



Manual - Lode (Cardiac) Rehabilitation Manager

Rehabilitation



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1 - Introduction

Cardiac rehabilitation is a medically supervised program to help heart patients recover quickly and improve their overall physical, mental and social functioning. The goal is to stabilize, slow down or even reverse the progression of cardiovascular disease, thereby reducing the risk of another cardiac event or death.

With the LCRM a new modular system for controlled ergometer training is developed. Ergometer training is particularly used in the areas of early mobilization and exercise therapy as part of in-patient as well as out-patient cardio rehabilitation, in order to increase the performance of cardiovascular patients. Studies show that training distinctly increases the performance level of patients (even those suffering from heart failure) and, as a consequence, also the quality of life. The PC software takes over the entire predefined training of the patients, documents all relevant data (e.g. ECG, heart rate, training data, etc.) at the same time and so relieves the therapist of routine work. As result the patients can be taken care of more intensively.

Together with the Lode ergometers (bicycle, treadmill, angio and recumbent) L(C)RM is ready for the future. Modular extensions and upgrade possibilities allow the equipment to be adapted according to increasing requirements (e.g. automatic blood pressure measurements (BP) and oxygen saturation of the blood (SpO₂)).



2 - Intended Use

During cardio-rehabilitation ECG data of the patient should be acquired in a non-obtrusive way with professional medical electrodes.

During the rehabilitation the data needs to be sent to a PC based stationary platform for assessment and storage. The ECG should be able to provide a heart rate trigger for blood pressure measurement.

LCRM is a software package for cardio rehabilitation. The software can control up to sixteen Lode rehab devices (including blood pressure and SpO2) and the Lode ECG streamer for monitoring.

The software is built to prepare and run cardio rehab sessions and also documents relevant data (e.g. ECG, BPM, SpO2, Speed, Inclination, RPM, Load) for later analysis (in software or as report). The main purpose is that the software controls the ergometers and the data, so the physician can focus on the patients.

The software/system/device has to be operated under the supervision of well-trained medical specialists in the field of use.

The ultimate judgment whether a test subject should undertake a stress test or training with the software/system/device must be made by the responsible medical specialist, based on the limitations of each individual, the medical history and all other applicable circumstances. Neither the manufacturer nor its distributors assume any responsibility for the final use of its software/system/device.



3 - Precautions



The operator should instruct the test subject prior to performing an exercise protocol. If, at any time during exercise, the test subject feels faint, dizzy, or experiences pain, stop the test and he or she should be consulted by the physician.



Before the training starts double check the devices (ergometer & ECG).



Check the BT connection between ECG and PC before the training starts.



Do not disconnect equipment or close a window during a test.



Heart rate monitoring systems, BP measurements or SpO2 monitoring may be inaccurate. Over exercise may result in serious injury or death. If the test person feels faint stop exercising immediately.



The installation should only be done by authorized persons who follow the installation instructions.



Mind the information on the screen (values, warnings and alarms) and act accordingly.



Read this manual before using the program and follow it carefully.



The LCRM software is not meant to be a diagnostic tool, the ECG signal can be used for monitoring, but when there are concerns about the data, always use a diagnostic ECG to (dis)confirm.



The program should be used by qualified personnel only.

4 - Notifications



Be aware that participant data is saved in the database, so always follow the rules of the GDPR regulations (only in Europe).



5 - Validity

This manual covers all Lode (Cardio) Rehabilitation Manager versions starting with the following part numbers:

950905 LRM
950902 LCRM

from software version 3.0.0.

Date of issue: 20-03-2020



Start up screen of the LCRM software, showing the software version, serial number, company name and address, website and email address.

The information can also be find in the About.



6 - Symbol list software

-  General software settings
-  Current User
-  Show view on 2 monitors
-  Help
-  All participants leave training. This will clear all slots
-  Participant groups
-  Participant Management
-  Slot control
-  Mute Alarm
-  Start training session
-  Go to next stage of the protocol
-  Go to previous stage of the protocol
-  Stop the training session



-  Pause the trainings session
-  Go to recovery stage
-  Participant leaves
-  Select participant
-  Select ergometer
-  Select protocol
-  Select ECG device
-  ECG details
-  Filter settings
-  Edit training notes and marks
-  Start blood pressure measurement
-  Cancel automatic blood pressure measurement
-  Linked ECG streamer, switched off
-  Linked ECG streamer, switched on



 Battery charge level

 Battery almost empty, charge as soon as possible

 Battery empty, charge immediately

 Poor Bluetooth Signal



7 - Abbreviations software

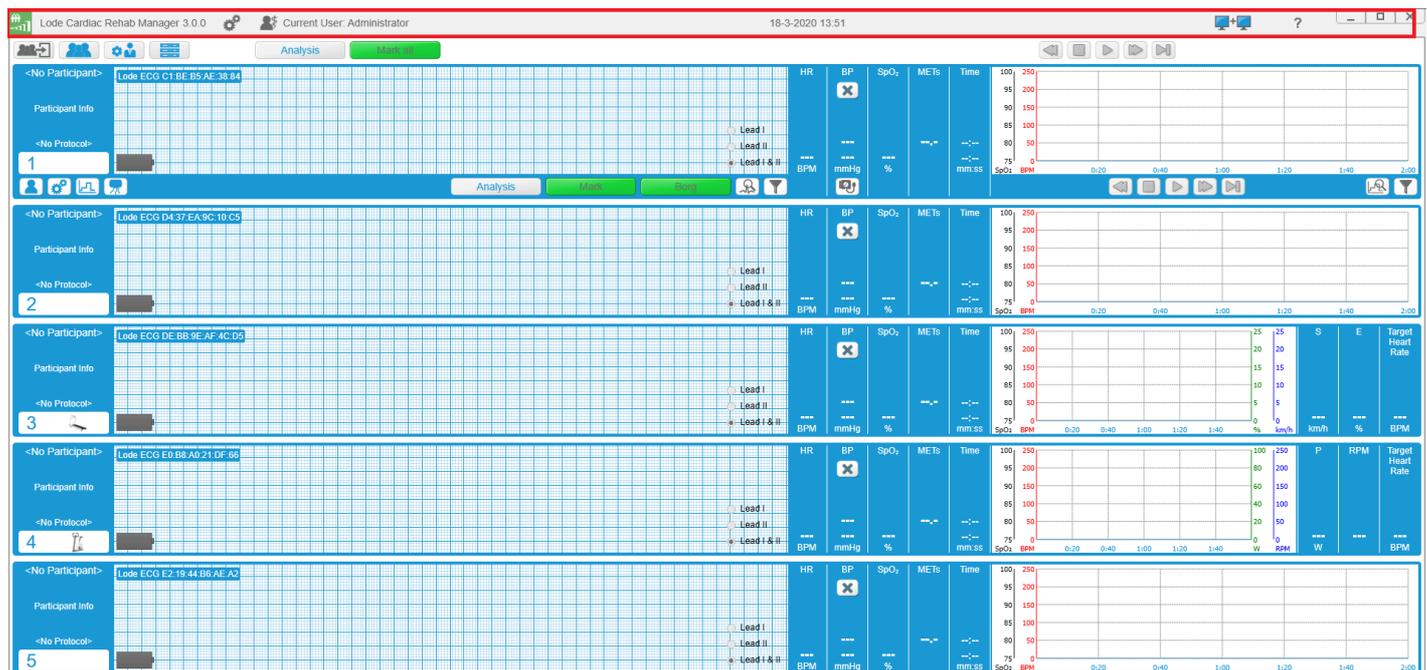
Abbreviation	Description	Unit
HR	Heart rate	BPM
BPM	Beats per minute	
BP	Blood pressure	mmHg
SpO2	Peripheral capillary oxygen saturation	%
P	Load	Watt
RPM	Revolutions per minute	
BT	Bluetooth	



8 - Software overview

The L(C)RM software is a software package with many possibilities, in order to easily following the manual an overview will be provided how the software is arranged, where you can find the different functionalities and how you can change the data view.

Overview main window focus on top line



On the top line of the main window you will find:

- Software version information
- General software settings
- User settings
- Current username
- Date and Time
- Screen control
- ? for manual
- Window control: minimize / maximize or resize / close



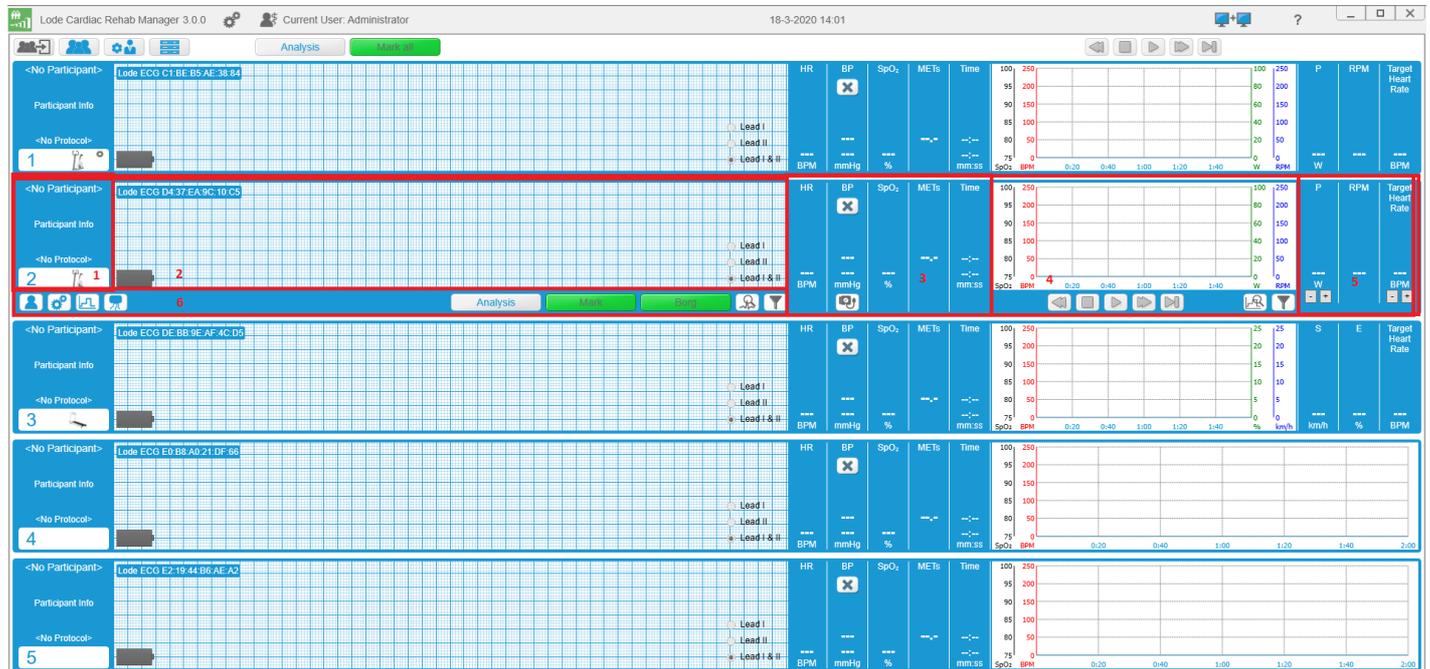
Overview main window focus on second line

On the second line of the main window you will find:

- 1: All participants leave training
- 2: Participant groups
- 3: Participant Management
- 4: Slot control
- 5: Analysis button
- 6: Mark all button
- 7: Control panel
- 8: Mute Alarm (only visible when alarms enabled and pc volume active)



Overview main window focus on active (selected) slot



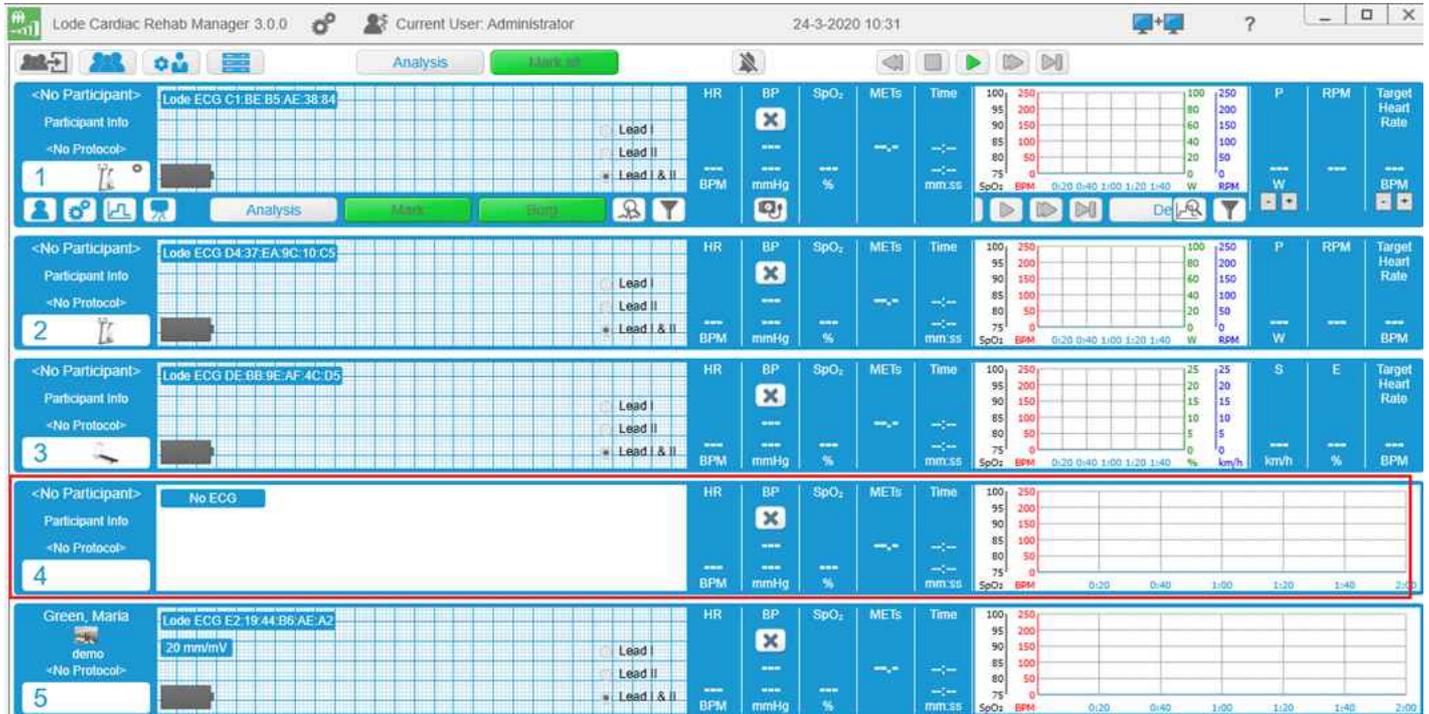
In a selected slot you will find:

- 1: Participant, protocol and ergometer information
- 2: ECG streamer connection, battery status and ECG graph lead I and/or II
- 3: Participant parameters
- 4: Protocol graph, information and HR filter
5. adjustability buttons selected protocol
- 6: From left to right: symbols to enter participant, ergometer, protocol, ECG streamer and buttons to analyse, mark, add borg scale, ECG detail and ECG filter/speed

A slot that is not selected is called an inactive slot, shown in the picture below. All the symbols to add participant, ergometer, protocol and ECG streamer as well as the functionalities to mark, change ECG filter and scaling etc.. are not visible.

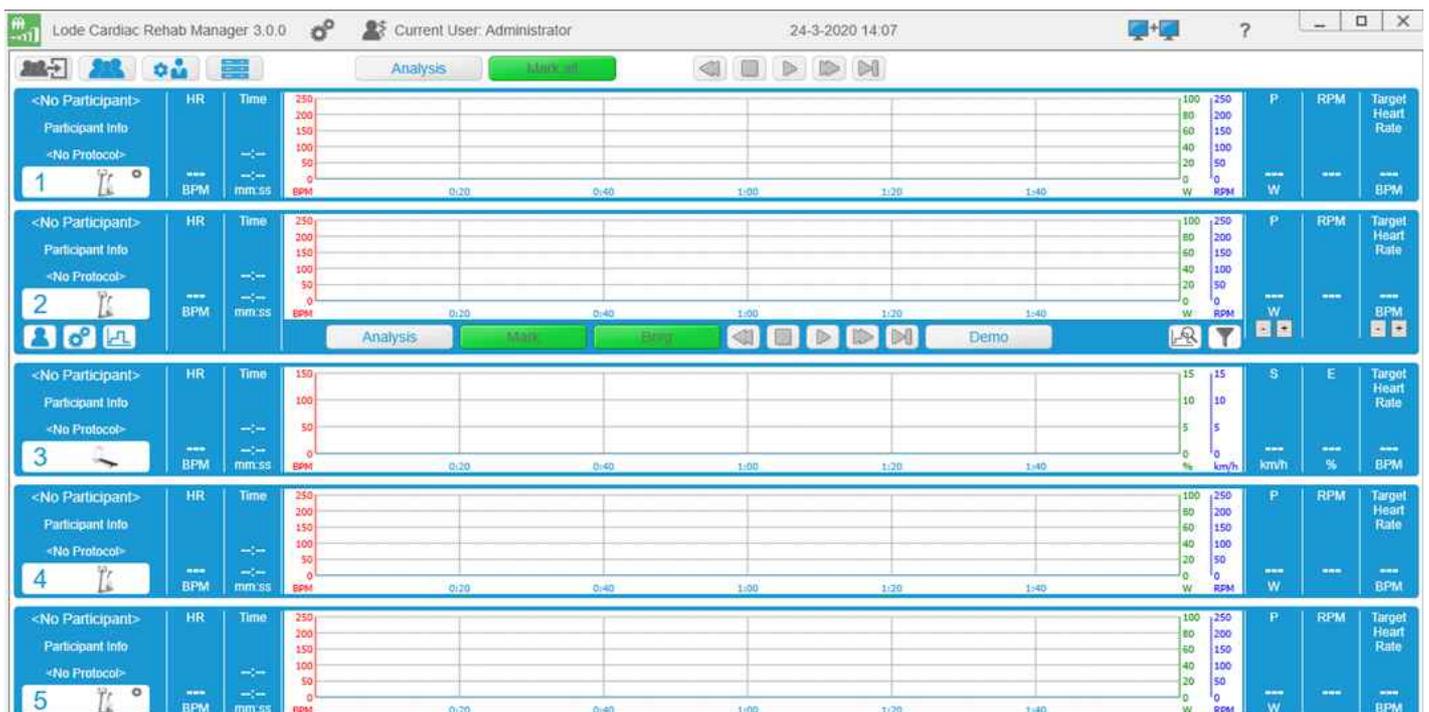


Overview main window focus on inactive (not selected) slot



If the software is used without ECG streamers, LRM, you can switch off the ECG graph in the general settings in order to have a more detailed look at the protocol graph.

