SRM
www.SRM.de

# User Manual

*We make your bike a mobile ergometer!*

# SRM User Manual
# Online Option & Ergometer
## English Language
## 4th Edition

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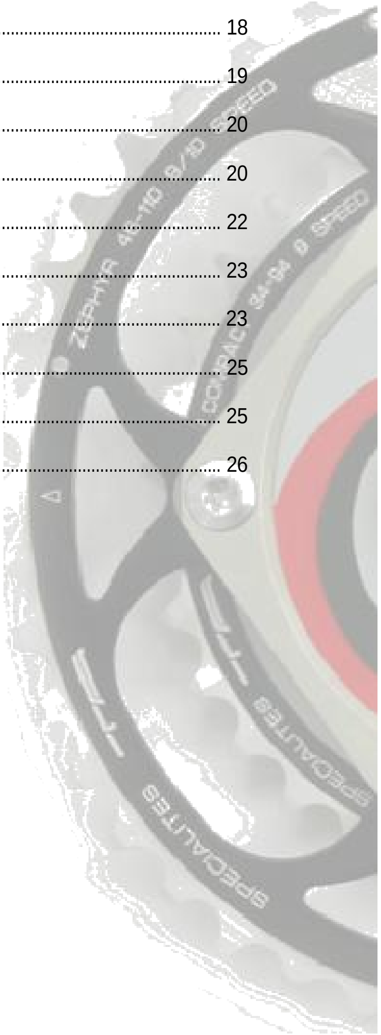
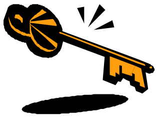


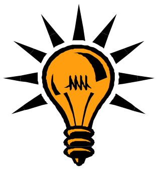
# Finding Points of Interest

Yes, we know this manual is awfully thick. Not very many of you are going to read the whole thing cover to cover, so we've flagged up interesting or important parts with icons in the margin to help you skip straight to the parts you want.

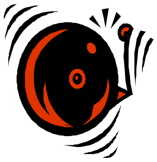
Here are the most common ones along with what they mean. There are lots of others throughout the manual, but mostly they're just there to brighten things up!



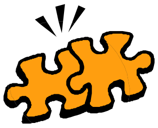
These keys point the way to bits of information that are important for making things work the way you want them to, but that aren't life-or-death kinds of things.



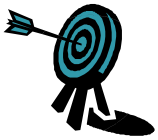
This manual doesn't just cover HOW to do stuff, it covers WHY you would want to do it as well. Any ideas are pointed out by lightbulbs, skip to these if you're on the hunt for help with interpretation.



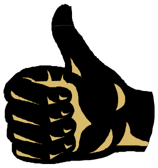
Anything terribly important is pointed out by alarm bells… It's our way of shouting "DON'T SKIP THIS BIT OR HORRIBLE THINGS WILL HAPPEN!". Ok, maybe not that horrible in the grand scheme of things, but important anyhow. Honestly.



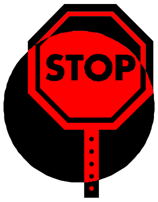
Explanations of anything somewhat puzzling get this icon. Settings, interpretation of some of the software features, anything that might make you say "Aha! That's what that means!".



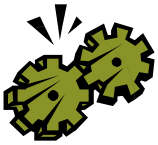
Learn about how SRMs can help you meet your goals by following the targets.



Some of the instructions are… well, fairly long. But with lots of pictures, so don't worry! These thumbs up icons point to the end of the section, when you get to finish up and move on.



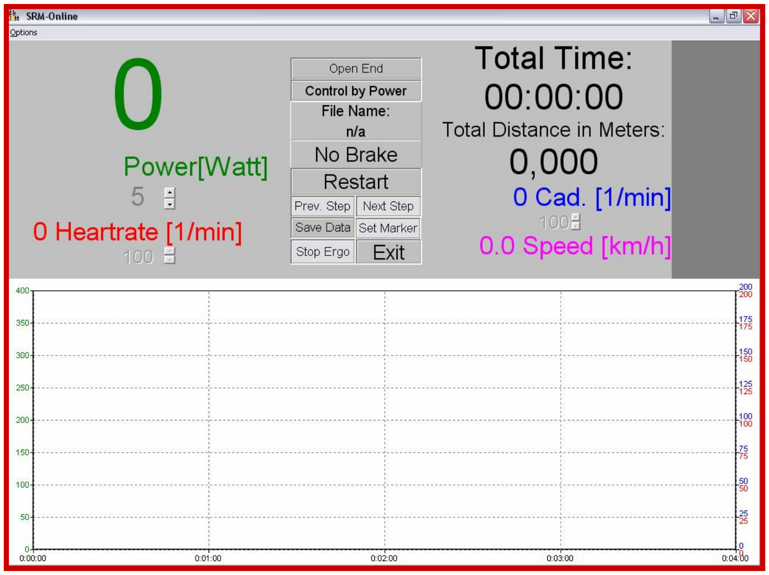
Come to a complete stop and count to three… For instance, before taking a hammer to your PowerMeter to try to remove a stubborn crank arm. Not alarm bells, but enough to give you pause, we hope.



Some people really want to know how things work, and they should look out for these icons. Some people really don't want to know, so they can look out for these so they can skip quickly onward!

# Part IX: Using the Online Option

Have you ever clicked on the icon in the SRMWin software that looks like a little ergometer? It takes you to a screen that looks like this:


SRM-Online
Options
0
Power[Watt]
5
0 Heartrate [1/min]
100
Open End
Control by Power
File Name:
n/a
No Brake
Restart
Prev. Step
Next Step
Save Data
Set Marker
Stop Ergo
Exit
Total Time:
00:00:00
Total Distance in Meters:
0,000
0 Cad. [1/min]
100
0.0 Speed [km/h]
400
350
300
250
200
150
100
50
0
200
175
150
125
100
75
50
25
0
0:00:00
0:01:00
0:02:00
0:03:00
0:04:00

Once you plug your 'online' PowerControl (this type of PowerControl has two ports on the back, and needs to be ordered specially) into your computer, this screen will show you real-time data from your SRM system while you ride. Not only that, but you can program your planned session into the software beforehand, and have it guide you through.

The online program has no way of controlling the brake on your indoor trainer, so it can't force you to do the power, cadence, or heartrate that you're aiming for, but it can tell you what your target is at that time (i.e. 300W), how much longer until your next step in the session, and what you've done so far. You'll need to adjust the resistance on your turbo trainer to achieve your targets. Your actual training session will be plotted as coloured lines on top of the grey shaded targets.

We recommend the online option for people who do a lot of specific turbo sessions as part of their training. It's a great way to make sure that you're meeting your goals for each session. So, how do you actually use it?

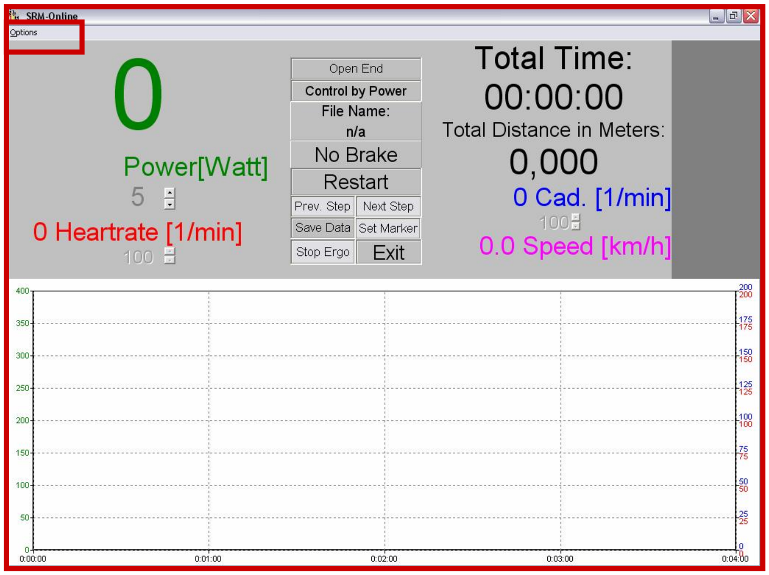
## How to use the Online option

First of all, make sure you have an "online" PowerControl. This has two ports in the back, one for the sensor cable from your bike to plug into, and one for the download cable so that you can connect the PowerControl to your computer. If you don't have one of these, you'll need to order one.

Then, you'll need to set your bike up on an indoor trainer next to your computer. If you need a longer download cable so that you can do this, you can order one of these from us as well. Make sure both your bike and your computer are secure, and that you can see the computer screen.

# Part IX: Using the Online Option

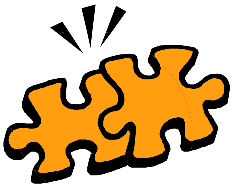
Now you'll need to fill in some preferences in the software. Open up the SRMWin software, and then click on the "Online" icon (it looks like a little ergometer). Then click on "Options" in the top left-hand corner.

