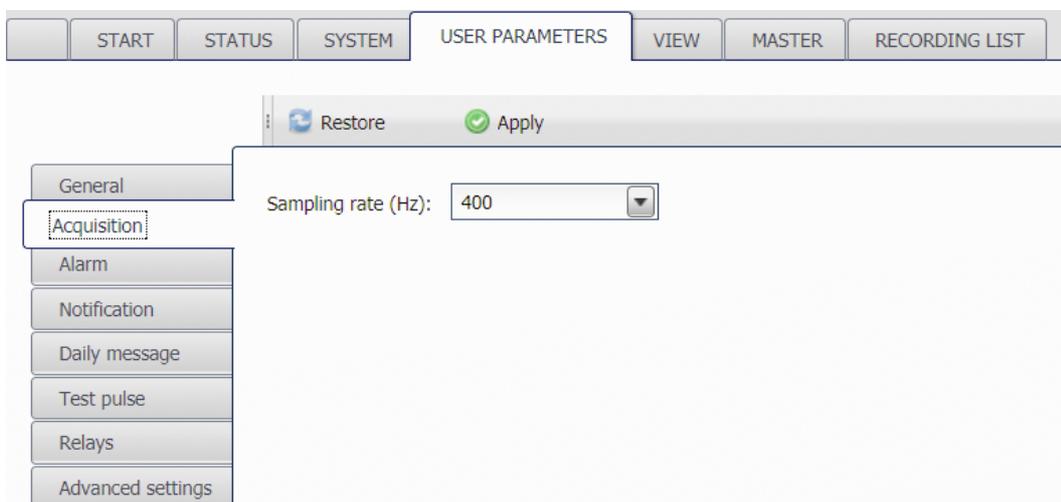


Figure 4.1.7. Selection of the sampling frequency.

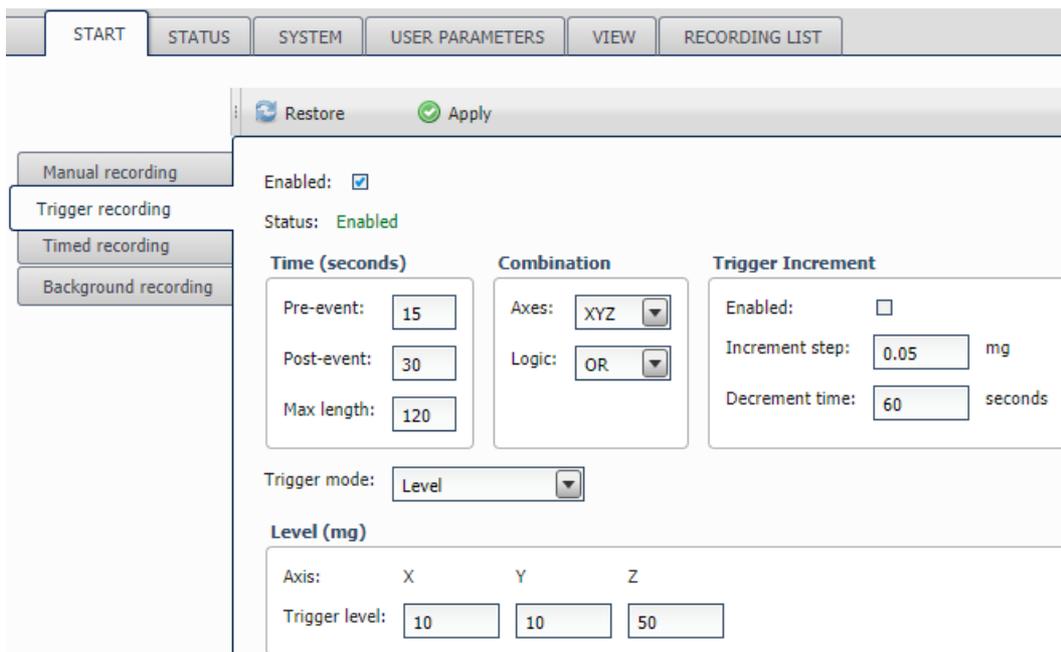


Figure 4.1.8. Set up of the trigger.

Successively, the alarm parameters should be defined. In this case, the alarm 1 threshold is fixed at 8 mg on the 3 axes. In addition, a user-defined alarm frequency-amplitude based (similar to an OBE-operating basis earthquake or SSE-Safe shutdown earthquake reference spectrum). For further details, please look at Subsection 5.4.3.

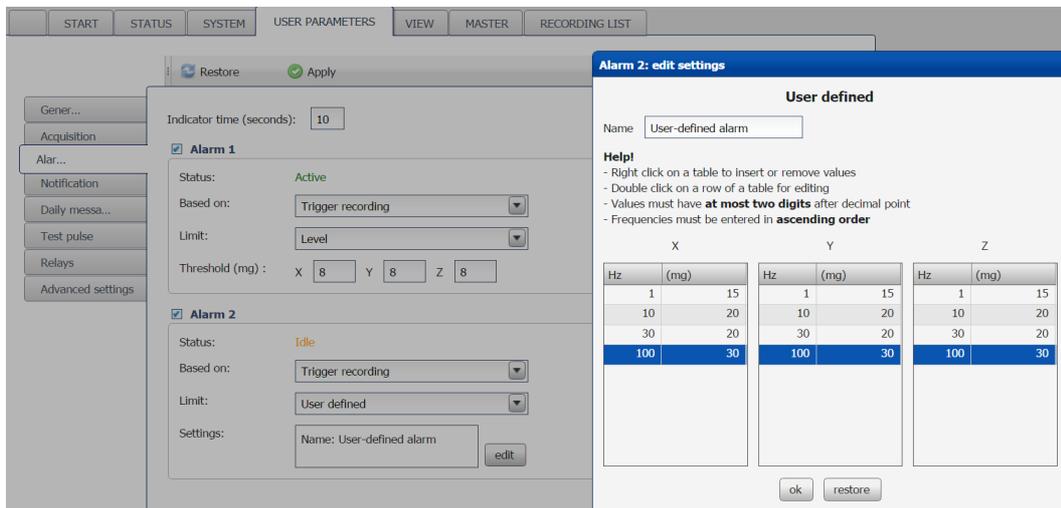


Figure 4.1.9. Set up of the alarm parameters.

It is important also to program periodic test pulses, to verify the good functioning of the device. For additional information, please read Section 5.4.6.

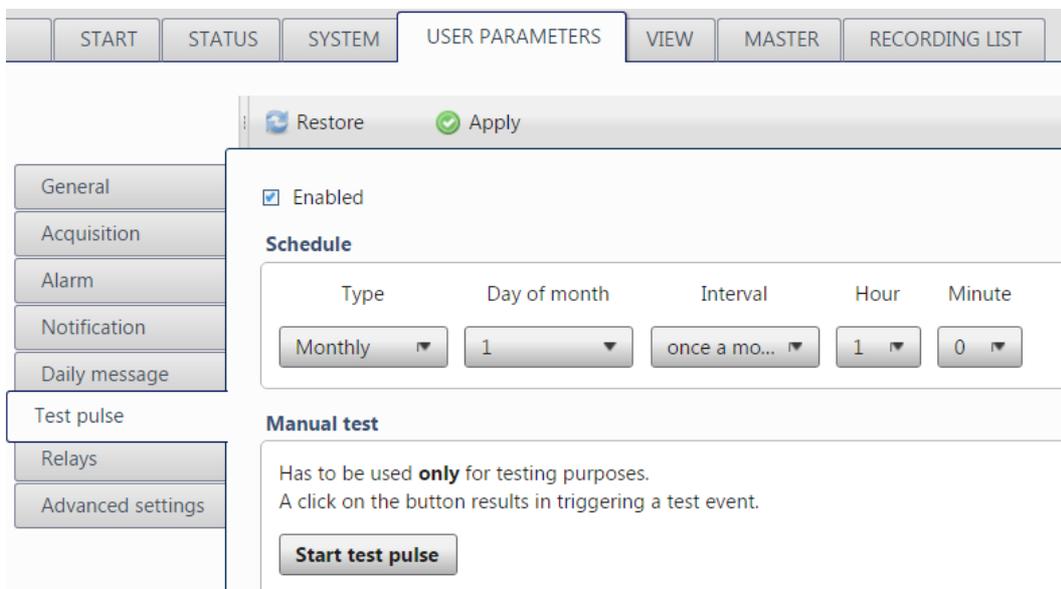


Figure 4.1.10. Screen dedicated to test pulse of the MR3000DMS.

**4.1.5. Site installation**

Now the unit can be installed on site, in a convenient place for the connection to an AC outlet. First it should be leveled and connected to the power. Once the unit is started up a final check before leaving the site is suggested.

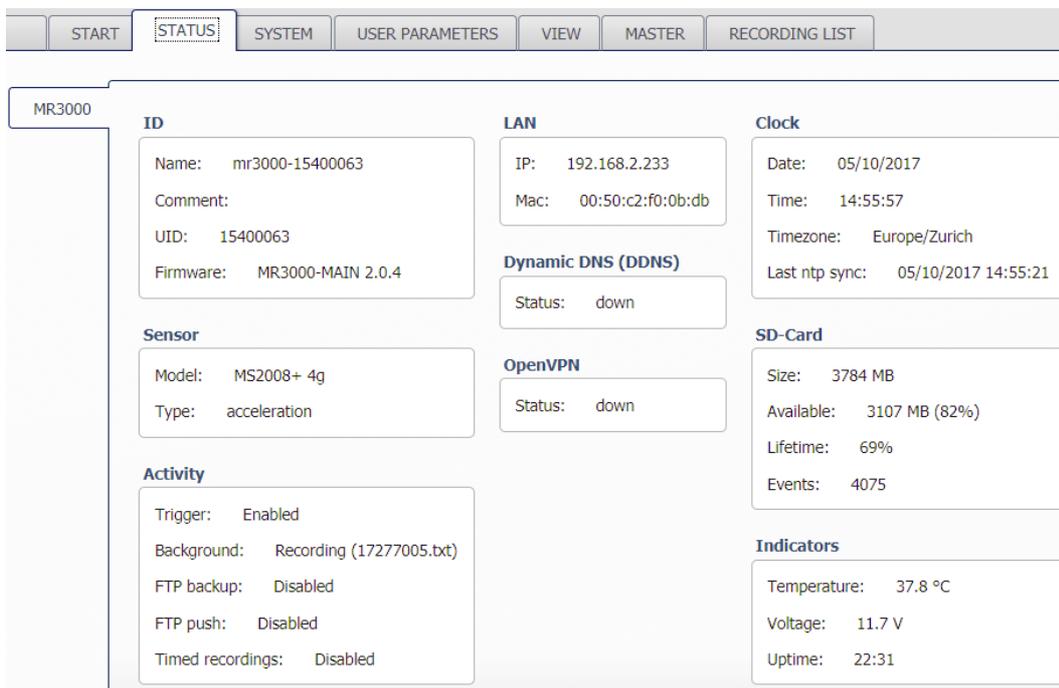


Figure 4.1.11. Screen dedicated to the status of the MR3000DMS.

**Status** tab (for all the details please refer to Section 5.2) should be open to check:

- 1) The status of the supply power;
- 2) The free space on the SD card and its lifetime;

Now the unit is operational.

## 4.2 Power Options

The MR3000DMS can be powered in different modes:

- Simply by the battery, for about 40 hours.
- AC power (100-240 VAC, 50-60 Hz).
- DC power (10-36 V)

### 4.2.1. Internal Battery

The battery capacity is 12 Ah, with a voltage of 12 V, and its autonomy can vary depending on the hardware and service settings you are using. Usually, it lasts about 40 hours.

The battery must be intended as a supplementary power in case of main power interruption.

The consumption of the MR3000DMS is:

- 4 W in case of charged battery, FO mode
- 25 W in case of AC max, with battery in charge

The autonomy of the DMS is about 40 hours.

#### 4.2.2. AC Power

In this case, you can simply connect the MR3000DMS to the main power. This solution is highly recommended.

#### 4.2.3. DC power

On request, the MR3000DMS may be powered also by DC power, as for example external power as solar panels. The voltage is from 10 to 36 V.

### 4.3 Additional services

This section describes the download of files from the DMS without using the interactive method in the tab **Recording List** in the WebUI (see Section 5.7)

#### 4.3.1. Embedded SFTP server.

The DMS has an embedded SFTP server that allows you to easily download events and background files from the device to your computer. SFTP stands for Secure File Transfer Protocol (FTP using SSH connection).

Do not mix up the SFTP server described here with the FTP send service described in Section 5.3.7. FTP send pushes the files in given time intervals to a remote server, the SFTP server allows you to interactively download the files on your PC.

To use SFTP you must install a SFTP *client* on your PC. Then you connect to the DMS (which is the *server*), and you can browse the events and background files. The login and password you need to know are:

Login: **user**

Password (default): **serial number of the MR**

**NOTE:** Every SFTP client has a refresh button somewhere. When you browse through the content of the DMS, and you don't see the files that are supposed to be there, just click the refresh button.

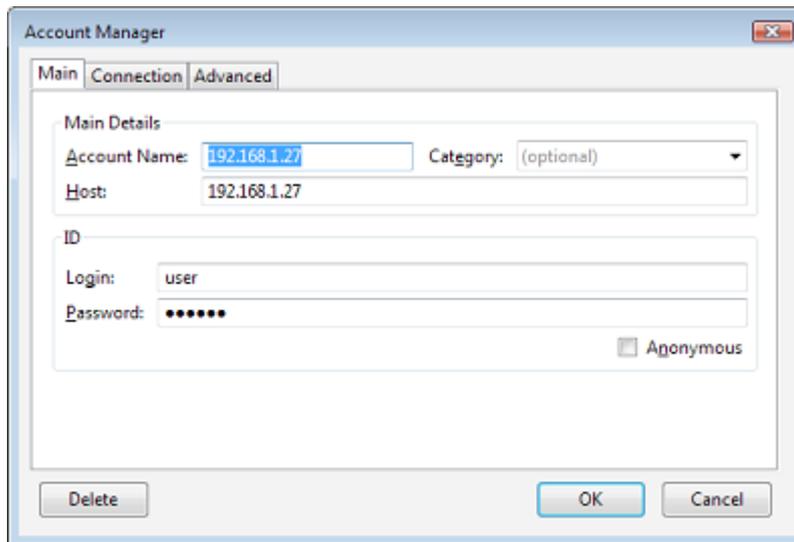
Below you will find a list of SFTP clients with a quick explanation on how to use it. All these software are free, and widely available on the Internet.

##### 4.3.1.1 FireFTP

If you are using Firefox as Web browser, this is the favored SFTP client. You have to install the add-on FireFTP. This SFTP client is directly integrated into your Web browser.

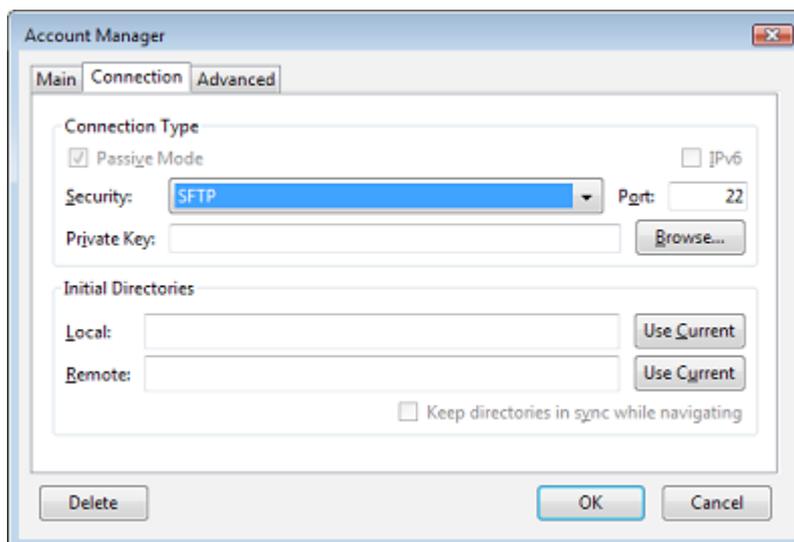
To install it, launch Firefox, and click on **Tools->Add-ons**. Then choose and install FireFTP, and restart Firefox. Then you need to add a button for a convenient access to FireFTP: just click on **View->Toolbars->Customize**, find the FireFTP button, and drag/drop it to the toolbar somewhere.

Click on this button now, the FireFTP tab will appear. Select "**Create an account**".



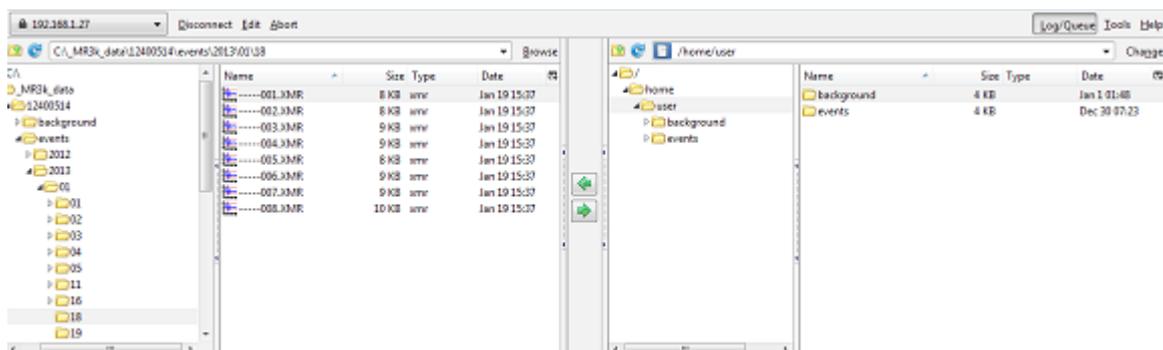
In the Main tab enter an account name (whatever you want to name this connection).

In the field **host** you enter the IP address of the DMS (real address for direct connection, VPN address for remote connection) **login** and **password** as mentioned above.



