Manual for
LC4
LC4r
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**Important**
Read the manual carefully before using the cycle and save it for future use.

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2014 MONARK EXERCISE AB, Vansbro, Sweden
Monark has 100 years’ experience of bicycle production. The Monark tradition has yielded know-how, experience, and a real feel for the product and quality. Since the early 1900s, Monark’s cycles have been living proof of precision, reliability, strength and service. Those are the reasons why we are now the world leader in cycle ergometers and the market leader in Scandinavia in transport cycles.

We manufacture, develop and market ergometers and exercise bikes, transport bikes and specialized bicycles. Our largest customer groups are within health care, sports medicine, public authorities, industry and postal services.

For more information: http://www.monarkexercise.se
Thank you for choosing a test cycle from Monark!

Ideal position is important for a performance to reach its maximum and increases the potential for a perfect performance. The new setting options, along with an upgraded workload adjustment, make Monark’s renowned bike even better.

- LC4 has a brand new frame that is adjustable in all directions
- LC4’s new frame also means the Q-factor can be reduced, which increases the opportunities for a better workout experience
- LC4 gives the condition, the rest is up to the rider
- LC4 is also prepared for additional equipment - channels behind the covers make it easy to install different equipment for different needs
- LC4 is a great bike as it is, with additional equipment, it can be even better
- LC4 can be calibrated, both mechanically and electronically

Force is a strong word which brings many associations. For us, force is interesting when it can be measured and calibrated. For a brake-force to be correct, regardless of the system, it must be calibrated and controlled. On LC4 the brake system and calibration have been updated so that it is safer and more accurate. LC4 has also a new and more powerful engine for faster workload control.

NOTE!
Use of the product may involve considerable physical stress. It is therefore recommended that people who are not accustomed to cardiovascular exercise or who do not feel completely healthy, should consult a physician for advice.
**Product Information**

**Facts**

NOTE! Before you start using the bike - remember to remove the pendulum locking devices and protective tape on the flywheel.

**Technical details**

- **Length**: 1405 mm (55")
- **Width**: 640 mm (25")
- **Height (max at display)**: 1240 mm (49")
- **Height (max at saddle)**: 1240 mm (49")
- **Weight**: 77 kg (179 3/4 lbs)
- **Weight flywheel**: 20 kg (44 lbs)
- **Max user weight**: 180 kg (396 3/4 lbs)
- **Painting**: Industrial powder coating
- **Rust protection**: Zinc-based basic powder coating on exposed areas

**Power output**

- **Continuous (50-100 rpm)**: 15-700 W
- **Peak (at rpm)**: 1400 W (200 rpm)
- **Smallest increment**: 1 W

**Technical data power adaptor**

- **Input voltage**: 100-240 V AC, 47-63 Hz
- **Output voltage**: 12 V DC
- **Current**: 2.5 A
- **Polarity**: n/a

(Art. No: power adaptor 9328-183, plug (EUR) 9328-192)

**Included**

- Chest belt
- Tool kit
- Power adaptor

**Recommended accessories**

- Calibration weight 4 kg

**PC software**

If you need a pc software to do exercise tests on the bike, our software is available for free download from our website: www.monarkexercise.se.

**Serial number**

The serial number is located on machine plate (4) according to Fig: Overview.

**Calories**

There have been different theories on how to calculate this, since it depends on several factors and this means that it can only be seen as an estimate.

As a standard calculation when we display calories on our calibrated bikes we use: 1 minute with 100W gives 7 kcal. It is easy to convert watts to calories if it was on the flywheel, the formula is $1W=0.2388\times10^{-3}$ kcal/s with four decimals. But when you normally show calories you want to show the total amount of calories your body has used during your training, not only the calories "burnt" on the flywheel.

We have chosen the formula given above that we think complies with the results given for a standard cycle position.

**Initial operation**

LC4 is mechanically calibrated in the factory. The user may wish to verify this by performing the mechanical calibration of the pendulum weight. See ‘Electronic calibration’.

Apply power to the test bike by first connecting the cable from the power adaptor to the test bike at the power connector (14) at the right side of the bike, see Fig: Overview. Then plug the power adaptor into the wall outlet. Turn on the power switch (10) and a green LED (9) lights up.

The cable from the power adaptor can be locked with the clamp (15) which is placed below the power connection.

Perform the electrical calibration as specified in section ‘Calibration’. Test by pedalling the bike. If the bike is working properly, it is ready for use.

**Power on crank or flywheel**

Monark bikes measure the effect of the flywheel, so it will be a friction of 6-8% if you measure the impact of the pedals (measure the effect of the crankshaft, the difference is 4-5 %). These percentages will be primarily due to friction in the chain, pedals and bearings.

LC4 is set to measure the workload at the flywheel. The bike can be set to work with effect in the pedals / crankshaft (the cycle constant).
Fig: Overview

1) Knob for horizontal adjustment of saddle
2) Scale for height adjustment saddle
3) Locking handle for height adjustment saddle
4) Machine plate (serial number)
5) Knob for height adjustment of handlebar and display
6) Handlebar stem
7) Display
8) Knob for horizontal adjustment of handlebar and display
9) LED
10) Power switch
11) Screw for adjustment kp-scale
12) kp-scale
13) Locking for front cover
14) Power input
15) Locking for cable (power adaptor)
Cycle adjustments

Adjustments of the bike

Crank: Steel, 52T, 172.5 mm, Q 146 mm
Pedals: 9/16”, combi SPD / Clips
Saddle: Moody
Seat post: Vertically: 530-940 mm (21"-37")
          Horizontally: 60 mm (2 1/3")
Handlebar: Racing, Ø31.8 mm at clamp
Handlebar stem: Vertically: 500-910 mm
                 Horizontally: 60 mm (2 1/3")
Distance saddle - handlebar: 140-840 mm (6.7" - 32")

Cycle adjustments

Seat height should be adjusted to a comfortable position. The appropriate height is to have the knee slightly bent when the sole of the foot is centred over the pedal axle with the pedal in the bottom position. When adjusting the saddle height and vertical position, loosen the respective locking handles. See Fig: Saddle adjustment.