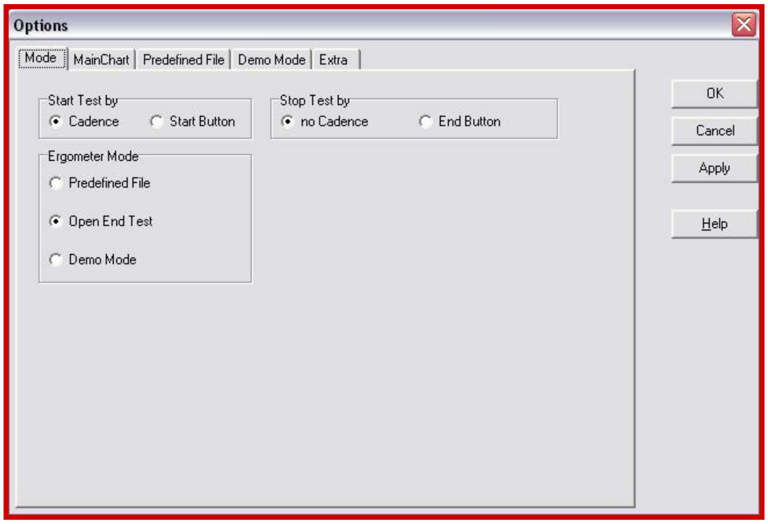

SRM-Online
Options
Open End
Control by Power
No Brake
Restart
Prev. Step
Next Step
Save Data
Set Marker
Stop Ergo
Exit
400
350
300
250
200
150
100
50
0
200
175
150
125
100
75
50
25
0
0:00:00
0:01:00
0:02:00
0:03:00
0:04:00

0 Power[Watt]
5
0 Heartrate [1/min]
100
File Name: n/a
Total Time: 00:00:00
Total Distance in Meters: 0,000
0 Cad. [1/min]
100
0.0 Speed [km/h]

This will bring up the "Mode" tab of the Options screen. Here you can choose whether you want to start the test (or session) by starting to pedal (choose "Cadence") or by hitting the Start button. You can also choose how you want to end the test, either when you stop pedalling (select "no Cadence"), or by pressing the End button. Then, you can select which mode to run the software in:

- "Predefined File" is a test or session that you've entered into the software
- "Open End Test" will simply show you what you're doing in real-time
- "Demo Mode" which you can only use with an ergometer




Options
Mode
MainChart
Predefined File
Demo Mode
Extra
OK
Cancel
Apply
Help

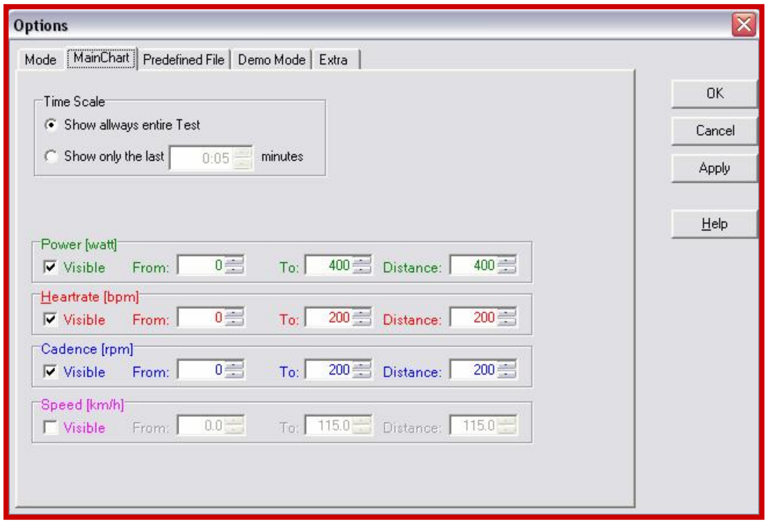
Start Test by
● Cadence ○ Start Button

Stop Test by
● no Cadence ○ End Button

Ergometer Mode
○ Predefined File
● Open End Test
○ Demo Mode

Select "Predefined File" if you want to run a session that you've entered (or are going to enter next).

By clicking on the “Main Chart” tab along the top, you can select how you’d like to see your session or test while it’s in progress. You can select “Show always entire test” if you want to see your whole session on the screen, or “Show only the last __ minutes” if you have a long session and only want to see, say, the last 5 minutes of it at any given time. Then you can choose what range of values you’d like to see for your power, heartrate, cadence, and speed, as well as if you want them visible at all.


Options
Mode
MainChart
Predefined File
Demo Mode
Extra
OK
Cancel
Apply
Help

Time Scale
● Show allways entire Test
○ Show only the last 0:05 minutes

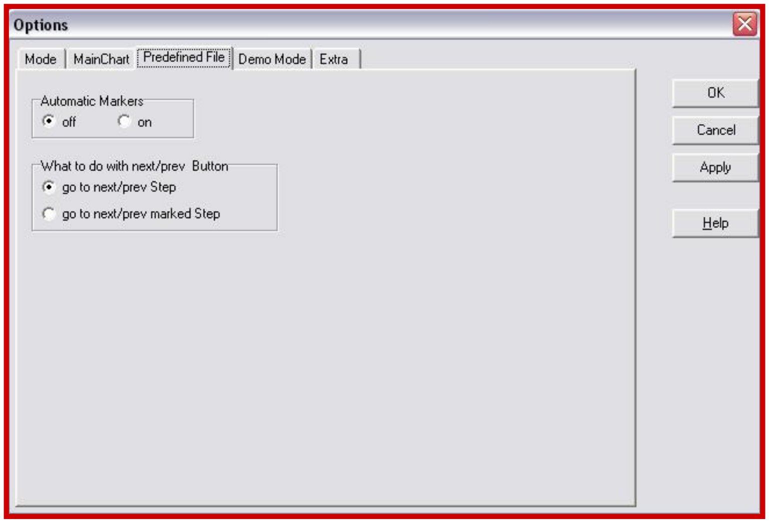
Power [watt]
☑ Visible From: 0 To: 400 Distance: 400

Heartrate [bpm]
☑ Visible From: 0 To: 200 Distance: 200

Cadence [rpm]
☑ Visible From: 0 To: 200 Distance: 200

Speed [km/h]
☐ Visible From: 0.0 To: 115.0 Distance: 115.0

In the “Predefined File” options, you can chose whether or not to have the software add markers into your file or not, as well as what to do when you click on “next step” or “previous step” while you’re running a session. You can have it skip to the next/previous step that you’ve programmed, or have it skip to the next /previous step that the software has marked


Options
Mode
MainChart
Predefined File
Demo Mode
Extra
OK
Cancel
Apply
Help

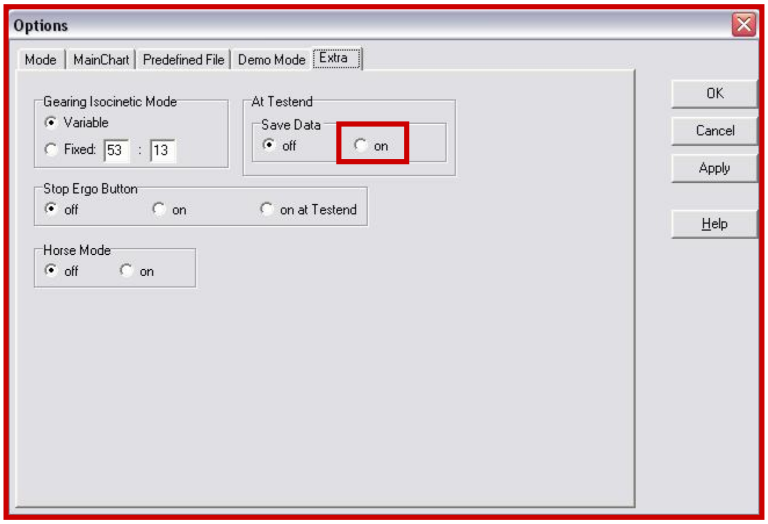
Automatic Markers
● off ○ on

What to do with next/prev Button
● go to next/prev Step
○ go to next/prev marked Step

Ignore the “Demo Mode” tab, since you need an ergo to run the demo mode, and go to the “Extra” options tab.

# Part IX: Using the Online Option

In the “Extra” options, you can select whether or not you’d like your data to be saved automatically at the end of your session. If you would, select “Save Data” “on”. Remember, the data will still be in your PowerControl if you decide you want to save it later. The rest of the options on this screen only apply to ergometers.