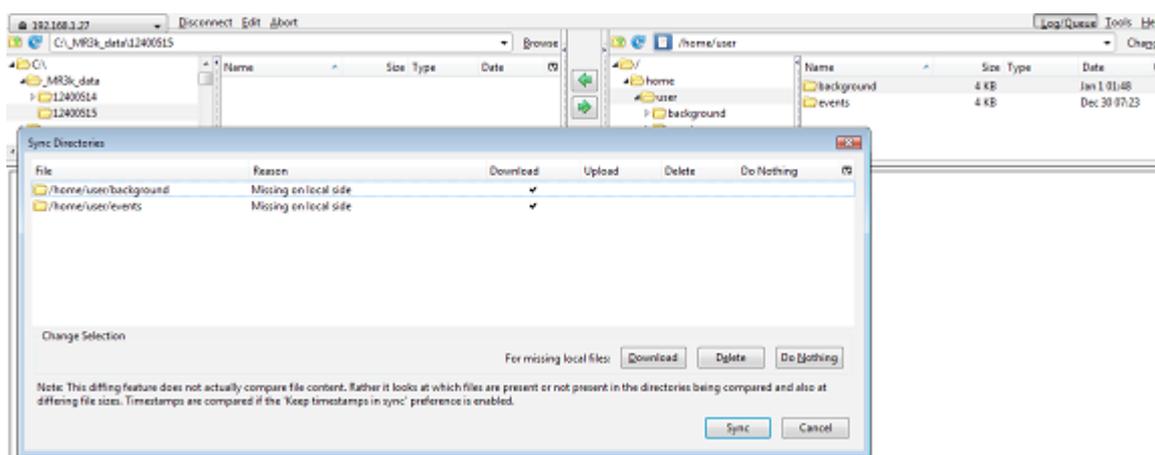
Then you go to the Connection tab and choose SFTP in the Security drop down menu. All other fields remain blank. There is nothing to edit in the Advanced tab.

Now click on the Connect button and the following main screen appears. On the left side you see the file system of your PC on the right side the file system of the MR3000DMS. On the PC you should create a specific directory for each MR.



To quickly retrieve ALL the data from the DMS, you navigate on the left hand panel (PC) to the directory of this DMS, on the right hand panel you navigate to the directory “user”. Then you open the menu Tools and select Sync Directories & Subdirectories... As shown in the picture below, the tool has already pre-selected the desired action, i.e. to Download both directories (background and events) to the local side. By clicking the Sync button, the transfer is started. Within a few seconds you have transferred ALL the files from the MR3000DMS to the local PC.

If there are new files in the DMS, just sync again.



#### 4.3.1.2 Filezilla

It is the most famous stand-alone FTP/SFTP client. You can download it at this address:

<http://filezilla-project.org/download.php?type=client>

The first time you launch it, click on **File->Site Manager...**, then click on **New Site**. In the **host** field, enter the IP address of the MR3000DMS. For the **protocol**, choose SFTP. For the **logon type**, choose normal. Then, enter your login and password, and click **Connect**.

#### 4.3.1.3 WinSCP

As an alternative to Filezilla, there is WinSCP. You can get it at this address:

<http://winscp.net/eng/download.php>

The first time you launch it, click on the **New** button.

## 5. The Web User Interface (WebUI)

Once the connection with the MR3000DMS is established, and the IP address of the MR3000DMS is known, the Web user interface (WebUI) must be opened. Just launch your favorite Web browser, and enter the IP address of the DMS in the address bar. Depending on your Web browser, you may have to enter the letters “http://” before the IP address.

You are prompted for the Login / password. By default the Login is **user** and the password is the **serialnumber** of the MR3000DMS – as shown on the housing.

The interface is divided in 7 main tabs:

- **Start** allows you to configure all parameters related to recording and allows you to easily retrieve the most recently recorded files.
- **Status** displays status information.
- **System** allows you to configure the interfaces and some services related to it.
- **User Parameters** contains the parameters related to alarms and alerting and other general parameters not related to recording. Relays can be configured in this tab as well.
- **View** allows a real-time graphical display of the waveform data or the vibration level (background recording)
- **Master** (only available in the Master recorder) allows you to set-up a network of DMS to perform common trigger and common alarm. This feature is only available if the Master/Slave option is activated on this recorder, which is called the master.
- **Recording List** shows the content of the memory card with all the recorded events. Here you may select files for immediate download.

After you modified some settings on a page, you can:

- Click **Apply** to validate your changes. It means that the content of the page is sent to the MR3000DMS, which will restart all services accordingly.
- Click **Restore** if you want to discard your changes.

NOTE: If you do not click **Apply** and leave the tab, your changes are lost.

### 5.1 Start

In this part you will find all the settings related to data acquisition and recording. When talking about “signal” in this chapter, it actually means “the signal coming from the sensor”.

#### 5.1.1. Manual recording

You can start recording an event by clicking on the **start** button, and stop the recording with **stop**. When the DMS is recording, the yellow LED turns on. The current recording status and the recording duration are shown.

In the table **Recording list** below all recordings currently stored on the SD card are shown. New files show up after clicking on the refresh icon. Double-clicking on a file starts the download of the file and the waveform is shown using the PC software EAWlight (only available for WINDOWS PCs). You may select one or many files for download and further analysis on the PC.

Data can also be sent automatically or downloaded and then uploaded on the SCS Cloud software. Please refer to section 5.3.8 and to the description on our website:

<http://www.syscom.ch/products/software/scs-cloud-software/>

The screenshot shows the 'Manual recording' interface. At the top, there are tabs for 'START', 'STATUS', 'SYSTEM', 'USER PARAMETERS', 'VIEW', and 'RECORDING LIST'. Below the tabs, there are 'Restore' and 'Apply' buttons. The 'Manual recording' section has a 'start' button, a 'stop' button, and the status 'Idle'. On the left, there are buttons for 'Trigger recording', 'Timed recording', and 'Background recording'. The 'Recording list' section contains a table with the following data:

datetime	duration	peak X	peak Y	peak Z	filename
2015-04-01 06:45:00	01m 00.0s	0.00710	0.00760	0.0179	15091012.XMR
2015-04-01 06:32:09	01h 41m 30.0s	0.168	0.209	0.340	15091004.BMR
2015-04-01 06:30:00	01m 00.0s	0.0319	0.0332	0.0856	15091011.XMR
2015-04-01 06:15:00	01m 00.0s	0.0144	0.0131	0.0116	15091010.XMR
2015-04-01 06:00:00	01m 00.0s	0.0175	0.0148	0.0127	15091009.XMR
2015-04-01 04:32:09	02h 00m 00.0s	0.0409	0.0365	0.0966	15091003.BMR
2015-04-01 03:45:00	01m 00.0s	0.00460	0.00430	0.00460	15091008.XMR
2015-04-01 03:30:00	01m 00.0s	0.00560	0.00500	0.00340	15091007.XMR
2015-04-01 03:15:00	01m 00.0s	0.00660	0.00550	0.00770	15091006.XMR
2015-04-01 03:00:00	01m 00.0s	0.00600	0.00580	0.00420	15091005.XMR
2015-04-01 02:32:09	02h 00m 00.0s	0.00980	0.0114	0.0113	15091002.BMR
2015-04-01 00:45:00	01m 00.0s	0.00430	0.00380	0.00380	15091004.XMR
2015-04-01 00:32:09	02h 00m 00.0s	0.00740	0.00850	0.0107	15091001.BMR
2015-04-01 00:30:00	01m 00.0s	0.00440	0.00370	0.00330	15091003.XMR
2015-04-01 00:15:00	01m 00.0s	0.00510	0.00400	0.00410	15091002.XMR
2015-04-01 00:00:00	01m 00.0s	0.00350	0.00310	0.00300	15091001.XMR
2015-03-31 22:32:09	02h 00m 00.0s	0.0449	0.0215	0.0502	15090064.BMR

255 recordings

Figure 5.1.1. Manual recording interface.

### 5.1.2. Trigger recording

The trigger is a feature that allows the DMS to start recording if the signal reaches the threshold level. In this case the MR3000DMS is "triggered". When the signal comes back below the threshold level, the trigger is "idle" – see section **Activity** on the **Status** screen.

In the **Time** section the duration of the recording can be set up:

- The **Pre-event** indicates how much time is recorded before the MR3000DMS is triggered. The Pre-event time depends on the sampling rate. For example, up to 30 seconds can be set for a sampling rate of 1000 Hz.
- The **Post-event** indicates how much time is recorded after the trigger has become idle. The post-event time can be chosen up to 100 seconds. If the MR3000DMS is triggered again during the post-event time, the post-event countdown will restart from the beginning and the DMS keeps on recording in the same file.

- The **Maximum length** setting allows to choose the maximum length of an event file. If this limit is reached, the DMS closes the file. If the DMS is still triggered it will start recording a new file. The maximum value is 1800 s.

Each channel (X, Y horizontal and Z vertical) has its own trigger threshold level that is set-up in the section **Level**. If the vibration exceeds the threshold level on a specific channel, the trigger condition becomes true for this channel.

In the section **Combination** you choose which channels are needed to fulfill the general trigger condition and subsequently lead the instrument to start recording. You may consider only 1 axis (=channel, e.g. Z vertical), or more. If you consider more than one **Axis**, you can decide if the MR3000DMS is triggered when all the axes are above the level, or just one of them. You choose it with the AND/OR **Logic**. A common setting is to consider all 3 axes, and trigger when any of them has reached the trigger level ("**OR**").

The trigger level may be automatically adjusted to the actual level of vibration if you activate the **Trigger increment** option. After each event or when the **Maximum length** of the recording is reached (see above), the trigger level is increased by the amount given as **Increment step**. It is decreased by the same amount after the period specified in **Decrement Time** has elapsed and no further event has been recorded.

The **trigger mode** can be selected between Level and the STA/LTA.

In both cases, before applying the trigger mode, a **band-pass trigger filter** between 0.5 and 15 Hz is applied on the signal. This means that an event is created only if both the conditions are fulfilled:

- the trigger condition is exceeded;
- the peak is associated to a frequency in the range 0.5 – 15 Hz.

In case of **Level**, the acceleration threshold for the trigger activation can be chosen on each of the three axes.

NOTE: Due to the presence of the trigger filter, values exceeding the trigger threshold do not necessarily lead to an event creation.

The screenshot displays the 'Trigger recording' configuration window. At the top, there are navigation tabs: START, STATUS, SYSTEM, USER PARAMETERS, VIEW, and RECORDING LIST. Below the tabs, there are buttons for 'Restore' and 'Apply'. On the left, a sidebar lists recording modes: Manual recording, Trigger recording (highlighted), Timed recording, and Background recording. The main configuration area includes:

- Enabled:**
- Status:** Enabled
- Time (seconds):**
  - Pre-event:
  - Post-event:
  - Max length:
- Combination:**
  - Axes:
  - Logic:
- Trigger Increment:**
  - Enabled:
  - Increment step:  mg
  - Decrement time:  seconds
- Trigger mode:**
- Level (mg):**

Axis:	X	Y	Z
Trigger level:	<input type="text" value="10"/>	<input type="text" value="10"/>	<input type="text" value="10"/>

Figure 5.1.2. Trigger recording interface.

**STA/LTA** is a trigger algorithm usually used in the field of weak-motion seismology. The STA/LTA continuously calculates the average values of the absolute amplitude of a seismic signal in two consecutive moving-time windows. The short time window (STA) is sensitive to seismic events while the long time window (LTA) provides information about the temporal amplitude of seismic noise at the site. When the ratio of both exceeds a pre-defined value, the trigger is activated and an event is recorded.

The screenshot shows a software interface for configuring recording settings. At the top, there are tabs: START, STATUS, SYSTEM, USER PARAMETERS, VIEW, and RECORDING LIST. The 'START' tab is active. On the left, there is a sidebar with buttons for 'Manual recording', 'Trigger recording', 'Timed recording', and 'Background recording'. The 'Trigger recording' button is highlighted. The main area shows a configuration window with the following settings:

- Enabled:
- Status: Enabled
- Time (seconds):
  - Pre-event: 1
  - Post-event: 3
  - Max length: 120
- Combination:
  - Axes: XYZ
  - Logic: OR
- Trigger mode: STA/LTA
- STA/LTA parameters:
 

Axis:	X	Y	Z
STA/LTA ratio:	4	4	4
STA (s):	1	1	1
LTA (s):	60	60	60

Figure 5.1.3. Trigger recording interface, in case of selection of STA/LTA as trigger mode.

### 5.1.3. Timed recording

In the section timed recording you can set-up a timetable to record files automatically, in addition or independently from the trigger. You set-up a **Starting time**, e.g. every Monday at 10 am (select **Weekly > Monday > once a week > 10 > 00**) or now (select **Hourly > Every hour > minutes: 1** minute from now). The expert mode provides you with the features of CRON (as it is known on LINUX systems) to set-up the start time.

At the **Starting time**, the DMS starts recording according to the settings in the **Parameters** section. Every **Period between recordings** starts with a recording of **Recording duration**. The rest of the period, the DMS is idle. **Number of recordings** tells the DMS how often this procedure will be repeated.

NOTE: Timed recording continues until you disable it or the unit is switched off.

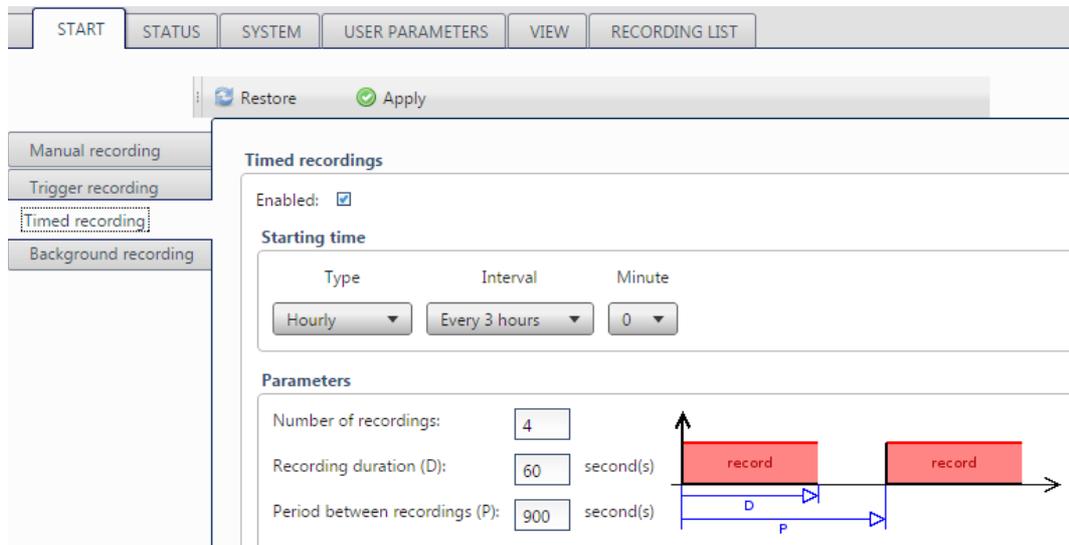


Figure 5.1.4. Timed recording interface.

#### 5.1.4. Background recording

In background recording mode the DMS records the peak values within a given time window. Please note that event recording is not affected by the peak recording – both services may run simultaneously.

In the field **Mode** you choose what kind of peaks should be recorded:

- **Peak** is the maximum value of the signal during each period (as defined below).
- **Peak + Vector Sum** includes the maximum of the vector sum of the 3 channels
- **Peak + Dominant Frequency** includes the dominant frequency for each period
- **Peak + Vector Sum + Dominant Frequency** includes the vector sum and the dominant frequency for each period

You have to set-up the **Period** and the total **Duration** of a file. For verification purposes, the DMS shows the number of periods in one file of the given duration as **Number of samples in file**.

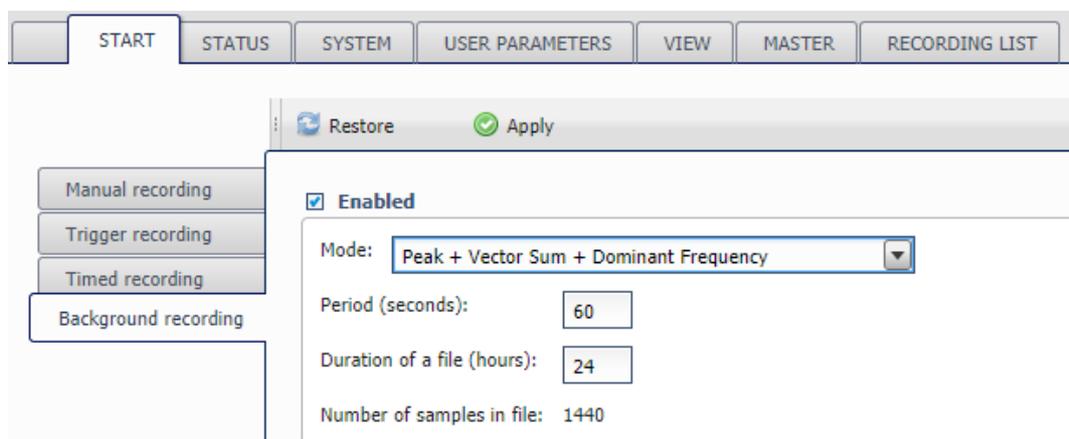


Figure 5.1.5. Background recording interface.

## 5.2 Status

This page displays information about the DMS. The page is updated automatically.