Overview main window without ECG graph





9 - User accounts

We strongly advise to work with user accounts in order to secure a standard working procedure for all the users. For every user an account should be created, secured with a pass word. To login on your own account, click on the button [Change User] in the top line of the software.

The screenshot shows a 'Change User' dialog box. It has a blue header with the text 'Change User' and a close button (X). Below the header, there are two input fields: 'User ID' and 'Password'. Below the 'Password' field is a button labeled 'Change User'. At the bottom of the dialog, there are two buttons: 'Manage Accounts' and 'Edit My Account'.

When you are in the possession of an user account, you click on the user account symbol in the top line of the software. Use your username and password and click on [Change User] to log in.

If you have no account, please request the system administrator, since only the user with an administrator account can create, edit or remove user accounts.

Note that the database is a shared database, so every user that can login can see the database and thus all participants.



10 - General settings

In the general settings you can change settings of the training, like parameters that are shown and graph settings, as well as setting affecting the analyse part of the software. Furthermore you can slightly change the user interface.

Changes in the general settings cannot be made when a training is running or when participant data is not saved yet.

Trainings

In the tab "Trainings" you can change some settings of the ECG graph. The scale and artifact filter can also be changed during training with the symbols below the ECG graph of the selected slot. The sweep speed and Mains frequency can only be regulated in the general settings. The sweep speed is the scaling of the x-axis and has an effect on the speed the signal is moving. The main frequency is to filter the power network frequency which is overall 50Hz and in the USA 60Hz.

Furthermore you can add or remove alarm settings for heart rate, blood pressure and SpO₂. The heart rate and blood pressure alarm are based on the settings in the participant characteristics. For the SpO₂ alarm you can choose with which percentage of SpO₂ the alarm should be activated.

When the "Audio Alarms" are enabled the button "Mute Alarm" will appear in the main window (see Overview software, main window second line). The button will be enabled as soon as an alarm is reached. Because audio alarms can disturb the participants, the alarm can be turned off with the button "Mute Alarm". The belonging visual alarm can't be turned off. As soon as a new or the same alarm is reached, the audio alarm will be heard again and can be turned off when it is disturbing the training.

The Participant Parameter Columns and Graph settings have an effect on the overview in the software during training. Checking or unchecking boxes will shown or not shown the related data.

Finally, you can choose which Borg Value Entry you want to use and how the data in the database is presented.



General Setting

X
Settings

Trainings
ECG Devices
Ergometers
Database
Analysis
User Interface
HL7
Authorization

ECG Settings

Mark Interval: s

Sweep Speed: mm/s

Scale: mV/cm

Artifact Filter:

Mains Frequency: Hz

Enable Baseline Filter

Alarm settings

Heart Rate Alarm

Blood Pressure Alarm

SpO₂ Alarm

Audio Alarms

Use Default Alarm Values

Participant Parameter Columns

Show METs values Show SpO₂ Values

Show Blood Pressure Values

Graph Settings

Show SpO₂ in Ergometer Graph Show ECG Graph

Show Heart Rate in Ergometer Graph

Borg Value Entry

Disabled

Standard (6-20)

Alternative (0-10)

Participant Name Format

First name first (eg. John Doe)

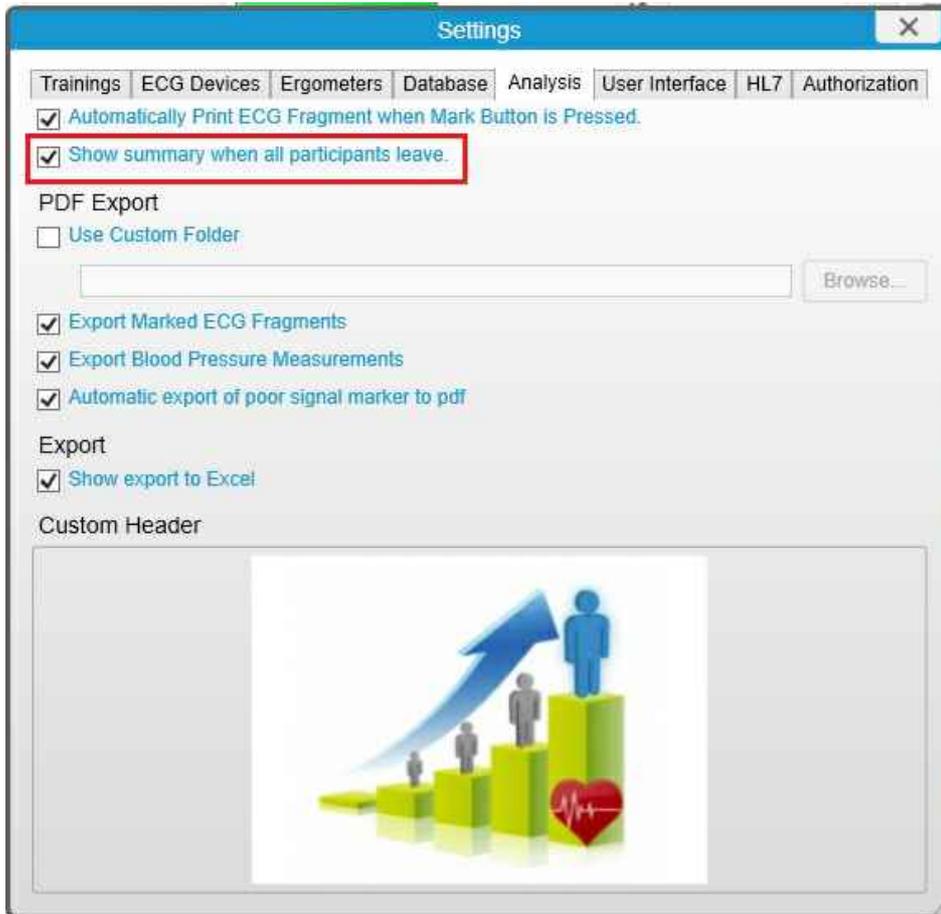
Last name first (eg. Doe, John)

Participant Portraits

Show Participant Portraits

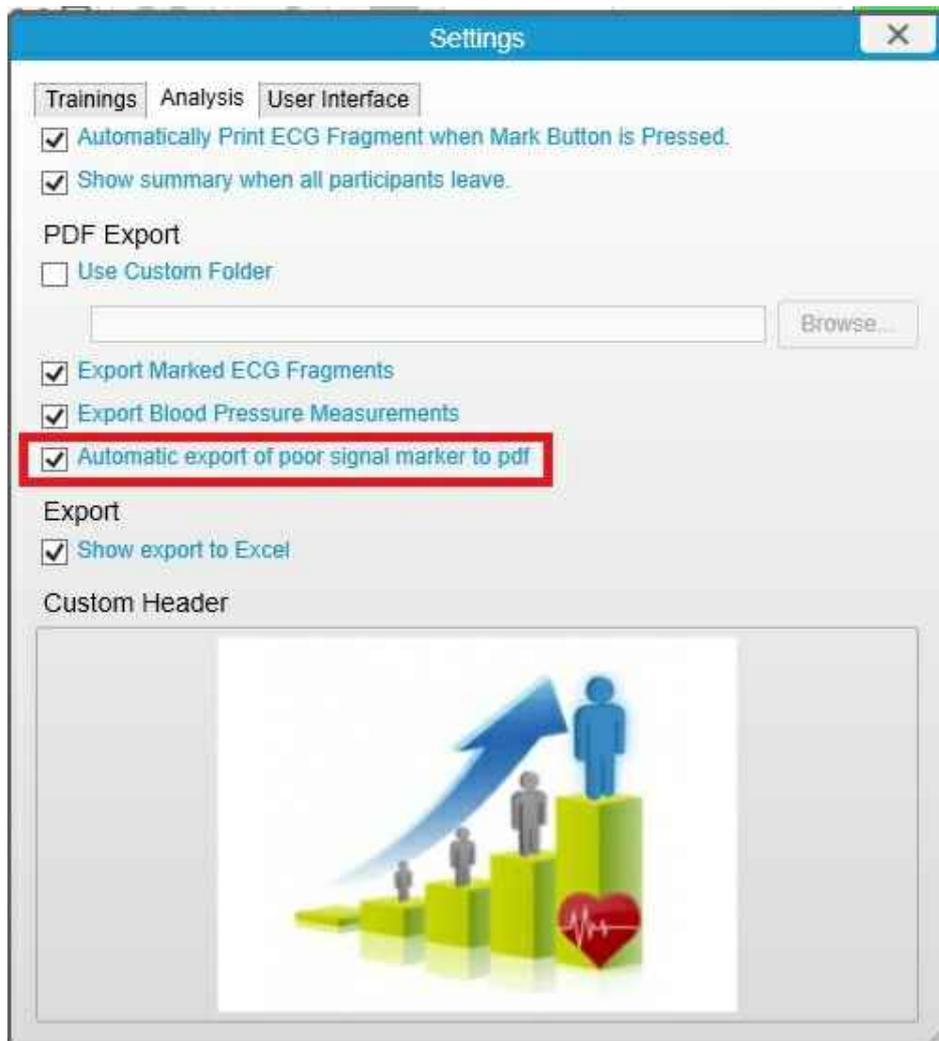
Demo Mode

Enable Demo Mode



Analysis settings

The tab "Analysis" gives you some options for the data export and the option to automatically print ECG data when setting a mark. Furthermore, it is possible to receive an overall summary of the total group of patients after a training.



The PDF report settings can be customized in this menu. When the "Automatic export of poor signal marker to PDF" is enabled, a purple mark (instead of green) is set every time the Bluetooth signal (not the ECG) is poor. Disable this automatic setting to reduce the PDF report. The Logo of the Hospital or Rehabilitation center can be added in the PDF Custom Header.

Besides the PDF Export it is also possible to export the training data to Excel.

Check boxes if you want to use one of these options.



User Interface

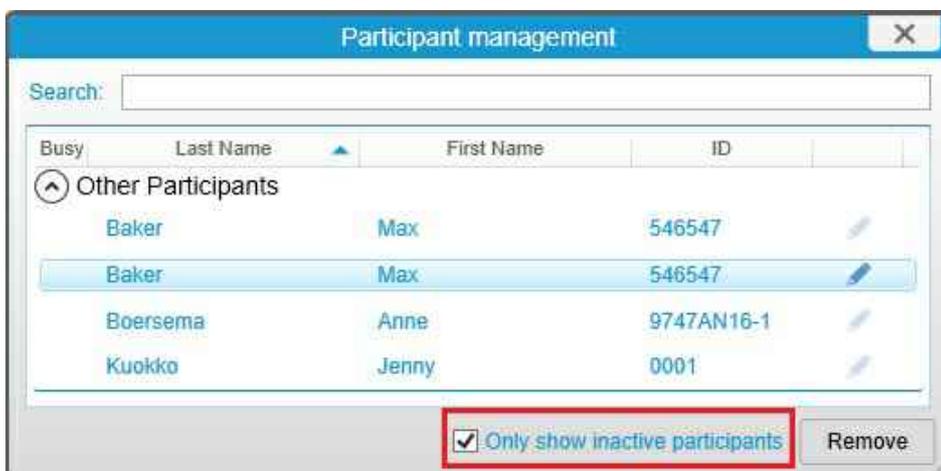
The tab "User Interface" gives the option to change the language or the main color of the lay out. It is always required to restart L(C)RM in order to apply the changes.



11 - Participant Management

In Participant Management it is possible to deactivate, reactivate or remove participant from the database. With this function participant who are ready with the cardio rehabilitation can be deactivated, in this way they won't be visible in the database anymore but their data still remains.

Deactivated participant can be activated again by pressing the pencil and reactivate again in the edit participant menu.



The screenshot shows a window titled "Participant management" with a search bar and a table of participants. The table has columns for Busy, Last Name, First Name, and ID. Below the table, there is a checkbox labeled "Only show inactive participants" which is checked, and a "Remove" button.

Busy	Last Name	First Name	ID
Other Participants			
	Baker	Max	546547
	Baker	Max	546547
	Boersema	Anne	9747AN16-1
	Kuokko	Jenny	0001

Only users with the correct privileges are able to Remove participants from the database. Enable the "only show inactive participant" button, select the participant whose data is wrong or not necessary anymore and press the "Remove" button. Be aware this action can't be reversed!

Deactivate, reactivate and remove actions are logged on username, action and id number, because of privacy and AVG regulations names and date of births are not logged. The logfiles can be found in %appdata%/lode/lcrm as AuditLod.csv.



12 - Prepare L(C)RM for a training

Before L(C)RM can be used for training some software preparation need to be done. The training participants need to be add or selected, training groups can be created, as well as different training protocols.

The ergometers (bicycle, treadmill and/or recumbent) are already add to the software and allocated to a destined slot during the installation. When ECG devices are used these are also already integrated in to the software during the installation. Information about adding devices to the software can be found in the installation manual.

12.1 - Add new participant

New participants can be added to the software at any moment, before the training session or during the training session. The only remark is that the training for a specific participant only can start when the participant is add to the system.

There are three ways to add a new participant to the software, you can do this via [Select Participant], [Participant groups] or via [Participant Management].

Select Participant

Busy	Last Name	First Name	ID
Other Participants			
	Baker	Max	5465478659324
	Baker	Jesse	8916345034
	Brown	Max	12346
	Butcher	Anne	80625345
	Fisherman	Benjamin	0132463
	Marhoum	Shkiba	378401345
	Wheelmaker	Todd	9747AN16-2
Active Participant Group: wednesday 2pm			
	Green	Maria	4324579
	Long	Noa BP	6526559
	Master	Conrad	01234
	McAllen	Ruben	012345
	Preacher	Steven B	654321

Participant Groups

Groups	Participants
All Participants	Search: <input type="text"/> Sort
Cardiac Friday 11-11:45	Baker, Max 5465478659324 Not Assigned To Slot
Lung Tuesday 10-11 am	Baker, Jesse 8916345034 Not Assigned To Slot
Neuro group A 3pm	Butcher, Anne 80625345 Not Assigned To Slot
Thursday 5pm	Fisherman, Benjamin 0132463 Not Assigned To Slot
Wednesday 2pm	Green, Maria 4324579 Not Assigned To Slot
Monday cardiac 3pm	Master, Conrad 01234 Not Assigned To Slot
Monday Cardiac 10am	
Logical name is day and time	
Test group A	
Wednesday 4pm	



 Participant Management

Participant management
✕

Search:

Busy	Last Name	First Name	ID	
⤴ Other Participants				
	Baker	Max	5465478659324	
	Baker	Jesse	8916345034	
	Brown	Max	12346	
	Butcher	Anne	80625345	
	Fisherman	Benjamin	0132463	
	Marhoum	Shkiba	378401345	
	Wheelmaker	Todd	9747AN16-2	
⤴ Active Participant Group: wednesday 2pm				
	Green	Maria	4324579	
	Long	Noa BP	6526559	
	Master	Conrad	01234	
	McAllen	Ruben	012345	
	Preacher	Steven B	654321	

Only show inactive participants
 Deactivate
New



All three methods come to this screen. Only an unique ID is required, but we strongly advise to fill in the upper part of this screen completely in order to create a useful database.

The information in the tabs characteristics, training, information, groups and SpO₂ can be very useful and even sometime required for certain training protocols. The different tabs will be discussed below.

Characteristics

Participant characteristics which can be important information during training or for the choice of protocol. Heart rate and blood pressure information can be used as alarm during the

training in order not to go over the physical limits of the participants.

Maximum heart rate is automatically calculated from the age of the participant, but this can be overruled by typing the maximum heart rate you want it to be. When it is calculated by age the color is grey, when another maximum heart rate is typed it is blue.

Furthermore you can choose a default protocol to work with.