Options
Mode
MainChart
Predefined File
Demo Mode
Extra
OK
Cancel
Apply
Help

Gearing Isocinetic Mode
● Variable
○ Fixed: 53 : 13

At Testend
Save Data ● off ○ on

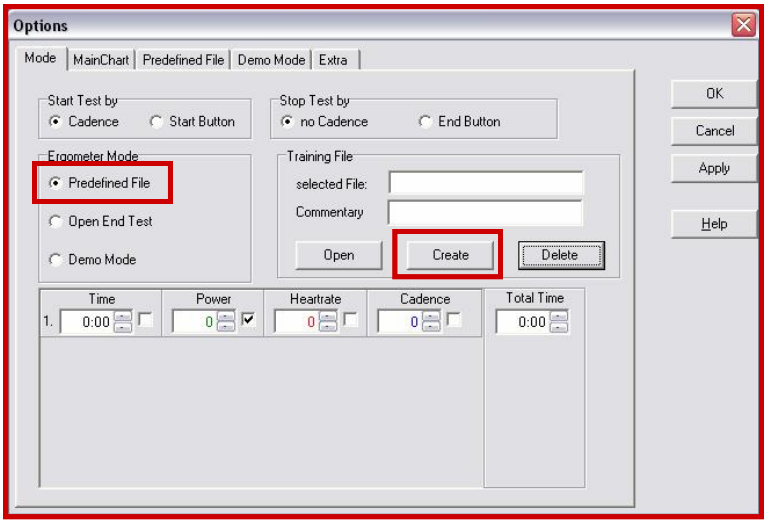
Stop Ergo Button ● off ○ on ○ on at Testend

Horse Mode ● off ○ on

Click on “Apply” to make sure that all of your choices are saved.

## Entering a new training session or test

Now that you’ve got all of the settings the way you want them, you can program your session. Go back to the “Mode” tab, and select “Predefined File”. More options will appear on the screen, as shown below. Click on the “Create” button.


Options
Mode
MainChart
Predefined File
Demo Mode
Extra
OK
Cancel
Apply
Help
Open
Create
Delete

Start Test by ● Cadence ○ Start Button

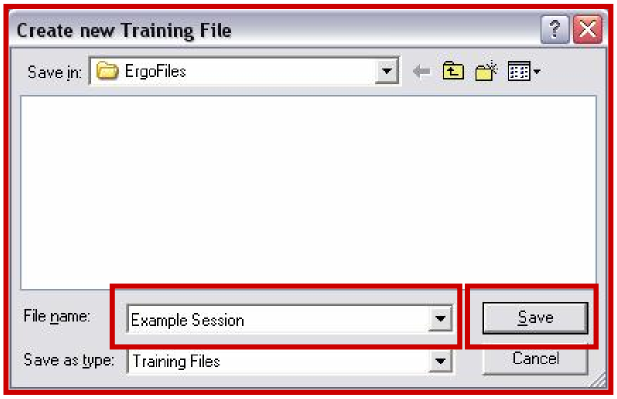
Stop Test by ● no Cadence ○ End Button

Ergometer Mode
● Predefined File
○ Open End Test
○ Demo Mode

Training File
selected File:
Commentary

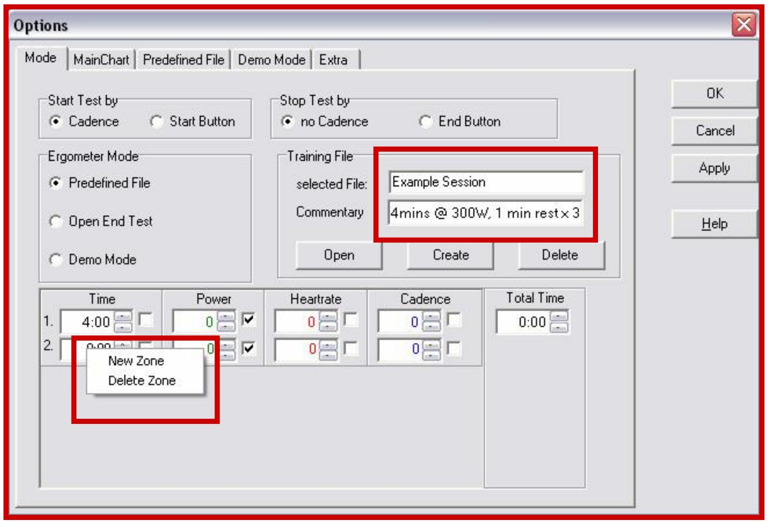
| | Time | Power | Heartrate | Cadence | Total Time |
|---|---|---|---|---|---|
| 1. | 0:00 ☐ | 0 ☑ | 0 ☐ | 0 ☐ | 0:00 |

The “Create New Training File” dialogue box will appear, where you can give your file a name. Here I’ve called it “Example Session”. Click on “Save” to move to the next step.



Save in: ErgoFiles
File name: Example Session
Save as type: Training Files

The file name that you entered now appears in the “selected file” field. You can enter a description of the session in the “Commentary” field beneath it, so that when you’ve entered lots of files you can tell which one does what. Make the descriptions as clear as possible, such as “4mins @ 300W, 1 min rest, x3”, rather than “interval session”. Now you can enter your session. You’ll notice that only one line for putting in your session appears automatically — put your cursor in the “Time” field and right-click with your mouse. “New Zone” and “Delete Zone” will appear. Click on “New zone”, and a second line will come up below the first line. Keep right-clicking and selecting “new zone” for as many lines as you need for your whole session.



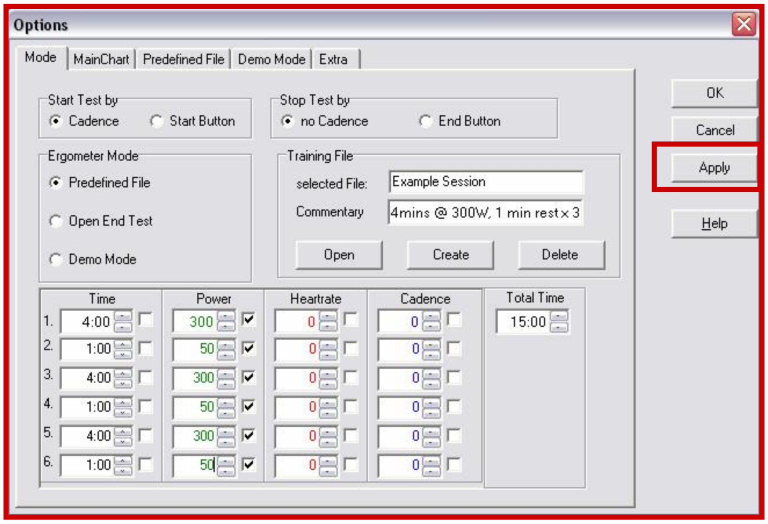
Start Test by: ● Cadence ○ Start Button
Stop Test by: ● no Cadence ○ End Button
Ergometer Mode: ● Predefined File ○ Open End Test ○ Demo Mode
Training File
selected File: Example Session
Commentary: 4mins @ 300W, 1 min rest x 3

| | Time | Power | Heartrate | Cadence | Total Time |
|---|---|---|---|---|---|
| 1. | 4:00 ☐ | 0 ☑ | 0 ☐ | 0 ☐ | 0:00 |
| 2. | 0:00 | 0 ☑ | 0 ☐ | 0 ☐ | |

Then, you can put in whatever you want for your session. For this example, I’ve done a short interval session, with three blocks of 4 minutes at 300W with one minute’s rest in between. Because the target variable is power, I’ve put a check in the box next to “Power” for each line, and entered the power to aim for in Watts. You could program a session where you work to heartrate or cadence as well. Put the time you want for each part of the session in each line, and double-check that you’ve entered what you intended to by checking in the “Total Time” box — it should add up to how long you want the session to be.

# Part IX: Using the Online Option

Here's what the finished session program looks like. Once you're done entering your session, click on the "Apply" button.


Options
Mode
MainChart
Predefined File
Demo Mode
Extra
OK
Cancel
Apply
Help
Open
Create
Delete