- **ID** contains:
  - *Name* of the MR3000DMS (by default this is mr3000, followed by a dash and its serial number). You may change the name, according to your needs (see Section 5.4.1).
  - *Comment*, for example a description of the location where you have installed the DMS. This text is shown together with the name in the messages (see Section 5.4.1).
  - *UID* unit ID (serial number) – can not be changed
  - firmware version.
- **Sensor** tells you for which sensor the DMS is configured.
- **Activity** reports the current activity of the data acquisition services:
  - *Trigger* shows 3 different states:
    - idle: the DMS is not recording an event
    - recording: the DMS is currently recording an event
    - triggering: one of the trigger conditions is fulfilled and the DMS is recording until the post-event time is elapsed.
  - *Background*: this shows if the DMS is currently recording a peak file (file name) or not (idle).
  - *FTP backup*: shows 4 different states:
    - in progress: currently a file is sent to the FTP server.
    - errors: errors occurred when communicating to the FTP server.
    - idle: service is active, but there is no new file to be copied.
    - disabled: service is not active.
  - *FTP push*: shows 4 different states:
    - Pushing N files: after starting the service the number of files to be sent is shown.
    - N files pending: N files are waiting to be sent in case of trouble or many files have been recorded recently and have not been transferred yet, eg. due to slow communication.
    - idle: service is active, but no scheduled push is currently going on.
    - disabled: service is not active.
  - *Timed recordings*: shows 3 different states:
    - active: the DMS is either recording (see trigger status above) or in the period between two scheduled recordings.
    - idle: service is active, but start time has not been reached yet.
    - disabled: service is not active.
- **LAN** displays the **IP** address of the DMS on the Ethernet port or FO, and the **MAC** address of the interface.

- **Dynamic DNS** shows 5 different states:
  - *up*: service is active
  - *starting*: service is starting up
  - *error\_server*: communication problem with the server
  - *updated*: the service has updated the DNS address. In this case an additional field with the WAN address that is related to the DNS entry is shown
  - *down*: service is not active.
- **OpenVPN** shows the **Status** and the **IP** address of the Virtual Private Network.
- **Clock** displays the current date and time on the DMS. **Last update** shows when the clock has been synchronized the last time.
- **SD-Card** shows the total size and the free size on the SD-Card. It also shows the number of events on the DMS.
- **Indicators** shows the current temperature inside the MR, the input voltage and the uptime (time since the last boot of the system).

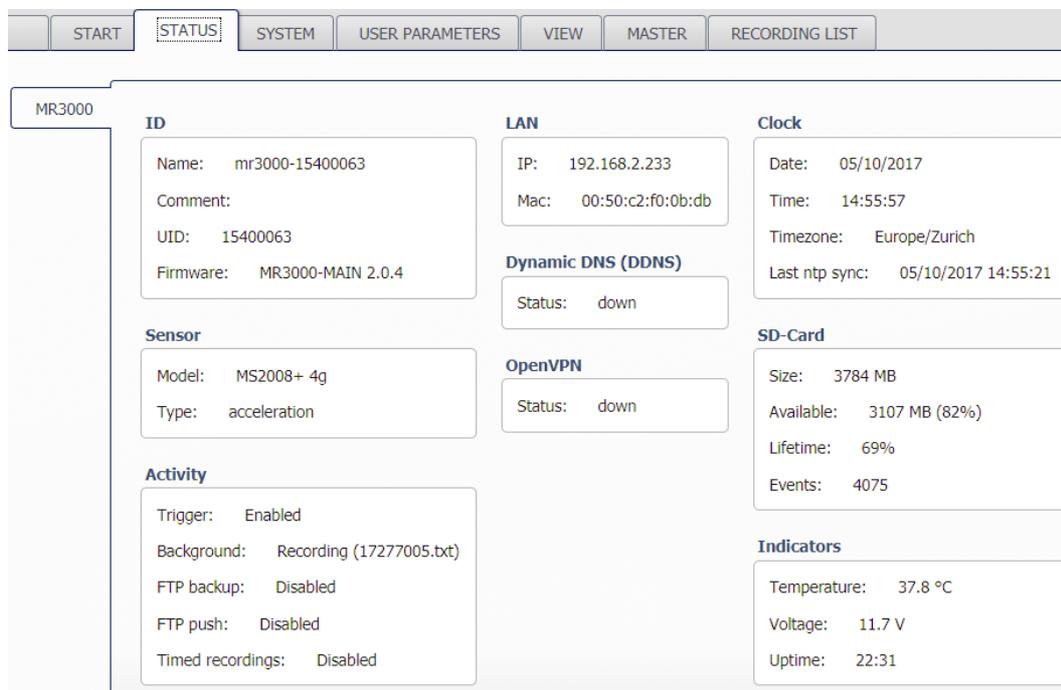


Figure 5.2.1. Status interface.

## 5.3 System

In this part, you find all the settings of the different hardware interfaces and software services of the MR3000DMS.

### 5.3.1. SD Card

This subsection shows the capacity of the memory card and the amount of memory available. Moreover, an indication of the remaining lifetime is displayed.

You can format the memory SD card with the relative button: this erases ALL the data memorized on the card. A dialog box pops up and asks for confirmation.

Wait until the formatting is done – takes approx. 10 seconds.

NOTE: a single file cannot be deleted.

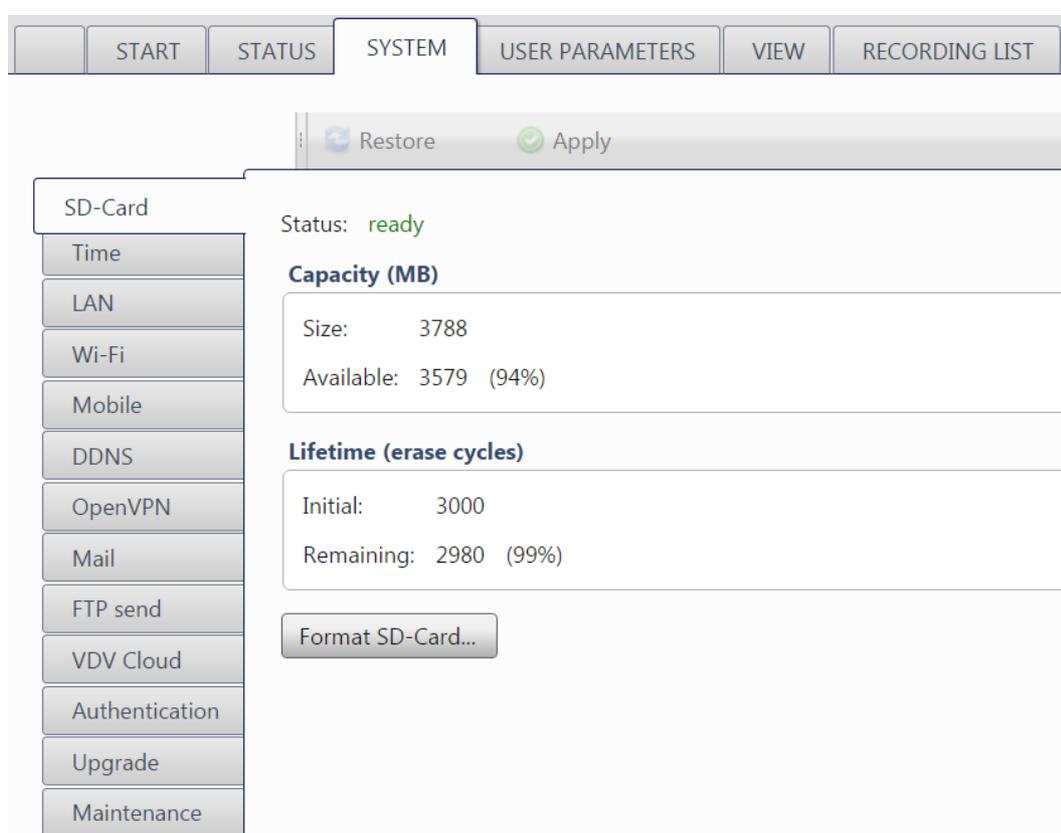


Figure 5.3.1. Subsection dedicated to SD-card.

### 5.3.2. Time

In this tab you configure the timing services of the DMS. In the **Timezone** section you can choose whether you prefer the DMS to work with UTC time, or local time. This only makes sense if you have activated time synchronization.

In the **Time synchronization** section you activate the synchronization with an external source.

- **Disabled** means that you don't need *continuous* synchronization. The internal clock keeps the time even when the unit is powered off. However, electronics component involved in timekeeping always have a drift, depending on unpredictable factors like temperature. As a consequence, the DMS will slowly drift away from the right time.

You can set the time of the MR3000 equal to the time of your PC, by means the functionality "Set time with your computer time".

As a second option, you may adjust the clock at once with an NTP server using the Internet connection. In the pop-up windows you have to set-up appropriate NTP servers. Alternatively the time can be set manually, and this works in every situation (i.e. without connection to the Internet).

- **Network (NTP)** means that the clock will *continuously* be synchronized using the Internet connection. 1 to 4 NTP servers can be specified. The more servers are used, the better precision is get.

It takes a variable time period – depending on the difference of the internal clock and the accurate time – to synchronize the clock once a valid NTP server is set-up and Internet connectivity is available. If the synchronization was successful, the time of the synchronization is shown as **Last clock update** in the **Status** section.

The accuracy of the synchronization depends on the quality of the Internet connection, and also of the servers you choose. The closer you are to the servers, the better precision you get.

The 4 default servers (*0.pool.ntp.org*, *1.pool.ntp.org* and so on) are in fact 4 servers randomly picked up around the world. It always works, but if you want a better accuracy, you should put in these fields servers from your country. For example, if the DMS is in Switzerland, you should set the 4 servers to *0.ch.pool.ntp.org*, *1.ch.pool.ntp.org* and so on.

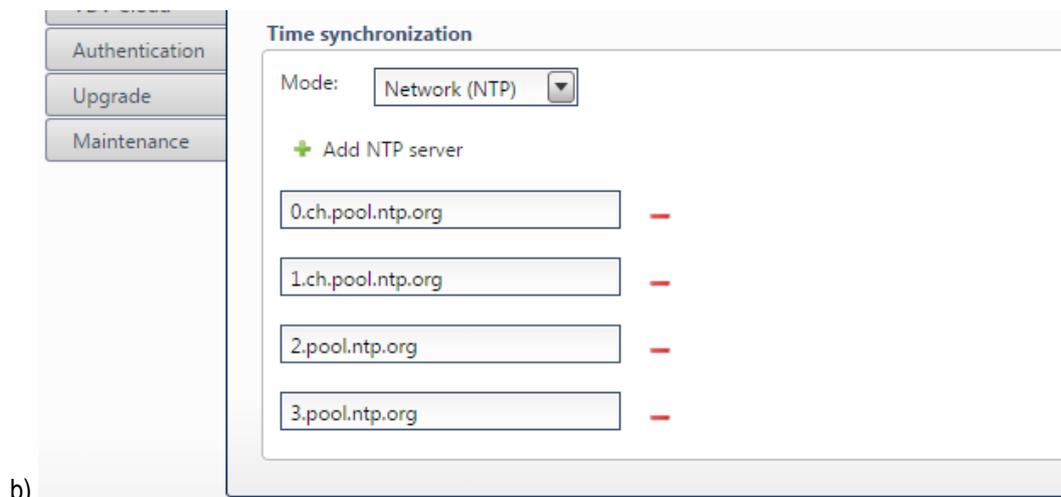
You can find more information about the NTP servers available in your country on the Web site [pool.ntp.org](http://pool.ntp.org).

- If you ordered the **GPS** option with your DMS, you need to select that. Then the DMS will keep its time synchronized with the GPS time, the accuracy being around 1ms.

a)

The screenshot shows the 'SYSTEM' configuration page in the BARTEC SYSCOM web interface. The 'Time' section is selected in the left sidebar. The main content area shows the following configuration options:

- Status:**
  - Local time: 04/08/2017 11:37:41 (Europe/Zurich)
  - UTC time: 04/08/2017 09:37:41
  - Last clock update: 04/08/2017 11:13:08
- Timezone:**
  - Use UTC time
  - Use local time
  - Region: Europe (dropdown)
  - City: Zurich (dropdown)
- Time synchronization:**
  - Mode: GPS (dropdown menu is open, showing options: Disabled, Network (NTP), GPS)



b) Figure 5.3.2. Subsection dedicated to the time synchronization in case of mode “Disabled” and mode “Network (NTP)”.

### 5.3.3. LAN

In this subsection, the settings for the Ethernet port (interface for wired connection) are shown.

**Mode** is as follows:

- **DHCP** means that the DMS will try to get an IP address by sending DHCP requests. Select this option if you connect the DMS to a network with a DHCP server. For example, your company network, or any network with a router. All settings for the LAN connection are made by the DHCP server and no further configuration is needed.

If this network provides Internet access, the DMS will be connected to Internet. You can check that with the ping button (see Section 5.3.10).

If the DMS fails to receive a reply of the DHCP request, the settings for the **Static configuration** are used if the case **Fallback to static IP if DHCP fails** is checked.

- **Static** means that the DMS will use the static IP address provided below. You should select this option if:
  - you plug the DMS directly to your computer. You also need to configure your computer accordingly, i.e. assign a different IP address from the same range and the same netmask.
  - you plug the DMS to a network without DHCP server.

In static mode, you must configure all the parameters manually - to do so you will probably need the assistance of your IT support.

If you plugged the DMS directly to your computer, only the **IP address** is relevant. If you plugged it to a network, you must fill all the parameters if you want the DMS to be able to reach Internet.

The most important setting is the **IP address** that you want to give to the DMS. It should be a private address within one of the following ranges:

- 192.168.0.0 to 192.168.255.255
- 172.16.0.0 to 172.31.255.255
- 10.0.0.0 to 10.255.255.255

The **Netmask** is 255.255.255.0 by default, and should remain like this except if you know exactly what you're doing.

The **Gateway** address must be filled if you connect the DMS on a network. This is the IP address of the router.

Same thing for the **Nameserver**. The default is 8.8.8.8 and should work fine.

**NOTE:** After you changed the IP address of the DMS and clicked Apply, you're not connected to the DMS anymore. You need to enter this new IP address in the address bar of your Web browser in order to reconnect to the WebUI. Check the LCD of the DMS to know the IP address of the DMS.

The screenshot shows the 'SYSTEM' configuration page for LAN communication. The interface includes a top navigation bar with tabs: START, STATUS, SYSTEM (selected), USER PARAMETERS, VIEW, MASTER, and RECORDING LIST. Below the navigation bar are buttons for 'Restore' and 'Apply'. A left sidebar contains a menu with options: SD-Card, Time, LAN (selected), DDNS, OpenVPN, Mail, FTP send, SCS Cloud, VDV, Authentication, Upgrade, Maintenance, and Sensor. The main content area is titled 'Mode' and contains two radio button options: 'DHCP' and 'Static'. The 'Static' option is selected. Below the mode selection is a section titled 'Static configuration' with four input fields: 'IP address' (192.168.1.4), 'Netmask' (255.255.255.0), 'Gateway' (192.168.1.1), and 'Nameserver' (8.8.8.8).

Figure 5.3.3. Subsection dedicated to the LAN communication.

#### 5.3.4. DDNS

DDNS stands for Dynamic DNS, a method to update a name server in the Domain Name System. Without going into technical details, DDNS allows you to communicate with a DMS that is out in the field where it does neither have a public (accessible from the WEB) nor a static (not changing) IP address. The router where the DMS is connected to needs a public IP address – this is the case for most ADSL or cable TV routers you find in private houses. You have to set-up port-forwarding in the configuration of the router to reach the DMS in the network. The DDNS service makes sure that you can access your DMS through a persistent domain name (e.g. mymr.dyndns.org).

Communication with the DDNS service needs an Internet connection – check with the PING function as described in Section 5.3.10.

For further details, please check the web-site of the DDNS service provider of your choice, the DMS supports the following services:

- dyndns
- no-ip
- ovh
- dyndnsit
- changeip
- sitelutions

The screenshot displays the DDNS configuration interface. At the top, there are navigation tabs: START, STATUS, SYSTEM (selected), USER PARAMETERS, VIEW, MASTER, and RECORDING LIST. Below these are 'Restore' and 'Apply' buttons. A left-hand menu lists various system settings: SD-Card, Time, LAN, DDNS (highlighted), OpenVPN, Mail, FTP send, SCS Cloud, VDV, Authentication, Upgrade, Maintenance, and Sensor. The main configuration area for DDNS includes an 'Enabled' checkbox which is checked. Under the 'Configuration' heading, the 'Status' is 'down'. The 'Service' is set to 'dyndns' in a dropdown menu. There are three text input fields for 'Username', 'Password', and 'Hostname'.

Figure 5.3.4. Subsection dedicated to the DDNS.

### 5.3.5. OpenVPN

VPN stands for Virtual Private Network. With this service, you will be able to communicate with the DMS when it is out in the field where it neither has a public (accessible from the WEB) nor a static (not changing) IP address. The OpenVPN service makes sure to access the DMS through a persistent IP address. OpenVPN service works nicely if the DMS is connected to a ADSL /cable TV router you find in private houses. No further settings on the router (e.g. port-forwarding as for DDNS) are required.

The VPN interface uses not the real, but a virtual IP address. This address remains always the same (or – depending of the configuration of the OpenVPN server – the address is at least known by the OpenVPN server) regardless of the real IP address and if the DMS is connected via wired connection. The virtual address is shown here and on the **Status** screen in the VPN section.

To complete the configuration, click the **Enabled** box, then upload the 4 configuration files on the DMS, and click on Apply. The configuration files (sometimes referred as VPN keys) are provided by the provider of the VPN service.

Communication with the VPN service needs an Internet connection – check with the PING function as described in chapter 5.3.10. The data stream for interactive communication through the WebUI

are routed via the OpenVPN server. The communication between your PC and the DMS is encrypted.

The other data (FTP push, NTP time synchronization, E-Mail, Firmware-upgrade) are not routed through the VPN tunnel, but use the normal Internet access.