Edit Participant
✕

ID* Get From HIS

Participant ID (HIS)

First Name

Last Name

Date of Birth d-M-yyyy

Gender Male Female

Remove image

Characteristics | **Training** | Information | Groups | SpO₂

Participant Parameters Click to Link X Axis

Load W Last training Average

Fall back value W

*Required Field

Show trainings Save

Training

In the tab "Training" the participants parameter load can be set. In some of the protocols it is possible to use a percentage of this participants set load as load setting for a certain step in the protocol. This load can be set manually, but it is also possible to choose for the setting "Last training average" or "Last training maximum".

To receive an overview of all training sessions of a participant, press "Show Trainings" and the menu "Select Trainings for Analysis" of this participant will appear.



Edit Participant
✕

?

ID*

First Name

Last Name

Date of Birth d-M-yyyy

Gender Male Female

Characteristics

Training

Information

Groups

SpO₂

Brief Information

Additional Information

*Required Field

Information

The tab "Information" gives the opportunity to write down information about the participant which can be important to know during the rehabilitation. There is an option for brief information, information typed here will be shown in the first column of a slot with the participant name and selected protocol. The additional information is only visible if you hover over the brief information shown in the first column. This information is not automatically added to the report. If it is important information for the report you have to copy-paste the information.



Edit Participant
✕

?

ID*

First Name

Last Name

Date of Birth d-M-yyyy

Gender Male Female

Characteristics

Training

Information

Groups

SpO₂

Check the groups you want this Participant to be a member of.

Product training 2018 (2)

Tuesday cardio 11.00-12.00 (2)

*Required Field

New participant groups

In the tab "Groups" you can select the groups where the participant must be added to. All available groups will be listed here. A participant can join more than one group at once. Furthermore it is possible to add a new Participant Group when you click on [Add Participant Group]. In the next paragraph these steps will be explained.

Participants can also be added to groups via the symbol [Participant Groups], this will be described in the next paragraph.

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Peripheral capillary oxygen saturation

SpO₂ can be used to control the load of the ergometer. In the tab "SpO₂" you can choose to use SpO₂ for automatic load adjustment and you can edit the settings.

First you choose in which range of the SpO₂ percentage the SpO₂ control should be active, if the control is active you have to set the load decrease and load increase settings. As default the adjustment will take place after 30 seconds out of SpO₂-range, either to high or to low. Besides the time, the amount of load which should be adjust has to be set, this can be a percentage or a fixed load.

When the SpO₂ settings are active the protocol will be overruled when the SpO₂ settings are meet.

12.2 - Create participant groups

As mentioned before it is possible to create participant groups. Participant groups are an easy way to prepare the software for a training, since with loading a participant group all slots will be filled automatically with the participants added to this group. When working in a setting with fixed training hours for each participant, working with participant groups is very easy and time efficient.

There are two ways to create a participant group. One is via the symbol [Participant groups] and the other is via [Select Participant] and then the tab "Groups".



Participant Groups

Participant Groups

Groups

- All Participants
- Product training 2018
- Tuesday cardio 11.00-12.00

Participants

Search: Sort

Book, Elly
54826
Not Assigned To Slot

Bread, Billy
58963
Not Assigned To Slot

Doe, Jane
457952
Not Assigned To Slot

Luckey, Guus
1234
Not Assigned To Slot

Rest, Brad
98563
Not Assigned To Slot

Add Remove Rename Remove Assign Slot **New Participant**

Move Participants between groups by dragging them from Participants to Groups. The Participant will be removed from the original group unless you drag with the control key pressed.

Activate Group

Select Participant

Edit Participant

ID*

First Name

Last Name

Date of Birth d-M-yyyy

Gender Male Female

Characteristics Training Information Groups SpO₂

Check the groups you want this Participant to be a member of.

Product training 2018 (2)

Tuesday cardio 11.00-12.00 (2)

Add Participant Group

*Required Field

Save

Participant Groups

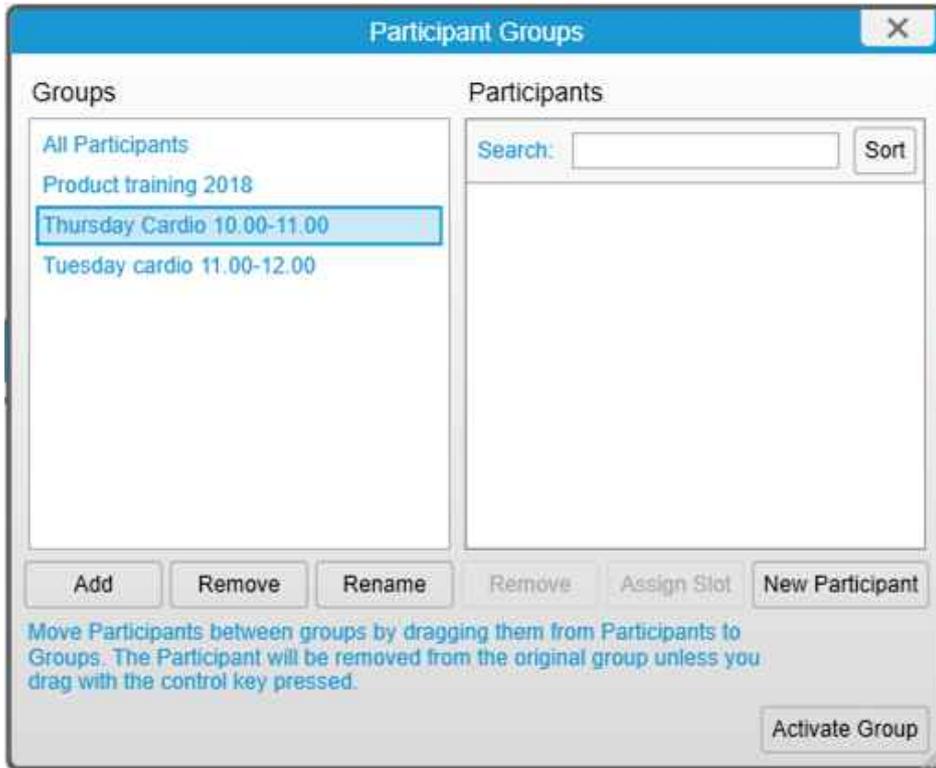
Enter the name of the new participant group:

Thursday Cardio 10.00-11.00

OK

Both ways will lead to a widget where you have to enter the name of the new group, for example "Tuesday cardio 11.00-12.00". When you click on [OK] you either end up in the widget Participant Group or in the widget Select Participant, this depends on which method you used to create a new

participant group.



When you created the new participant group via the symbol [Participants groups], the new group you created will show up in this widget. When the group name is selected you can [Remove] or [Rename] the group or you can [Add] another group.

In order to add participants to the group, you have to select "All Participants" and you can drag and drop the participant from the list in the desired group. As explained in the widget, as default participants can be add to one specific group. If a participant needs to

be in more than one group you have to use [Ctrl].

A participant can be removed from a group when you select first the group and then the participant, now the [Remove] button below the participant list is activated.



After you add participants to a group you can assign a slot to a participant. In this way all participants of the selected group will be placed in the same slot every training. In order to assign the participant to a group you have to select the group and then select the participant. Click on [Assign Slot] and click on the number of the slot you want to use for that participant. Below the participant name you can see to which slot a participant is assigned, if the participant is not assigned to a slot you can see that as well.

If you do not assign participants to specific slots, the participants will be added to a slot in alphabetic order when you select the training group.



When you created a new participant group via [Select Participant], the new group shows up in the list. Check the box of the group in which you want to add the participant to. It is possible to check more than one box at the same time.

12.3 - Create protocols

With the LCRM installation some default protocols are installed as well. It is possible to create your own training protocols. These protocols can be made on beforehand, so that you can select the desired protocol when the training starts. It is possible to select for each participant their own protocol. It is also possible to change protocols during the training, this will be explained in the chapter Training.

To create a new protocol click on [Select Protocol], you will find this symbol in the activated slot. To create a bicycle protocol you have to activate a slot with a bicycle ergometer as ergometer, when you want to create a treadmill protocol you have to activate a slot with a treadmill as ergometer.

If in the activated slot no protocol is selected yet, you can also click on "no protocol". This will lead to the same screen as [Select Protocol] and will therefore not be described separately in this manual.



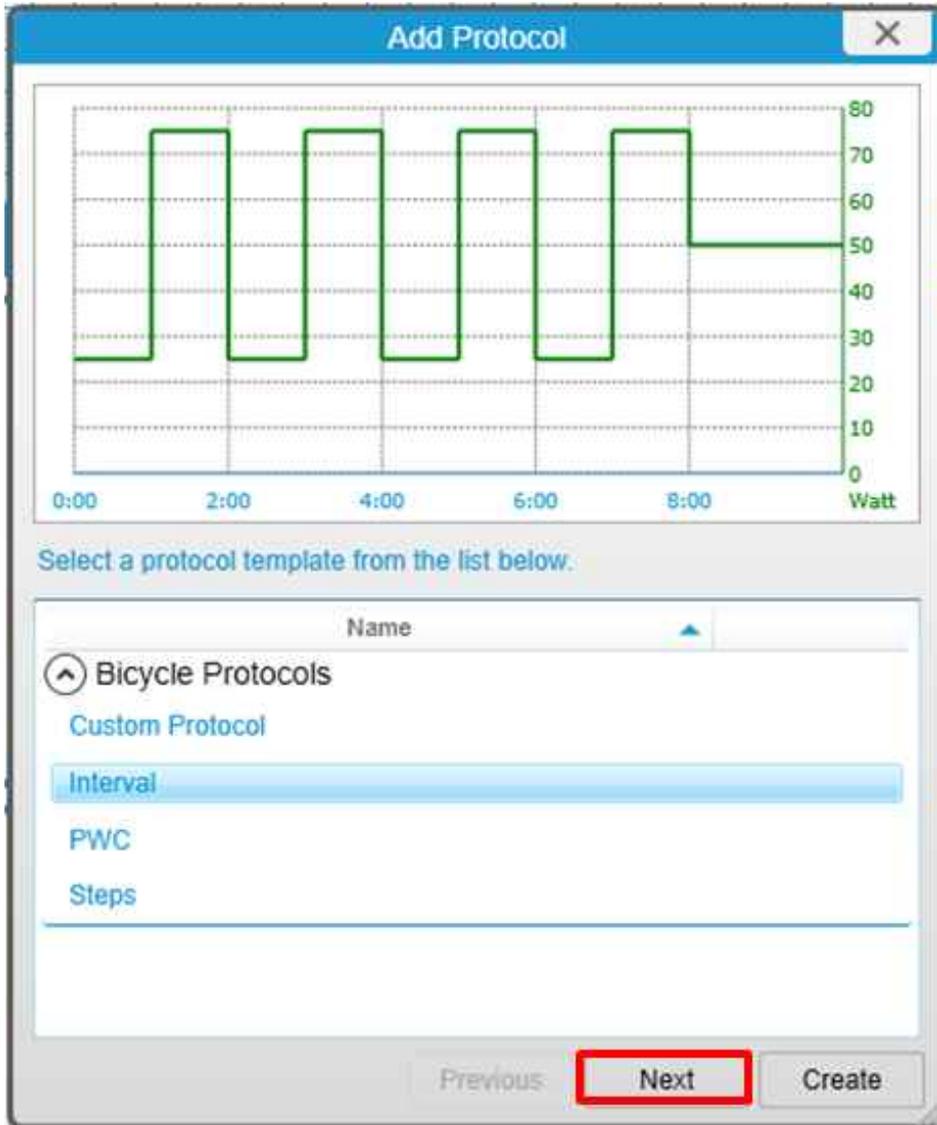
Select Protocol

In the widget Select protocol you see the list of default protocols based on which ergometer (bike or treadmill) is active in the activated slot. If there are already custom made protocols they will also be shown in this list. Note, that you first have to select the type of ergometer in the active slot, before you can select or create protocols.

To create a new protocol click on [Add]. Depending on the type of ergometer that is selected, it is possible to select different types of protocols. For the bike you can choose for Custom Protocol, Interval, PWC and Steps. For the treadmill there are three types of protocols: Custom Protocol, Interval and Steps.

A Custom Protocol is completely empty and can be created from start, while the Interval, PWC and Steps protocols already have the default settings suitable for these protocols, so you only have the change the

values to come to your own protocol.



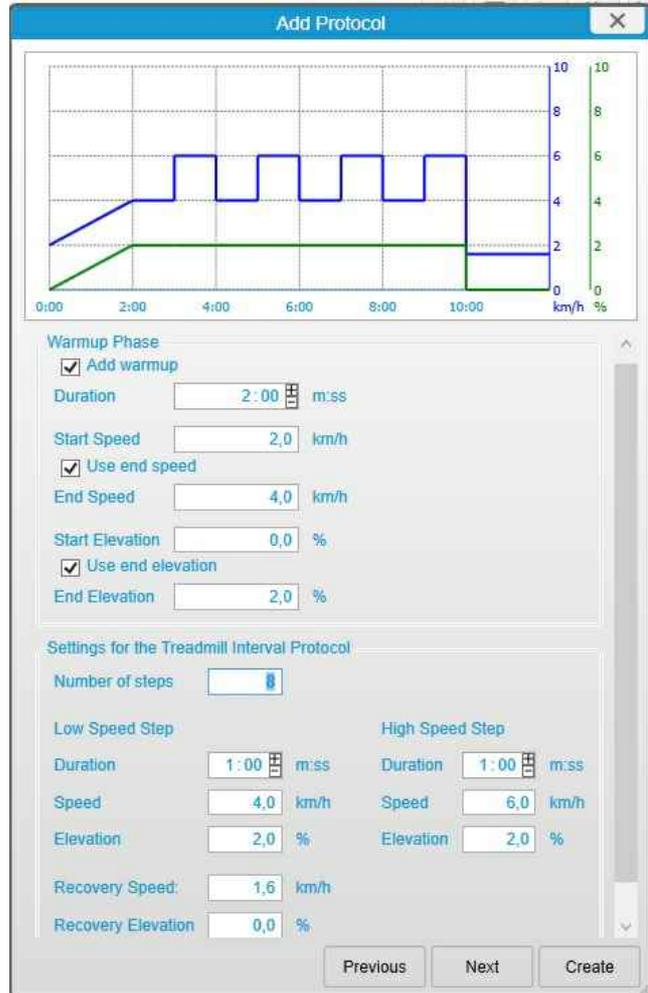
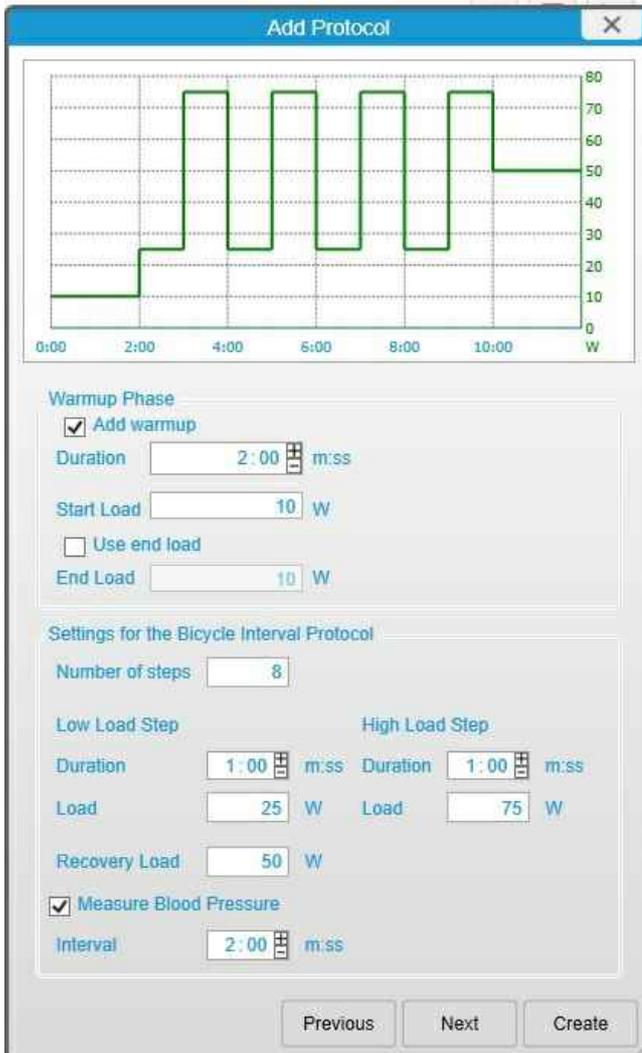
Create Interval Protocol

The idea behind an Interval Protocol is a sequence of steps alternating between high and low intensity. The intensity between a high and low interval should be different, the duration between high and low interval can be different. But the intensity and duration with an interval (high or low) is all the time the same.

You can also create an interval protocol with the Step Protocol option, but the steps are not linked. With an interval protocol however you only need to enter a few values to create the protocol.

During the training you can adapt the high and the low steps in one go.

Select "Interval" and click on [Next].



Creating an interval protocol for a bike or treadmill ergometer is more or less the same, only the variables to set a high or low interval are different. For the bike ergometer the load [Watt] is used, for the treadmill speed and inclination can be used to define the intensity of an interval.