The handlebar setting should be in a comfortable position when cycling. During longer exercise sessions it is recommended to occasionally change handlebar position. The handlebar can be adjusted both horizontally and vertically. This is done by loosening the respective locking handles. See Fig: Handlebar adjustment.

NOTE! Be sure that the stem and seat post are inserted to at least 100 mm in the frame. This is marked with “MAX” on the stem.

Fig: Saddle adjustment

Validation

The following procedure ensures that the bike works for daily use.

- Check the HR function if you use chest belt, see section, on 'Heart rate'.
- Check the braking force by putting on a certain workload and check that the load is applied.
- Test by pedalling and check that a reasonable rpm is obtained - verify by a clock. Feel if the pedals move smoothly. Listen for unusual sounds. Remedy if necessary.
- Adjust the handlebar and saddle and make sure they are securely attached and that the adjustment is working properly.
- Make sure the support legs are in position by rocking the bike. Tighten if necessary.

If something unusual is found during the daily inspection that you cannot resolve, please call customer service.
The user’s heart rate can be measured with a chest belt that senses the electronic output of the heart. Chest belt ANT+ is supplied as standard.

Fuss-free HR measurement requires that the belt is correctly placed. Make sure that your skin is clean where the chest belt should be placed. When it is correctly fitted the logo on the belt will be central and readable, outward and upright, by another person. The chest belt should be placed with a comfortable tension around the mid section of the chest, just below the breast muscle, see Fig: Placement chest belt.

Moisten the electrodes before use, see Fig: Moistening the electrodes.

NOTE! Electromagnetic waves can interfere with the telemetry system. Cellular phones are not allowed to be used near the bike during test.

Pulse standard (chest belts)

The following pulse standard / chest belts can be used:

- Standard, uncoded 5K chest belts (5-5.6 kHz)
- Chest belts with ANT+

Short range ANT+: 0.6-0.8 m (24”-31 ½”)
Long range ANT+: 4-5 m (13-16 ft)
Range 5K: 0.8 m (31 ½”)

Monark Exercise AB recommend that you use an ANT+ chest belt for best function.

Pairing display and chest belt

Normally the display connects to the first ANT+ chest belt in "short range" and shows the heart rate until the chest belt is outside the "long range". If there is no ANT+ chest belt but a 5K chest belt in "short range", the heart rate from the 5K chest belt is displayed until the signal is lost.

ANT+ is prioritized and the first choice of the display. 5K is discriminated, but after 30 seconds with only 5K the display is locked to this chest belt as long as you do not lose the signal.
Display Description

<table>
<thead>
<tr>
<th>Display</th>
<th>Pedal revolution (RPM)</th>
<th>Pedal revolutions / min</th>
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<tr>
<td></td>
<td>HR</td>
<td>bpm</td>
</tr>
<tr>
<td></td>
<td>TIME</td>
<td>min:sec</td>
</tr>
<tr>
<td>Workload (WATT alt. km/min)</td>
<td>Watt</td>
<td></td>
</tr>
<tr>
<td>Speed</td>
<td>km/h</td>
<td></td>
</tr>
<tr>
<td>Distance</td>
<td>km</td>
<td></td>
</tr>
<tr>
<td>Calories (KCAL)</td>
<td>kcal</td>
<td></td>
</tr>
<tr>
<td>% Max HR</td>
<td>%</td>
<td></td>
</tr>
</tbody>
</table>

We recommend to use only the AC adaptor when using the bike. Without the AC adaptor, there will be no workload control and display alarm is activated.

Calibration and basic settings are saved even when the power fails.

(The display can be powered by batteries, 4x1.5V, R14, but only when you make the basic settings.)

The meter has the following functions:

- Settings for different units of measurement
- It is possible to calibrate the meter to get the correct workload
- Personal data such as age, max pulse, weight and gender can be set
- USB port for continuous output of data to an external computer
- Several different programs, see table ‘Available Programs’
- The meter also shows current pulse as percentage of max. HR
- The workload is rpm independent

If the values for rpm and watt start flashing during use, the set workload requires higher brake power than 7 kp. To solve this, increase the rpm or decrease the set workload.

Available programs:

<table>
<thead>
<tr>
<th>LC4</th>
<th>LC4r</th>
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<tbody>
<tr>
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<td>Training</td>
</tr>
<tr>
<td>YMCA</td>
<td>METS</td>
</tr>
<tr>
<td>PWC</td>
<td>-</td>
</tr>
<tr>
<td>Increment</td>
<td>-</td>
</tr>
<tr>
<td>METS</td>
<td>-</td>
</tr>
<tr>
<td>Training</td>
<td>-</td>
</tr>
</tbody>
</table>

Sleep mode

Sleep mode is activated after 10 minutes if you do not press any button or if no rpm is recorded.

All settings are saved, but the personal settings are erased (to protect your personal privacy).

The meter wakes up when you press any button or if rpm is recorded. The meter goes directly to 'Quick start' (see separate section).
Personal settings

Usually you are asked to set the personal data needed when you start a program or a test. This data can also be set before, during e.g. "Warm up" in Training program with this function.

Set weight

Weight kg 75

Set gender

Woman

Set age

Age 35

Set max HR

Max HR 185

The display returns to start view

The settings are saved until the meter goes into sleep mode. When the display wakes up the personal settings are changed to default values (this is to protect your personal privacy).

Alternative power / force display

The meter displays power in watts (default). If you want to display the power in kpm / min instead, press the HEART button for 5 seconds. Then you can switch between WATT, KPM / MIN and current kp-value using the (+/-) button. Press ENTER or wait 10 seconds to confirm and exit the setting.

NOTE!