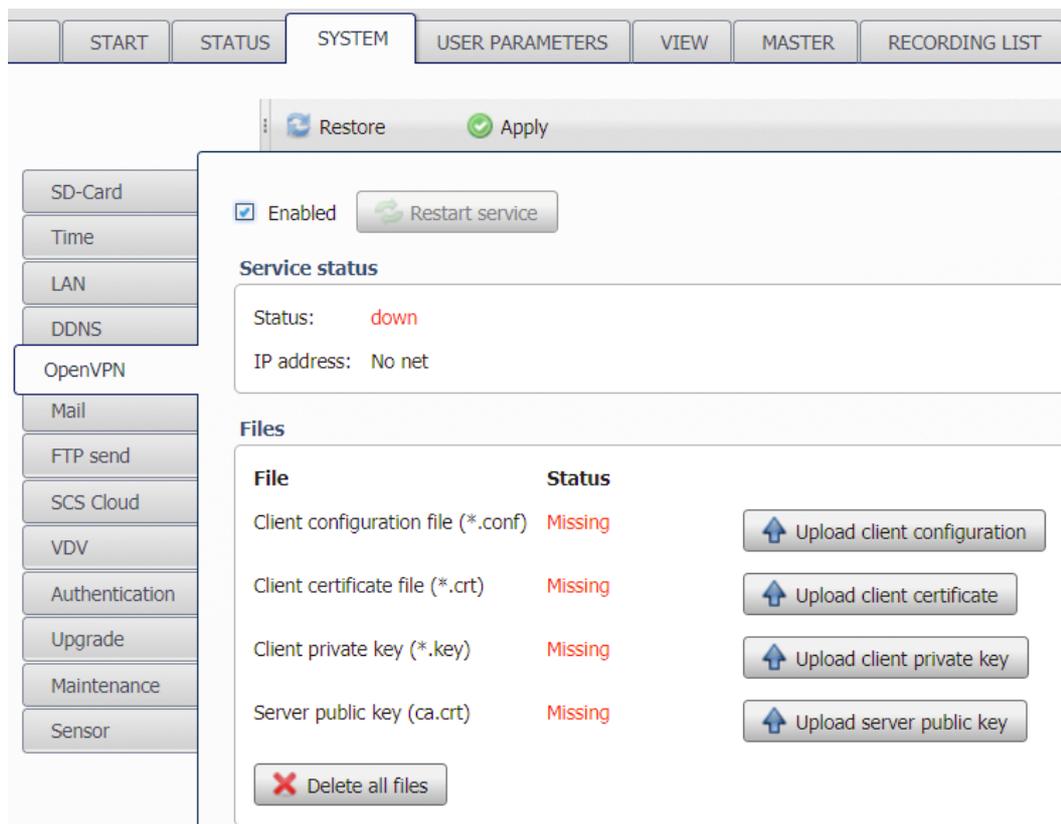


Figure 5.3.5. Subsection dedicated to the OpenVPN.

### 5.3.6. Mail

In this section, you can configure the e-mail settings, in order to receive automatically mails from MR3000DMS. For this purpose you need an e-mail account and Internet access for the DMS—check with the PING function as described in Section 5.3.10

You have to enter the access data of your e-mail account, i.e **User address** (e-mail address of your e-mail account) and the **Password** in the section User identity. In the section SMTP server you have to enter the **URL** (name or IP address of the SMTP server) and the **Port**.

You don't need a unique e-mail account for every DMS - you can have one e-mail account with a single e-mail address for all of your DMS as this address is only used to send e-mails, not to receive.

If you use a different e-mail service you will have to check the documentation of your service provider to figure out the URL and the port of the SMTP server.

- Create an address, e.g. mr3k.syscom@yourprovider.com
- Enter this address as **User address** together with **Password** in the section User identity
- The settings for the SMTP server can be found on the provider site.

NOTE: The quality of the mail service varies with the provider.

Figure 5.3.6. Subsection dedicated to the mail.

### 5.3.7. FTP send

If this service is enabled, the DMS will periodically connect to a remote FTP server and copy its data to it. This feature has two main purposes:

- a permanent backup — your data exist both on the DMS and the server.
- a way to make the DMS data easily available, as the access to the data on the server is much faster than to retrieve the data from the MR3000DMS.

First you have to set-up the access to your FTP server in the **FTP server settings**:

- **Host** is the URL (e.g. myftphost.com) or the IP address of your FTP server (without the ftp:// prefix). You may add a specific sub-directory to the host name (e.g. myftphost.com/mydir/mr) in this case, the DMS will create the corresponding sub-directory on the FTP server.
- **Sub directory** for this specific DMS. This directory is created below the main directory, as set-up under **Host**. By default the **Name** of the DMS is used (see chapter 5.4.1), alternatively you may use the UID (Serial number of the DMS – see chapter 5.2) or you may enter a specific directory name. The right choice depends on the setting of your FTP server.
- **Username** is your login for this server
- **Password** is used to authenticate the user on this server.

It is highly recommended to test your settings with the **Test FTP server** button. Your DMS needs Internet access to perform the test.

The **FTP send** service has two options – both can be active:

- In **Push mode** the DMS will push a new event file to the FTP server as soon as recording of the file is done. The current background file may be updated continuously on the FTP server. In **User parameters > Advanced settings** – see chapter 5.4.8 - you specify how often the current background file is updated on the FTP server.

**Preserve SD-Card hierarchy** means that you have the same directory structure on the FTP server as in the DMS `../events/2014/01/09/` - year, month, day and `/background/2014/01` - year month. If this option is not checked, the files are copied to the directories `/events` and `/background`.

- In **Backup mode** the DMS will keep the FTP server synchronized with its data. At each connection, the DMS will compare its own data to the FTP data, and any missing file on the FTP will be copied. This option can be combined with the **Push mode**. It checks the integrity of the data on the FTP server in scheduled time intervals.

Backup mode always maintains the hierarchy on the SD-Card. If you have not checked this option above and both, **Push mode** and **Backup mode** are enabled, you will have two copies of the same file on your FTP server – of course this also doubles the amount of data sent to the FTP server.

The screenshot displays the 'FTP server settings' configuration page. The interface includes a top navigation bar with tabs: START, STATUS, SYSTEM (selected), USER PARAMETERS, VIEW, MASTER, and RECORDING LIST. Below the navigation bar, there are 'Restore' and 'Apply' buttons. A left sidebar contains a menu with items: SD-Card, Time, LAN, DDNS, OpenVPN, Mail, FTP send (highlighted), SCS Cloud, VDV, Authentication, Upgrade, Maintenance, and Sensor. The main content area is titled 'FTP server settings' and contains the following fields and options:

- Host:** ftp.syscom.ch
- Sub-directory:** Name-S/N (dropdown menu) with value mr3000-15400063
- Username:** Test
- Password:** Masked with dots
- Test FTP server:** A button with a play icon.
- Push mode:** Checked checkbox.
  - Preserve SD-Card hierarchy:** Checked checkbox.
- Backup mode:** Checked checkbox.
- Scheduling table:**

Type	Interval	Hour	Minute
Daily	once a day	8	0

Figure 5.3.7. Subsection dedicated to the FTP.

NOTE: The name of the main directory for a specific DMS (`main-dir/events/2014/...`) is what you have set-up as **Sub directory Name** of the DMS. If you change this setting, the DMS will generate a new directory on the FTP server.

### 5.3.8. SCS Cloud

## SCS

The MR3000 can be connected to the **SCS (Syscom Cloud Software)** to easily visualize the data coming from it. The web address of the cloud software is <http://scs.bartec-syscom.com>. The MR must have internet connection to communicate with the SCS. Please see the related tutorial video “LINK A MR3000 TO THE SCS” on the dedicated [webpage](#) to have more information about the peering MR3000-SCS.

In case of connection MR3000-SCS, the data are stored in a Swiss server.

NOTE: The Cloud option and the FTP send option (Section 5.3.7) can be activated in parallel.

NOTE: When using the SCS, please set the MR time to NTP (refer to Section 5.3.2).

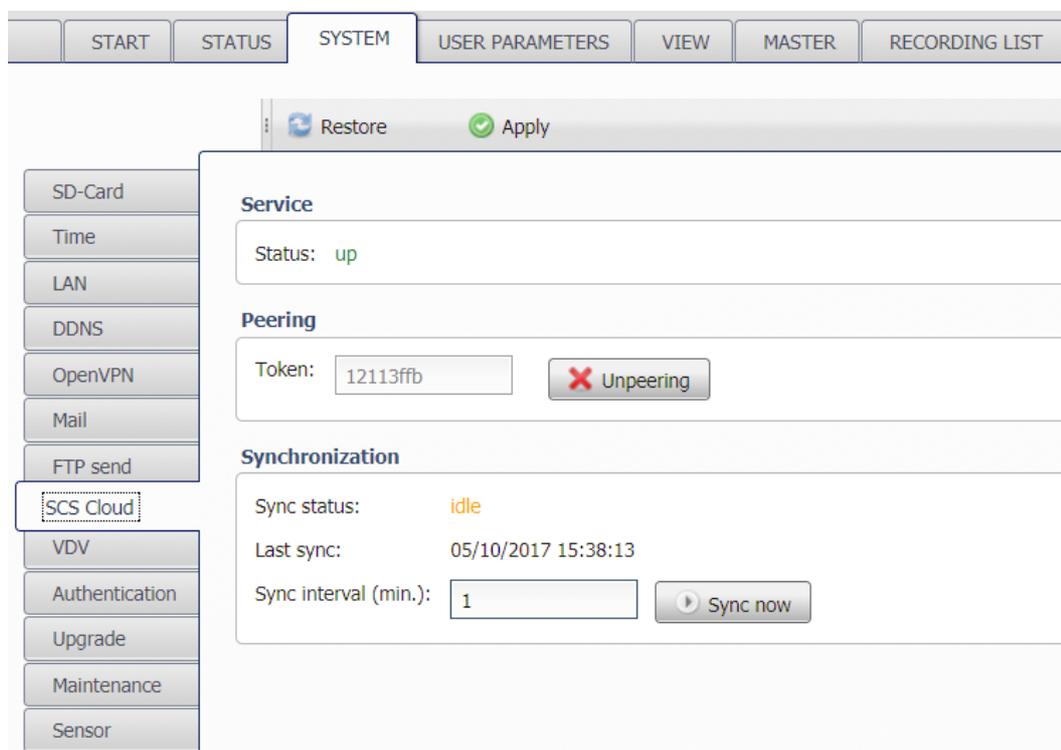


Figure 5.3.8. Subsection dedicated to the SCS Cloud software.

In the **Service** subsection, it is possible to see if the connection to the SCS is enabled or not.

In the **Peering** subsection, a code generated from the SCS cloud must be inserted. This allows connecting the MR3000 to the SCS cloud software. The command “Unpeering” allows eliminating the connection.

In the **Synchronization** subsection, the user can

- check the synchronization status with the SCS
- check the last synchronization to the cloud software
- select the interval between two synchronizations with the cloud software.

The synchronization with the cloud software is necessary because certain parameters related to the measurements can be also modified in the SCS cloud software. These parameters are:

- Name of the device
- Comment
- Trigger levels
- Alarm 1 parameters
- Alarm 2 parameters
- Background settings

During the synchronization, both the MR3000 firmware and the SCS check if the parameters have been changed. There are three cases:

1. The parameters have been changed only in the firmware → the SCS is updated during the synchronization;
2. The parameters have been changed only in the SCS → the firmware is updated during the synchronization;
3. The parameters have been changed in the firmware and in the SCS → the firmware has the priority, therefore the last values registered in the firmware are uploaded on the SCS during the synchronization.

For any additional information on the SCS cloud software, please refer to the dedicated page on the [website](#) or visit <http://scs.bartec-syscom.com>.

### 5.3.9. Authentication

Here you can change the password of the DMS. The password is used for the WebUI access and for the SFTP service (see chapter 4.3.1). By default, the password is the serial number of the DMS – shown as **UID** on the Status screen (see chapter 5.2).

Figure 5.3.9. Subsection dedicated to the authentication.

NOTE: please remember your password, if forgotten it is no more possible to access the DMS.

### 5.3.10. Upgrade

In this section, you find:

- The **Ping** button allows you to send a ping request to a Web site. It's useful if you want to know whether the MR has Internet connectivity. If you can ping a well-known Web site (e.g. *wikipedia.org*), if it succeeds, the Internet connection is working.
- The **Upgrade from remote server** part is used to do an upgrade of the MR's firmware. The MR needs an Internet connection for that. In order to upgrade to a new firmware, you need to know the URL for this upgrade. This is provided by SYSCOM when a new firmware is issued. For example:

[firmware.syscom-instruments.com/mr3000/2.0.6/mr3000-main-upgrade.json](http://firmware.syscom-instruments.com/mr3000/2.0.6/mr3000-main-upgrade.json)

Once you entered this URL in the field, click on the **Start** button. Upgrade takes 1 to 2 minutes, but it can be longer if the Internet connection is slow. The MR must not be turned off during the upgrade process. If an error happens, a message will be displayed on the LCD screen of the MR.

- The **Upgrade from files** feature allows to flash a new firmware directly from your PC, without Internet access on the MR. The internet access is needed only on your PC. In this case, please open a browser on your PC and insert the URL given by Syscom but without the final part. For example:

Entire URL: [firmware.syscom-instruments.com/mr3000/2.0.6/mr3000-main-upgrade.json](http://firmware.syscom-instruments.com/mr3000/2.0.6/mr3000-main-upgrade.json)

To be inserted in the browser: [firmware.syscom-instruments.com/mr3000/2.0.6](http://firmware.syscom-instruments.com/mr3000/2.0.6)

Then download the 6 files on your PC and successively upload them on the section "Upgrade from files". If the extension **.txt** is automatically added by your operating system (e.g. Windows), please delete it.

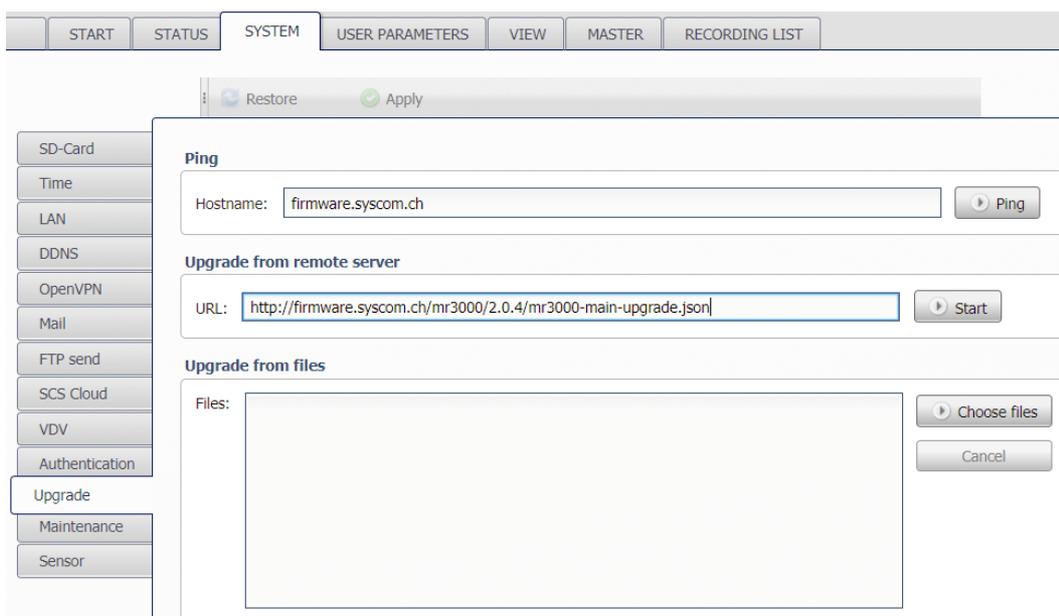


Figure 5.3.10. Subsection dedicated to the Upgrade.

NOTE: It is recommended to upgrade the MR3000 at the end of a monitoring session.

Please contact [support@bartec-syscom.com](mailto:support@bartec-syscom.com) for further clarifications.

### 5.3.11. Maintenance

Here you may generate a report of the system to make further investigations in case of trouble. The report is automatically downloaded to your PC.

**NOTE:** The log files and other variables used to generate the Diagnostic report are in volatile memory, do not switch of the DMS before the report is generated. Make a report as soon as a problem has been encountered. If you wait for too long time, the interesting part of the log file might be overwritten.

The Reboot button initiates a warm start of the DMS.

The **User Parameters** section is useful to import user parameters defined in other devices (or even in the same device), and to export them for future use. During the import phase, you can choose between a standard import operation, with all the parameters, and a custom importation, where you select not to modify the current WLAN setting, all the name and comment settings, and the ftp parameters.

**IMPORTANT:** If the parameters must be imported from MR1 to MR2, it is necessary that MR2 have the same firmware version of MR1 or a more recent version.

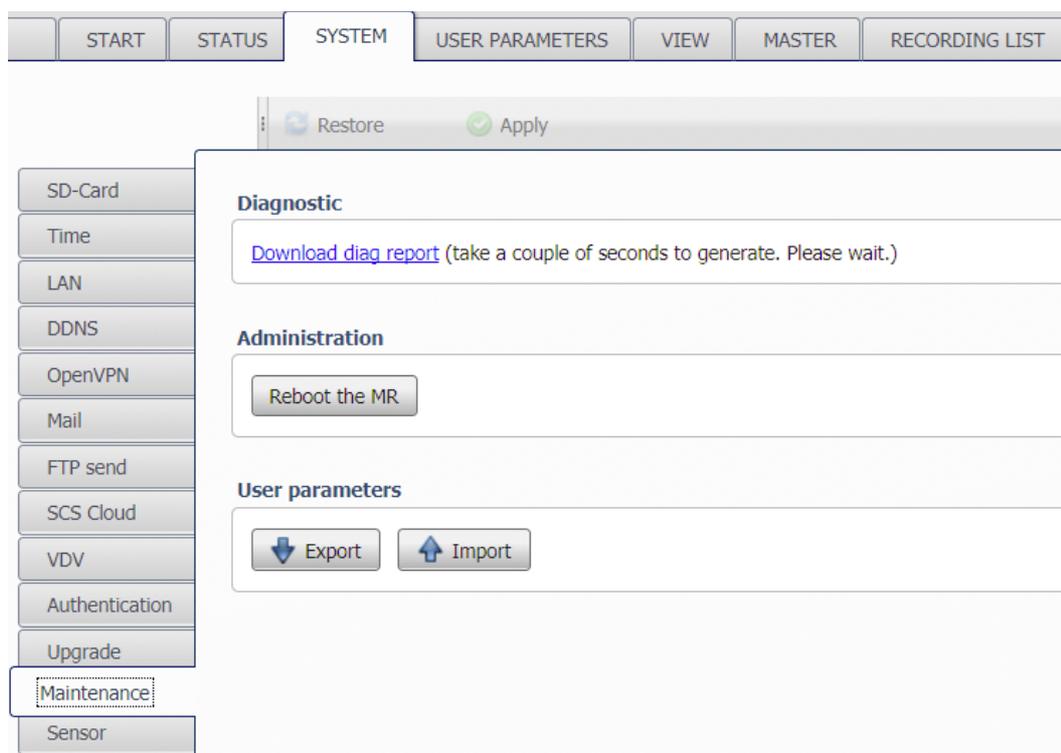


Figure 5.3.11. Subsection dedicated to the Maintenance.