As you can see in the pictures above (left is for the bike, right is for the treadmill) you first can decide to add a warmup phase with a start and end load or speed/slope. The next step is to fill in the number of steps your protocol will exist of. Then you have to choose the duration and intensity (load and speed) for the low and for the high step. For the treadmill it is also possible to set the inclination for both steps. For the bike and the treadmill both the recovery load or speed must be set, this will be the load/speed the ergometer will have after the interval period.

Additionally, it is possible to set an automatic blood pressure measurement if the option is present in the device. Check the box and choose the interval time when the measurement should be done.

Click on [Next].



Enter the name of the protocol.

Interval 75 - 150

Previous Next **Create**

A suggestion is made how to name the protocol.

Note: choose a protocol name which identifies the content of the protocol.

For example "Interval 75-150" where 75 watt is the low intensity step and 150 watt the high intensity step.

Click on [Create] to go to the final step.



In the last step you are able to change some default protocol settings for Automatic ECG Markers and Blood Pressure Measurement. As default no automatic ECG Markers are set or automatic blood pressure measurement are done. You can change this to markers and/or measurements on fixed intervals or a specific interval before the end of each stage.

There is also an option to lock your protocol (check the box [Lock Protocol]) in order to protect the protocol for editing.

If you haven't changed the protocol name in the previous step you are still able to change the name in this screen. Furthermore you are able to create a folder in which the protocol should be saved. By default this is the folder "User Defined". Any other name you will use will create a new folder. All earlier created folders are selectable in the drop down menu (an example of the different protocol folder can be

seen at the beginning of the paragraph Create protocol).

Click on [Save] to create the new protocol. The protocol can be find in the list protocols under the correct ergometer.



Add Protocol

450
400
350
300
250
200
150
100
50
0
Watt

0:00 2:00 4:00 6:00 8:00 10:00 12:00 14:00 16:00

Select a protocol template from the list below.

Name

^ Bicycle Protocols

- Custom Protocol
- Interval
- PWC
- Steps**

Previous **Next** Create

Create Step Protocol

The idea behind an Step Protocol is a sequence of steps with increasing intensity. The time and incremental load for each step is the same.

Select "Steps" and click on [Next].



Add Protocol [X]

0:00 5:00 10:00 15:00 W

Warmup Phase

Add warmup

Duration m:ss

Start Load W

Use end load

End Load W

Settings for the Bicycle Steps Protocol

Number of steps

Step Duration m:ss

Start Load: W

Load Increment W

Recovery Load W

Measure Blood Pressure

Interval m:ss

Previous Next Create

Add Protocol [X]

0:00 2:00 4:00 6:00 8:00 10:00 12:00 14:00 16:00 km/h %

Settings for the Treadmill Steps Protocol

Number of steps

Step Duration m:ss

Start Speed km/h

Start Elevation %

Speed Increment km/h

Elevation Increment %

Recovery Speed km/h

Recovery Elevation %

Previous **Next** Create

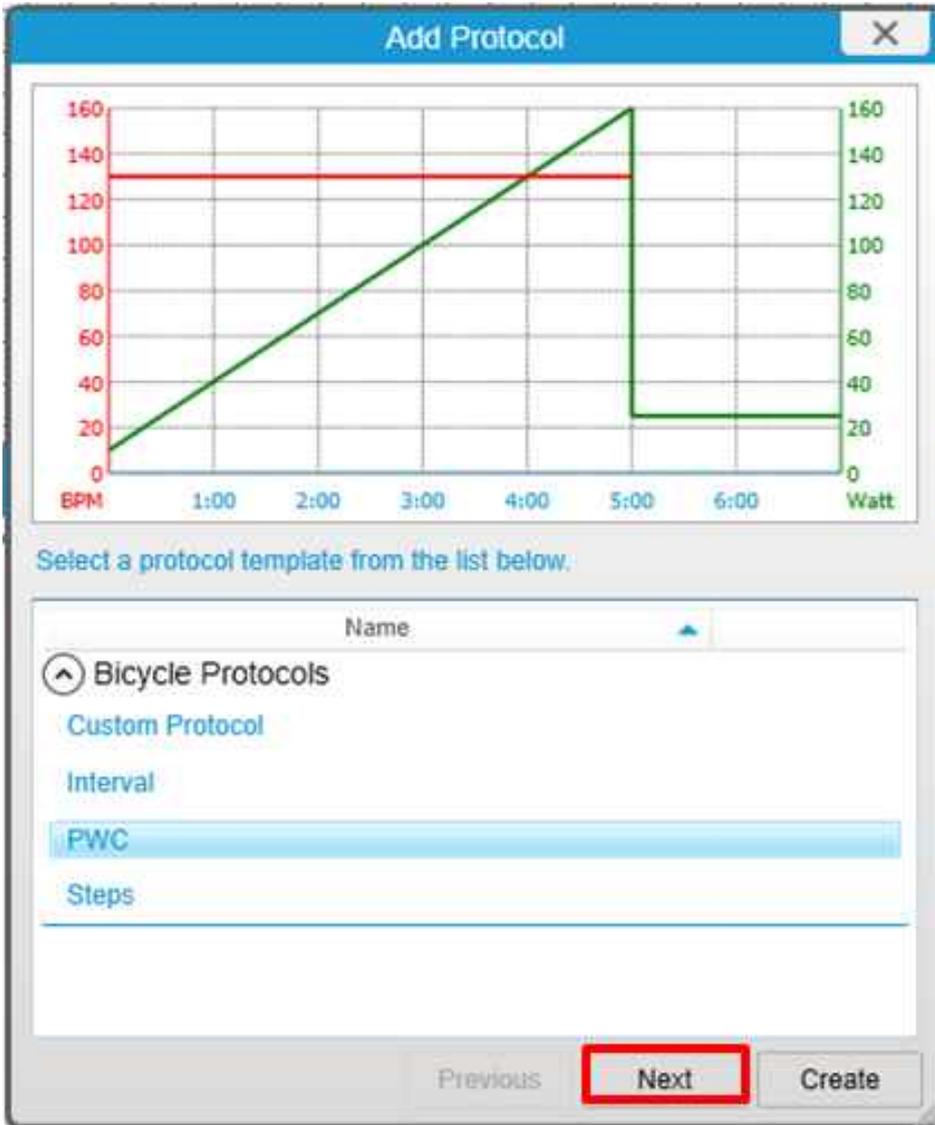


Creating a step protocol for a bike or treadmill ergometer is more or less the same, only the variables to set an incremental step are different. For the bike ergometer the load [Watt] is used, for the treadmill speed and inclination can be used to define the incremental step.

As you can see in the pictures above (left is for the bike, right is for the treadmill) you first can decide to add a warmup phase with a start and end load or speed/slope. The next step is to fill in the number of steps your protocol will exist of and the duration of a step. Then you have to choose the load or speed and inclination you want to start with and additionally the incremental load or speed and inclination of a step. Finally, you have to set the recovery step.

Additionally, it is possible to set an automatic blood pressure measurement if the option is present in the device. Check the box and choose the interval time when the measurement should be done.

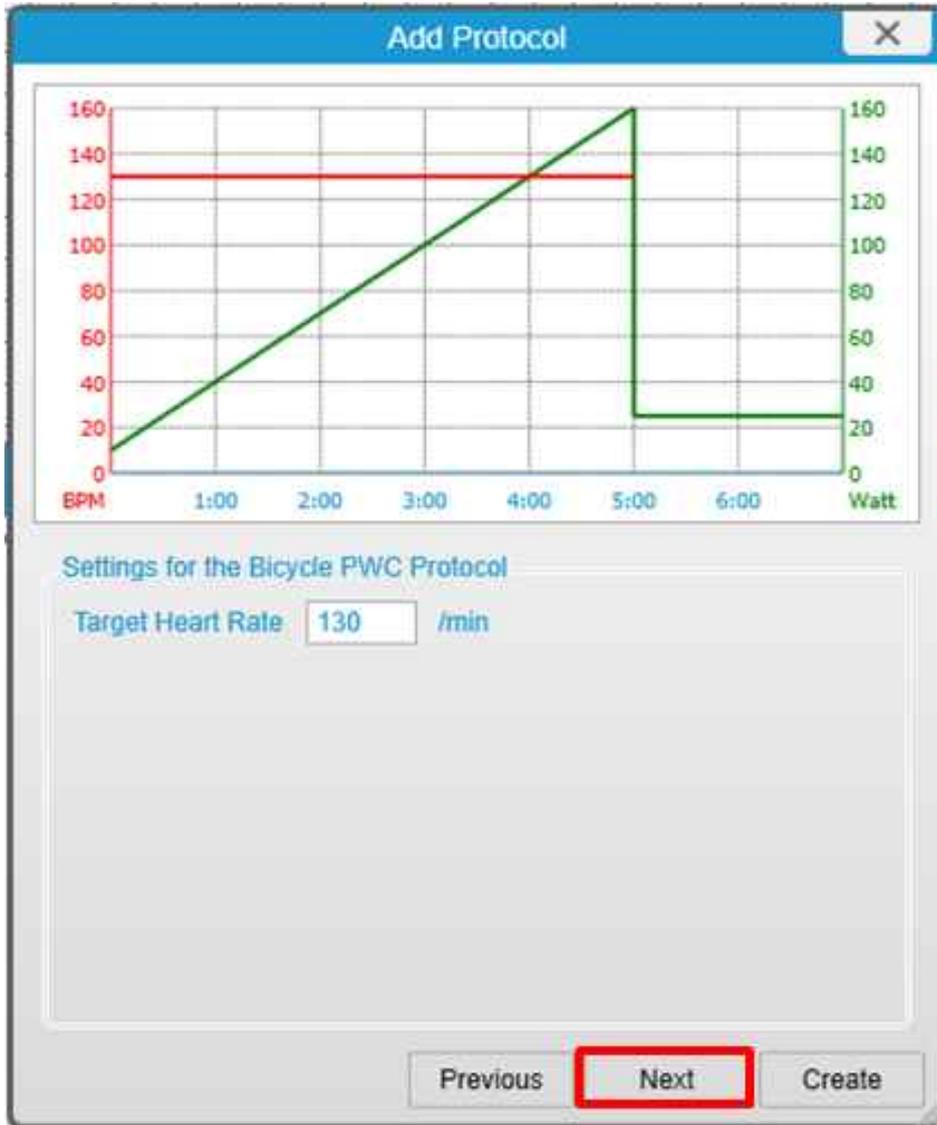
Click on [Next]. The following steps are the same as the previous described Interval Protocol, (re)name your protocol and choose if you want to set ECG marker and/or if blood pressure measurements should be taken automatically. And save your protocol, it will be saved the protocols of the ergometer type in question.



Create Physical Work Capacity protocol

A Physical Work Capacity (PWC) Protocol is created to train on a certain heart rate. During a PWC protocol the workload will increase every 2 seconds with 1 watt until the set heart rate is reached. This protocol is only available for bicycle ergometers.

Select "PWC" and click on [Next].



The only setting for a PWC protocol is the target heart rate. When the target is reached the protocol will switch to recovery mode, which is 25 Watt.

After setting the target heart rate the other steps are the same as the previous described protocols ((re)name protocol, set ECG marker and set blood pressure measurements).



Create Custom Protocol

If you want to create a specific exercise protocol that does not fit within the border of a Interval, Step or PWC protocol, you can choose for a custom protocol. With this option it is possible to create heart rate controlled protocols, as well as ramp protocols. Furthermore you can create a step protocol combining incremental and descending steps or even make mixed protocols with all the different protocol types available.

Click on [Next] to start creating your specific training protocol.



Add Protocol [X]

100
80
60
40
20
0

0:10 0:20 0:30 0:40 0:50 1:00

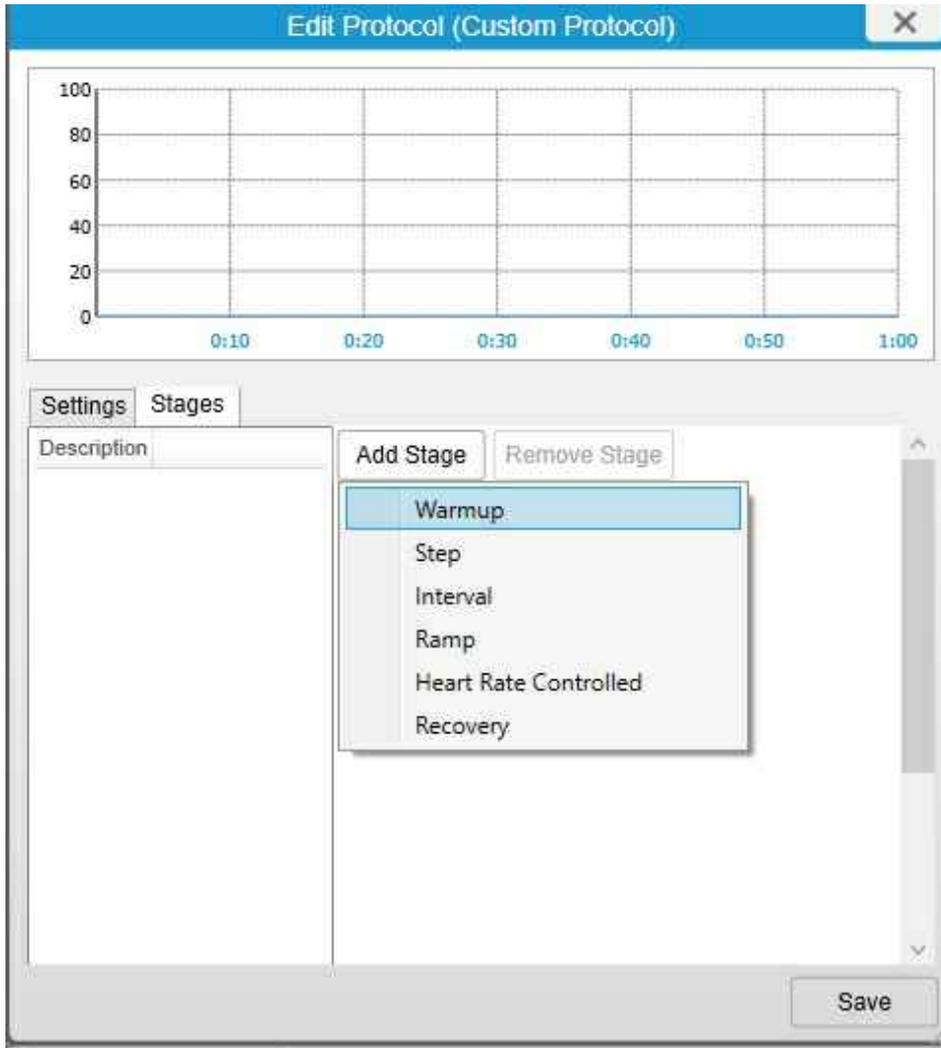
Enter the name of the protocol.

Custom Protocol

Previous Next **Create**

First rename your protocol, ideally the protocol name fits the content, so it is easy to recognize when you want to select a certain protocol.

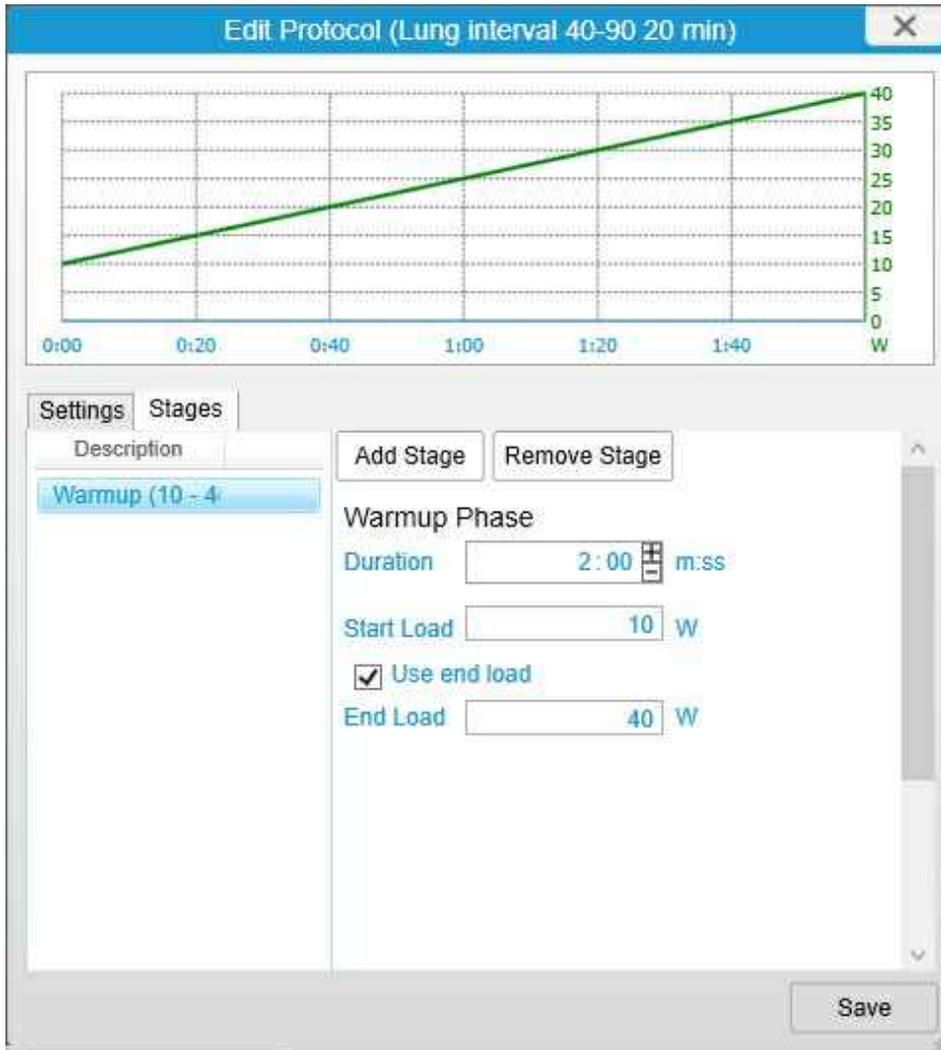
Click on [Create] to adjust the ECG and Blood Pressure Measurement (only when available on your ergometer) settings and to choose the stages you want to have in your protocol.