Start Test by: ● Cadence ○ Start Button

Stop Test by: ● no Cadence ○ End Button

Ergometer Mode: ● Predefined File ○ Open End Test ○ Demo Mode

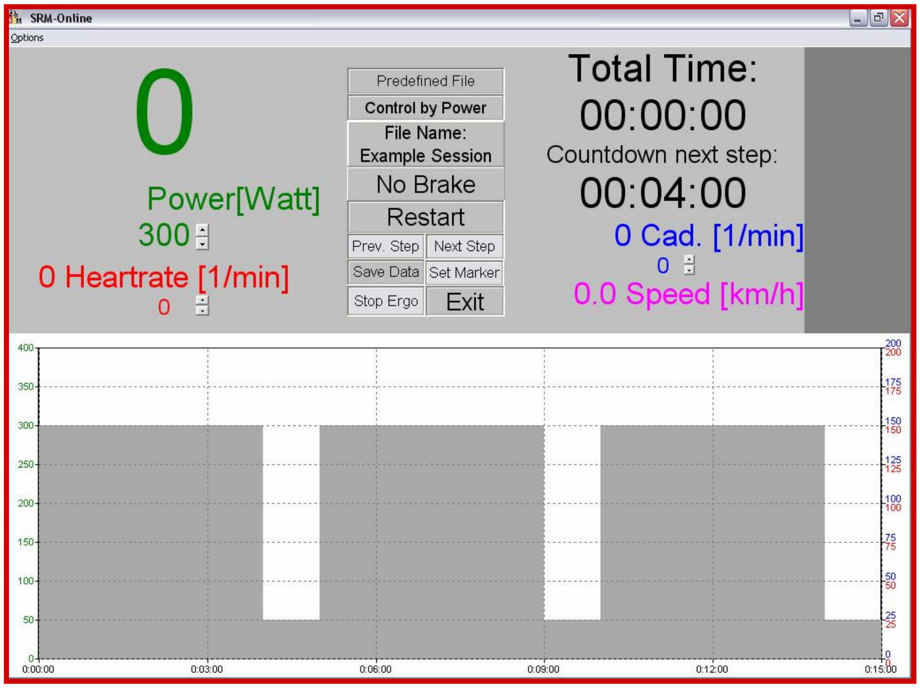
Training File

selected File: Example Session

Commentary: 4mins @ 300W, 1 min rest x 3

| | Time | | Power | | Heartrate | | Cadence | | Total Time |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 4:00 | ☐ | 300 | ☑ | 0 | ☐ | 0 | ☐ | 15:00 |
| 2. | 1:00 | ☐ | 50 | ☑ | 0 | ☐ | 0 | ☐ | |
| 3. | 4:00 | ☐ | 300 | ☑ | 0 | ☐ | 0 | ☐ | |
| 4. | 1:00 | ☐ | 50 | ☑ | 0 | ☐ | 0 | ☐ | |
| 5. | 4:00 | ☐ | 300 | ☑ | 0 | ☐ | 0 | ☐ | |
| 6. | 1:00 | ☐ | 50 | ☑ | 0 | ☐ | 0 | ☐ | |

When you click on "Apply", your session is saved and the software will bring up the Online screen with your session open, as shown below. You can see the planned session power targets on the bottom of the screen, shaded grey, and the first target power in the top left-hand corner, in green. It also tells you how long to go until the next step. Once you start pedalling or hit the start button (whichever you chose in the settings), your actual power, heartrate, cadence and speed will be shown, as well as your total time completed. The centre panel tells you that you're working to a Predefined File, with the target variable being power, as well as the File Name (here it's the same "Example Session" that I entered earlier).


SRM-Online
Options
No Brake
Restart
Prev. Step
Next Step
Save Data
Set Marker
Stop Ergo
Exit
400
350
300
250
200
150
100
50
0
0:00:00
0:03:00
0:06:00
0:09:00
0:12:00
0:15:00
200
175
150
125
100
75
50
25
0

0

Power[Watt]

300

0 Heartrate [1/min]

0

Predefined File

Control by Power

File Name:
Example Session

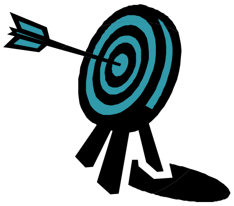
Total Time:
00:00:00

Countdown next step:
00:04:00

0 Cad. [1/min]

0

0.0 Speed [km/h]



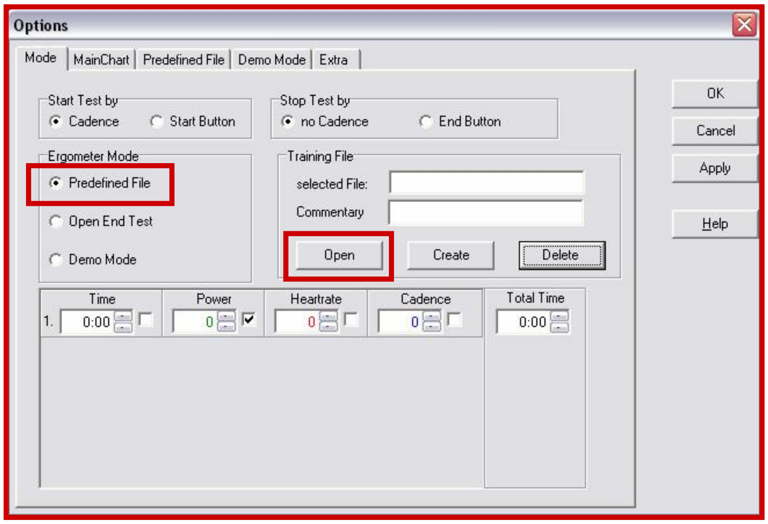
# Part IX: Using the Online Option

Once you start the session, you can skip to the next step (the next line that you programmed in) by clicking on the “next step” button. Similarly, you can go back and repeat the previous step by clicking on the “prev. step” button. If at any point you decide you want to restart the session, click on the “Restart” button. You can add a marker manually at any time by clicking on the “Add marker” button, and you can save the file by clicking on the “Save file” button. If you want to quit the session and go do something else, click on “Exit”.

If you’re in the middle of your session and you decide that a given step is too easy or too hard, you can adjust the target variable to a new level by using the up– and down-arrow button next to it. For instance, in the example session you could increase the 300W target to 315W by clicking on the up-arrow next to “Power”. If you had a session that was set to heartrate or cadence, you could use the arrows next to those variables. That way you don’t have to stop your session to go reprogram everything.

## Opening an existing training file

If you want to run a session that you’ve entered earlier, go into the Online screen and click on “Options”. Select “Predefined File”, and then click on “Open”.



Start Test by: ● Cadence ○ Start Button

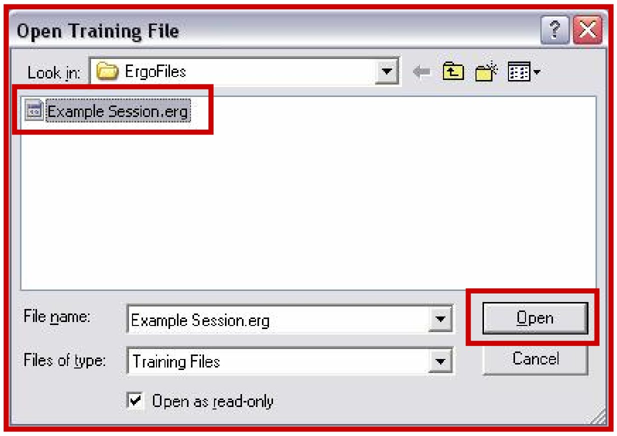
Stop Test by: ● no Cadence ○ End Button

Ergometer Mode:
● Predefined File
○ Open End Test
○ Demo Mode

Training File
selected File:
Commentary:

| | Time | Power | Heartrate | Cadence | Total Time |
|---|---|---|---|---|---|
| 1. | 0:00 ☐ | 0 ☑ | 0 ☐ | 0 ☐ | 0:00 |

You’ll then be given a choice of files to open, from the “ErgoFiles” folder. Click on the one you want to use, and then click on “Open”. Click on “Apply” in the Options screen to open the file for use.



Look in: ErgoFiles

Example Session.erg

File name: Example Session.erg

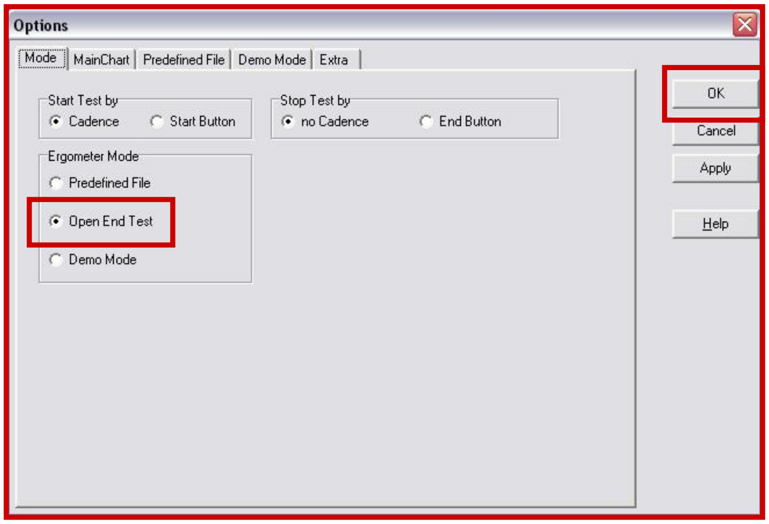
Files of type: Training Files

☑ Open as read-only

# Part IX: Using the Online Option

## Using the Online screen for real-time feedback

You don't necessarily have to program in a session to use the Online option. If you select "Open End Test" in the "Mode" options, you can simply watch what you're doing as you go.