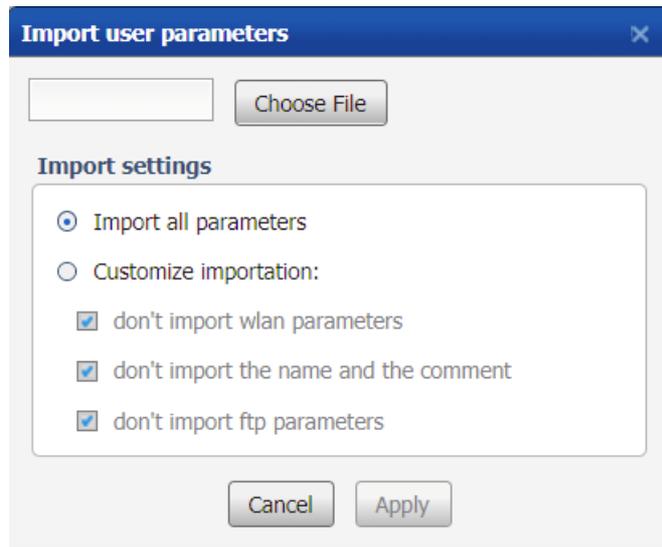


Figure 5.3.12. Subsection dedicated to the import of user parameters.

### 5.3.12. Sensor

Inside the current section, there is one subsection dedicated to the sensor of the MR3000DMS, which is an internal triaxial accelerometer.

Inside this section, the sensor model, the type, unit of measure and the serial number are indicated.

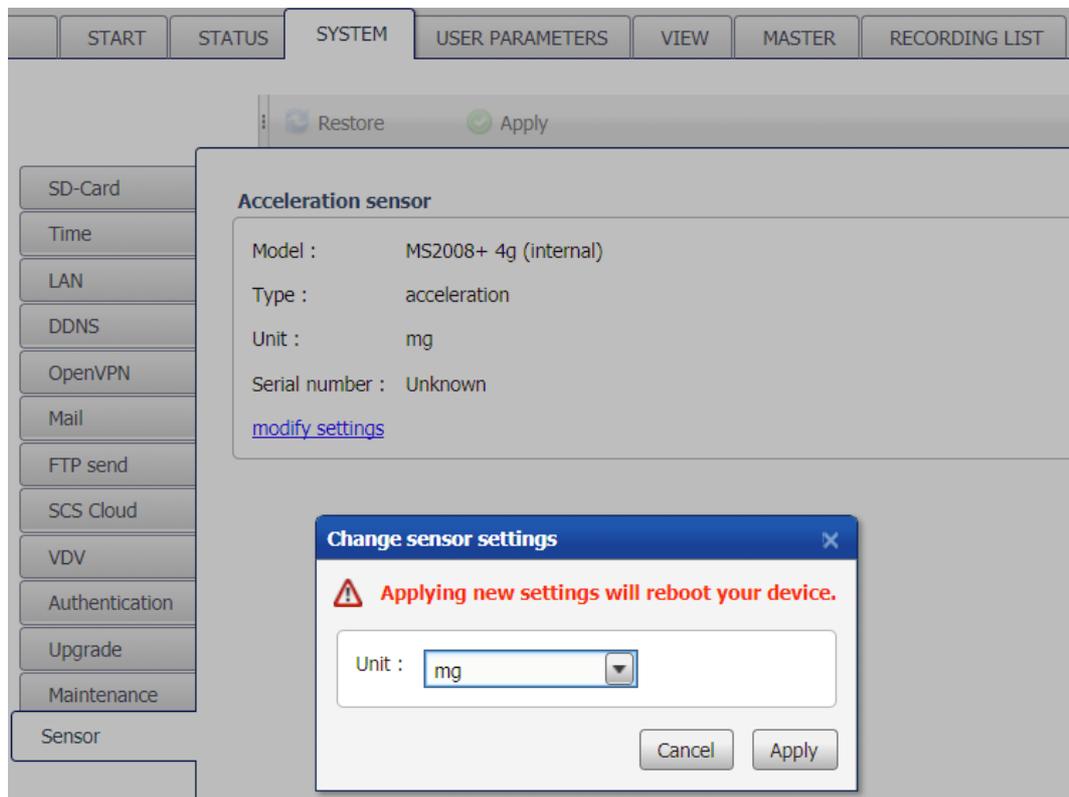


Figure 5.3.13. Subsection dedicated to the sensor settings with the selection of the desired unit of measure.

With **modify settings** you can modify the unit of measure of the sensor. It is possible to select metric or imperial units, in particular mg (default value) or m/s<sup>2</sup> or in/s<sup>2</sup>.

NOTE: if you do not want to change the settings please click on CANCEL, because otherwise the MR will reboot.

### 5.3.13. Monitoring

The section Monitoring has been added in firmware version 2.0.7. It includes the possibility to choose the warning level of the power supply voltage of the device.

In particular, two threshold levels must be indicated by the user:

- **warning threshold**, meaning that a warning is created when the voltage measured decreases below this level.
- **release threshold**, meaning that the warning condition is released when this level is exceeded.

The screenshot displays the 'SYSTEM' configuration page in the BARTEC SYSCOM web interface. The top navigation bar includes buttons for 'START', 'STATUS', 'SYSTEM' (selected), 'USER PARAMETERS', 'VIEW', 'MASTER', and 'RECORDING LIST'. Below the navigation bar, there are 'Restore' and 'Apply' buttons. A vertical sidebar on the left lists various system settings: SD-Card, Time, LAN, Wi-Fi, Mobile, DDNS, OpenVPN, Mail, FTP send, SCS Cloud, Authentication, Upgrade, Maintenance, Sensor, and Monitoring (highlighted with a dashed border). The main content area is titled 'Power supply' and contains the following settings:

- Enabled:
- Voltage (V):
  - 11 warning threshold
  - 11.5 release threshold

Figure 5.3.14. Subsection dedicated to the system monitoring.

## 5.4 User Parameters

In this part you set-up the parameters related to Alerting and the general parameters that are not related to data acquisition.

### 5.4.1. General

Here you can modify the **Name** (ID) of the DMS (by default mr3000, followed by a dash and the serial number UID of the DMS) and the **Comment** string.

- The **Name** may be used as the root-directory for the FTP service. No special characters and no spaces are allowed for the **Name**. The **Name** is written in the Header of each XMR / BMR file.
- The **Comment** string should describe the location of the DMS. It is intended to be included in the alarm messages. Special characters are allowed.

The screenshot shows a web-based interface for configuring user parameters. At the top, there is a navigation bar with buttons for 'START', 'STATUS', 'SYSTEM', 'USER PARAMETERS' (which is active), 'VIEW', 'MASTER', and 'RECORDING LIST'. Below this is a toolbar with 'Restore' and 'Apply' buttons. The main content area is divided into a left sidebar with a menu of options: 'General' (selected), 'Acquisition', 'Alarm', 'Notification', 'Daily message', 'Test pulse', 'Relays', and 'Advanced settings'. The 'General' section is titled 'Device information' and contains two input fields: 'Name' with the value 'mr3000-15400063' and a note '(allowed characters are A-Z a-z 0-9 \_-#.)', and 'Comment' which is currently empty.

Figure 5.4.1. Subsection dedicated to general information about the device.

### 5.4.2. Acquisition

You may override the default setting for **Sampling rate** and choose a higher sampling rate. You may also record the unfiltered data – keep in mind that there is always an anti-aliasing filter, cutting off the frequency contents above 80 % of Nyquist frequency (= half of the sampling rate).

**NOTE:** Higher sampling rates accumulate more data and create larger files.

In the MR3000DMS there is a band-pass trigger filter on the data between 0.5 and 15 Hz. This means that an event is created only if both the conditions are fulfilled:

- the trigger level is exceeded;
- the peak is associated to a frequency in the range 0.5 – 15 Hz.

**NOTE:** Values exceeding the trigger threshold do not necessarily lead to an event creation.

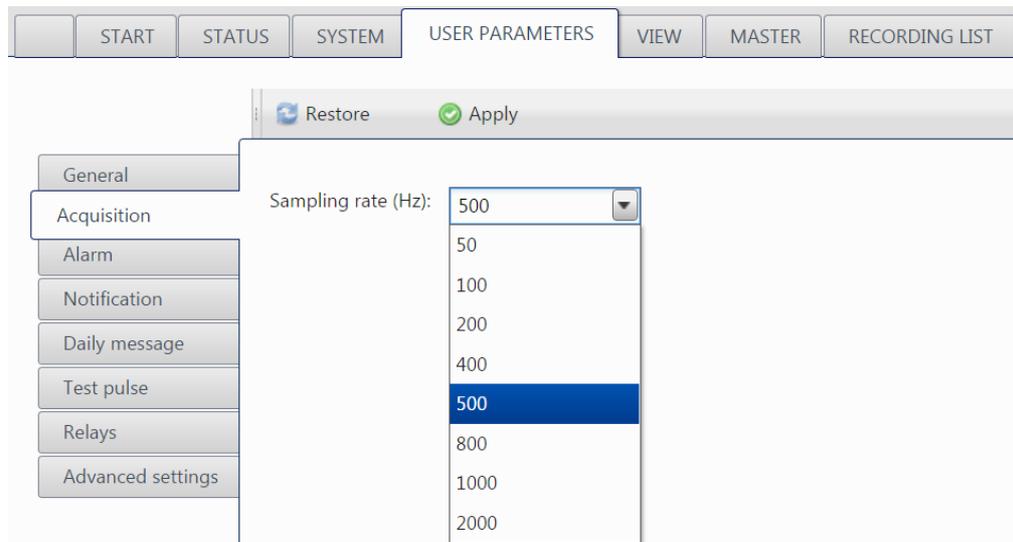


Figure 5.4.2. Subsection dedicated to system acquisition.

### 5.4.3. Alarm

The alarm service checks if the vibration exceeds the defined alarm threshold levels. In this case, the notification service of the MR3000 sends an e-mail to the people listed in contacts where Alarm 1 or Alarm 2 have been checked (see chapter 5.4.4).

**Indicator time (seconds)** is the period between the first exceeding of the alarm threshold and the end of the alarm condition. For event related alarms this setting is not relevant. For the difference between Alarm based and event based messages see chapter 5.4.4.

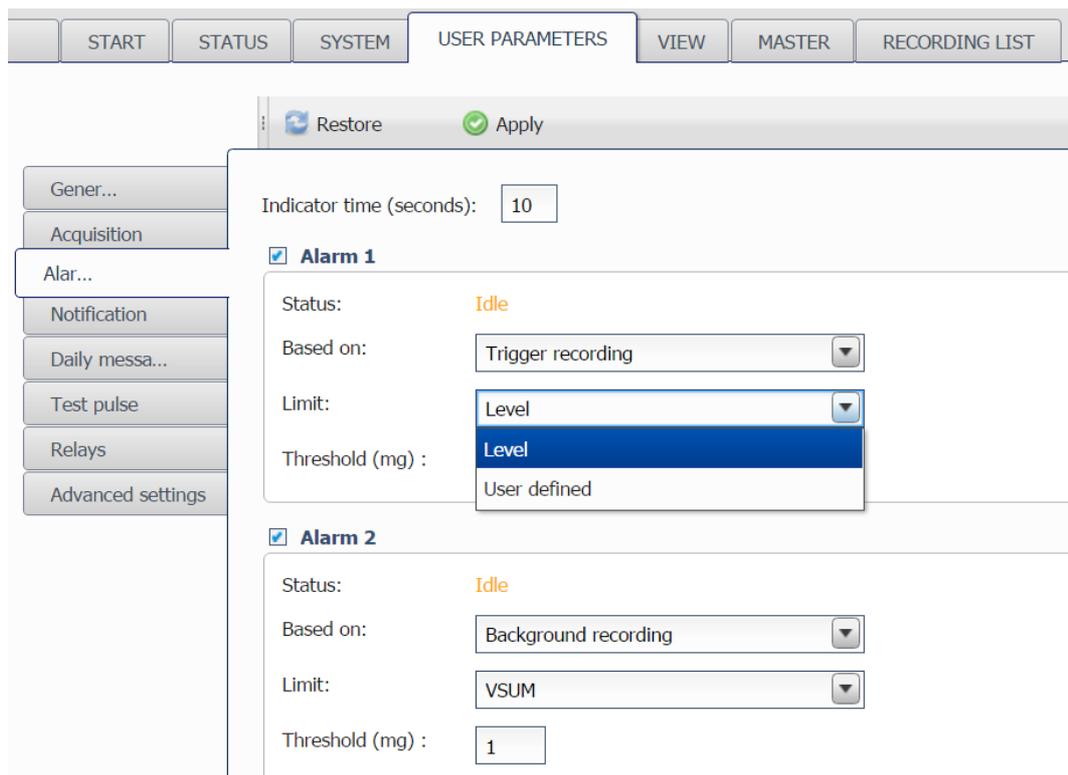


Figure 5.4.3. Subsection dedicated to the alarm settings.

It is possible to define two levels of alarms: alarms 1 and alarm 2. They can be configured completely independently.

In the field “Based on”, the alarm can be activated on the trigger or on the background recording. In the following, let us analyze the two situations separately.

### Trigger recording

Figure 5.4.3 shows the possibilities for the choice of the alarm limit, when the alarm has been selected on the trigger recording. The possibilities are:

- **Level**
- **User defined**

In case of “Level”, a threshold level for the 3 channels must be defined. The alarm is triggered if at least one of the three axes exceeds the limit value.

In case of “User defined”, a curve can be defined by the user, by inserting up to eight points for each channel. The acceleration limit can be defined depending on the frequency. In other words, the maximum peak and the relative dominant frequency represent a unique point to be placed on the graph and to be compared with the limit curve.

**Alarm 1: edit settings**

**User defined**

Name

**Help!**

- Right click on a table to insert or remove values
- Double click on a row of a table for editing
- Values must have **at most four digits** after decimal point
- Frequencies must be entered in **ascending order**
- Values in mg must be in the range **[0.1, 2000]**

X

Y

Z

Hz	(mg)
1	40
5	40
10	60
50	60

Hz	(mg)
1	50
10	50
30	100
50	100

Hz	(mg)
1	60
20	70
50	80
100	100

Figure 5.4.4. Settings of the user-defined norm.

Once chosen “User-defined”, clicking on “Edit” in the field “Settings” leads to another window, shown in Fig. 5.4.4. It is possible to give a name to the norm and then to add the desired number of

points for each channel. A maximum number of 8 points can be set for each channel. Moreover, each channel can be set completely independently, meaning that X can have 2 points, Y can have 4 points and Z no points. The button “Restore” allows to reset the name and the values defined.

NOTE: If an alarm is defined on a user-defined norm, it is not possible to set the trigger value higher than the alarm threshold. The reason is the fact that the frequency must be calculated and therefore an event must be created. Contrarily, in case the alarm is based on “Level”, the trigger can be chosen even higher than the alarm level.

### Background recording

The alarms can be based also on background recording. It is possible to have simultaneously an alarm on the background recording and another one on the trigger recording.

The possibilities for the background recording are:

- **VSUM**
- **User defined**

In case of “VSUM”, a threshold level for the Vector Sum of the 3 channels must be defined. If this option is activated, in the section Start → Background recording, the mode “Peak + Vector sum” must be activated (Subsection 5.1.4).

If the choice of the alarm is the “User-defined” norm, then clicking on “Edit” in the field “Settings” leads to another window, shown in Fig. 5.4.5. It is possible to give a name to the norm and then to add the desired number of points for each channel. A maximum number of 8 points can be set for each channel. Moreover, each channel can be set completely independently, meaning for example that X can have 4 points, Y no points and Z 3 points. The button “Restore” allows to reset the name and the values defined.

**Alarm 2: edit settings**

**User defined**

Name:

**Help!**

- Right click on a table to insert or remove values
- Double click on a row of a table for editing
- Values must have **at most four digits** after decimal point
- Frequencies must be entered in **ascending order**
- Values in mg must be in the range **[0.1, 2000]**

X		Y		Z	
Hz	(mg)	Hz	(mg)	Hz	(mg)
1	15	1	50	1	70
10	30	100	50	100	70
100	50				

ok restore

Figure 5.4.5. Settings for a user-defined norm for a background recording.

If the user defined norm is activated, in the section Start → Background recording, a mode including the dominant frequency must be also activated (Subsection 5.1.4).

The screenshot shows the 'USER PARAMETERS' tab in the software interface. On the left, a sidebar contains menu items: General, Acquisition, Alarm (highlighted), Notification, Daily message, and Advanced settings. The main area displays two alarm configurations:

- Alarm 1:**
  - Indicator time (seconds): 10
  - Status: Idle
  - Based on: Background recording
  - Limit: VSUM
  - Threshold (mm/s): 100
- Alarm 2:**
  - Status: Idle
  - Based on: Background recording
  - Limit: User defined
  - Settings: Name: Test background (with an 'edit' button)

Figure 5.4.6. Configuration of the alarms causing a warning.

The figure consists of two parts, a) and b):

**a)** Screenshot of the 'Background recording' configuration. The 'Background recording' menu item is selected in the sidebar. The main area shows the following settings:

- Enabled
- Mode: Peak + Dominant Frequency
- Period (seconds): 30
- Duration of a file (hours): 6
- Number of samples in file: 720

**b)** Screenshot of the 'Configuration issues' section. It displays a table with the following content:

Level	Message
Warning	Alarm1 cannot happen.

Figure 5.4.7. a) Setting of the background recording; b) Warning message caused by the definition of the alarm as in Fig. 5.4.6.