The ECG and BPM settings are the same as in the previous described protocols. To add stage to the protocol switch to the tab "Stages".

Click on [Add Stage] to choose which type of stage you want to add. The options are Warmup, Step, Interval, Ramp, Heart Rate Controlled and Recovery. Every type will be described below.

You can add as many stages as necessary.



Warmup

The warmup stage is always the first stage of a protocol. It can be programmed as a normal Step or as a Ramp stage towards the next workload in the protocol. The results of this stage are mentioned separately in the analysis.



Step

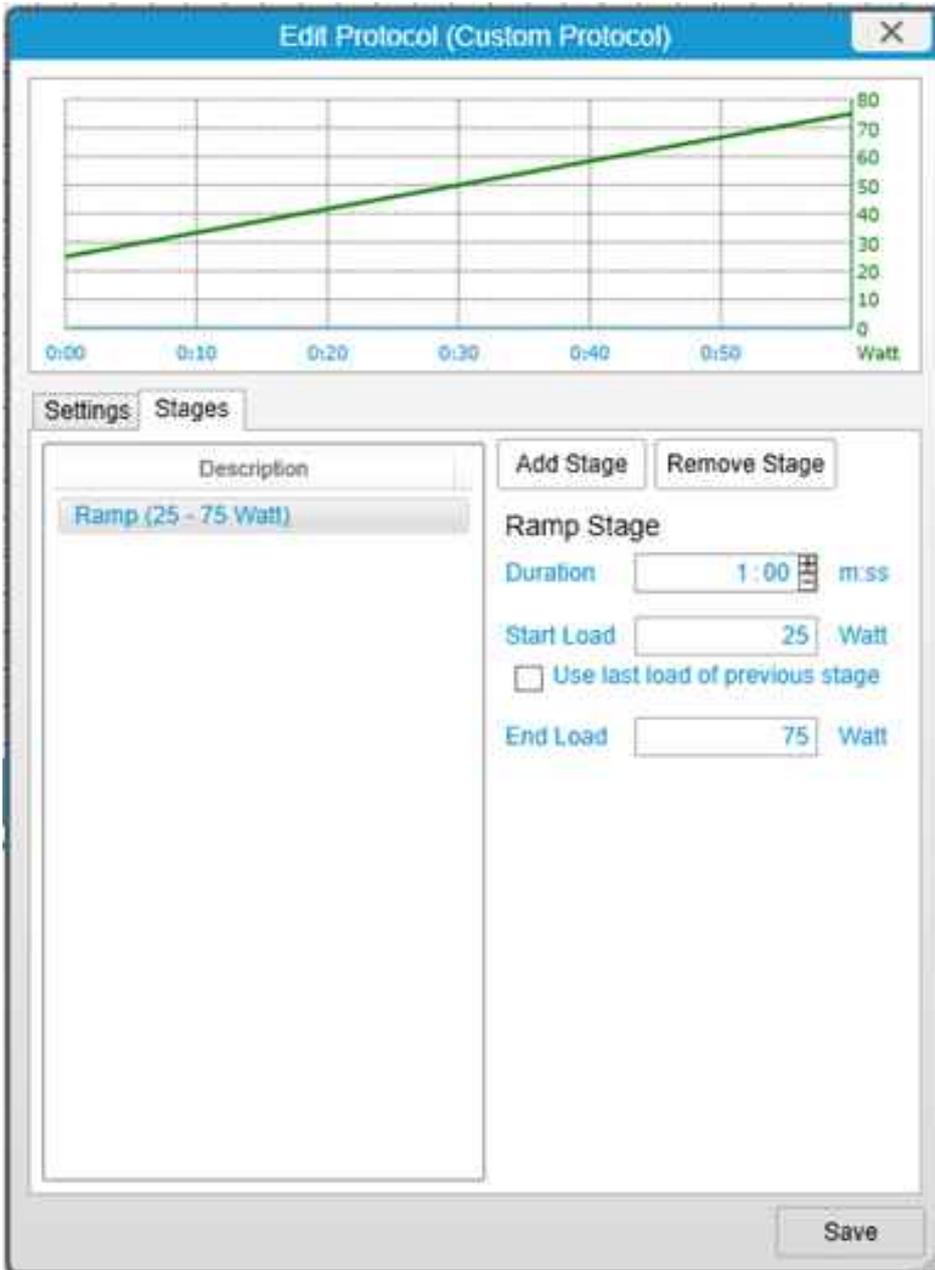
The stage Step is a single step of which you can set the duration and the load or speed and inclination when creating a treadmill protocol. If you want to create a protocol where the duration and intensity (load or speed and inclination) of the steps should be different all the time you can add more step stages to the protocol with all different durations and intensities.



Interval

With the stage Interval you can create the same protocol as previously described for Interval protocol, a certain amount of steps with a low or high intensity and the same duration for each low or high step. First choose the amount of steps and then set the duration and intensity. Again for the bicycle ergometer the intensity is defined by load, for the treadmill this can be speed and/or inclination.

An extra options in the bicycle ergometer protocol is that instead of a fixed load you can select "Use participant Load" and choose the percentage of participant load that should be use in the low and/or high step. The participant load is a training parameter which can be filled in the participant information.



Ramp

With the ramp stage you create a protocol with a constant increasing load. The duration of the stage and the difference between start and end load determines the slope and thus the watts per second (or speed/inclination per second). This will determine the intensity of this protocol stage.

When the protocol is created for a bicycle ergometer it is possible to choose the load from the previous stage as start load.



Heart Rate Controlled

The stage Heart Rate Controlled gives you the opportunity to create a protocol to train with a certain heart rate. You have to set the training duration and the target heart rate. The intensity (load or speed and inclination) will be controlled by the software in order to come to this certain heart rate as well as to keep the heart rate stable around the target.

To set "The Target Heart Rate" you can choose between absolute heart rate, relative to max heart rate or Karvonen. With absolute heart rate you determine which heart rate is the target. When you select "relative to max heart rate", the maximum heart rate of the participant is used to calculate this value. This is only possible when it is defined in the participants characteristics

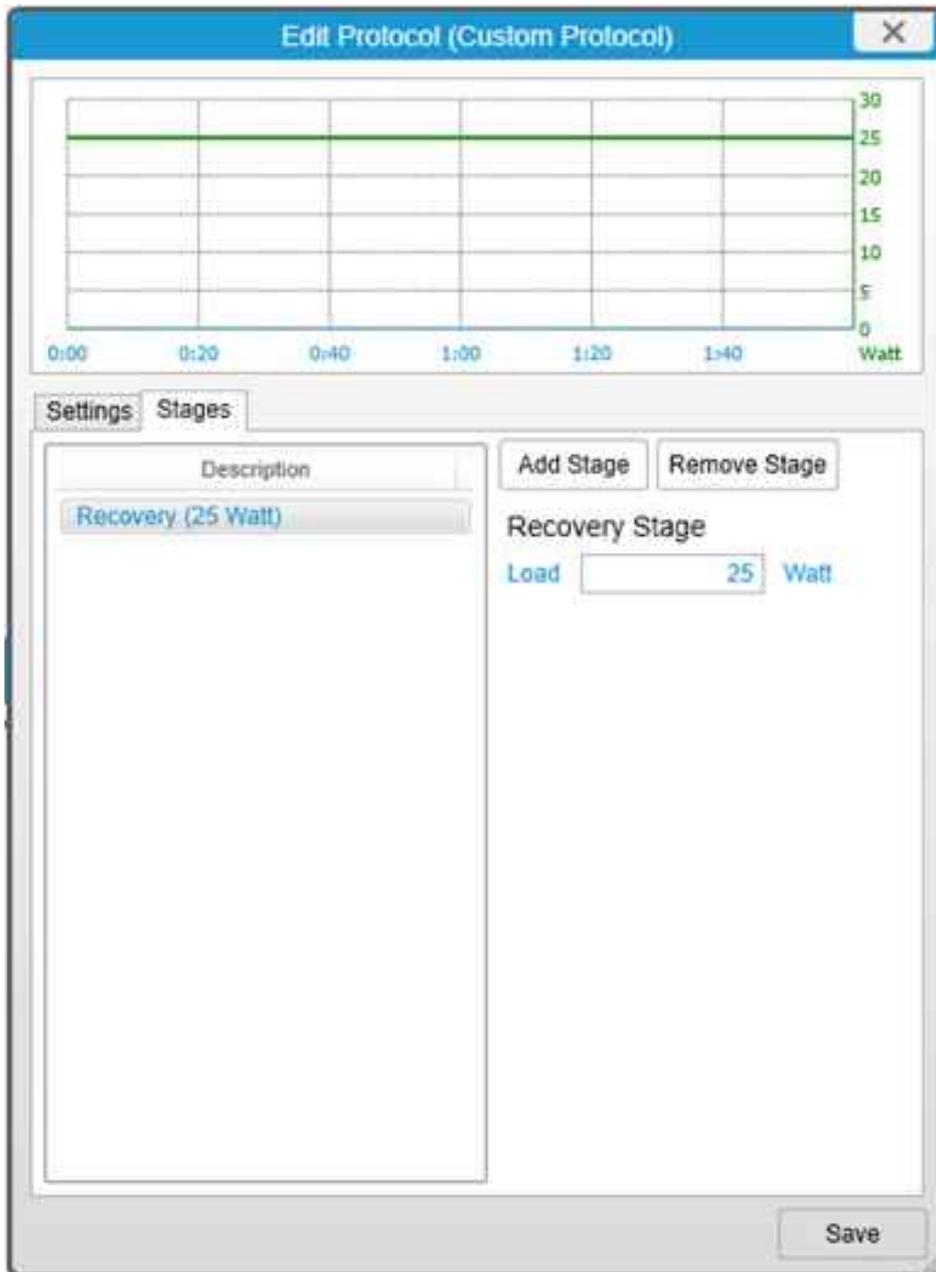
(automatically happens when day of birth is filled in).

The last option is Karvonen, this is a formula based on maximum heart rate and resting heart rate:

$$HR \text{ (Karvonen)} = HR_{\text{rest}} + (HR_{\text{max}} - HR_{\text{rest}}) * x\%$$

The percentage is defined by the physician depending on the physical improvement of the participant. The use this the resting heart rate and maximum heart rate should be defined in the participant characteristics.

For safety reasons is possible to set a maximum load (bicycle) or maximum speed and inclination (treadmill).



Recovery

The Recovery stage is normally added to the end of the protocol, so the participant can recover from the effort with a very low intensity. The load (bicycle) or speed and inclination (treadmill) needs to be set, the recovery stage will end if the protocol will be stopped (in the software) at the end of the training.

Note: if you do not add a recovery stage to the protocol, the software will automatically add a recovery stage, since for safety reasons it should always be possible to switch directly to the recovery mode via the software.

If all the stages you need are added to the protocol and the settings of the stages are correct, click on [Save]. Your protocol will be saved under the ergometer type for which the protocol is created.



Add Protocol

100
80
60
40
20
0

0:10 0:20 0:30 0:40 0:50 1:00

Select a protocol template from the list below.

Name: [dropdown arrow]

ECG Only Protocols

ECG Only Protocol

Previous Next **Create**

ECG Only Protocols

If there is no ergometer connected to the slot, you can create ECG Only Protocols. These protocols are meant to monitor ECG while the participant is doing exercises without ergometer, like squats, lunges or jumps.

Click on [Select Protocols] and then on [Add], select in the next screen ECG Only protocols and click on [Create]. If there is an ergometer connected to the slot, the protocols available for this ergometer will be shown. Creating an ECG Only Protocol is only possible if the slot is cleared.



Edit Protocol (Mark Interval - 02:00) X

100
80
60
40
20
0

0:10 0:20 0:30 0:40 0:50 1:00

Settings Stages

Name: Mark Interval - 02:00

Lock Protocol

Automatic ECG Markers

Do not add markers automatically

Add markers at fixed intervals.

Interval 2:00 m:ss

Save

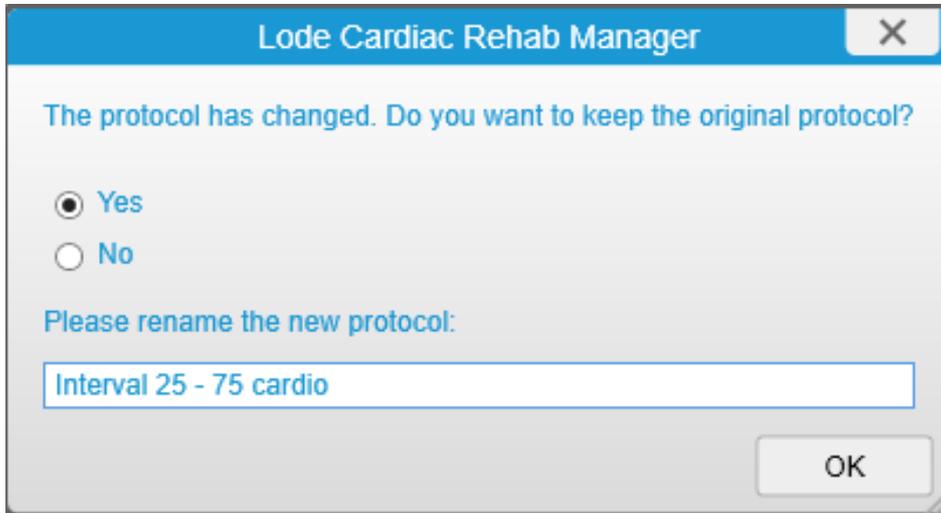
In the next screen you can rename your protocol, ideally the protocol name fits the content, so it is easy to recognize when you want to select a certain protocol. Furthermore you can choose if you want to add automatic ECG markers.

As with all the protocols you create you are able to lock the protocol for further changes.

You only can delete protocols, if you have an user account with the right to delete protocols. Protocols can be deleted one by one by selecting a protocol and click on [Remove]. It's also possible to select more than one protocol using the ctrl-button and remove the protocols at once.



12.4 - Edit protocols



The stages and protocol settings of all kind of protocols can be adjusted when the user has the privileges to perform these adjustments. Saving the adjusted protocol will show you the message: "Do you want to keep the original protocol?" When the original protocol needs to be kept you have to rename the new protocol. The original protocol will be replaced by the new one when

"No" is selected.



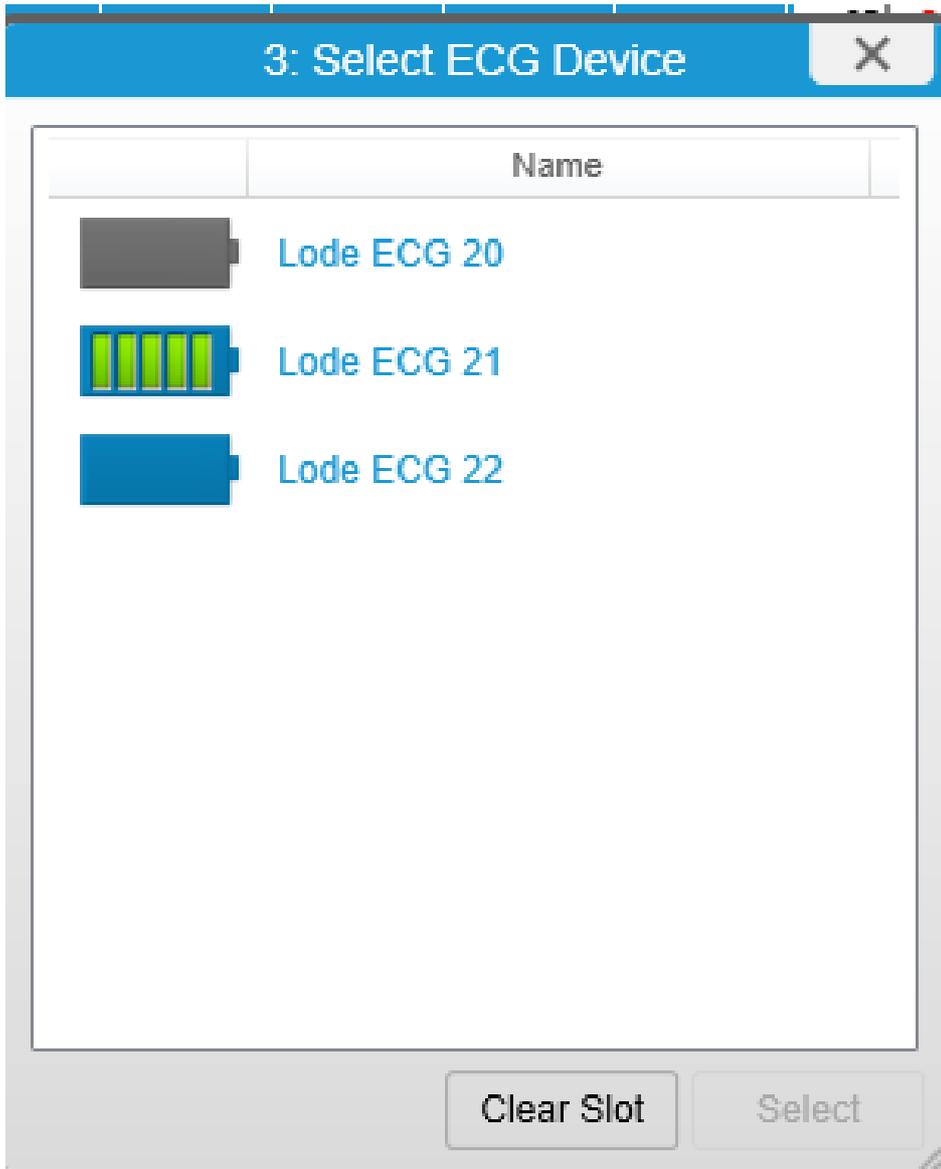
13 - ECG Streamers (only LCRM)

ECG streamers are only available for LCRM, when you use LRM there are no ECG streamers included and there will be no cardiac monitoring available during rehabilitation training.