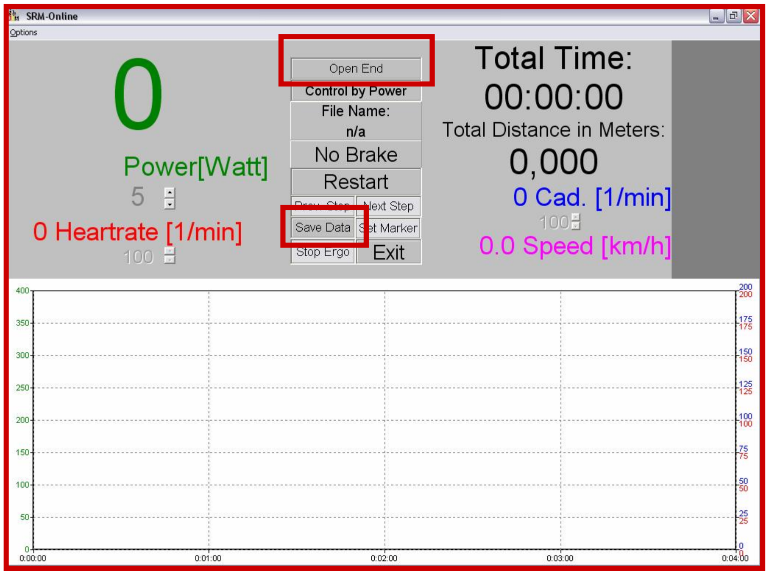

Options
Mode
MainChart
Predefined File
Demo Mode
Extra
OK
Cancel
Apply
Help

Start Test by
● Cadence ○ Start Button

Stop Test by
● no Cadence ○ End Button

Ergometer Mode
○ Predefined File
● Open End Test
○ Demo Mode

In this view, your real-time data will be shown on the top half of the screen, including power, heartrate, cadence, speed, distance, and time completed. Your session will also be graphed on the bottom half of the screen, with the power values shown in green (axis on the left), heartrate values shown in red (red number on the right axis), and cadence values shown in blue (blue numbers on the right axis).


SRM-Online
Options
Open End
Control by Power
No Brake
Restart
Prev. Step
Next Step
Save Data
Set Marker
Stop Ergo
Exit
400
350
300
250
200
150
100
50
0
200
175
150
125
100
75
50
25
0
0:00:00
0:01:00
0:02:00
0:03:00
0:04:00

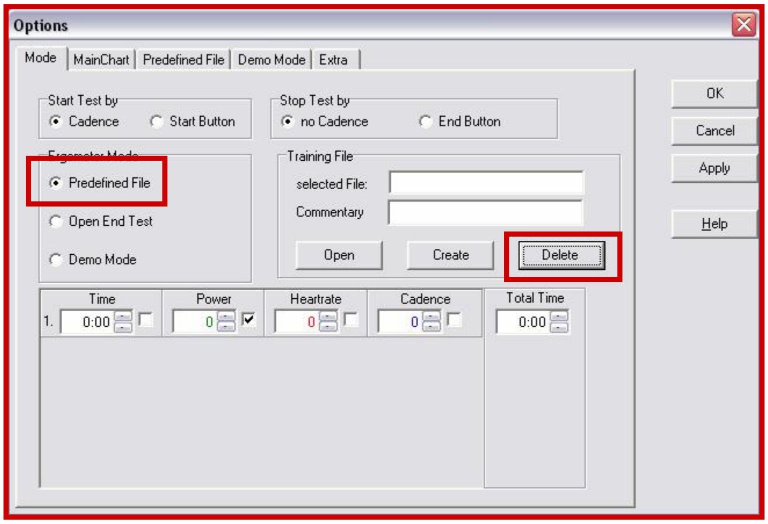
0 Power[Watt]
5
0 Heartrate [1/min]
100
File Name: n/a
Total Time: 00:00:00
Total Distance in Meters: 0,000
0 Cad. [1/min]
100
0.0 Speed [km/h]

When you're finished your session, click on "Save Data" and then close the Online screen by clicking on the "X" in the top right corner. If you want to look at your file later on, you'll find it in the file database as if you had downloaded the file from your PowerControl.

### Deleting training files

While it's a good idea to keep your training session programs to use again in the future, it's possible to end up with so many that you can never find the one that you're looking for. If it's taken you two or three attempts to program in a session the way you want it, go back and delete the ones that you're not going to use. Here's how.

Go into the "Options" in the Online screen. Open up the file that you want to get rid of, and then click on the "Delete" button.  That's it, it's that quick, so be sure you really want to be rid of the file before you click!



Start Test by: ● Cadence ○ Start Button

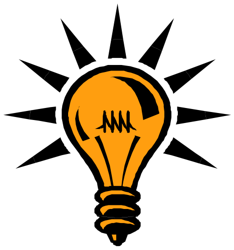
Stop Test by: ● no Cadence ○ End Button

Ergometer Mode: ● Predefined File ○ Open End Test ○ Demo Mode

Training File
selected File:
Commentary

| | Time | Power | Heartrate | Cadence | Total Time |
|---|---|---|---|---|---|
| 1. | 0:00 ☐ | 0 ☑ | 0 ☐ | 0 ☐ | 0:00 |

### Using the Online option versus the SRM ergometer



If you are a coach or physiologist who uses this program regularly to run tests on cyclists or other athletes, we would recommend that you consider using an SRM ergometer instead of a turbo. The ergometer gives the software control over the brake, helping the riders achieve exactly what you set them, and also allows you to conduct isokinetic tests or training sessions. Please see the section on the ergometer for more information.

The Online option is great because it's a much more portable solution for setting and monitoring sessions. Turbo trainers, bikes, and laptops can go pretty much anywhere, while the ergometer… well, it CAN go pretty much anywhere, but you won't enjoy the journey.

If you have a facility that you use regularly, and that your riders can access easily, the ergometer is the better choice because it gives you that added level of control over the session. If you're not sure which option is best for you, please get in touch with us and we'll help you work it out.

# Part X: SRM High Performance Ergometer

## Why is it better than other ergometers?

The SRM ergometer was designed for use with cyclists, and was developed in cooperation with the German Cycling Federation, Peter Keen from the British Cycling Federation, and Dr. Wolfgang Stockhausen from the University Hospital Freiburg. It allows the same measurement tool to be used in the laboratory as is used in the field, providing excellent validity.

It is accurate, reliable, and is built to withstand the high resistive torques generated by the world's most powerful cyclists. It is adjustable to match any cyclist's bike position, from sprint positions to triathlon positions. It feels as much like riding a bike as possible, because standard bicycle parts are used (such as handlebars, saddles, and cranks). The ergometer comes with a series of different flywheels, in order to provide a variety of kinetic energy profiles, so you can replicate the feel of riding uphill or on flat ground.

The software, combined with the mechanical design of the braking system, provides incredible flexibility for designing test protocols. It can run true isokinetic tests, as well as ramp tests, Conconi tests, even low cadence strength endurance interval sessions. Specific tests can be designed for any type of cyclist, from BMX to road to track sprint.

With the SRM Science PowerMeter, the accuracy of the ergometer power reading is ±0.5%. The SRM Training System is accepted as the Gold Standard for power measurement.

## What does it do?

The ergometer can do three basic things, which can be tailored and modified to create an infinite number of tests or training sessions. These are:

1. Hold a cyclist's power to a programmed level (Constant power, or hyperbolic mode)
2. Hold a cyclist's cadence to a programmed level (Constant cadence, or isokinetic mode)
3. Allow a cyclist to ride freely, while providing minimal braking to mimic rolling resistance (Open ended mode).

Tests can be programmed on a second-by-second basis, if needed, providing rapid response for high-intensity interval sessions or tests.

## How does it work?

The heart of the SRM High Performance Ergometer is the eddy current brake, which provides resistance by creating an electromagnetic field through which a metal disk runs. The resistance of the brake is a function of it's angular velocity and the current supplied to it. This system is controlled directly by the SRMWin Software, and is connected to both the PowerControl and the computer, allowing constant fine adjustments to braking force to be made based on actual power and cadence measurements.

In constant power, or "hyperbolic" mode, the desired power output is specified by the user in the SRMWin Software. While the cyclist pedals, power is measured by the PowerMeter and is fed back to a controller. The resistance of the brake is controlled to ensure that the desired power is maintained by the rider. To get the best results in this mode, the rider should be encouraged to hold a steady cadence, since the feedback loop is based on actual measured power. This means that if the cadence drops, the power will automatically increase, and vice versa, leading to a battle between the ergo controller and the rider if their cadence varies widely. The rider can choose to ride at whatever cadence they prefer, and can make changes to this, as long as the changes are relatively smooth and gradual. The brake controller has been carefully tuned so that changes in demanded power are implemented smoothly and quickly, but most users require some time to become accustomed to riding in this mode.

The isokinetic mode can be used to determine high or low cadence strength endurance, optimum cadence for maximum power, or maximum aerobic power. In this mode, the angular velocity of the brake is controlled with a very high bandwidth, so that the pedalling speed remains exactly constant regardless of the position of the cranks or the power produced by the cyclist. It allows the rider to pedal below the desired cadence, but not above it, so they can accelerate and then produce their maximum power against the resistance provided by the brake at the desired cadence.