NOTE: A configuration like in Fig. 5.4.6 is not correct because the MR3000 is not able to save the vector sum and the dominant frequency at the same time (Subsection 5.1.4). For example, if the option “Peak + Dominant Frequency” has been selected, then a warning indicating that Alarm 1 cannot happen is shown (Fig. 5.4.7).

#### 5.4.4. Notification

In this section it is possible to:

- Create contacts to whom the emails related to the monitoring are sent. The subsection is called “Contacts”.
- Decide how to configure the notification messages. The subsection is called “Messages”.

The MR3000 is able to automatically send emails with the desired options to the user-defined contacts.

**Add contact**

**Contact details**

Name: Bartec Syscom

E-mail: info@bartec-syscom.com

**Messages**

**Recordings**

Trigger events

All

Only those that reach alarm 1 or 2

**Alarms**

Alarm 1

Alarm 2

**State of health**

Test pulse

SD-Card ?

Battery ?

**Miscellaneous**

Daily message

**Network**

Common Alarm 1

OK Cancel

Figure 5.4.8. Setting of a contact with related messages.

### Contacts

In this subsection, it is possible to add Contacts for the notification service. Contacts are people who receive notification from the MR3000. To add a new contact click on the **Add** button. To edit a contact, just click the corresponding line. Clicking the **Del** button will delete the corresponding contact.

Once clicked on a contact line or on the add button, a window like in Fig. 5.4.8 is shown. In the first part (**Contact details**), it is possible to insert name and e-mail of the contact. In the second part (**Messages**), the user can choose the desired messages to be sent to the contact.

The condition to trigger a message can either be related to **Event recording** or – regardless of the recording of an event – when the vibration reaches the **Alarm** threshold (see Section 5.4.3). The difference between the two methods is:

- Alarm messages related to Event recording include additional information, like the event peak, peak of the vector sum of the event and the dominant frequency of the event. To use this option, you have to make sure that the trigger threshold is below the alarm threshold. Such messages are sent immediately after the event is recorded, i.e. the vibration is again below the threshold level or the max recording time has elapsed (see Section 5.4.3).

Messages sent to an E-Mail address may additionally include a graphical presentation of the waveform data (PNG graphics). The waveform data and the FFT are NOT calculated if the duration of the event exceeds 60 seconds (@ 1000 sps sampling rate).

- Alarm messages based on the **Alarm** threshold are independent from event recording. They are sent immediately after the alarm threshold is exceeded. In that case, the alarm threshold can be also set below the alarm threshold.

Additionally you may send other information to any of the contacts, as for example a **Daily Message** (see Section 5.4.5), as you can see in the following section “Messages”.

If the **Network** option is active, there are additional messages for common Alarm and common trigger (see Section 5.6).

After having changed something on the contact list, don't forget to click on the Apply button.

In Fig. 5.4.9 the main page related to contacts is displayed. In each line, the selected messages for the related contact are highlighted.

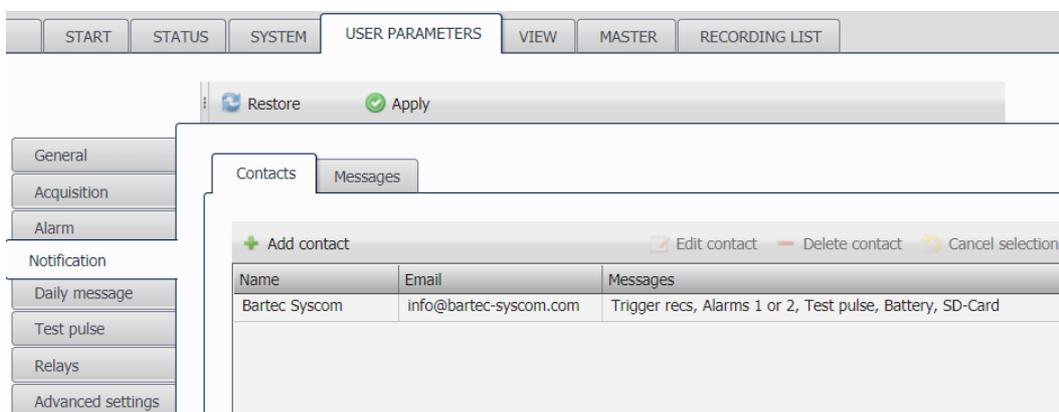


Figure 5.4.9. Summary of contact definition.

### Messages

In this section the user can configure each type of notification by inserting the desired information. In details, it is possible to set the following messages:

- Trigger event
- Alarm 1
- Alarm 2
- Daily messages
- Test pulse
- SD Card state of health
- Battery state of health

In Fig. 5.4.10, two windows related to the different messages are shown. In case of Alarm 1, Alarm 2 and Daily message, the user can also add a comment, that will be displayed in the message.

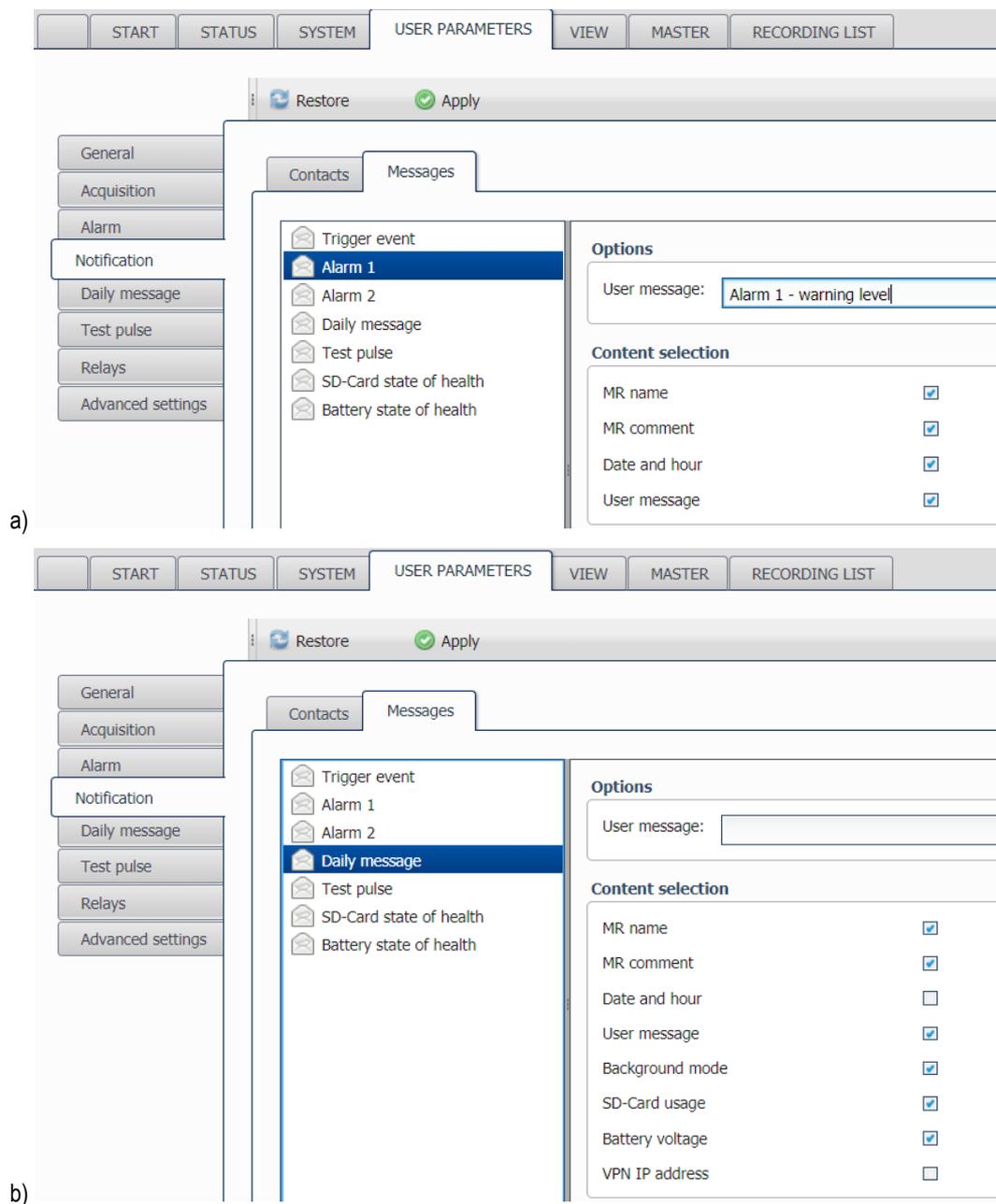


Figure 5.4.10. Subsection dedicated the notifications, for the selection of messages.

### 5.4.5. Daily message

This service sends you an e-mail notification every day. You can set-up the **Time** when you wish to receive this notification. Some information is automatically appended: the number of events, the memory available, the lifetime of the SD-Card and the background mode.

The recipients of this message are set-up in the section contacts – see the subsection 5.4.4. You can also receive this information once the device is switched on.

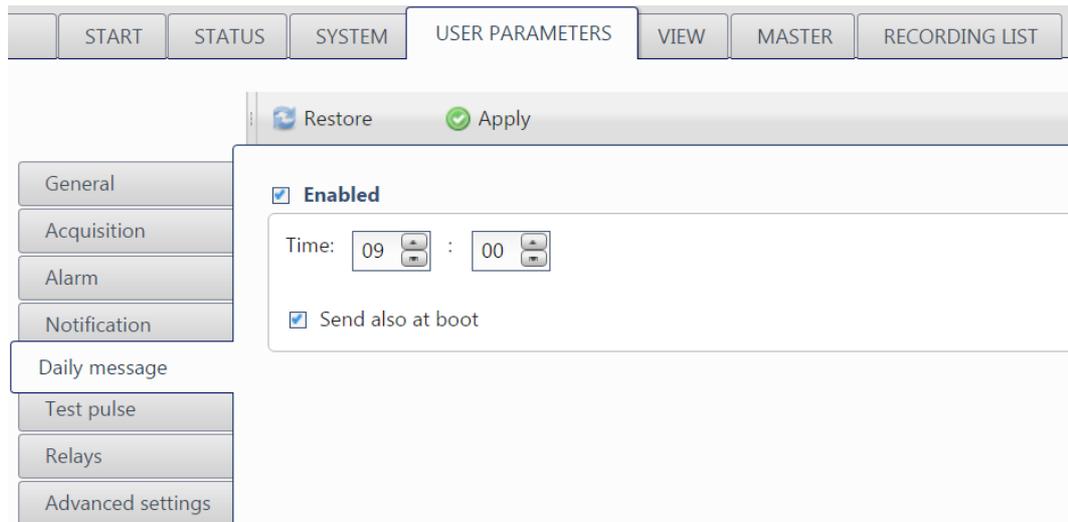


Figure 5.4.11. Subsection dedicated to the daily message.

### 5.4.6. Test Pulse

The test pulse function is useful to test the instrument by creating a pulse. You can do that:

- periodically, by indicating the desired interval between successive tests
- manually, by clicking on the “Start test pulse” button.

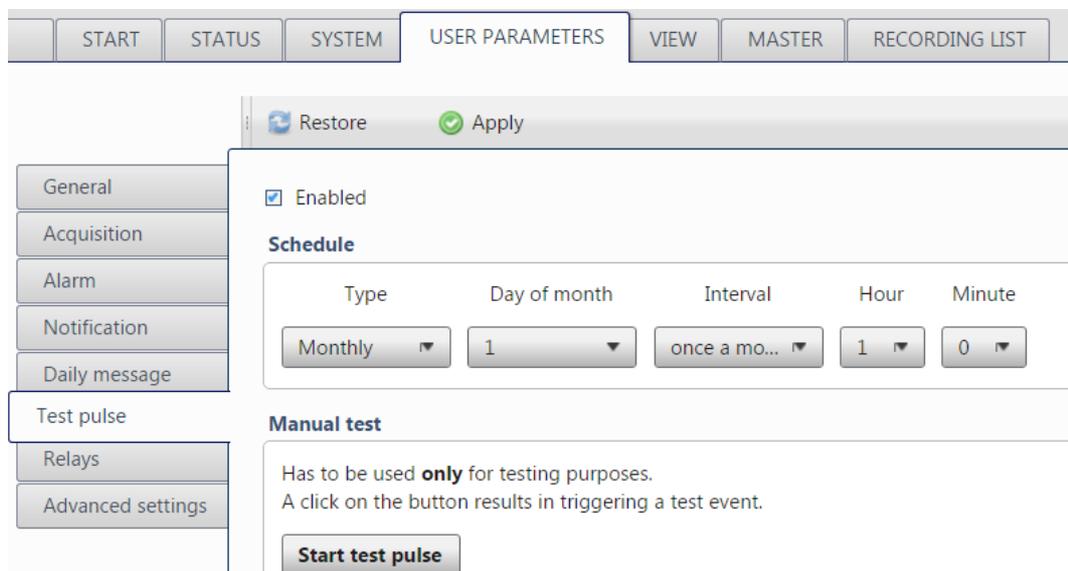


Figure 5.4.12. Subsection dedicated to the test pulse.

### 5.4.7. Relays

In the section dedicated to relays, you can configure each of the relays present inside the MR3000. In particular:

- The parameter connected to a certain relay:
  - **Alarm 1 and Alarm 2:** the relay is activated when the related alarm threshold is exceeded.
  - **Trigger:** the relay is activated when an event (created by a trigger) is recorded.
  - **Error:** the relay is activated when an error is detected
  - **Error and warning:** the relay is activated when an error or a warning is detected.
  - **Recording:** the relay is activated at the beginning of a recording of a manual recording, a timed recording, a trigger recording, a common trigger recording or a hardware trigger recording. The test pulse is not taken into account.
  - **Common Alarm 1, common Alarm 2 and common trigger** are available only for the master device in a network of different interconnected devices.
- How long the relay remains activated (Holding time), if the latch condition is not selected.
- If the relay is latched.
- If in the default state the relay is powered or unpowered.

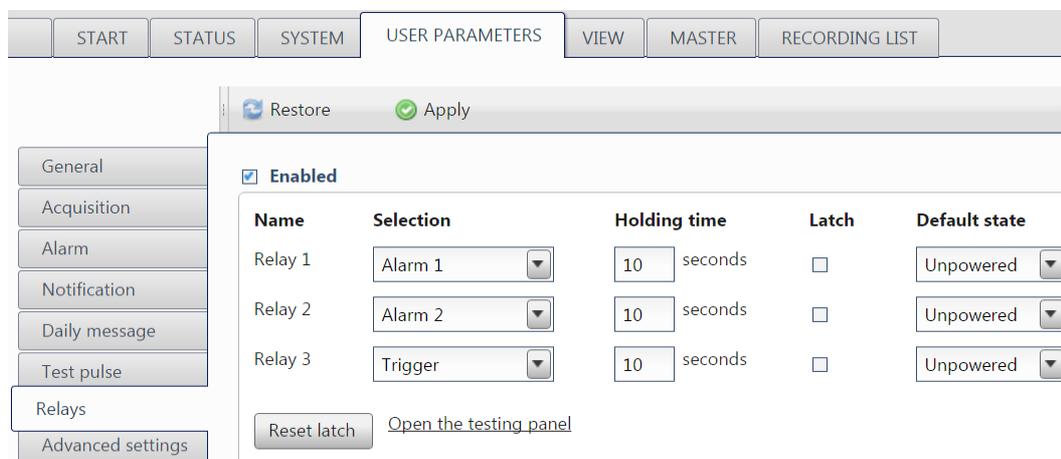


Figure 5.4.13. Subsection dedicated to the relays.

### 5.4.8. Advanced settings

This section is divided in Recording settings and Traffic settings.

In **Event recording settings** you can choose between two file formats:

- **XMR**, the proprietary format prepared by Bartec Syscom for events.
- **ASCII**, a simple format where all the data recorded is put in a simple text file. It is convenient if you plan to use software like *GNU Octave*, *Matlab* or other commercial software to view and process your data.

Moreover, you can choose the maximum duration for manual events. This means that if you do not stop the measure, the entire measure is divided in files having the duration set at this point. Limitation for triggered recordings can be set in chapter 5.1.2.

In **Background recording settings** you can choose between two file formats:

- **BMR**, the proprietary format prepared by Bartec Syscom for background files.
- **ASCII** format

In **Traffic settings** you can set-up how often the background files are pushed to the server, choosing a value included from 1 to 60 minutes. Moreover, you can choose to push the files after a trigger event.

Figure 5.4.14. Subsection dedicated to advanced settings.

## 5.5 VIEW

### 5.5.1. Acquisition

This service provides a real-time display of the waveform data, as they are recorded if the trigger criteria (see Section 5.1.2) are fulfilled. The data are filtered and the sampling rate is as set in Acquisition (see Section 5.4.2).

Each axis can be unselected, so that you can display only one axis if you want.

The **Query refresh period** is the period between two requests from your computer to the DMS. If you set it to a small value (like 100ms), the display is smooth, but also requires more CPU time on your computer. If you see that the display is slow, you should increase the query refresh period to e.g. 10 seconds.

The **Sample grouping** tells how many samples represent 1 pixel. If you set it to 1, the line displayed represents exactly the signal at the same rate of that used for the acquisition. If you want to have time to see what it is happening, you must increase this value. As a result, the display is slower, and the line becomes an approximation of the signal – one pixel represents the mean value of a group of samples – this has the same effect as applying a low-pass filter to the signal. Behind

the line, with the same color but lighter shade, the envelope of the signal (with the true peaks) is drawn.

The **Vertical zooming**, or simply zoom, is exactly what its name suggests. A value of 1 means no zooming; a value of 100 means that signal is multiplied by 100.