For the ECG streamer a separate user manual is available. This manual contains information about how to switch on/off the streamer, the meaning of the different LED indicators and how to place the electrodes and the wires correctly.

In this chapter will be explained how to connect the ECG streamer to the correct slot and thus the correct participant. This is only possible when the ECG streamers are available in the software. Information about adding devices to the software can be found in the installation manual.

To add an ECG streamer to a slot, you first have to activate the slot by clicking on it. Then you can click on the symbol [Select ECG device] and a list will appear with all the available ECG streamers.



In the list of ECG streamers all streamers added to the software are visible. The name behind the icon can be set by the administrator. Normally it corresponds with an identification of the device itself. The symbol of the streamer can be grey, blue or the battery level is visible.

Grey: ECG streamer is connected to the software and available to use, but switched off.

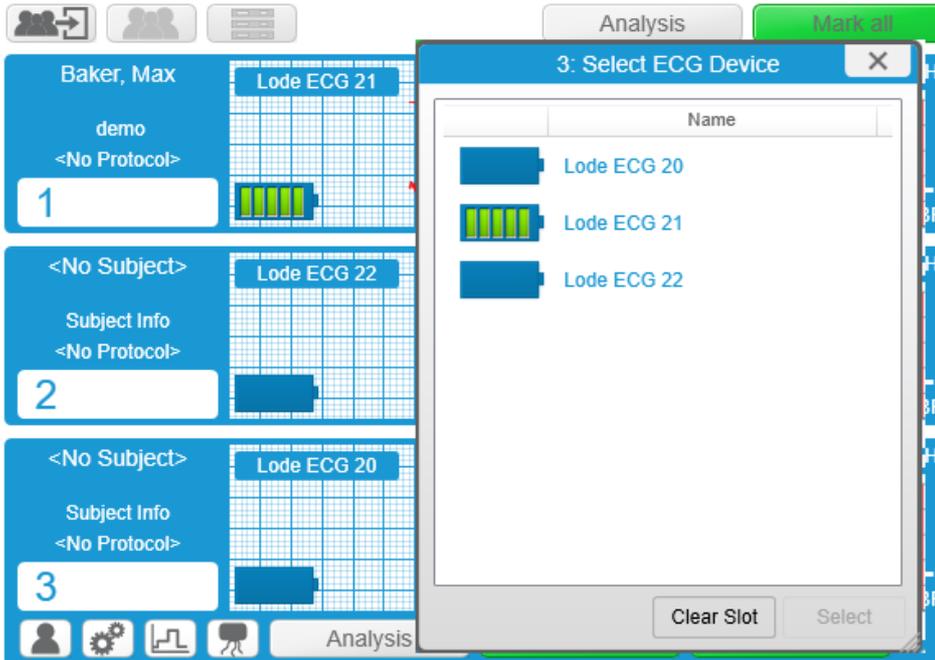
Blue: ECG streamer is connected to the software, available to use and switched on.

Blue and battery level visible: streamer is already connected to a slot/participant.

All streamers can be selected but ECG streamers that are switched off won't generate

data, so there is no ECG signal visible in the software.

Be aware that when you select the ECG streamer for a certain slot, the streamer and the participant wearing the streamer should be connected to the same slot.

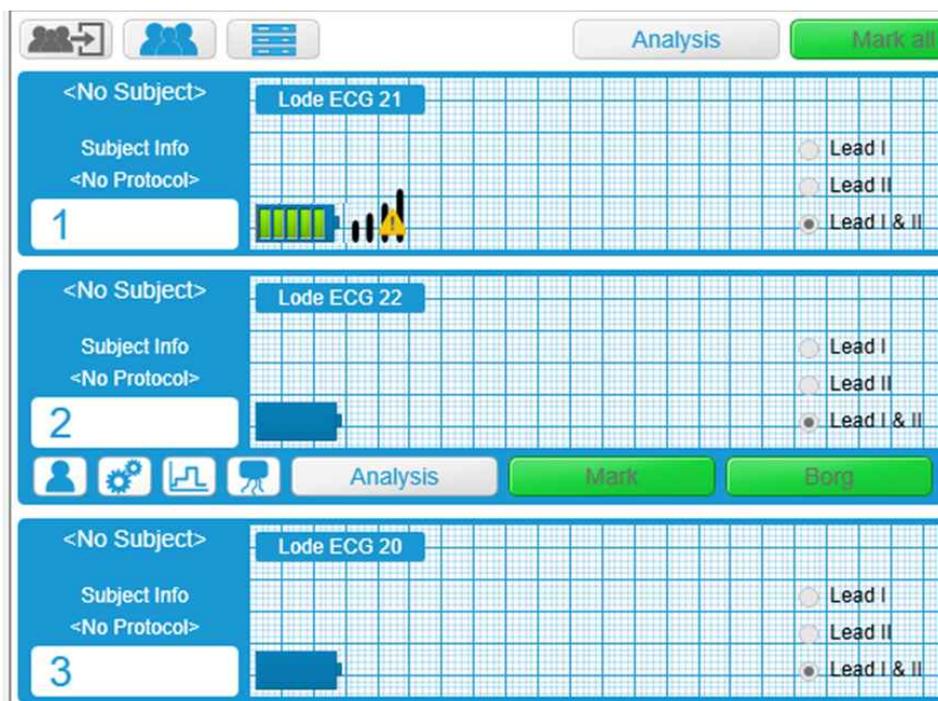


When you have selected an ECG streamer, the symbol of the ECG streamer is visible in the ECG graph of the slot (left bottom corner). Now the symbol has a battery indication which provides information about the charging level of the streamer.

Green: fully charge
 Orange: almost empty, recharge as soon as possible
 Red: empty, recharge immediately

Furthermore in the left upper corner is shown which streamer is matched with that slot.

Repeat the selection of ECG streamers for each slot/participant. A connected ECG streamer directly shows data in the ECG graph (this data will not be saved, only data collected at the moment that the protocol is running is saved), in this way you can adjust the signal (when necessary) before the training starts. When all the streamers and the data are visible in the software you can start the training.



The ECG streamers are connected to the PC with bluetooth and therefore wireless, thus the participants can move freely around. If a participant will move to far from of the receiver there is a risk for signal loss. In case of a reduced signal quality the software will give a warning in the slot of the relevant ECG-streamer. Always check why the signal is reduced and if it can be solved.



14 - Perform a L(C)RM training

At the start of a training you have to make sure that all participant of training are assigned to the correct slot. The correct slot is the slot with the ergometer the participant will use during the training (not only the right type, but also the correct serial number). Furthermore you have to select a protocol and assign the correct ECG streamer to a participant. If that is done you are ready to start the exercise. During the training you are able to change the view, start BP measurements, change the protocol and to have a detailed look at the ECG. This will all be explained in this chapter.

Note that the ergometers are already assigned to a slot, this has been done during the installation.

Since trainings exist of a different amount of participants it is possible to select the amount of slots you want to have on your screen in order to get the best possible view. Click on the symbol [Slot Control] and select the amount of slots you want to see during the training.

14.1 - Participant or group assignment

By choice you can add one by one all the participants or you can add a group of participants. It is also possible to add a single participant after you have selected a group or the other way around. If one of the group members will not participate you can remove this participant, without removing the whole group.

If you want to add one participant to the training you have to select the slot with the ergometer the participant will use. Click on the symbol [Select Participants].



 Select Participant

Busy	Last Name	First Name	ID
	Baker	Max	546547
	Book	Elly	54826
	Bread	Billy	58963
	Doe	Jane	457952
	Luckey	Guus	1234
	Rest	Brad	98563
	Test	Thea	45824
	Tester	Petr	456456
	Wood	Tim	48952

Buttons: Add... Edit... Remove Select

You can use the search tool or scroll through the list of participants to find the participant you want to add to the training. Select the participant and double click or click on [Select]. The participant will be add to the slot.

As you can see, it is also possible to add a new participant or the edit or remove the selected participant. These possibilities are all described in the chapter Add new participant.

If you want to add a group to the training session you have to click on the symbol [Participant Groups], located in the second line at the top.

If you want to add a group to



Participant Groups

Participant Groups
✕

Groups	Participants
<ul style="list-style-type: none"> All Participants <li style="background-color: #e0e0e0;">Cardiac Friday 11-11:45 Lung Tuesday 10-11 am Neuro group A 3pm Thursday 5pm Wednesday 2pm Monday cardiac 3pm Monday Cardiac 10am Logical name is day and time Test group A Wednesday 4pm 	<div style="border: 1px solid gray; padding: 5px; margin-bottom: 5px;"> Search: <input style="width: 80%;" type="text"/> Sort </div> <div style="border: 1px solid gray; padding: 5px;"> <p>Baker, Max 54654786593241 <u>Assigned to Slot: 6</u></p> <hr/> <p>Baker, Jesse 8916345034 <u>Assigned to Slot: 4</u></p> <hr/> <p>Butcher, Anne 80625345 <u>Assigned to Slot: 2</u></p> <hr/> <p>Fisherman, Benjamin 0132463 <u>Assigned to Slot: 8</u></p> <hr/> <p>Green, Maria 4324579 <u>Assigned to Slot: 3</u></p> <hr/> <div style="background-color: #e0f0ff; padding: 5px;"> <p>Long, Noa BP 6526559 <u>Not Assigned To Slot</u></p> </div> <hr/> <p>Master, Conrad 01234 <u>Not Assigned To Slot</u></p> </div>

Add
Remove
Rename
Remove
Assign Slot
New Participant

Move Participants between groups by dragging them from Participants to Groups. The Participant will be removed from the original group unless you drag with the control key pressed.

Activate Group

Select the group you want to add to the training and double click or click on [Activate Group]. If the participants are assigned to a certain slot (and thus a certain ergometer) they will be add to that slot, otherwise they will be add to the slots in alphabetical order.

Again it is also possible to create new groups of participants, remove groups or add participants to existing groups. How to do this is all explained in the chapter Create participant groups.

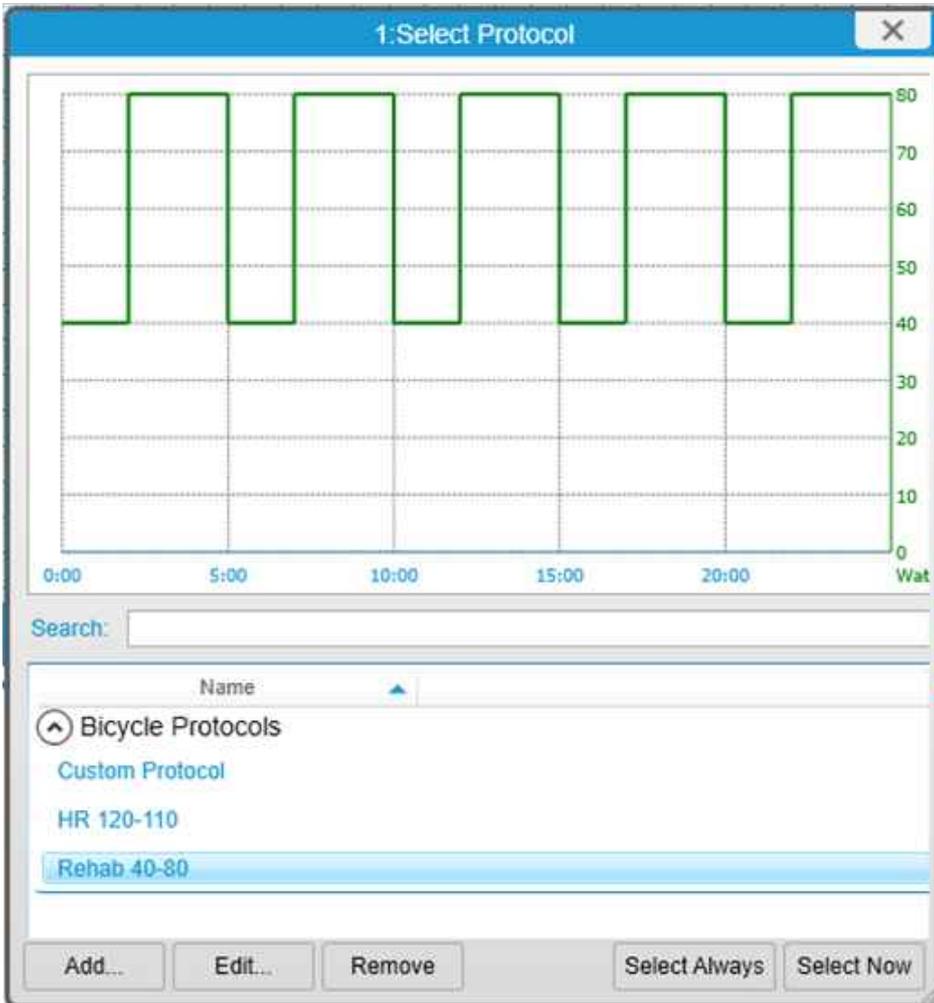
If some of the participant in the selected group won't join the training, you can clear them from the slot by clicking on the symbol [Participant leaves. This will clear the test slot]. This will clear the slot, but it won't remove the participant from the group.

14.2 - Protocol Assignment

Next step is to add the correct protocol to the slot/participant. If in the participant characteristics is chosen to set a default protocol this will automatically load at the moment that the participant is selected. If no default protocol is assigned, activated the slot for which you want to assign a protocol and click on the icon [Select Protocol].



Select Protocol



Create Protocols.

Only the protocols suitable for the selected ergometer are shown. Select the required protocol and double click or click on [Select Now]. The protocol will be shown in the selected slot on the right side. It's also possible to click on [Select Always], in this case the protocol will be set as default protocol for the participant and always be chosen when the participant is selected. If a default protocol is chosen in the participant characteristics, it will be overwritten.

Note that it is only possible to select a protocol when there is an ergometer assigned to the slot.

Also for the protocols it is possible to add, edit and remove protocols. These steps are explained in the chapter



14.3 - ECG streamer assignment

Finally, the ECG streamer needs to be assigned to the correct slot/participant. Click on the symbol [Select ECG Device].

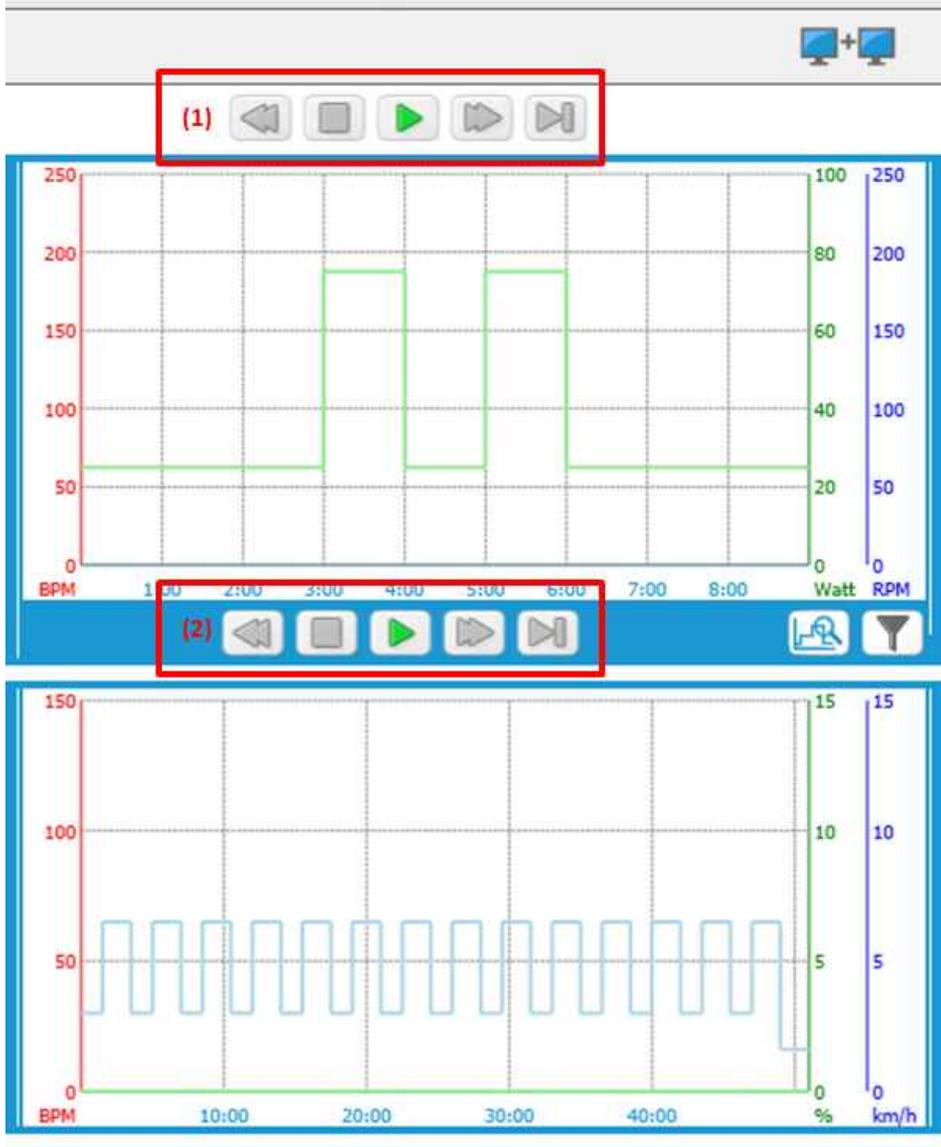


Select the ECG streamer the participant is wearing (check the corresponding number in the device name and the number on the device itself). The ECG streamer which are shown with a battery indication are already assigned to a participant. It is possible to select an ECG streamer which has already been connected to another participant. The assignment will change to the last selected participant. No warnings occur.