Open ended mode can be used for warm-ups, or for maximum sprint power tests. It allows the rider to pedal freely, with enough braking power to mimic the feel of riding on the road. Different flywheel masses can be fitted to create the feel of riding uphill or on flat ground. The resistance increases proportionally to the speed, as it does on the road. Resistance can be easily increased or decreased in the SRMWin Software while the session is running.

Please note that on the ergometer, speed measurements are made based on the angular velocity of the flywheel, which has only a vague relationship to speed on the road. No significance should be attached to speed or distance measurements made with the ergometer.

# Part X: SRM High Performance Ergometer

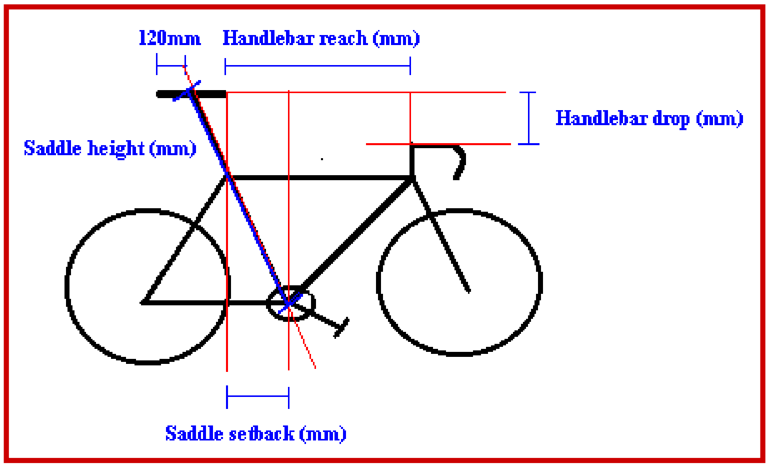
## Setting up the ergometer

The SRM High Performance Ergometer should be placed on a level floor, near two or more electric sockets. A PowerControl with the Online option should be placed on the handlebar clip, and connected to the sensor cable running from the ergometer. The ergometer should be connected to the Power Supply, which should then be plugged in but not turned on. If the Torque option is going to be used, connect the torque cable from the appropriate plug in the back of the PowerControl to the parallel port of the data collection computer. Plug the Online cable into the Online plug on the back of the PowerControl, as well as into the appropriate Serial or USB port on the computer that is going to run the SRMWin software.

Once all of the cables are connected, turn on the Power Supply with the switch on it’s front. The small light should turn orange briefly, and then turn green and remain green.

## Bike fitting

The best way to ensure a close match between a cyclist’s position on their own bike and on the ergometer is to measure all of the dimensions in the vertical and horizontal planes. Measurements can’t be taken from the ground up, because the ergometer sits higher than a bicycle.

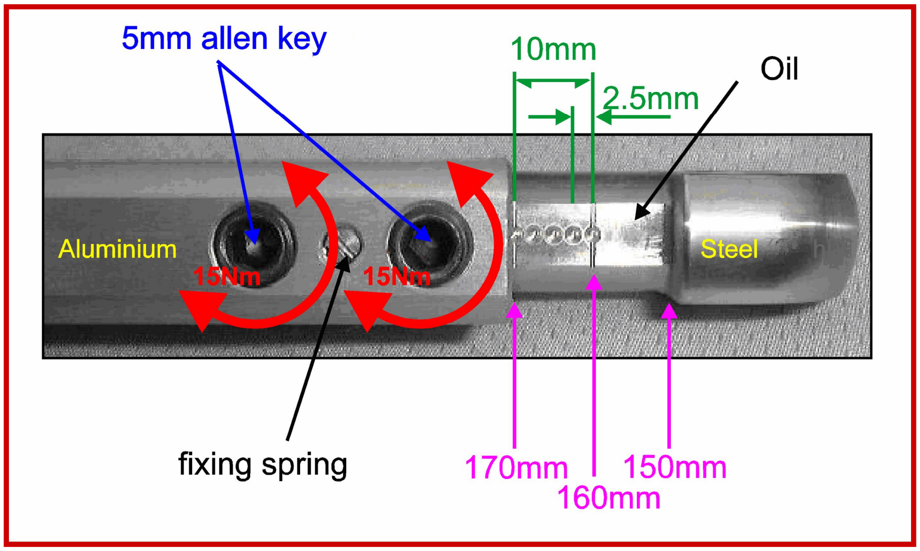


The ergometer seat and handlebars can be adjusted up and down, as well as forwards and backwards, giving total flexibility in bike setup. All of these adjustments can be made by loosening the appropriate quick release bolts, sliding the post into the desired position, and then retightening the bolt. Rulers are attached to each of the adjustable parts to allow an absolute measure of the position of each. If these measurements are recorded, ergometer setup for any repeat visits by that athlete is extremely fast.

Pedals can be changed, allowing a rider to use their own pedals for their session. Either an allen key (usually 8mm) or a pedal wrench is needed for this. Pedals are loosened by turning the bolt towards the back of the bike or ergometer.

## Multilength Cranks

The multilength cranks allow quick and easy adjustments to be made to crank length, in 2.5mm increments from 160mm to 190mm. If the crank is pushed all of the way in, it is 150mm long. While these cranks are extremely strong, the adjustments are very fine and if they are done incorrectly the crank will be damaged.



To change the length of the crank, undo the two 5mm allen key bolts at least one full turn (remember, “lefty loosey, righty tighty” - it’s silly, but it works!). DO NOT UNDO THE FIXING SPRING SCREW, as this is what clicks into each of the indentations every 2,5mm. Slide the crank along, feeling it click past every 2.5mm, until it reaches the length you want. Make sure the fixing screw is in the centre of the indentation, you should feel and hear it click into place. If it hasn’t, and you tighten the allen key bolts, you will add a new hole where the fixing screw meets the steel, and it will make it more difficult in the future to find the accurate length.

The length is marked out on the steel part of the crank by lines every 10mm, starting at 160mm, with indentations between lines marking out each 2.5mm. So, if you wanted a crank length of 165, for instance, you would start at the first line (which indicates 160mm), and then move two dots along towards the 170mm line (first dot 162.5mm, second dot 165mm). MAKE SURE THE CRANKS ARE SET THE SAME ON BOTH SIDES.

To tighten the cranks back up once you’ve made the adjustments, tighten both allen bolts by about 15Nm, so that they don’t loosen during cycling. Don’t overtighten them, however, as you may find that you can’t get them undone again, and need to send them to a service centre.

To maintain your multilength cranks, place a small amount of oil on the steel part of the crank, and slide it back and forth into the aluminium part. This protects it from sweat, and will help it to move freely for a long time.

## Setting up the computer(s)

You will need one computer to run the SRMWin Software for the ergometer. This can be a desktop or laptop computer, with at least one Serial or USB port so that you can connect the computer with the PowerControl with the Online cable.

If you are going to be running the Torque option as well, you will need a second computer, preferably one that will run in MSDOS mode, although it is possible to run PtNew in normal Windows mode as well. This computer should be connected to the ergometer PowerControl by the torque cable.

WHEN RUNNING THE CABLES FROM THE ERGOMETER TO THE COMPUTER(S), TAKE CARE TO KEEP THE DATA CABLES (ONLINE AND TORQUE) APART FROM THE POWER SUPPLY CABLE. If they are too close together, the current from the power supply cable can cause interference with the data being sent back and forth between the PowerControl and the computer, and this can cause interruptions in the test program. This causes the brake to suddenly cut out for a few seconds, which can seriously affect the results of the test.

## Running the ergometer

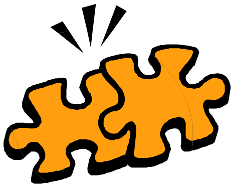
To run the ergometer, open up the SRMWin Software, and click on the “Online” icon. Please refer to the “Online Option” section of this manual for full instructions on how to use this feature. In this section, we’ll cover the options that are only available to ergometer users, i.e. those that concern the control of the ergometer brake, and the isokinetic mode.

You can operate the ergometer in three different modes, as previously mentioned. The first one, “Open End Mode”, is excellent for warm-ups, fine-tuning the bike position, and for maximal sprint efforts. For instructions on how to use Open End Mode, please see page 106.

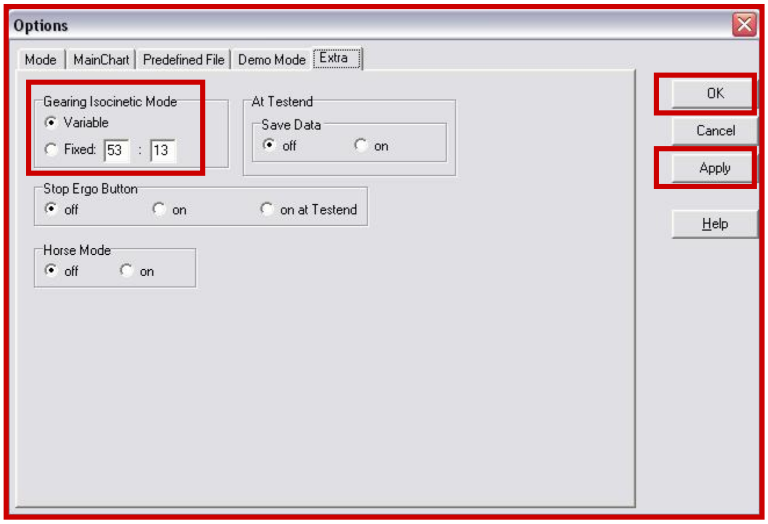
“Predefined File” Mode allows you to program a test or training session. For detailed instructions on this, please see pages 102-105. If you program a predefined file based on power, you are using “Hyperbolic” mode. If you program a file based on cadence, you are using “Isokinetic” mode.