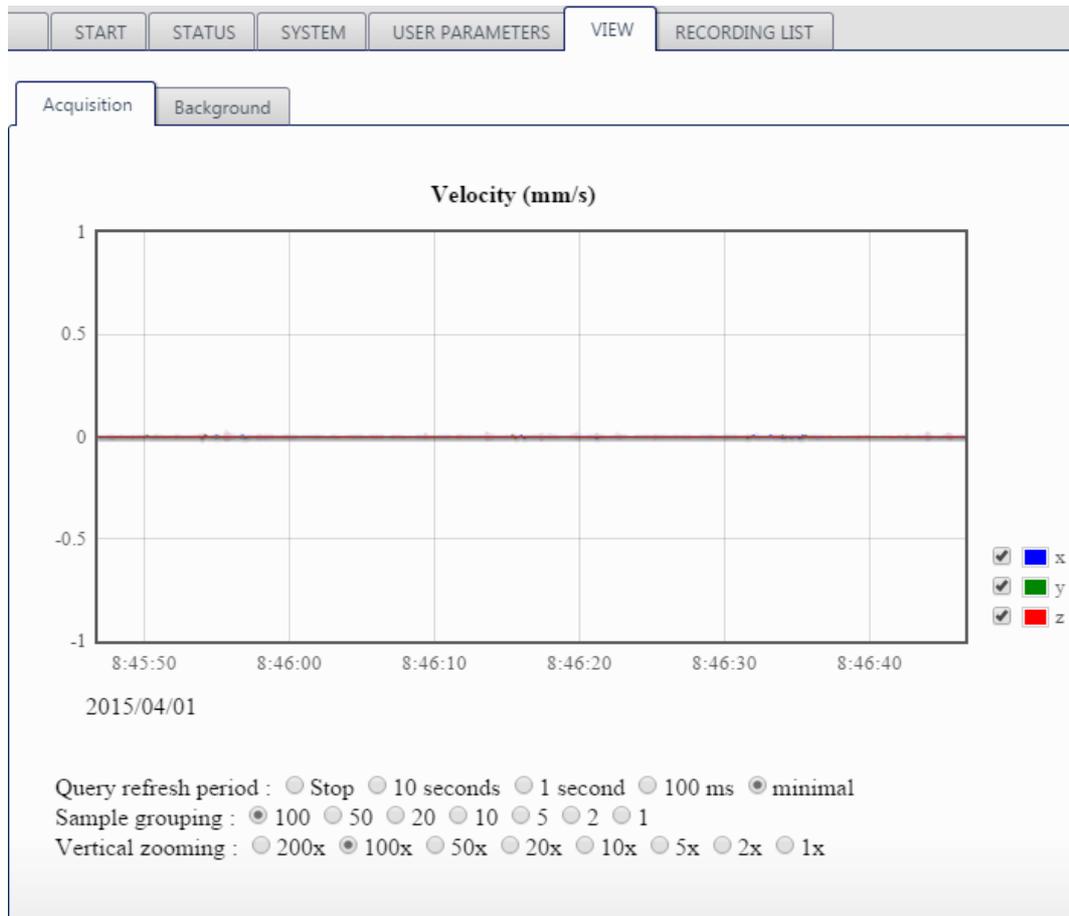


Figure 5.5.1. Real-time visualization of data.

## 5.5.2. Background

This service provides a real-time display of the vibration level of the past (background file). This presumes that background recording is active (see chapter 5.1.4).

The settings are the same as for the waveform display (Acquisition – see above). Additionally you can move the display with the arrows. You can see at least one day back in time, probably more. It depends on the period you set in the background settings. The simple arrows allow you to move forward or backward, and the double arrows send you back at the beginning or the end of the graph.

If you are positioned at the end of the graph, it will scroll by itself when a new sample arrives.

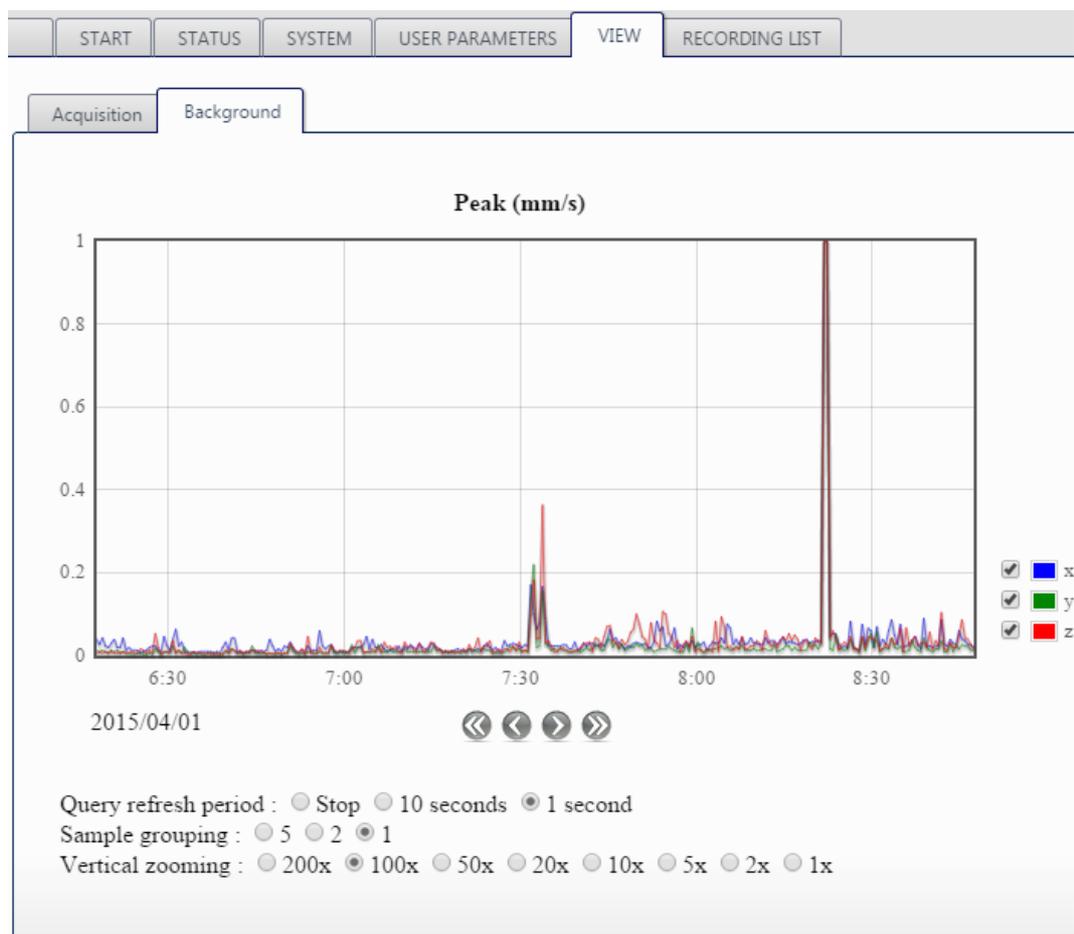


Figure 5.5.2. Real-time visualization of background data.

## 5.6 Master functionality

To use this feature the option must be activated in one of the instruments – the **Master**. The other instruments are standard instruments – called **Slaves**. Communication in the network is handled by the Master.

With this feature up to 32 MR3000DMS or MR3000C can be integrated in a network to perform common sampling, common trigger and common alarm.

Common sampling means that all the MRs in the network are synchronized. This is essential when studying wave propagation, modal analysis and cross-correlation. This is achieved by synchronizing the clocks of all MRs in the network by one single MR (not necessarily the Master). This MR may be equipped with a GPS clock or itself be synchronized by an NTP server. If common sampling is not needed, all MRs in the network may be configured to individually synchronize to an external NTP server (default setting).

Common trigger means that all MRs in the network start recording if a single MR or a group of MRs meet the trigger criteria. A group is defined by a logical AND combination of individual MRs. It is possible to define several groups. The groups are combined with a logical OR condition.

Common alarm provides an alarm voting logic. The set-up is – similar to the common trigger – made by logical AND and OR combinations.

### 5.6.1. Config / Status and Master/slave configuration

Here you define which MRs are part of the network. Simply **add** the IP-address of the MR. The Master itself *must* be included (simply check the **itself** box). The IP address of the Master could be shown as 127.0.0.1 (localhost) or as its own IP address (Figure 5.6.1).

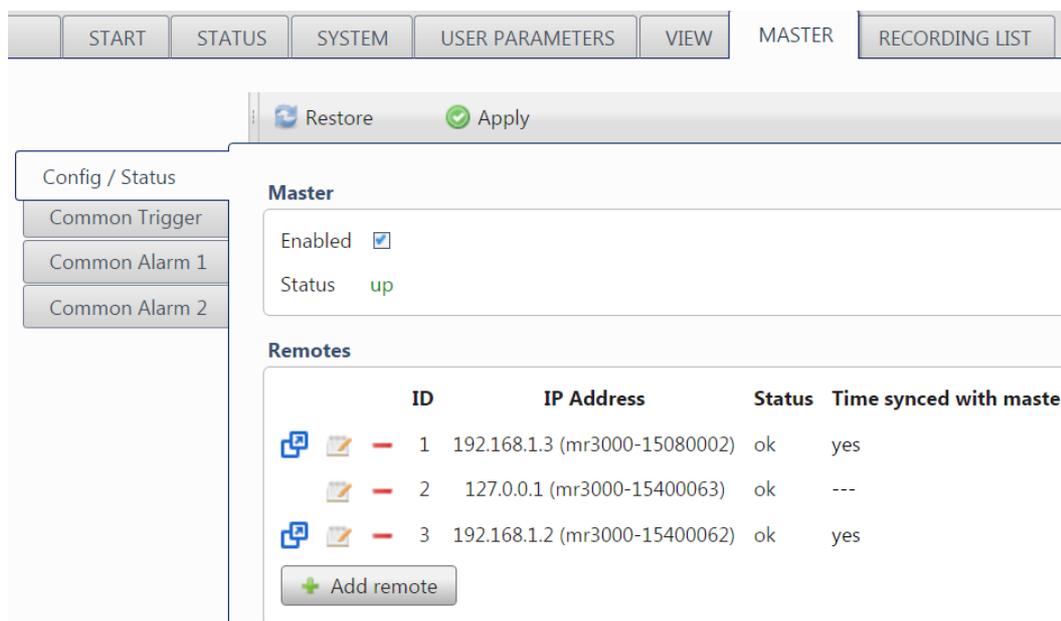


Figure 5.6.1. Subsection dedicated to the configuration of the network.

If the MRs are connected by wire in the same physical network, you use the real IP address (as shown on the LCD of each MR). If the MRs have a virtual address (VPN address) in addition to the physical address, you better use the virtual address. Don't forget to check the **Enabled** box and click on **Apply**.

The column **MRs status** should show ok: this means the Master is able to communicate with the Slave. The column **Time synced with master** should show **yes**. This means the time difference in the corresponding MR is less than 3 seconds compared to the Master. This is usually the case if all MRs have access to a NTP server in the Internet or if a specific MR in the network is acting as time server. If you have an MR as internal time server, configure all other MRs to use the IP address of this MR as NTP server. (see chapter 5.3.2).

In the example proposed in Figure 5.6.1, three MRs are connected on the same local network, and the IP address has been changed manually.

NOTE: the time synchronization might take few minutes to be synchronized at start.

### 5.6.2. Common Trigger

Here you define the conditions for a common trigger, named recording in all MRs in the network. Each line contains a condition, the lines are logically OR combined. A condition might be a single MR or a group of different MRs. If more than 1 MR is defined, the trigger condition in the single MR must occur within 3 seconds.

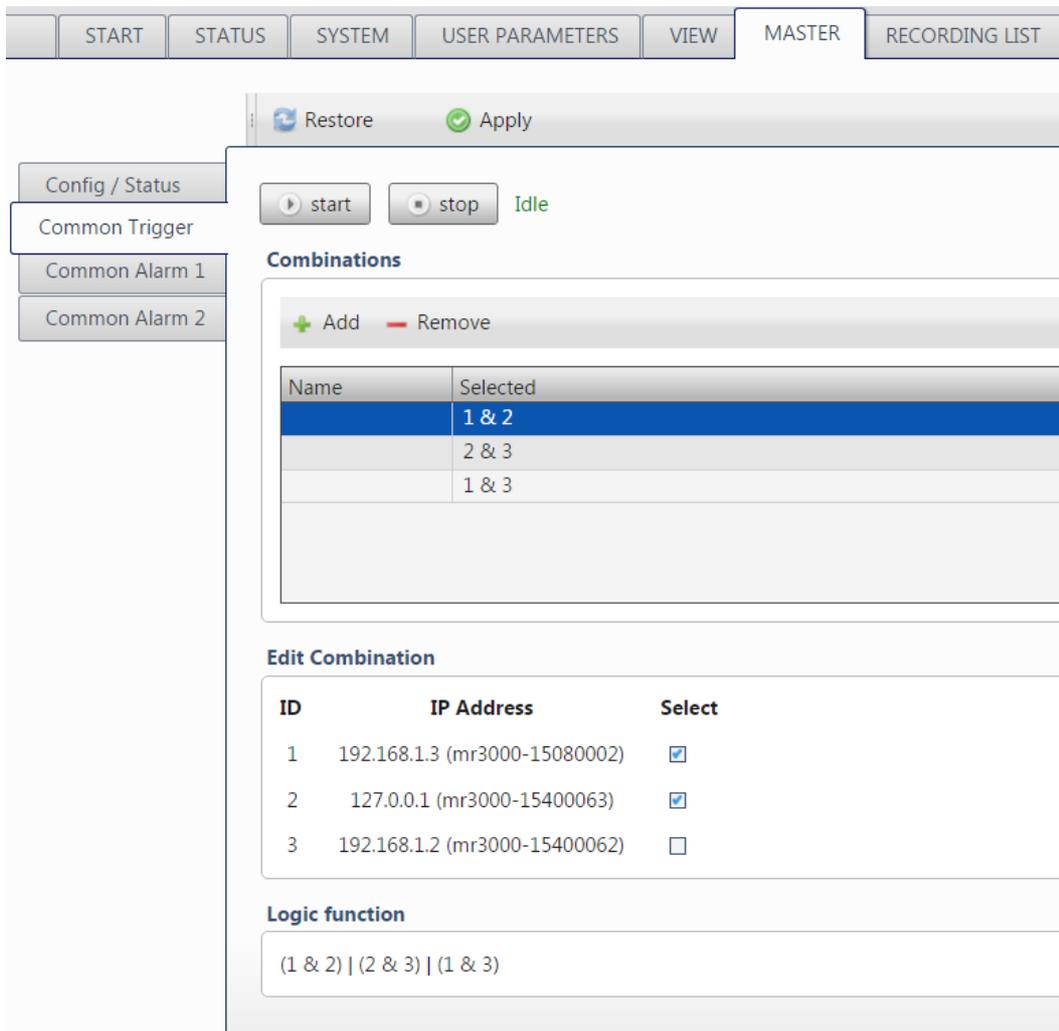


Figure 5.6.2. Subsection dedicated to the setting of the common trigger.

Click on the **Add** button to set-up a new condition. Click in the **Edit combination** section the **select** box for the single MRs. In the column **Name** you may enter a mnemonic for this condition (e.g. MR in cellar). In the column **Selected** the logical combination of this condition is shown. The logical combination of all conditions is shown in the section **Logic function**.

A simple example is here presented. You have to install 2 instruments to monitor the vibration in a 5-floors building (or 5 measurement points on a dam). 1 MR is in the cellar, one MR in the middle of the room on the 5th floor. As there is a lot of activity in the room on the 5th floor, you don't want to use a trigger (disable the trigger) on this instrument, but you would like to have a recording on this instrument if the vibration in the cellar exceeds the threshold level. For this simple example, the MR in the cellar alone can issue a common trigger, so you have one single condition and you check only the MR in the cellar.

If a file is recorded due to a common trigger condition, this is shown in the **Recording List** with the entry **Common** in the column **Reason**. If at the same time in the corresponding MR also the local criteria for triggering were met, there will be 2 recordings of the same time history, but with different starting time and duration – the file recorded due to the common trigger overlaps the file due to the local trigger. The files due to common trigger have the same start time and the same duration in all the MRs in the network.

To get only files due to a common trigger from the **Recording list**, you will have to apply a filter for the **Reason**.

### 5.6.3. Common Alarm 1 and 2

Common Alarm means that there is a voting logic for the alarms. Here you define the conditions for the voting logic. The procedure is exactly the same as for the common trigger. Make sure to activate the **Common Alarm** in the tab Contacts to get a message if there is a common alarm.

The screenshot displays the configuration interface for Common Alarm 1 and 2. At the top, there are navigation tabs: START, STATUS, SYSTEM, USER PARAMETERS, VIEW, MASTER, and RECORDING LIST. Below these, there are buttons for 'Restore' and 'Apply'. The left sidebar contains a menu with 'Config / Status', 'Common Trigger', 'Common Alarm 1', and 'Common Alarm 2'. The main content area is titled 'Combinations' and includes a '+ Add - Remove' control. A table lists combinations with columns 'Name' and 'Selected':

Name	Selected
1 & 2	<input checked="" type="checkbox"/>
1 & 3	<input type="checkbox"/>
2 & 3	<input type="checkbox"/>

Below the combinations table is the 'Edit Combination' section, which contains a table with columns 'ID', 'IP Address', and 'Select':

ID	IP Address	Select
1	192.168.1.3 (mr3000-15080002)	<input checked="" type="checkbox"/>
2	127.0.0.1 (mr3000-15400063)	<input checked="" type="checkbox"/>
3	192.168.1.2 (mr3000-15400062)	<input type="checkbox"/>

The 'Logic function' section shows the expression: (1 & 2) | (1 & 3) | (2 & 3)

Figure 5.6.3. Subsection dedicated to the common alarms.

## 5.7 Recording List

On this tab you may select single files for immediate download – it is called “interactive mode” (similar as VIEW > EVENT for the MR2002). All the files in the memory are presented in chronological order (default). You may change the sorting order by clicking on the corresponding column title. For each file the **Peak** values, the recording **Duration**, the file **Type** and the **Reason** for the recording are shown.

Use the arrow keys << >> at the upper right edge to go to the first / last page, the simple arrows < > go the next/previous page.

If you move the mouse over a single line, additional detail information for this file is shown. Clicking on the line will start an immediate download of the file. If you have EAWlight (the WINDOWS

software to visualize the data) installed, the file (peak or event) is shown immediately. You may use EAWlight to perform a Frequency Analysis (FFT) of the waveform and to print the waveform.