When all participants are assigned to a slot with an ergometer, protocol and ECG streamer (in case of LCRM) the participants can start with their training.

14.4 - Start training

The training can start for all participant in the same time or you can start the training for each participant separately. The same counts for stopping the training, skipping steps of the protocol or directly switch to recovery stage.



At the moment you use the main control panel (1) in the second line from the top, you are controlling all the completely assigned slots at the same time. If you use the control panel (2) which appears when you select a slot, you are only controlling the ergometer of that certain slot.

At the moment you click on one of the start symbols (green arrow), the training begins. The ergometers will follow the protocol as stated in the slot and in the same graph as the protocol it is possible to see the RPM and load (bicycle ergometer) or speed and inclination (treadmill), heart rate and SpO₂. Data from the ECG streamer is only shown in the ECG graph (left part of the slot).

The graphical representation can be changed in the general settings, see the chapter General Settings. You can switch off SpO₂ and heart rate, so the graph will only show the protocol and RPM/load or speed/inclination. If there are no ECG streamers (LRM software) used you can also switch off the ECG graph, the protocol graph will be show over the total length of the slot.



HR	BP	SpO ₂	METs	Time
---	---	---	---	---
BPM	mmHg	%		mm:ss

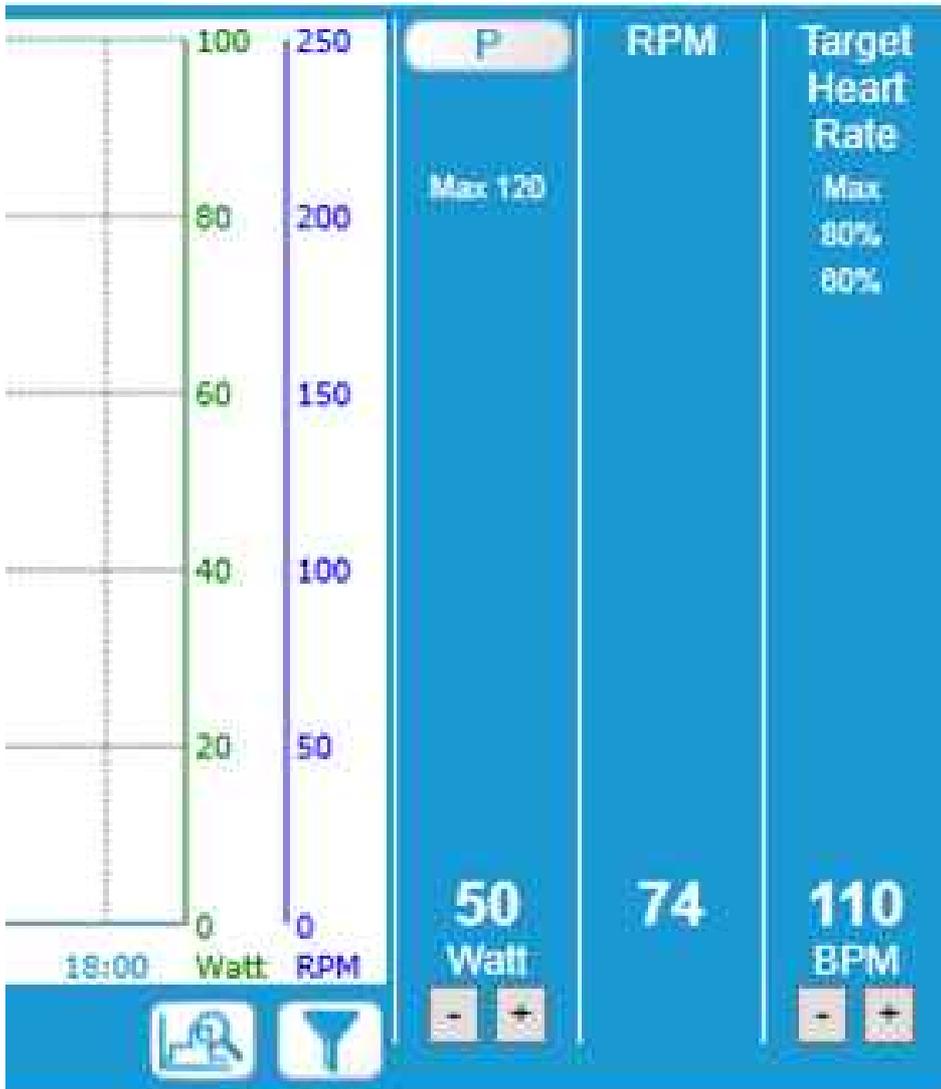
Besides the graphical display participant parameters are presented as numeric value. These are shown in the blue columns left from the protocol graph. Which parameters you want to see can be selected in the general settings, see chapter General Settings. The parameters blood pressure, SpO₂ and METs can be switched off. Heart rate and time will

always be visible.

The column with the parameter blood pressure (BP) has two additional buttons. To enter a manual measured BP or to start an (extra) automatic BP measurement, press the [Start blood pressure measurement] button.

The manual start of an automatic BP measurement can be stopped in the window which will appear when you click on [Start blood pressure measurement]. If a preprogrammed BP measurement is not desired at a specific moment the “cross” can be pressed. The following message will appear: *Skip the next blood pressure measurement? (Any ongoing measurements will be cancelled)*. Choose [Yes] or [No].

Note that all the above described changes in data presentation are general, so they will affect all the slots not only the selected slot.



On the right side of the protocol graph some protocol parameters (Load, RPM or Speed, Inclination and Targeted Heart Rate) are shown in real values. For load (P) and Target Heart Rate there is the option to make changes in a running protocol with the plus and minus.

The plus and minus are only visible in the selected slot and give the opportunity to instantly change these protocol parameters. This provides the option to easily change the protocol when the protocol seems to easy either to heavy for the participant. These changes will not be saved in the original protocol.

Load

During a Step, Ramp and Interval Protocol it is possible to change the load with plus and minus. Changes of the load during an Interval Protocol or Interval Step in a Custom Protocol will remain during the total protocol or interval step. If you changes the load in a high interval step all remaining high interval steps will also changes to the new load setting. If you change the load in a low interval step all remaining low interval steps will change to the new load setting. For the other protocols or protocol steps in case of a Custom Protocol the change of load will only be for the relevant step. It is also possible to change to load during a Heart Rate Controlled Protocol, be aware that with this change the Heart Rate Controlled Protocol will switch to a Step Protocol with the load you have set. Click on [P] (Change to Static Stage) in the column with the load information and choose the load.

Target Heart Rate

During a Heart Rate Controlled Protocol it is possible to change the Target Heart Rate with the plus and minus, the new Target Hart Rate will be used for the remaining protocol. For all the other protocol types it is also possible to switch to a heart rate target. Click on [Target Heart Rate] in the column with the target heart rate information, as you can see in the protocol graph the current protocol step will



change to a heart rate controlled step (purple line). The new setting only counts for the current step, the next step will be as defined in the selected protocol.

14.5 - Functionalities during training

There are some tools available in LCRM which can be used during the training. With these functionalities it is easier to monitor the participants during the training, but also for analyse the data afterwards.

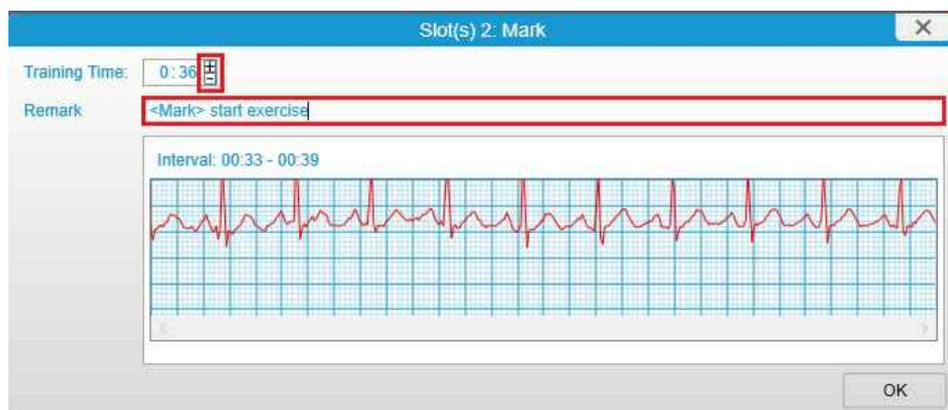
In this paragraph all tools will be explained.

Analysis

During a training it is possible to analysis previous trainings. When you click on the [Analysis] button in the second line all participants are shown. Select one of the participant and click on [Select] or double click on the name and a list with all saved trainings will appear. You can select one or more trainings by checking the boxes and click on [Analysis].

It is also possible to click on [Analysis] in the selected slot. This will show only the saved trainings of the participant which is assigned to this slot.

A further explanation of this function can be find in the chapter Analysis.



Mark

The option Mark is also available in the second line as well as in the selected slot. When you click on [Mark] 8 seconds of ECG will appear and a time stamp will be created. You can scroll back and a little forwards in time with the + and - buttons to have a closer look at the ECG. This time stamp can

be used during analysis later on. It is also possible to write a short note in order to know why the mark was made. It is also possible to use the event button of the ECG streamer to set a mark. Push once shortly on the blue button of the ECG streamer and a marker is set in the software. Using the streamer to set a marker will not give the possibility to write a note.



Hovering with the mouse over the Mark button shows the set marks and their notes.



Borg scale

If in the general settings the standard or alternative Borg Value Entry is selected, every slot has a button [Borg]. Using this button will be asked for a Borg value of the participant, the value will be saved at the moment in time you have clicked the button. It is possible to be asked the Borg value more than once per training.

Hovering with the mouse over the Borg button shows the time stamps and the Borg scores.



 ECG Details



ECG monitoring

The ECG signal is always visible in the ECG graph, but LCRM has some options to optimize the monitoring. The first one is the symbol [ECG details]. This will provide a graph with the ECG signal measured until the moment you have clicked. The graph gives you an opportunity to have a better look at the signal, since it is not moving. You can choose to show one of the two available leads, by

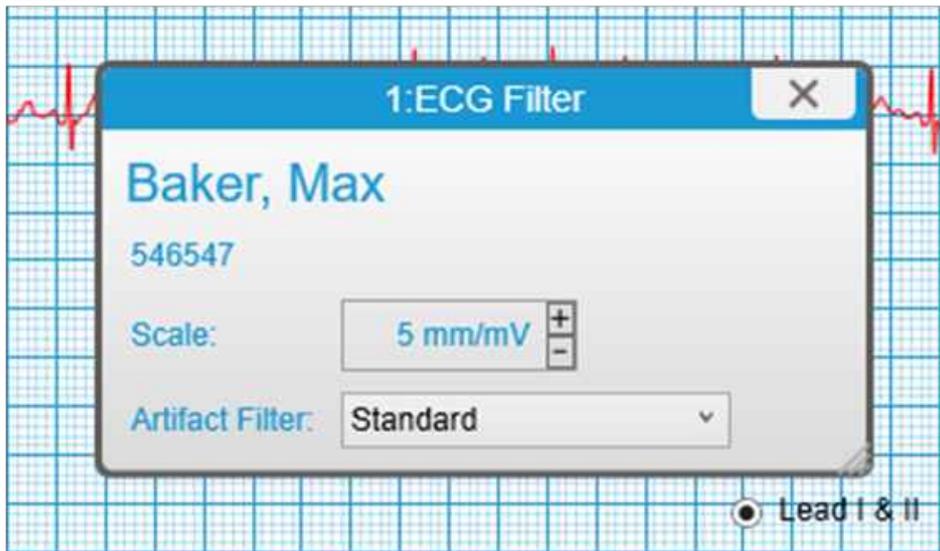
selecting Lead I or Lead II in the selecting array under the graph. The scaling in x- and y-direction can be changed to further optimize the signal. Changing the "Scale" will adjust the signal in the y-direction, while "Sweep Speed" will adjust the scaling in the x-direction.

If markers are set, these will also be visible in the graph (see the green marks) and the messages given with these marks are listed. The control panel can be used to move from marker to marker. If you check the box "auto update" the graph will be updated every 10 seconds.

The [Update] button will update the graph and will show the data from start to the moment you have clicked [Update]. Furthermore it is possible to print or export the ECG details.



 **Filter Settings**



Besides having a detailed look to the ECG signal in ECG details it is also an option to optimize the moving ECG signal. This can be done by changing the scale and/or applying another Artifact filter. There are four scaling factors 5 mm/mV, 10 mm/mV, 20 mm/mV and 40 mm/mV, these are in line with de scaling factors used by other ECG devices. Click on [Filter Settings] in order to open the window for changes. The filters are created in order to suppress the noise

on the signals generated by extensive movement during the exercise. You can choose between no filter or a standard, moderate or extreme filter. The more movements the participant is making the stronger the filter has to be.

Note that the quality of placement of the electrodes can also have an effect.

 Please note that the filter limits the data range, always be aware of that when analysing the data.

Blood pressure measurement

Although it is possible to set up the blood pressure measurement in the protocols, it is also possible to perform a measurement at another moment then prescribed by the protocol. This can be necessary when one of the participant is complaining about pain or fainting. At the moment you click on the button [Enter blood pressure manually or start automatic manually] a blood pressure measurement will start. The data will be shown in the column and also saved for further analysis.

Furthermore, this button has the option to enter the data of a blood pressure measurement device which is not connected with L(C)RM. If you click on the button [Enter blood pressure manually or start automatic manually] while an external device is used you can manually fill in the values of the measurement. Again the data will be shown in the column and also saved for further analysis.

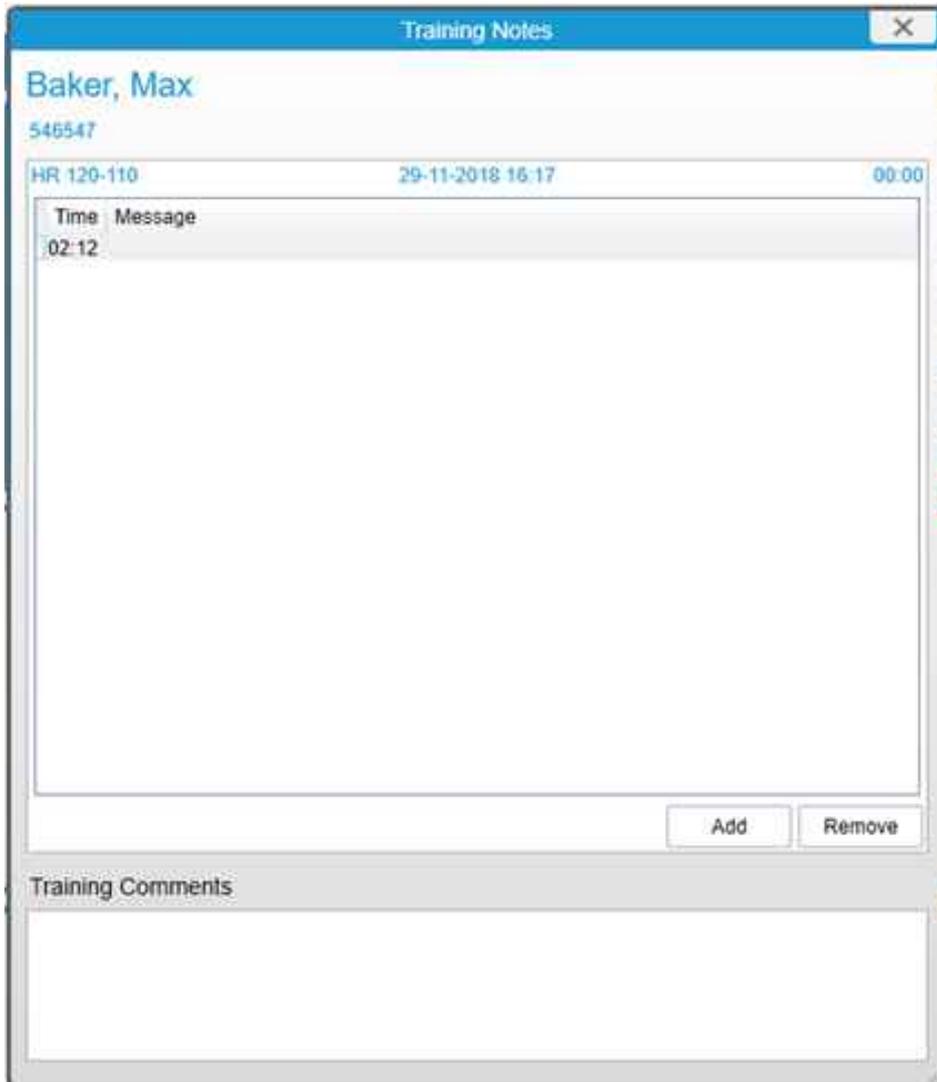


Show Graph Details



Protocol graph

The same as with the ECG graph it is also possible to have a detailed look at the protocol graph, containing information about the protocol, heart rate, SpO₂ and RPM, load or speed and inclination. Click on the symbol [Show Graph Details], an extra window will open with the protocol graph up till the moment you have clicked. Under the graph information can be found about the average heart rate during different phases in the protocol.