Even if you select kp as unit, it is the power in watts which is set in the background when you press (+/-) button.

The displayed kpm / min is a simplified calculation (1 kp = 10 N) according to Astrand’s tables.

(Although the displayed kp value is correct and not rounded as above. For all calculations in the display the exact value is used, 1 kp = 9.80665 N)

Set units

Default (kg, km, km/h, ml/min/kg)

Press HEART button for 5 seconds.

Press ENTER to enter the menu for Personal settings.

Set units

Default (kg, km, km/h, ml/min/kg)

You can switch between these different units

When the units you want to use appears in the display, press ENTER to confirm

NOTE!

When you press the HEART button the meter starts searching for a HR signal. (Remember this if you also set the Steady State.)
User settings

Here you can make individual adjustments to optimize the bike for your needs on first use and when needed.

Units

Kg, km, km / h, ml / min / kg are default. You can switch between the different unit combinations with (+/-) button.

Cycle constant

The cycle constant is as default set to 1.00. Change using the (+/-) button.

When the cycle constant is set to 1.00 the power is measured at the flywheel. This is used in Astrand test, YMCA etc.

When the cycle constant is set to 1.05 the power is measured at the crank. This is often used on electronically-braked bikes.

Metronome cadence

Metronome diodes show pedalling revolutions (rpm) relative to the set reference value. The metronome is located at the back of the meter. The default value is 60 and can be adjusted with (+/-) button. The green LED in the middle flashes twice for each pedal revolution which helps to keep the right pedal cadence, see Fig: Display and Fig: Metronome.

The meter can be rotated so that the rider does not see the values in the display, but only sees the flashing diodes (in order to keep the right pedal cadence).

BikeID

This ID is a parameter that the PC software can ask for. It is used to identify or number bikes when multiple bikes are controlled by same PC or similar.
**Base Power**  
*Except RC4r*

Default value which is used as "idle" power when no program or test is active. The default value is 25 but can be adjusted with (+/-) button.

**Steady State HR**  
*Except RC4r*

Default value is (±)3 but can be adjusted between 1 and 10 with (+/-) button.

Steady State (SS) HR is used only in Astrand program. SS is checked by comparing the mean value of HR during the period 4:45 to 5:00, and the mean time between 5:45 to 6:00. If the difference between these two values is the same or less HR is counted in SS.

---

**Fig: Display**  
1) START STOP  
2) ENTER  
3) (+/-) button  
4) HEART button (pairing meter and chest belt)  
5) PROGRAM  
6) Metronome (on the back)
Calibration

NOTE!
Calibration can only be done from the display!

To calibrate the bike, you must have a 4 kg calibration weight. This is available as an accessory.

- Zero the scale, see ‘Scale - Zero adjustment’
- Release the brake belt tension by lifting the pendulum over 0.5 kp (the motor starts).
- (The brake belt tension can also be loosened by running the engine manually. This is done by pressing (-) in the calibration mode.)

Press START STOP and PROGRAM for 2 seconds to enter calibration mode.

Check the potentiometer value at 0 kp

Move the pendulum to current value and hold it still until the potentiometer value stabilized

Press ENTER for next step

Repeat according to the pictures to the right

Two short beeps are heard and the calibration is finished.
The bike is ready to use.

If you have started the calibration mode but change your mind, you can press the START STOP button to exit without saving. (However, if you press ENTER the calibration process has begun and must also be completed.)

Calibration electronics

Usually it is not necessary to recalibrate the cycle electronically, but it should be done after each service, change of electronic part, movement or if you adjusted the 0-index.

The calibration coefficient calculated by the computer is stored in main memory. No matter when the power is turned on, the last stored calibration will be placed in main memory. New calibration automatically replaces the old.

Manual motor control

By pressing the (+/-) button in the calibration mode, the motor can be run manually if rpm is less than 30. This is to ensure the functioning of the engine for service or support, and to release the brake belt tension.

= Tightens brake belt
= Slackens brake belt

NOTE!
The pendulum must be kept still at the different positions. This is done by pressing down the pointer into the groove on the scale at each kp value.
Calibration

All LC4 are calibrated in the factory, but a calibration of the pendulum can still be done to verify this. If so, please do the following.

Open the front cover. Check that the brake belt (3) is loose. If not, move the pendulum to 0.5 kp and hold it there a while to loosen it. Unhook the brake belt from the spring. Check that scale 0-index is in line with the pointer. Adjust if necessary, see section ‘Zero adjustment of scale’.

Calibration weight 4 kg (Art. No: 9000-211) is hooked on the spring.

NOTE!
The flywheel must be completely stopped before the weight is hung on!

This weight (4 kg) can, when properly adjusted, be read at the corresponding point on the scale. If there is a deviation, adjust the pointer to the correct position by adjusting the weight (2) inside the pendulum. To change the adjustment weight loosen the adjustment screw (1). If the pointer shows too low, the internal weight must be moved upwards. If the pointer shows too high, the adjustment weight is moved down. This process is repeated until pointer is in the correct position. Hook the brake belt in the spring and close the front cover.

Check the calibration of the pendulum weight once a year or when needed.

Zero adjustment of scale

Check that 0-index (3) on the scale (2) is in line with the pendulum pointer when the bike is at a stand still and the brake belt is loose. If not, an adjustment must be done. Loosen the screw and adjust the scale. Tighten the screw (1) after adjustment. See Fig: Adjustment scale.
Current potentiometer value

For best flexibility we recommend a potentiometer value between 40 and 60 at 0 kp.

Error message: CalErr - if the value is outside the window.

NOTE!
Potentiometer values shown in the photos are examples only, varies depending on the potentiometer value at 0 kp.

Fig: Display ‘Calibration mode’
1) Bike model
2) Current potentiometer value
3) START STOP
4) ENTER
5) Software version
6) Hours in use
7) Cycle constant (1.00)
8) Calibration point
9) PROGRAM
Training

Personal data can be set for estimated HR (default HR is 185). See ‘Personal settings’.