Isokinetic mode can be operated in two ways:

1. The actual cadence is kept constant, regardless of the gear selection (true isokinetic mode, or "variable” mode)
2. The angular velocity of the brake is kept constant, but the cadence can be changed if the gear selected is changed (“fixed” mode)



To operate in true isokinetic mode, go into the Options screen from the main Online screen in the SRMWin software. Then click on the “Extra” tab. Select “Variable” from the “Gearing Isokinetic Mode” section. Click “Apply”, and then “OK” to exit. The desired cadence will be kept regardless of gearing.


Options
Mode
MainChart
Predefined File
Demo Mode
Extra
OK
Cancel
Apply
Help

Gearing Isocinetic Mode
● Variable
○ Fixed: 53 : 13

At Testend
Save Data
● off ○ on

Stop Ergo Button
● off ○ on ○ on at Testend

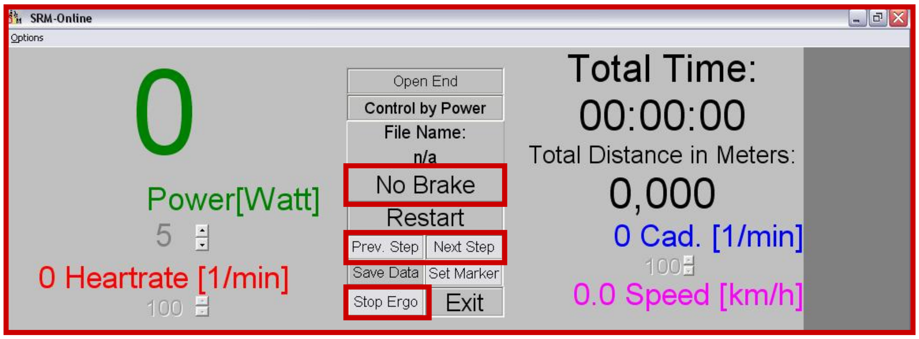
Horse Mode
● off ○ on

To enable an adjustment of cadence while maintaining a constant flymass angular velocity, or if you need a fast reaction of the brake, selected “Fixed” from the “Gearing Isokinetic Mode” section. In this mode, the controller will not adjust the brake when the gear selector is moved. The exact cadence can be modified by changing the chainring and cog tooth number in the boxes provided (and by shifting gears).

You can also select automatic data downloading at the end of a test by choosing “on” from the “At Testend” menu. You an also enable an ergometer stop switch, which appears on the main control panel, which can be used to stop the flymass whenever the rider is not pedalling (for instance, between repeated sprint efforts). Click on “OK” to save your selections and exit the Options screen.

During a test, the ergometer brake can be overridden in several ways, using the toggle buttons on the main panel.

- No Brake/Brake: Click here to toggle the brake off, and click again to turn it back on, during a test
- Pause/Resume: Click here to stop the training timer. The brake will remain at it’s current set point.
- Stop Ergo: Click here to stop the flymass. This feature is only enabled when no cadence is detected.
- Next or Previous step: Skip ahead or back in the training schedule.


SRM-Online
Options
Open End
Control by Power
No Brake
Restart
Prev. Step
Next Step
Save Data
Set Marker
Stop Ergo
Exit

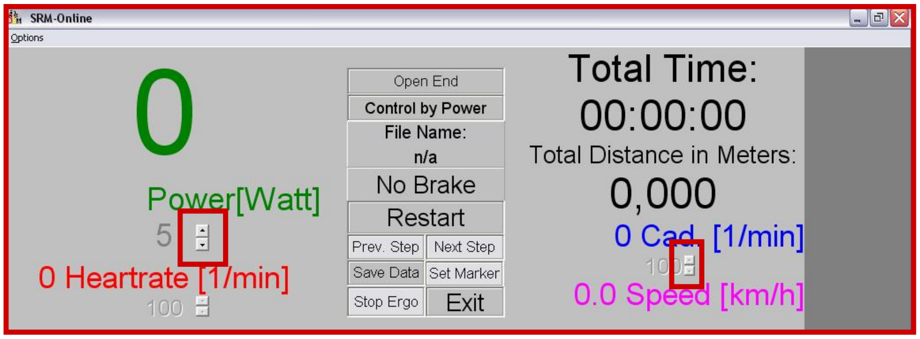
0
Power[Watt]
5

0 Heartrate [1/min]
100

File Name:
n/a

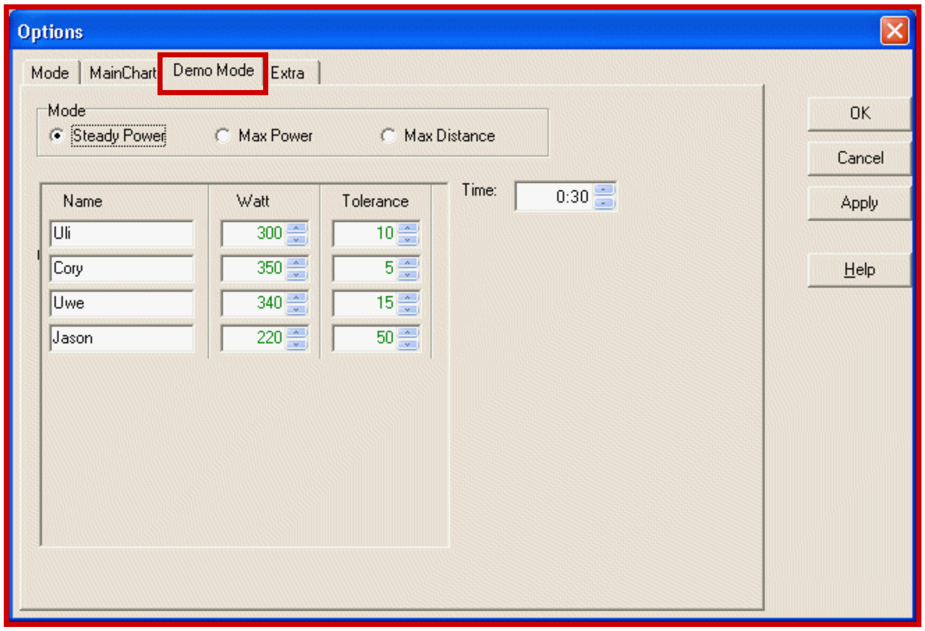
Total Time:
00:00:00
Total Distance in Meters:
0,000
0 Cad. [1/min]
100
0.0 Speed [km/h]

While the ergometer is running a file, it is possible to increase or decrease the power or cadence that the program is holding the rider to. Simply click on the up or down arrows next to the programmed power or cadence.


SRM-Online
Options
0
Power[Watt]
5
0 Heartrate [1/min]
100
Open End
Control by Power
File Name:
n/a
No Brake
Restart
Prev. Step
Next Step
Save Data
Set Marker
Stop Ergo
Exit
Total Time:
00:00:00
Total Distance in Meters:
0,000
0 Cad. [1/min]
100
0.0 Speed [km/h]

## Demonstration Mode

This mode is normally only used for demonstrations at open houses, trade shows, or exhibitions. Enter the time for a test, and the method of ranking subjects - by how steadily the power is maintained, by the maximum power generated, or by the maximum distance travelled during a test.


Options
Mode
MainChart
Demo Mode
Extra
OK
Cancel
Apply
Help

Mode
● Steady Power ○ Max Power ○ Max Distance

| Name | Watt | Tolerance |
|---|---|---|
| Uli | 300 | 10 |
| Cory | 350 | 5 |
| Uwe | 340 | 15 |
| Jason | 220 | 50 |

Time: 0:30

## Resistance unit and gearbox

The brake in the ergometer is an eddy current brake, which provides resistance by creating an electromagnetic field through which a metal disk runs. The resistance of the brake is a function of its angular velocity and the current supplied to it.

The ergometer gearbox contains two fixed stages of gear reduction, which results in an increase in speed of the brake. This has two operational benefits:

1. The braking force of an electromagnetic brake is a direct function of its speed. Increasing the speed decreases the current required for a given resistance. A lower current prolongs the life of the power supply.
2. The gearbox contains user-changeable flymasses to recreate the kinetic energy of riding on the road in the lab. The range of outdoor conditions that can be duplicated with a given size of flymass is increased at higher speeds.