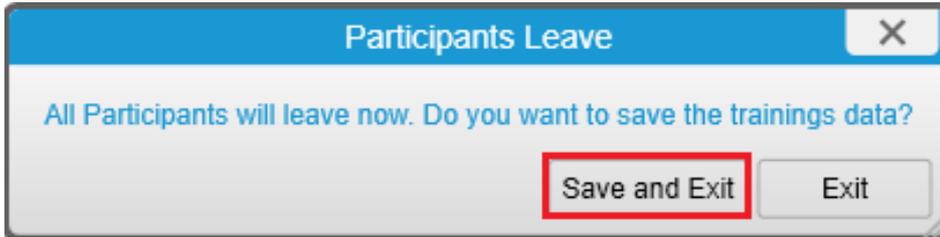


It is possible to make a time stamped note, click on the pencil symbol. A screen will open where you can add notes. Click on [Add] to add the protocol time to the comments list. Double click in the message line behind the time and you can add your note. For a new note at another time you have to click [Add] again. Below the comments list you can write down training comments which are not related to the time in the protocol.

Furthermore, there is a filter options for the heart rate. With this option you can change the moving average and ignore extreme values (high and low) in order to get a more robust signal. If you click on the symbol [Filter Settings] you can set the filter to none, light, moderate or extreme.

14.6 - End of training

When the training has ended you can stop the protocols, either all at once or separately for each participant. You can choose if you want to save the data or not. This question will pop up if you remove the participant from the assigned slot when you click on [Participants leave. This will clear the test slot.]. The data will be saved under the participant name with the notification that the training has been done. Again this can be done for each participant separately or all at ones, when you use the symbol [All participant leave. This will clear all slots]. in the second line.



When you use the symbol “all participants leave”, you select “Save and Exit”(or exit without saving anything at all). It is possible to receive an overall summary of the total group of patients when this functionality

is enabled in the General Setting tab" Analysis".

When all slots are cleared the software is ready for the next group of participants.



15 - Analysis options

The software has also an analysis function which can be used after or during the training. Only data that is saved can be analysed with this function. During a training you can either use the [Analysis] button at the second line or the [Analysis] button in the selected slot if you want to analysis data from the participant selected in that slot. After a training when all slots are cleared it is easier to use the [Analysis] button at the second line.

Select the participant of interest, double click or click on [Select] and all saved training sessions will be shown. Now you are able to select one or more training sessions.

15.1 - Analysis of a single training

Select the test of interest and click on [Analysis], L(C)RM will show the details of a single test.



Select the test of interest and click on [Analysis], L(C)RM will show the details of a single test.

The first tab "Graph" shows the graph data from the protocol graph as well as from the ECG graph. Furthermore, there is a summary from the different training stages of heart rate and load or speed and inclination. The same scaling and filter options are available as described in the chapter Perform L(C)RM training. If there have been set markers the controls can be used to go from marker to marker. By hovering over the protocol graph, data will be visible at specific times. Finally, you can edit trainings note and marks when you click on the symbol with the pencil.

The second tab "Statistic" shows the training results in real values, with a little bit more

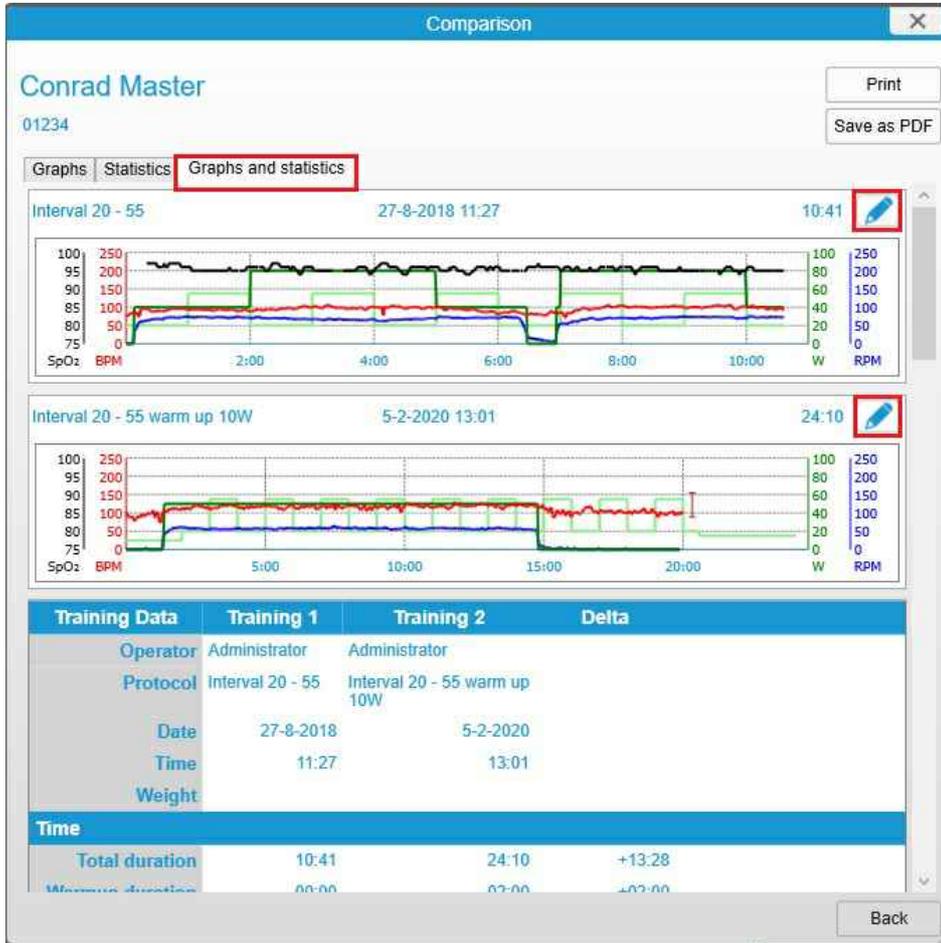
information than the summary in the "Graph" tab. The statistics are more useful when comparing two or more trainings.

The third tab "Graphs and statistics" shows all results of this single training. Training notes can be edited and more comments added to complete the analysis and report.



15.2 - Compare two training sessions

Select two test of interest if you want to compare the trainings data and click on [Analysis]



Both protocols graphs are shown, the hovering function is active. The ECG graphs, summary, scaling and filter options and the controls are not available. You can write notes at both graphs.

All numeric values of both trainings can be find in [Statistics], besides the training results also the delta between two trainings is presented. As standard the difference will be presented as absolute, but below the table it's possible to check the box "Show relative Values".

The third tab "Graphs and statistics" shows the protocols graphs and statistics together. Training notes can be edited

and more comments added to complete the analysis and report.

15.3 - Compare more than two training sessions

If you want to compare more than 2 training sessions the report only contains statistics. From all selected training sessions the results are shown and extra columns are add with the minimum, average and maximum values of the training sessions.

All generated reports can be printed or saved as PDF.



15.4 - Comments and Marks in analysis

Time	Message
00:18	resting position on bike
02:00	start cycling
04:00	-<Mark>
07:07	POB
20:00	

Training Comments
 Training session okay, improving compared to first weeks

The messages belonging to Marks set during the training are shown in blue and can be adjusted in text when the message itself is selected. Use the pencil symbol. The time stamp can't be adjusted it is possible however to remove a total Mark when it is not correct or unnecessary.

With the [Add] button new marks can be added during the analysis with the correct time notations by pressing the time

until the time notation is adjustable. These marks are visible in black.

In the "Training Comments" a summary or confirmation can be written when necessary. Both the marks and training comments will be present in the PDF or Excel export.



Analysis

Baker, Jesse

8916345034

Print

Save as PDF

Export To Excel

Graphs | Statistics | Graphs and statistics

Summary

	Warmup	Training	Recovery
HR		80.8	
Load		26.5	

Heartrate Filter



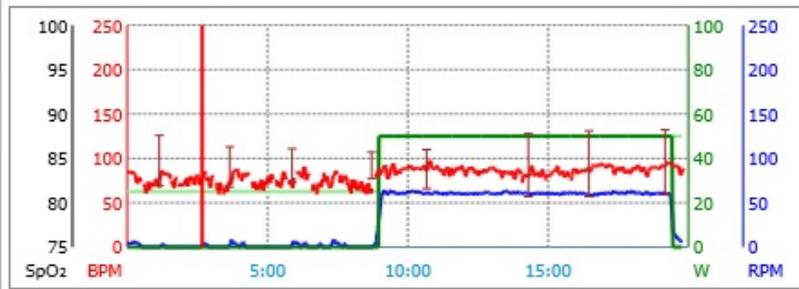
Scale

20 mm/mV
 Auto Scale

Sweep Speed

12.5 mm/s
 25 mm/s

VALIDATE BP 12-11-2019 10:39 19:50



Interval: 02:35 - 02:45



Navigation controls: Play, Previous, 1/2, Next, Stop, and a dropdown menu for 'Lead I'.

Training Data

Operator	Administrator
Protocol	VALIDATE BP
Date	12-11-2019
Time	10:39
Weight	

Time

Total duration	19:50
Training Duration	19:50

Heart Rate (Average)

Training	81
Max.	99

Load (Average)

Training	27
Max.	50

METs (Average)

Training	
----------	--

Training Notes

06:46	extra ECG POB
08:30	ST level okay
19:50	recovery no POB
20:50	
22:00	extra comments

Comments

Confirmed by Dr Hendrikson

Back



16 - Troubleshooting

Ergometer or treadmill are not visible in LCRM

The missing devices are not yet integrated in LCRM or the licenses are incorrect. Contact your distributor for help.

I can select an ergometer or treadmill, but when I start a test the message 'Cannot open comport' appears

The devices are integrated in LCRM but there is no communication possible. Check if the device in question is switched on. If the device is on but the problem still exist the data cable could be out of the pc or the communication is with the wrong comport on the pc. Contact your distributor for help.

ECG streamer not visible in LCRM

If the ECG streamer is switched on and the streamer is selected in one of the slots in LCRM, but the ECG streamer icon is still grey, there could be a problem with the Bluetooth connection. Please contact your distributor or your IT or technical department if they are involved in the system.

I selected a group of participant, but they are not all visible in the software

If there are more participants in the group than slots visible in the software you need to add more slots with the "Slot Control". If the amount of slots should be enough, you have to check if the missing participants are assigned to a slot with a higher number.

The server database is not available anymore

If the connection with the server is lost, the server database cannot be opened. LCRM automatically will give a warning that the software will switch to the local database. It is not recommended to switch, since it is not possible to upload the data easily from the local database to the server database. Contact your IT department to reconnected with the server.

We are using ECG streamers, but there is no ECG graph visible in LCRM

The user interface of the software can be changed in the General Settings. Check the box "Show ECG graphs" below Graph Settings. The ECG graph is now visible.

The test is running in the software, but the participant does not see anything on the control unit

The graph on the control unit only fills with information when the participants press "Start Timer" on the display (green button) or "Refresh" (grey button) when the time is still running from the previous test. The start button in LCRM does not communicate with the control unit.

The start button is grey, I cannot start the training

The start a training participant, device, protocol and ECG streamer must be selected, otherwise a training cannot start. If the chosen protocol as based on participant load, this load must be add to the



participant information.

If issues are not described above or the offered solutions are not working, please contact your distributor for help. See for distributors <https://www.lode.nl/en/contact/distributors>.



17 - Release Notes

This file lists the changes for each version.

Description:

NEW: New features added.

BUG: Bugfixes or comments

ENH: Enhancements

CHG: Changes

Version 3.0.0 (2020-04) (public release)

ENH:

- 6005 : Added extra tab in analysis screen with 'graphs' and 'analysis' combined.
- 14222: 'graphs' and 'analysis' also present when selecting 2 tests.
- 11104: Live update of values in table when changing the heartrate filter.
- 17800: Reduce number of ecg prints in report caused by badsignal quality.
- 18422: Added training notes to report.
- 18984: Bad signal quality markers are now in another color.
- 19643: Print selected lead in report.
- 20098: Added warning on protocol edit.
- 20110: Improved resizing a popup.
- 20633: Text of marker in PDF above ecg plot.
- 17147: Select protocol button disabled when no ergometer/ECG device is selected.

NEW:

- 16398: Added 'Manage participants' window.
- 17314: Added mute button to temporarily silence alarms.
- 18421: ECG details screen now contains comments.
- 20099: Abort bloodpressure measurement.
- 20271: Added warmup stage.
- 20274: Added warmup/training/recovery data to PDF.
- 20330: Added 'show trainings' button in edit participant screen.
- 8241 : Added setting to show analysis after all participants left.
- 20512: Show analysis after all participants left added to PDF.
- 20320: (de)activating/removing participants is logged to an auditlog.

CHG:



- 16398: Disable patients instead of removing them, an admin can remove the patients.
- 17976: Changed ordering of buttons in select patient screen.
- 17981: Default number of steps for an interval stage is now 8 (was 0).
- 18043: Target Heart Rate minimum is now 45 instead of 0.
- 20115: Minimum interval of 1 minute for a bloodpressure measurement.
- 20310: Analysis table bloodpressure remove max and average rows.
- 20599: Changed splashscreen.

BUG:

- 17129: Added scrollbars in edit protocol screen.
- 18278: Sweep speed settings are now reflected in ECG details.
- 20568: Max heart rate cannot be lower than rest heart rate.



18 - Accessories

<p>Lode ECG Streamer</p> <p>Partnumber: 950920</p> <p>Compact wireless ECG registration</p>  <p>Lode ECG Streamer</p>	<p>Additional device license L(C)RM</p> <p>Partnumber: 950906</p> <p>Versatile data and ergometer</p>  <p>Additional device license L(C)RM</p>	<p>Medical Keyboard</p> <p>Partnumber: 945860</p> <p>Maximum hygiene</p>  <p>Medical Keyboard</p>	<p>Medical Mouse</p> <p>Partnumber: 945861</p> <p>Maximum hygiene</p>  <p>Medical Mouse</p>
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19 - Science

Effects of cardiac rehabilitation and exercise training programs on depression in patients after major coronary events

Date

1996-10-01

Author(s)

Richard V. Milani, Carl J. Lavie MD, Mark M. Cassidy MD

Source

[American Heart Journal, Volume 132, Issue 4, October 1996, pages 726 - 732](#)

Exercise with cardiac patients

Date

2012-07-01

Author(s)

Project Group "Sport and Exercise Therapy in Cardiology"

Source

[DVGS e.V. \(German Association for Health-Related Fitness and Sport Therapy\)](#)



20 - Specifications

Accuracy

60 Hertz Filter	✓
50 Hertz Filter	✓
Two channel ECG monitoring	✓

Comfort

Alarm Heart Rate	✓
Alarm Blood Pressure	✓
Audio Alarm	✓
Remote Battery Indication	✓
Versatile database connection	✓

User Interface

Customized Screenviews	✓
Customized Reports	✓
Personalized Color Settings	✓
Software available in English	✓
Software available in German	✓
Software available in Dutch	✓
Software available in French	✓
Software available in Russian	✓
Software available in Polish	✓
Software available in Japanese	✓

Connectivity

RS232 connection to Lode ergometers	✓
USB connection to Lode treadmills	✓
Bluetooth available	✓
Max. wireless slots per monitor	8

Minimum System Requirements

Intel Core based processor	2.4 GHz
Monitor	1920 x 1080 pixels
Internal RAM	4000 MB
Minimum Free Hard Disk space	20 GB
CD Rom drive required	✓
Number of free USB ports	4
Mouse	✓
Keyboard	✓

Order info

Compatibility

HL7 compatible	✓
Compatible with MS SQL Server	✓
Database	SQL Compact
Database limit	4 GB
Microsoft Windows 10	✓
Microsoft Windows 8	✓
Microsoft Windows 7	✓

Included parts

PC included	✓
PC software included	✓
Keyboard and mouse included	✓
PC monitor included	✓
All cables included	✓

Partnumber

950902