Start Training program

Stop Training program

To end the Training program, press START STOP and the results are displayed on three pages.

Average value  Min value  Max value

INTERVAL TRAINING
Start with eg. 300 W - press START STOP and the cycle goes down to the base power - press ENTER and the power returns to the previous power (300 W).

QUICK START

‘Quick start’ can be used as a separate program. (If START STOP is pressed, the TRAINING program is activated.)

The program is active and starts with base power, adjust with (+/-) button. No time is counted so the test person can warm up, use it as a ‘quick start’ or train without logging any values.

TRAINING

Press START STOP in ‘Quick Start’ and the display begins to show, count and log values. Press START STOP again and the test is completed and the results are displayed on three pages in the display and you can switch between the pages by pressing (+/-) button.

Workload adjustment

The power is adjusted with (+/-) button, press and hold for quick adjustment. The power can be set between 15 and 700 W in 5 W steps.
During the test METS and l/min are continuously counted and displayed.

**Calculation**

METS values are displayed and calculated from the current workload. The two VO$_2$ values displayed during the test continuously calculate the average value for 5 seconds.

The formula used (values from ASTRAND original table) to calculate VO$_2$ at different workloads is:

\[ 0.2333 \ldots \text{l} / \text{kpm} = 0.01428 \text{L} / \text{W} \]  

(2.8 l/min at 1200 kpm)

This is according to Astrand's table between 150 W and 300 W, and a good approximation for 15-700 W and a cadence of about 50-65 rpm.

**References / Literature:**

- Astrand P-O, "Ergometri - konditionsprov", Monark, Sverige
- Åstrand I, "Aerobic work capacity in men and women with special reference to age", Acta Physiol Scand. 49 (suppl. 169), 1960
- Astrand P-O, "Experimental studies of physical working capacity in relation to sex and age", Munksgaard, Kopenhagen, 1952.
**Astrand**

*(Except LC4r)*

**Set weight**
- Weight kg 75

**Set gender**
- Woman
- Man

**Set age**
- Age 35

**Set max HR**
The meter suggests an estimated max HR based on your age (220-age) Change if desired.
- Max HR 185

**Start Astrand program**

**Stop Astrand program**

If Steady State is reached the test stops after 6 minutes. If not, the test continues until Steady State is reached or the time reaches 12 minutes. After 6 minutes, the test can also be stopped manually.

- **Average value**
- **Min value**
- **Max value**

Press ENTER (for 5 seconds during the test) and a new test is started with the same settings.

Press START STOP (for 5 seconds during the test) and the test is reset.

It is recommended not to adjust the braking power after the first three minutes.
The test is automatically stopped after six minutes if Steady State (SS) is active. If not, the test continues until SS is reached or the time reaches 12 minutes.

Steady State (SS) is checked by comparing the average HR during the period 4:45 to 5:00 with the average HR during the period 5:45 to 6:00. If the difference between these two average values is the same or less considered SS.

When the test is completed the results are calculated and shown directly in the display.

You can stop the test manually after six minutes by pressing START STOP even if SS is not active (an error message is shown). The result is calculated and displayed.

Explanations to error messages:

LO Hr  The end pulse is too low and outside the Astrand tables so no results can be calculated

HI Hr  The end pulse is too high and outside the Astrand tables so no results can be calculated

Err  Another reason why no results can be obtained

No SS  The test is cancelled manually without SS after 6 minutes or no SS at time 12 minutes

References / Literature:

- Astrand P-O, "Ergometri - konditionsprov", Monark, Sverige
- Astrand I, "Aerobic work capacity in men and women with special reference to age", Acta Physiol Scand. 49 (suppl. 169), 1960
The test is automatic after it has been started. Two or three levels (6 or 9 minutes) run automatically according to the table on the next page.

After six or nine minutes the test stops automatically and the YMCA will stop flashing. The results are shown in the display.

You can stop the test manually after two levels (6 minutes) by pressing START STOP and the results are calculated if the values are within the tables.

If the test values are outside tables so that no results can be given, you will hear a long beep and an error message appears.

Explanations to error messages:

- **LO Hr**: The end pulse is too low and outside the Astrand tables so no results can be calculated
- **HI Hr**: The end pulse is too high and outside the Astrand tables so no results can be calculated
- **Err**: If the test is stopped manually too early, or other reasons that no results can be given

References / Literature:

- Golding L. A, Myers C. R, Sinning W. E, "Y’s way to physical fitness", YMCA of the USA, Rosemont, IL, 1982
**Men:**

Level 1:
- HR: < 90 → 90 - 105 → > 105
- 300 kpm/min / 50W

Level 2:
- HR: < 120 → 120 - 135 → > 135
- 900 kpm/min / 150W
- 750 kpm/min / 125W
- 600 kpm/min / 100W

Level 3:
- HR: < 120 → 120 - 135 → > 135
- 1350 kpm/min
- 1200
- 1050
- 1200
- 1050
- 900
- 1050
- 900
- 1350 kpm/min
- 225
- 200
- 175
- 200
- 175
- 150
- 175
- 150
- 225 W

**Women:**

Level 1:
- HR: < 103 → > 102
- 150 kpm/min / 25W

Level 2:
- HR: < 138 → > 137 → < 123 → > 122
- 450 kpm/min / 75W
- 300 kpm/min / 50W

Level 3:
- 750 kpm/min / 125W
- 600 kpm/min / 100W
- 450 kpm/min / 75W

**NOTE!** The given HR values are at the end of each level
Increment
(Except LC4r)

Set age
**Age 35**

Set max HR
The meter suggests an estimated max HR based on your age (220-age) Change if desired.
**Max HR 185**

Set time for each step
**TIME 3:00**

Set start power
**Init WATT 25**

Set power increase per step
**Step WATT 25**

Start Increment program

Stop Increment program

The test is stopped when:
- The cadence is <30 for more than 5 seconds
- When you press START STOP
- 700 W workload is achieved

The results are displayed on three pages that you switch between with the (+/-) button:

Enter the following data:
- **End value**
- **Min value**
- **Max value**

**NOTE!**
If the meter does not get any rpm indication at start, the test stops. To restart, press ENTER.

Press ENTER (for 5 seconds during the test) and a new test is started with the same settings.