To maximize ergometer life, the gear selector switch should generally be set on a higher gear rather than a lower one. As a general rule, when operating the ergo with power in excess of 300W (particularly at low cadences), the Rohloff hub should be set at gear 9 or higher. For ergometers with a Shimano Nexus hub, gear 4 or higher should be used. Conversely, when operating at very low power levels, it is necessary to operate in a lower gear. The drivetrain and gearbox themselves provide an internal resistance, and even with the brake turned completely off; at a cadence of 90 rpm the power required is about 50W. It is not possible to regulate below this value.

## Ergo flymasses: duplicating the kinetic energy of cycling

When riding outdoors, a cyclist applies force against a resistive torque on the crankset. The resistive torque is caused by contact and wind resistance, and by increases in altitude - all of these work to slow the bicycle. The amount by which the bike slows between the application of force on each pedal depends on the exact the wind conditions, speed and terrain. At slow speeds and when climbing hills, the cyclist has little kinetic energy, and the cadence varies significantly over a complete pedal revolution. At high speeds, the rider and bicycle have more kinetic energy, the resistive torque and cadence are more constant at every crank angle. These two situation feel very different to the rider.

To duplicate the “feel” of riding in both conditions, the ergometer gearbox can be operated with different flymasses, a large one, a small one, both, or neither. To change flymasses, remove the gearbox cover from the left-hand side of the ergometer and undo the brass knurled nut. The nut should be hand tightened afterwards.

The kinetic energy of the gearbox depends on both the speed and the number of masses. By changing masses and shifting gears in the internal hub, it is possible to operate with a wide range of kinetic energy at any cadence.

The following chart shows the approximate kinetic energy in Joules of a rider with bike at various speeds.

| | Kinetic Energy Cyclist+Bike | | | | | |
|---|---|---|---|---|---|---|
| **Mass** | 10 km/h | 20 km/h | 30 km/h | 40 km/h | 50 km/h | 60 km/h |
| **50Kg** | 193 | 772 | 1736 | 3086 | 4823 | 6944 |
| **55Kg** | 212 | 849 | 1910 | 3395 | 5305 | 7639 |
| **60Kg** | 231 | 926 | 2083 | 3704 | 5787 | 8333 |
| **65Kg** | 251 | 1003 | 2257 | 4012 | 6269 | 9028 |
| **70Kg** | 270 | 1080 | 2431 | 4321 | 6752 | 9722 |
| **75Kg** | 289 | 1157 | 2604 | 4630 | 7234 | 10417 |
| **80Kg** | 309 | 1235 | 2778 | 4938 | 7716 | 11111 |
| **85Kg** | 328 | 1312 | 2951 | 5247 | 8198 | 11806 |
| **90Kg** | 347 | 1389 | 3125 | 5556 | 8681 | 12500 |
| **95Kg** | 367 | 1466 | 3299 | 5864 | 9163 | 13194 |
| **100Kg** | 386 | 1543 | 3472 | 6173 | 9645 | 13889 |

In order to work out which flymasses and gears to use in order to replicate the kinetic energy in the table above, if your ergometer has a Shimano Nexus hub, use the table below.

| | Flymass of Ergo | | | | Gear | Cadence |
|---|---|---|---|---|---|---|
| **Speed** | **None** | **Small** | **Big** | **Both** | | |
| **20km/h** | 60 | 420 | 770 | 1130 | 1 | 86 |
| **25 km/h** | 90 | 660 | 1230 | 1800 | 2 | 91 |
| **30 km/h** | 130 | 940 | 1750 | 2560 | 3 | 96 |
| **35 km/h** | 180 | 1290 | 1410 | 3520 | 4 | 95 |
| **40 km/h** | 230 | 1670 | 3120 | 4560 | 5 | 94 |
| **45 km/h** | 290 | 2130 | 3970 | 5800 | 6 | 91 |
| **50 km/h** | 360 | 2620 | 4870 | 7130 | 7 | 87 |
| **55 km/h** | 430 | 3180 | 5930 | 8680 | 7 | 96 |
| **60 km/h** | 520 | 3790 | 7060 | 10330 | 7 | 104 |
| **65 km/h** | 610 | 4440 | 8270 | 12100 | 7 | 113 |
| **70 km/h** | 700 | 5150 | 9600 | 14050 | 7 | 121 |

For example, if you had a rider who weighed 75kg together with his bike, and you wanted to set the ergometer up so that they would have the same feeling as riding on the road at 60km/h, you would look at the first table to see what their kinetic energy would be. In this case, it would be 10417J. Then, you would look at the second table, along the "60 km/h" row, until you saw a number that was similar. In this example, 10330J would be created if you put both flymasses on the ergometer, set it to gear 7, and had the rider pedal at approximately 104rpm.

A kinetic energy calculator for ergometers equipped with a Rohloff hub will be posted on www.srm.de.

## Power supply

The power supply was developed by SRM particularly for use with the Ergo. The power supply changes the magnetic field in the eddy current brake very rapidly to ensure a constant rotational speed in isokinetic mode. In the isokinetic mode it is necessary to reduce the braking power to near zero when the cranks are in vertical position. When the cranks are in the horizontal position the required braking power may reach 4000 watts, in order to maintain the desired rotational speed. At a cadence of 120 rpm, the magnetic field in the brake has to be precisely set and removed four times per second.

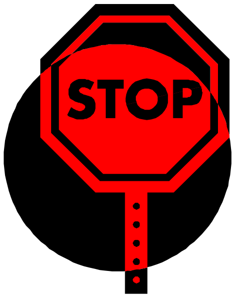
The power supply is specified to operate on either 220V or 110V. 1.6A fuses are incorporated into the supply. The power point which is used for the power supply has to be well earthed (grounded) in order to avoid electrostatic charging of the athlete. WARNING: OPERATION OF THE ERGO THROUGH AN POORLY GROUNDED POWER RECEPTACLE COULD BE DANGEROUS TO THE HEALTH OF THE ATHLETE AND OPERATOR, AND CAN ALSO LEAD TO INCORRECT ECG READINGS.

The operating mode of the power supply is indicated by a green LED display. The yellow LED display indicates the operation of the brake. The yellow LED should blink on and off during isokinetic mode.

Place the power supply in dry, well aired condition, in a place where it cannot be contaminated with sweat. Avoid switching the power supply on and off in rapid succession. Never clean the power supply with water or other fluids, the electronics will be damaged. Use a dry cloth.

The current transmitted to the brake is +/- 24 V, and the power supply also provides charge to the Powercontrol. If the Powercontrol is not charged over a period of about 3 months, it may lose the programmed operating parameters (slope and zero). In this case, charge the PC using the dedicated charger and enter all operating parameters again with the SRMWin software.

## Ergometer maintenance



The key to long ergometer life is cleanliness. Human sweat is a very corrosive substance that will damage the drivetrain, gearbox, and frame if left on the ergometer. This means that THE ERGOMETER SHOULD BE WIPED CLEAN AFTER EVERY USE, to ensure that all sweat is removed (your lab will smell better as well). Periodically the covers should be removed and the gearbox area thoroughly cleaned with warm soapy water.

The chain should be cleaned and kept well oiled, so that the drivetrain components will only need very infrequent replacement. Handlebar tape should be removed and replaced periodically. Follow the guidelines in the appropriate sections of this manual for Powercontrol and Powermeter maintenance and battery replacement.

# Part X: Troubleshooting

## The ergometer makes a grinding noise whenever someone pedals

This usually indicates that the bottom bracket is worn out, and needs to be replaced. Be sure to replace it with exactly the same bracket that it came with, and be careful when fitting the new one to make sure that it is threaded correctly.

## There is a regular clunking sound whenever someone pedals

Check that the two allen key bolts are tight on both of the adjustable cranks. If this doesn't solve the problem, check that the cranks are mounted properly onto the bottom bracket, and that you can't wiggle them at all. If you still hear a sound when someone pedals, remove the ergometer covers to check that nothing is hitting them. Be sure that the ergometer is placed on a level surface.

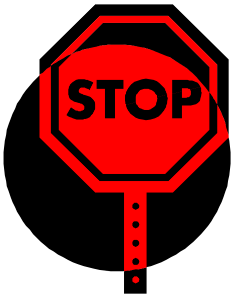
## The ergometer PowerControl has died

Try recharging it with a regular SRM charger for an hour or more. If this works, check that all of the operating settings are still correct, such as the slope and wheel circumference. Reset the zero offset before running any tests.

If recharging it doesn't work, send the PowerControl to one of our service centres for a new battery.

## The speed is wrong

For the ergometer, the wheel circumference needs to be set to 1000mm. Check that this setting is correct, and that you are working in your preferred units (metric or imperial).

Please be aware that the speed is calculated from the angular velocity of the flymass, which has only a vague relationship to speed on the road. No significance should be attached to speed or distance measurements made with the ergometer.