You may select several files and then click on the **Download** button. The files are packed in a single Zip-File and transferred to the PC. The Zip-File is stored in the DOWNLOAD directory of the PC.

The screenshot displays the 'Recording list' section of the software interface. At the top, there are navigation tabs: START, STATUS, SYSTEM, USER PARAMETERS, VIEW, and RECORDING LIST. The 'Recording list' section shows a table with the following columns: Sel, Type, Reason, Date / Time, Duration, Peak X, Peak Y, and Peak Z. The table contains 11 rows of data, with the 10th row highlighted in red. A tooltip is visible over the 10th row, displaying the following information:

Sel	Type	Reason	Date / Time	Duration	Peak X	Peak Y	Peak Z
<input type="checkbox"/>	B	Continuous	2015-07-07 20:15:03	01h 00m 00.0s	0.143	0.0949	0.165
<input type="checkbox"/>	B	Continuous	2015-07-07 19:15:03	01h 00m 00.0s	0.559	0.343	0.253
<input type="checkbox"/>	B	Continuous	2015-07-07 18:15:03	01h 00m 00.0s	0.306	0.168	0.105
<input type="checkbox"/>	B	Continuous	2015-07-07 17:15:03	01h 00m 00.0s	0.745	0.352	0.295
<input type="checkbox"/>	B	Continuous	2015-07-07 16:15:03	01h 00m 00.0s	0.359	0.357	0.545
<input type="checkbox"/>	B	Continuous	2015-07-07 15:15:03	01h 00m 00.0s	0.368	0.227	0.157
<input type="checkbox"/>	B	Continuous	2015-07-07 14:15:03	01h 00m 00.0s	0.443	0.263	0.188
<input type="checkbox"/>	B	Continuous	2015-07-07 13:15:03	01h 00m 00.0s	0.298	0.224	0.190
<input type="checkbox"/>	B	Continuous	2015-07-07 12:15:03	01h 00m 00.0s	0.460	0.336	0.344
<input checked="" type="checkbox"/>	E	Trigger	2015-07-07 10:39:05	02.0s	8.40	18.8	1.68
<input type="checkbox"/>	E	Trigger	2015-07-07 10:39:05	02.3s	5.54	22.9	3.81
<input type="checkbox"/>	B	Continuous	2015-07-07 10:39:05	03h 12m 00.0s	8.40	22.9	3.81
<input type="checkbox"/>	B	Continuous	2015-07-07 10:39:05	24h 00m 00.0s	9.21	9.35	5.46
<input type="checkbox"/>	B	Continuous	2015-07-07 10:39:05	24h 00m 00.0s	0.450	0.287	0.317

The tooltip for the selected row (10th row) contains the following details:

- Date / Time: 2015-07-07 10:39:05
- Type: Event
- Reason: Trigger
- File: /events/2015/07/07/15188002.XMR
- Size: 7.3 kB
- Number of sample: 801
- Sample rate: 400
- Duration: 2.0025 [s]
- Peaks: 8.40 / 18.8 / 1.68 [mm/s]

Below the table, there is a 'Selected recording list' section with a 'Download' button and an 'Add' button.

Figure 5.7.1. Section dedicated to the recording list.

A more sophisticated method is to enable the **Filters** section and to click on the **Add** button (see Figure 5.7.2). You may then select all the files matching certain criteria (e.g. all the files that have been recorded since a specific date). You may use more than one line to narrow down your selection.

**NOTE:** It is recommended to erase the SD-card at the beginning of the measurements at a specific location and to keep all the files on the SD-card throughout the whole monitoring period. In order to have seamless (without any interruption) recordings (peak files if the vibration level was below the trigger threshold or additionally event files if the vibration level exceeds the trigger threshold) throughout the whole monitoring period, it is NOT possible to erase single files. The SD-card is considered as documentary evidence.

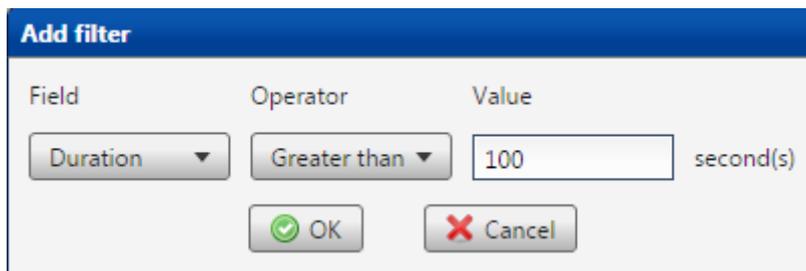


Figure 5.7.2. Subsection dedicated to the filters for the recording list.

## 5.8 System warning

In case there are anomalous settings about the parameters of the MR3000DMS, warning or errors will be displayed in order to alert the user.

For example, if the user does not activate the alarms but he wants to receive the mails also with notification of the alarm then, immediately after confirmed the operation with the “Apply” button, the program will show a warning at the top left of the user interface.

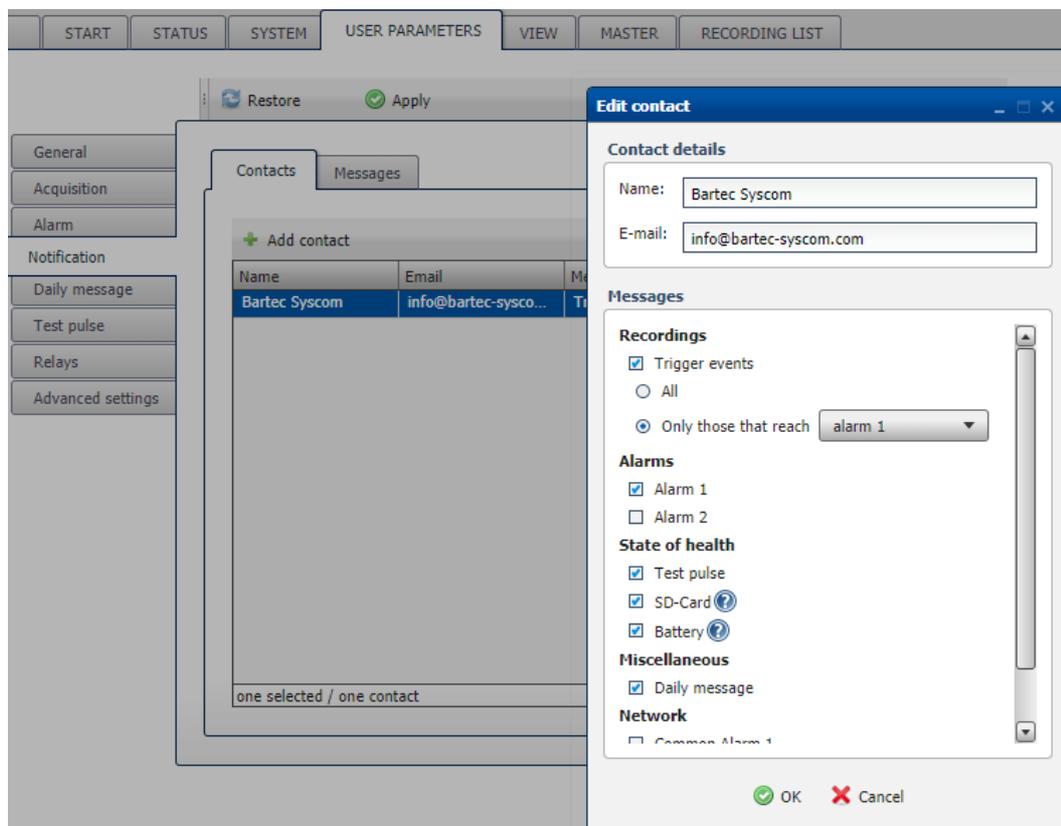
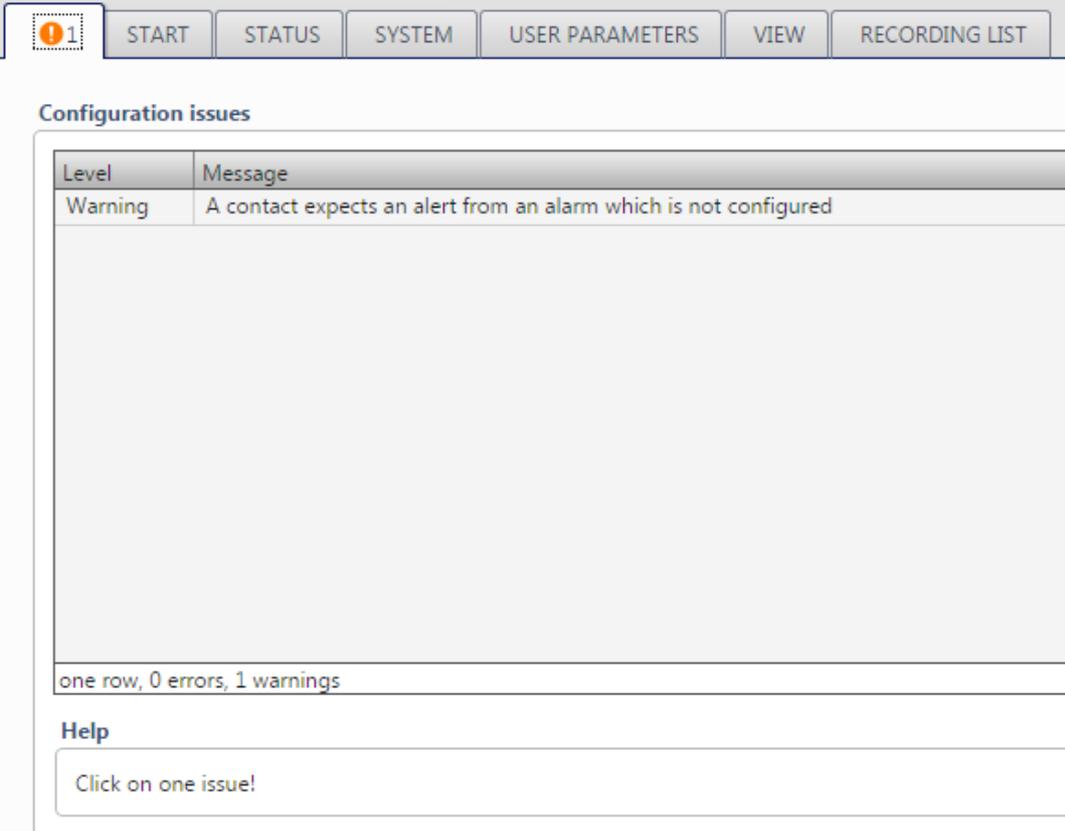


Figure 5.8.1. Setting of the messages desired for a contact, where the Alarm 1 has been selected even if it has not been considered in the “User Parameters” section.



The screenshot displays a software interface with a navigation bar at the top containing buttons for START, STATUS, SYSTEM, USER PARAMETERS, VIEW, and RECORDING LIST. A notification icon with the number '1' is visible on the left. Below the navigation bar, the 'Configuration issues' section is active, showing a table with one row of data. The table has two columns: 'Level' and 'Message'. The row shows a 'Warning' level with the message 'A contact expects an alert from an alarm which is not configured'. Below the table, a summary line reads 'one row, 0 errors, 1 warnings'. A 'Help' section is located at the bottom, containing the text 'Click on one issue!'.

Level	Message
Warning	A contact expects an alert from an alarm which is not configured

one row, 0 errors, 1 warnings

**Help**

Click on one issue!

Figure 5.8.2. Automatic warning produced by the software.

## 5.9 Rest API

The REST API functionality have been added on the firmware 1.6. Please contact Bartec Syscom for more information at [info@bartec-syscom.com](mailto:info@bartec-syscom.com).

## 6. Available spare parts and accessories

In the following, a list of spare parts is shown.

Battery (12V / 12 Ah)	74.21.1024
Backup battery (3V)	74.21.0018+
Fuse (1.6AT / 250V 5×20 mm)	74.15.0005+
Over Voltage Protection, pluggable arrester	87.00.0301
SD card 4GB (SWISSBIT)	74.90.0035+
Mounting Plate + screws and bolts	13.00.0048
Kit GPS (cable, connector, GPS)	12.11.0201
IP66 connector for kit LAN	72.52.0044+

## Appendix A: SAFETY INSTRUCTIONS

### Introduction

Thank you for choosing this Bartec Syscom product. Before operating it, please read this manual thoroughly and retain it for future reference.

#### Note

- Before operating the product, please read "Safety information".
- Pictures and illustrations used in this manual are for reference only and may differ from actual product appearance.

#### Location of the identification label

A label indicating the Model No. (P/N) and Serial No. (S/N) is located on the left hand side of the product.

#### Warning

To prevent the spread of fire, keep open flames away from this product at all times.  
When present, batteries must not be exposed to excessive heat such as fire.

#### Important notice

This product has been manufactured by:

Syscom Instruments SA, Rue de l'Industrie 21, 1450 Sainte-Croix, Switzerland

Inquiries related to product compliance based on European Union legislation shall be addressed to your authorized representative. For any service or guarantee matters, please refer to your representative or to the factory.

#### Notice for Wireless Signal

Hereby, Syscom Instruments SA declares that this unit is in compliance with the essential requirements and other relevant provisions of Directive 2014/53/EU.

### Installation / Set-up

Install and use the product in accordance with the instructions below in order to avoid any risk of fire, electrical shock or damage and/or injuries.

#### Installation

- The product should be installed near an easily accessible power supply.
- Install the product on a stable, level surface to avoid it from falling down and cause personal injury or damage to the product.
- Install the product where it can not be pulled, pushed or knocked over.
- Only qualified personal should operate the product.
- The product is not intended to be operated by children.

#### Transporting

- Before transporting the product, disconnect all cables.
- When transporting the product for repairs or when moving, pack it using the original packing material.

#### Mains lead

Some products have an AC powering (mains) cable and socket.

If applicable, handle the mains lead and socket as follows in order to avoid any risk of fire, electrical shock or damage and/or injuries:

- Insert the plug fully into the mains socket.
- Operate the product on an appropriate supply.
- When wiring cables, be sure to unplug the mains lead for your safety and take care not to catch your feet on the cables.
- Disconnect the mains lead from the mains socket before working on or moving the product.
- Keep the mains lead away from heat sources.

- Unplug the mains plug and clean it regularly. If the plug is covered with dust and it picks up moisture, its insulation may deteriorate, which could result in a fire.

**Note**

- Do not use the supplied mains lead on any other equipment.
- Do not pinch, bend or twist the mains lead excessively. The core conductors may be damaged, exposed or broken.
- Do not modify the mains lead.
- Do not put anything heavy on the mains lead.
- Do not pull on the mains lead itself when disconnecting the mains lead.
- Do not connect too many appliances to the same mains socket.
- Do not use a poor fitting mains socket.

**Prohibited Usage**

Do not install the product in locations, environments or situations such as those listed below or the product may malfunction and cause a fire, electrical shock, damage and/or injuries.

**Location**

- Do not place the product under water.
- Avoid moving the product from a cold area to a warm area. Sudden surrounding temperature changes may cause moisture condensation. This may cause the product to show malfunctions.

**Environment**

- Do not place the product in a room with oily smoke or steam. Fire, electric shock or warping may result.
- Do not heat the case of a product with an internal lead battery above 50°C. Such condition may damage the internal lead battery casing.

**Situation**

- Do not use the product when your hands are wet, with the cover removed or with attachments not recommended by the manufacturer.
- Disconnect the product from mains socket during lightning storms.
- Do not install the product so that it impair travelling along usual paths. Injury or damage to a person or object bumping into the product may result.

**Broken pieces**

- Do not throw anything at the product. The impact may break an antenna, a connector or the screen glass (when present).

**For children**

- Do not allow children to play near the product.
- Keep small accessories out of the reach of children, so they are not mistakenly swallowed.

**Description**

This product is a vibration measuring instrument. It can be equipped with a Wi-Fi interface and/or a GPRS interface (according to configuration).

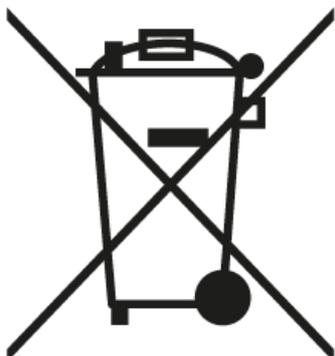
The Wi-Fi interface is intended for product configuration.

The GPRS interface is mainly intended for data transfer.

This product uses internationally harmonised frequencies.

This product may be used in a domestic or industrial environment.

## Disposal of the product



### **Disposal of Old Electrical & Electronic Equipment (Applicable in the European Union and other European countries with separate collection systems)**

This symbol indicates that the product shall not be treated as household waste. Instead it shall be handed over to the applicable collection point for the recycling of electrical and electronic equipment. By ensuring this product is disposed of correctly, you will help prevent potential negative consequences for the environment and human health, which could otherwise be caused by inappropriate waste handling of this product. The recycling of materials will help to conserve natural resources. For more detailed information about recycling of this product, please contact the company where you purchased the product.



### **Disposal of waste batteries (Applicable in the European Union and other European countries with separate collection systems)**

This symbol indicates that the battery provided with this product shall not be treated as household waste. On certain batteries this symbol might be used in combination with a chemical symbol. The chemical symbols for mercury (Hg) or lead (Pb) are added if the battery contains more than 0.0005% mercury or 0.004% lead. By ensuring these batteries are disposed of correctly, you will prevent potentially negative consequences for the environment and human health which could otherwise be caused by inappropriate waste handling of the battery. The recycling of materials will help to conserve natural resources. In case of products that for safety, performance or data integrity reasons require a permanent connection with an incorporated battery, this battery should be replaced by qualified service staff only. To ensure that the battery will be treated properly, hand over the product at end-of-life to the applicable collection point for the recycling of electrical and electronic equipment. For all other batteries, please view the section on how to remove the battery from the product safely. Hand the battery over to the applicable collection point for the recycling of waste batteries. For more detailed information about recycling of this product, please contact the company where you purchased the product.