Press START STOP (for 5 seconds during the test) and the test is reset.

The meter suggests an estimated max HR based on your age (220-age) Change if desired.
About Increment test
Increment is a testing protocol, where the power is increased according to a predetermined schedule. An increment is used to see the HR increase in relation to the rising power. It is used in both submaximal to maximal tests to track the maximum capacity.

The test continues until the test manager or test person cancels the test.

Time for each step
Set the time (minutes:seconds) for each single step. Preset time setting the first time is 3 minutes.

Start power
Set the first power level.

Power increase per step (step)
Set the power increase between each step of 5 to 200 W. Last value is presented as default.

Test procedure
The display begins with the start power (which is specified in ‘Start Power’) and begins the countdown to the next step. The display will increase the power at the specified power increase each time the set time has passed and a new countdown begins. At the same time you hear a beep.

The test is automatic after it has been started.

If the test is stopped because of the low rpm it starts automatically even if the rpm increases again.
PWC
(Except LC4r)

**Set weight**
- **Weight kg 75**

**Set age**
- **Age 35**

**Set test level**
- **P 150**
  - The meter suggests a level based on your age and estimated max HR.

**Set power increment per step**
- **02:00**
  - Power increase (two set)
  - 25 W step 2 min / 50 W step 3 min

**Set start power**
- **Init**
  - 25 Watt

The test continues until the selected HR level is reached.

The program is automatic until the test HR level is exceeded.

**Stop PWC program**

The test is stopped when:
- HR level is reached (cool down starts)
- You press START STOP (if you press START STOP after the HR level reached the results are displayed)

To see the results that appear on each page, see the table on the next page.

The test can always be stopped manually by pressing START STOP. Then the display shows the analysis pages but “Err” is displayed instead of watts value and watts / kg results, if the test is stopped before the countdown started and only the complete step data is displayed.

Press ENTER (for 5 seconds during the test) and a new test is started with the same settings.

Press START STOP (for 5 seconds during the test) and the test is reset.

Current time
Remaining time to next step

Power increase (two set) 25 W step 2 min / 50 W step 3 min
PWC test level
The meter suggests a level based on your age. Can be adjusted with (+/-) button.

<table>
<thead>
<tr>
<th>Age (year)</th>
<th>Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;30</td>
<td>P170</td>
</tr>
<tr>
<td>30-50</td>
<td>P150</td>
</tr>
<tr>
<td>&gt;50</td>
<td>P130</td>
</tr>
</tbody>
</table>

Power step
The display shows time 2:00 and power 25 W. Switch with (+/-) button to time 3:00 and power 50 W. Press ENTER to save.

Start power
The display shows "Init". Set the initial power of the first step between 25 and 400 W with 25 W steps. Default value is 25 W. Press ENTER to save.

How it works
At the end of each step calculated average HR during the last 15 seconds, a beep sounds, 25 W or 50 W is applied workload, and a new countdown starts. In the first five seconds of the next steps the display shows test time, workload and estimated average HR during the previous step. During these five seconds the values flash.

This continues until the 15-second average HR is higher than the target HR (130 / 150 / 170). Then the test is stopped, a beep sounds, the workload reverts to start power, the final 15 seconds of average HR is displayed. The text "COOL." is displayed and the six-minute countdown starts. A 15-second average HR is displayed after 1, 3 and 5 minutes of the countdown.

You can skip the "cool down" by pressing the START STOP and the results appear instantly.

Results
After 'cool down' two quick beeps are heard and the meter calculates and displays the results. The results are displayed on several pages that you switch between with the (+/-) button:

<table>
<thead>
<tr>
<th>Page Results that are displayed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Results</td>
</tr>
<tr>
<td>Total test time (end time), chosen test, total kcal, target HR, calculated result $W_{PT}$/kg and calculated result $W_{PT}$</td>
</tr>
<tr>
<td>End value</td>
</tr>
<tr>
<td>Total test time (end time), chosen test, target HR (end value) and calculated value per step</td>
</tr>
<tr>
<td>Second last</td>
</tr>
<tr>
<td>Second last test time, chosen test, step HR and calculated value per step</td>
</tr>
<tr>
<td>...&gt;</td>
</tr>
<tr>
<td>Chosen test, step HR and calculated value per step</td>
</tr>
<tr>
<td>0:00</td>
</tr>
<tr>
<td>Test time, chosen test, start HR and calculated value per step</td>
</tr>
<tr>
<td>Cool 1 m</td>
</tr>
<tr>
<td>Time C1:00, chosen test and step HR</td>
</tr>
<tr>
<td>Cool 3 m</td>
</tr>
<tr>
<td>Time C3:00, chosen test and step HR</td>
</tr>
<tr>
<td>Cool 5 m</td>
</tr>
<tr>
<td>Time C5:00, chosen test and step HR</td>
</tr>
</tbody>
</table>

NOTE!
The displayed value for calories is the total estimated calorie consumption incl. 'cool down'.

PWC target HR watt calculation:
The estimated watt value at target HR (WPT) is calculated from the following data:

\[ WPT = W1 + (W2-W1) \times \frac{(PT-P1)}{(P2-P1)} \]  \[W\]

Relative WPT:
\[ \text{WPT / kg} = \frac{\text{WPT}}{\text{Weight}} \]  \[W / kg\]

For further information please refer to the reference literature.

References / Literature:

- Dr. Theodor Stemper, Diplom-Sportlehrer
- STEMPER, Th.: Gesundheit - Fitness - Freizeitsport. Bund-Verlag, Köln 1988 (zu beziehen über SSV-Verlag, Hamburg)
Testing using LC4

The versatility of the LC4 enables it to be utilized in a variety of testing environments. The precision and reproducibility of the test values obtained with the bike, along with the uncomplicated way to set up the tests, means the bike can be used in clinical work tests, in occupational health services for the fitness tests as well as fitness centers, schools, sports clubs and the like.

In general, one should note that stresses on the tested person can become quite severe, whether in a clinical work test or a simple fitness test in physical activity contexts. As a precaution, it may be advisable, prior to beginning an exercise protocol, that each subject consults with a physician.

Before testing, the operator should review the entire protocol operation with the test person, explaining the work which will be required and the duration of the procedure. One should also agree on how the test person shall give signs of any fatigue, chest pain or other abnormal physical reactions.

The test person should not engage in heavy physical activity for several hours prior to testing to establish maximum oxygen consumption. In addition, all testing and exercise protocols should be performed a reasonable time after meals. The test person should also refrain from smoking within an hour of the testing period.

The tested person shall also have the appropriate clothing for a work test. Training suit or loose-fitting clothing is best. More detailed instructions are rarely needed, regarding the ride, but it may still be appropriate for the test leader to give some advice on pedalling, saddle height and position of the handlebars. It should be comfortable to ride. The appropriate height of the saddle is when the knee is slightly bent when the sole of the foot is centred over the pedal axle with the pedal in the bottom position.

Let the test subject try to ride with low workload and see how it feels to hold a steady rpm.

Finally, the chest belt shall be put on, see Fig: Placement chest belt for correct position. Check for a minute that a proper heart rate is displayed. The baseline heart rate may also be of assistance in determining the nervousness of the test subject. It may be appropriate to let the test person rest long enough before the test so a more or less stable resting heart rate can be read.

Test person enforcement

The bike performs automated tests virtually by itself, requiring minimal intervention by the test operator. This allows the operator to pay careful attention to the test person without distraction. The response to the exercise protocol can be accurately estimated and appropriate action taken to assist the test person, if necessary. Some programmes have sections where the test person may develop significant physical activity. The effect on the test person should not be underestimated.

During the test it is important to observe the test person’s appearance and heart rate. The testing should be stopped immediately if the test person reports chest pain, difficulty in breathing, etc. A system of prompt medical attention should be set up prior to testing, in case of emergency.

The test person may also have difficulty in keeping a steady pedalling speed. This is of minor importance (except in cases where the program assumes a constant braking force, since the effect is automatically adjusted to the correct value as long as the pedal speed is at least 30 rpm. However, it is important to consider what each test documentation says about the pedal speed.

![Garmin](image1)

**Fig: Placement chest belt**

![Moistening the electrodes](image2)

**Fig: Moistening the electrodes (1)**
Reviewing results

The maximum oxygen uptake is a standard measure of the condition of the heart- and lung-functions. Dependent on the linear relationship between work and oxygen uptake and between work and heart rate, the heart rate response to work may be used to estimate the oxygen consumption. If the maximum heart rate is considered, the maximum oxygen consumption may be determined.

The YMCA and Astrand protocols estimate the maximum oxygen consumption, based on a submaximal workload while all others report the oxygen consumption required by the final workload.

The estimated maximum oxygen consumption derived from some of the ergometer tests is subject to the error of the “age related predicted maximum heart rate“. Although there is a definite and linear relationship between work and oxygen uptake, there are some differences in actual oxygen uptake based on individual work efficiency. Test persons who are less familiar with bike exercise and those individuals who are less fit, are more likely be less efficient than those who ride bikes frequently.

It should be noted that these results are estimates or predictions of maximal response and have a greater chance of being in error than if the individual were tested to their actual maximum value. Interpretation should therefore be made more carefully with an understanding of the possibility of errors in the methodology.

Power calculation

1 rpm = that a point on the flywheel moves 6 meters per minute.

50 rpm = 300 m
2 kp force makes 2 x 300 = 600 kpm/min

100 rpm= 600 m
1 kp force makes 1 x 600 = 600 kpm/min

Exact calculation:
Watts = rpm x kp x 0.98065

"Rule of thumb" calculation:
Watts = rpm x kp
(2% error, but may be good enough in many cases)
## Troubleshooting guide

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Probable Cause / Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>The display is not working</td>
<td>• Check that there is power in the socket and that no fuse has blown.</td>
</tr>
<tr>
<td></td>
<td>• If there is power in the socket but the display still does not work, contact the service centre.</td>
</tr>
<tr>
<td>LED does not light up</td>
<td>• No current in the outlet. Check the fuses.</td>
</tr>
<tr>
<td></td>
<td>• Power switch disconnected on the bike.</td>
</tr>
<tr>
<td></td>
<td>• Check cables and connections.</td>
</tr>
<tr>
<td></td>
<td>• Correct power adaptor? Check that the transformer information (voltage, current, polarity, AC / DC) in</td>
</tr>
<tr>
<td></td>
<td>section ‘Facts’ complies with the transformer which is used.</td>
</tr>
<tr>
<td>No connection to PC</td>
<td>• Check cables (connections and type).</td>
</tr>
<tr>
<td>No workload</td>
<td>• Pendulum stuck. Contact service centre for action / replacement.</td>
</tr>
<tr>
<td></td>
<td>• Check calibration.</td>
</tr>
<tr>
<td></td>
<td>• Check that brake belt is hooked in the spring.</td>
</tr>
<tr>
<td>No heart rate</td>
<td>• Check that the battery is alright in the chest belt, moisten your thumbs and click on the electrodes,</td>
</tr>
<tr>
<td></td>
<td>a low clicking sound will be heard at the battery cover, alternatively that the heart rate is displayed</td>
</tr>
<tr>
<td></td>
<td>in the computer software.</td>
</tr>
<tr>
<td></td>
<td>• Make sure the belt fits correctly on the test person, see Fig: Placement of chest belt in section ‘</td>
</tr>
<tr>
<td></td>
<td>Heart Rate’, and that the strap is sufficiently tightened. Moisten the electrodes, in severe cases it</td>
</tr>
<tr>
<td></td>
<td>may be necessary to use gel alternative, one drop of dish washing liquid mixed in water. Pulse signal</td>
</tr>
<tr>
<td></td>
<td>strength varies from person to person. Try the belt with a person known to have a good pulse wearing a</td>
</tr>
<tr>
<td></td>
<td>chest belt.</td>
</tr>
<tr>
<td></td>
<td>• Check for loose cables or jack if you have a plug-in receiver. Use another HR receiver (HR watch or</td>
</tr>
<tr>
<td></td>
<td>test bike monitor) to check the chest belt.</td>
</tr>
<tr>
<td></td>
<td>• Check that it is the correct receiver and that it is in the correct place. If it have a round Polar</td>
</tr>
<tr>
<td></td>
<td>logo, the logo should be readable.</td>
</tr>
<tr>
<td>Uneven heart rate</td>
<td>• Use an external unit, for example a HR watch, to check if it also indicates an irregular pulse. If this</td>
</tr>
<tr>
<td></td>
<td>is the case, there is probably a disturbance in the room. The disturbance may be electronic fields from</td>
</tr>
<tr>
<td></td>
<td>power cables, elevators, lamps etc. or other electronic devices which are too close (eg. cell phones).</td>
</tr>
<tr>
<td></td>
<td>Move the bike to a different location in the room or change rooms. If an irregular HR remains it should</td>
</tr>
<tr>
<td></td>
<td>be checked manually. If the HR remains irregular at work the person’s health should be examined.</td>
</tr>
<tr>
<td>No rpm reading</td>
<td>• Check cable.</td>
</tr>
<tr>
<td>Unable to calibrate force</td>
<td>• The potentiometer shaft is not attached to the pendulum shaft, tighten the screw.</td>
</tr>
<tr>
<td></td>
<td>• The potentiometer is misadjusted. Check the menu for calibration and that potentiometer value is within</td>
</tr>
<tr>
<td></td>
<td>the recommended window. If not, contact service.</td>
</tr>
<tr>
<td>Symptoms</td>
<td>Probable Cause / Corrective Action</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>There is a click noise when pedalling (increases with the weight)</td>
<td>• The pedals are not tight. Tighten them or change pedals.</td>
</tr>
<tr>
<td></td>
<td>• The crank is loose. Check, tighten.</td>
</tr>
<tr>
<td></td>
<td>• The base bearing is loose. Contact your dealer for service.</td>
</tr>
<tr>
<td>CalErr shows in the display</td>
<td>• Incorrect calibration or not calibrated at all. Calibrate the Ergometer.</td>
</tr>
<tr>
<td>Scratching sound is heard when pedalling</td>
<td>• Check that the carriage block is taken off and that nothing is against the crank, chain, or wheel</td>
</tr>
<tr>
<td></td>
<td>• except the brake belt.</td>
</tr>
<tr>
<td>There’s a click noise and a squeak noise when pedalling</td>
<td>• Loosen the chain.</td>
</tr>
<tr>
<td>Any problems with the computer software</td>
<td>• Send an email to the software developer HUR labs support:</td>
</tr>
<tr>
<td></td>
<td><a href="mailto:support@hurlabs.com">support@hurlabs.com</a></td>
</tr>
</tbody>
</table>
Service

Note that the text about service and maintenance is universal and that all parts may not be relevant to your bike.

Note!
Make sure the voltage indicated on the appliance corresponds to the local mains voltage before making connections.

Warranty

EU countries - Private use
If you are a consumer living in the EU you will have a minimum level of protection against defects in accordance with EC Directive 1999/44/EC. In short, the directive states that your Monark dealer will be liable for any defects, which existed at the time of delivery. In case of defects, you will be entitled to have the defect remedied within a reasonable time, free of charge, by repair or replacement.

EU countries - Professional use
Monark Exercise products and parts are guaranteed against defects in materials and workmanship for a period of one year from the initial date of purchase of the unit. In the event of a defect in material or workmanship during that period, Monark Exercise will repair or replace the product. Monark Exercise will not, however, refund costs for labour or shipping.

Other countries
Monark Exercise products and parts are guaranteed against defects in materials and workmanship for a period of one year from the initial date of purchase of the unit. In the event of a defect in material or workmanship during that period above, Monark Exercise will repair or replace (at its option) the product. Monark Exercise will not, however, refund costs for labour or shipping.

Service check and Maintenance

It is important to carry out a regular service on your ergometer, to ensure it is kept in good condition.

Always keep the bike clean and well lubricated.

Service action:
- We recommend isopropyl alcohol to disinfect the surface of the bike. Use a damp but not wet cloth to clean the surface you wish to disinfect.
- Surface treatment with a rust inhibitor, especially when the bike is clean and the surfaces are dry. This is done to protect the chrome and zinc parts as well as the painted parts (4 times per year).
- Check now and then that both pedals are firmly tightened. If not the threading in the pedal arms will be damaged. When the Ergometer is new it is important to tighten the pedals after 5 hours of pedalling (4 times per year).
- Check that the pedal crank is secure to the crank axle (4 times per year).
- Be sure that the pedals are moving smoothly, and that the pedal axle is clear of dirt and fibres (4 times per year).
- When cleaning and lubricating be sure to check that all screws and nuts are properly tightened (twice a year).
- Check that the chain is snug and there is no play in the pedal crank (twice a year).
- Check that pedals, chain and freewheel sprocket are lubricated (twice a year).
- Be sure that the brake belt does not show significant signs of wear (twice a year).
- Check that the handlebars and seat adjustment screws are lubricated (2 times per year).
- Be sure that all moving parts, crank and flywheel are working normally and that no abnormal play or sound exists. Play in bearings causes fast wearing and with that follows a highly reduced lifetime.
- Check that the flywheel is placed in the center and with plane rotation.
- Grind the brake belt contact surface, see section ‘Brake belt contact surface’ (once a year).
Batteries

If the meter is battery-operated, the batteries are in a separate package at delivery. If the storing time has been long the battery power can be too low to make the computer act correctly. Batteries must then be changed.

Flywheel bearing

The flywheel bearing is long-term greased and requires no supplementary lubrication. If a problem arises, please contact your Monark dealer.

Crank bearing

The crank bearing is greased and normally requires no supplementary lubrication. If a problem arises, please contact your Monark dealer.

Transportation

During transport the brake cord should be tightened to prevent it from falling off the flywheel.

Replacement of brake belt

To replace the brake belt remove covers if necessary. Make sure that the belt is loose.

Pendulum bike with engine:
To loosen the brake belt on pendulum bikes with engine, connect power to the unit and raise the pendulum to 4 kp. Hold it there until brake belt is loose. Please note how the belt is assembled. Remove it from the bike. Attach the new brake belt and assemble the bike in reverse order.

Weight basket bike:
To loosen the brake cord on cycles with a weight basket set the basket to its upper position. Loosen the lock washer that is holding the cord and remove it from the tension center. Loosen or cut off the knot on the other end of the cord and then remove the whole cord from the bike. When assembling a new brake cord, first enter one end into the hole in the tension center, and tie a knot and let the knot fall into the bigger part of the hole. Lock the end of the cord with the lock washer.

Manual pendulum bike / exercise bike:
To loosen the brake belt on the bike remove all tension. Please note how the belt is assembled. Remove it from the bike. Attach the new brake belt and assemble the bike in reverse order.

NOTE!
When replacing the brake belt it is recommended to clean the brake surface. See ‘Brake belt contact surface’.

Brake belt contact surface

Deposits of dirt on the brake belt and on the contact surface may cause the unit to operate unevenly and will also wear down the brake belt. The contact surface of the flywheel should be smoothed with fine sandpaper and any dust removed with a clean dry cloth.

Remove any potential covers and all workload on the brake belt and then remove it. Grind with a fine sand paper. Grinding is easier to perform if a second individual cautiously and carefully pedals the cycle.

Irregularities on the brake belt contact surface are removed by means of a fine sand paper or an abrasive cloth. Otherwise unnecessary wear on the brake belt may occur and the unit can become noisy.

Always keep the brake belt contact surface clean and dry. No lubricant should be used. We recommend replacing the brake belt when cleaning the contact surface. In regard to assembly and adjustment of the brake belt, see ‘Replacement of brake belt’.

Fig: Brake belt contact surface
Check the lubrication and tension of the chain at regular intervals. In the middle of its free length the chain should have a minimum play (1) of 10 mm (1/4 inch). See Fig: Chain adjustments. When the play in the chain is about 20 mm (3/4 inch) the chain must be tightened. Otherwise it will cause abnormal wear of the chain and sprockets. Therefore it is always recommended to keep the chain play as small as possible. Loosen the hub nut (2) on both sides and tense the chain with the chain adjuster (3) when needed.

When the chain has become so long that it can no longer be tightened with the chain adjusters it is worn out and should be replaced with a new one.

To adjust or replace the chain, remove covers if required.

To adjust the chain the hub nuts (2) should be loosened. Loosening or tightening the nuts on the chain adjusters (1) will then move the hub and axle forward or backward. Then tighten the nuts on the hub axle again. See Fig: Chain adjustments.

To replace the chain, loosen the chain adjusters as much as possible. Dismantle the chain lock (6) and remove the chain. Use pliers to both release the lock washer and mount it again (4). Put on a new chain and assemble the chain lock. The spring of the chain lock should be assembled with the closed end in the movement direction (5) of the chain. See Fig: Chain replacement.

NOTE!
At assembly the flywheel has to be parallell with the centerline of the frame. Otherwise the chain and sprockets make a lot of noise and wear out rapidly.

Then assemble the removed parts as above but in reverse order.
Freewheel sprocket

When replacing the freewheel sprocket remove frame covers if necessary. Dismantle the chain as described in part 'Chain 1/2” x 1/8”'.

Loosen the axle nuts and lift off the flywheel. Remove the axle nut, washer, chain adjuster and spacer on the freewheel side. Replace sprocket-adaptor and assemble the new parts in reverse order according to the above.

The sprocket should be lubricated with a few drops of oil once a year. Tilt the cycle to make it easier for the oil to reach the bearing. See Fig: Lubrication.
Spare parts list
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>9334-110</td>
<td>Saddle</td>
<td>15</td>
<td>1</td>
<td>9310-71</td>
<td>Lock to front cover</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>9336-421</td>
<td>Saddle adaptor 22 mm</td>
<td>16</td>
<td>2</td>
<td>9328-1315</td>
<td>Bushing with hole</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>9311-23</td>
<td>Sledge, complete</td>
<td>1</td>
<td>9311-3</td>
<td>-</td>
<td>Handlebar with stem and clamp, compl.</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>9311-24</td>
<td>-Locking handle M10x32, black</td>
<td>17</td>
<td>1</td>
<td>9311-33</td>
<td>-Handlebar stem</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>9311-21</td>
<td>Saddle post</td>
<td>18</td>
<td>1</td>
<td>9311-24</td>
<td>-Locking handle M10x32, black</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>8321-75</td>
<td>Pedals SPD with clips and strap</td>
<td>19</td>
<td>1</td>
<td>C2205419-120</td>
<td>-Reparto corse stem 120 mm Al</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>9301-3</td>
<td>Support tube rear, complete</td>
<td>20</td>
<td>1</td>
<td>C2305771-42</td>
<td>-Reparto corse handlebar</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>9328-51</td>
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<td>-Rubber foot with screw M8</td>
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