

# Manual 839 E



**EN**

 **MONARK**  
**SPORTS & MEDICAL**

### **Important**

Read the manual carefully before using the cycle and save it for future use.

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## Monark Exercise AB

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>



# Product Information

## *Congratulations on your new Ergometer!*

The Monark Ergomedic 839 E is one of the world's most precise and user-friendly computerized pendulum ergometers.

The Ergometer is controlled by either a control unit, an external PC or other external units. The bike can perform max and submax fitness tests and calculate the VO<sub>2</sub> max. The ergometer can be connected to ECG to do work tests.

It is possible to build personal programs that are custom made for the user. The bike can also be used for normal exercise.

### **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.

## Serial number

The serial number is placed according to *Fig: Serial number*.



*Fig: Serial number (1)*

## Facts

- Large, well-balanced flywheel 20 kg (44 lbs)
- Brake power 0-1400 W at 200 rpm
- Pendulum scale, easy to calibrate
- Adjustable saddle and handlebar
- Stable frame, solid steel tube.
- Powder painted
- Wheels for easy transport

## Computer

- Computer system 8 MHz
- Multi-colour rpm pacing bar graph display
- Visual metronome or heart rate
- Serial communication port: 300 - 38400 baud

## Width

517 mm (20 1/3") at handlebar

640 mm (25") at support tubes

## Length

1150 mm (45 1/3")

## Height

945-1295 mm (37-51") at handlebar

790-1110 mm (31-43 1/2") at seat

## Weight

56 kg (123 1/2 lbs)

Max user weight 250 kg (551 lbs)

## Included

- Calibration weight, 4 kg
- Chest belt
- Power adaptor
- Tool kit

## Technical data power adaptor

Input voltage: 220-240 V AC, 50 / 60 Hz.

Current: 650 mA

Output voltage: 24 V DC switching adapter alt. 18 V AC.

(Sweden, 18 V, Art. No: 9339-67, other countries incl. USA, 24 V, Art. No: 9339-66)

NOTE! The power adaptor must be approved by your national electrical authorities. In Europe, it must be CE marked.

## 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](http://www.monarkexercise.se).

# Operating Instruction

Here are instructions for connection and options for connection to external devices. The need for advanced technical documentation / protocols for systems building, contact Monark Exercise AB, Sweden.

## Power on crank or flywheel

When the Ergomedic 839 Medical is adapted to ECG work tests it is set to measure the power on the crank.

When the Ergomedic 839 E is adapted to fitness tests it is set to measure the power on the flywheel.

A sticker, placed on the display, see *Fig: ECG-sticker*, informs that the ergometer is set to measure the power on the crank.



Fig: ECG-sticker

## Operation of the ergometer

Ergomedic 839 E is built on a stable frame, a large well-balanced flywheel, a break belt and a pendulum weight which measures the force. Pedals and a chain drive are provided to spin the flywheel as a tension device tightens the belt to regulate the braking force applied to the wheel. The pendulum indicates the applied force directly on the scale located on the right side of the flywheel.

The computer system consists of one main unit and one control unit (terminal, PC or ECG). The main unit reads in the pedal speed, the applied force and determines the subjects heart rate by a chest transmitter. Additionally, the base control activates the motor to adjust the tension of the brake belt, thereby regulating the applied braking force. The force may be automatically varied in response to changes in pedal speed to maintain a constant power workload.

For information about how respective control units works, see respective sections.

The Monark Ergometer 839 E can be controlled externally from a terminal, a PC or an ECG device. Direct printer connection port.

The control is performed over a serial line using ANSI/ISO/ASCII format commands. The interface is a 9-pin male D-sub connector, compatible with the RS232 standard, located on the front of the main unit.

It is also possible to use an analogue control from any external source to set the workload. This is done by the contacts b32 och z32 on the main connector on the bike.

The ergometer need not to be turned off prior to connection of the external components, although removing the power from all devices may prevent erroneous data transfer between equipment during interconnection. Caution must be exercised in the connection of various types of equipment from different manufactures to avoid electrical hazards and physical damage. The user must be certain that the instrument connector and the cable are designed for the intended purpose. Serious injury to the user and / or equipment may result if inappropriate connections are attempted.

## Measured quantities

<b>Distance</b>	<b>meter, miles</b>
<b>Energy</b>	<b>kcal</b>
<b>Heart rate</b>	<b>bpm</b>
<b>Force</b>	<b>Newton (N), kp</b>
<b>Power</b>	<b>Watts (W), kpm / min or VO<sub>2</sub> ml/min/kg</b>
<b>Time</b>	<b>min:sec</b>
<b>Weight</b>	<b>kilogram (kg), pounds (lbs)</b>

## Rpm meter with optical pulse / metronome

The metronome (the two green LED bars in the middle) flashes once per pedal stroke at a preset rate. The two green LED bars in the middle can also be set to show pulse. Pedal frequency compared to metronome rate is always shown.

### Underspeed:

Pedal speed is lower than desired metronome rate 2, 4, 8, 16 or more depending which LED bar that indicates.

### Overspeed:

Pedal speed is greater than desired metronome rate 2, 4, 8, 16 or more depending which LED bar that indicates.

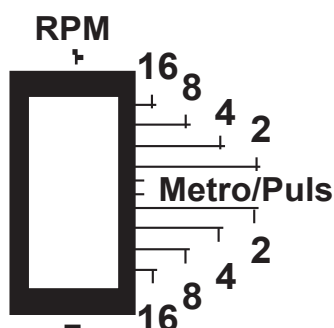


Fig: RPM display

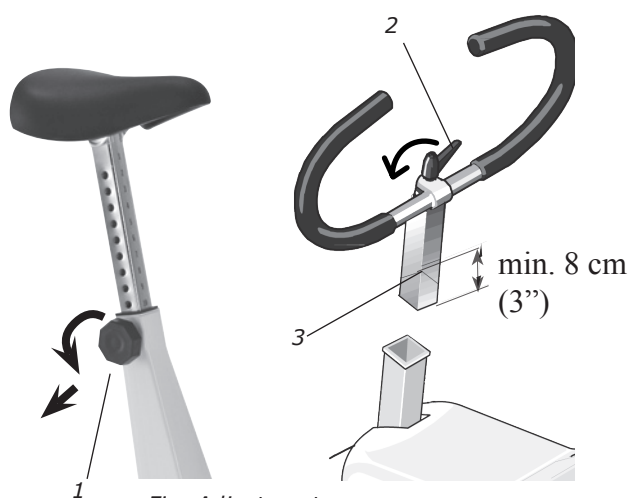


Fig: Adjustments  
1) Locking knob, saddle  
2) Locking handle, handlebar  
3) Inserted min. 3"

## 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.

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

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  $1W=0,2388 \times 10^{-3}$  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.

## Initial operation

The ergometer 839 E is to 100 % calibrated at 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 ergometer by first connecting the cable from the power adaptor to the ergometer at the front connector labelled "24VDC / 18VAC". Then plug the power adaptor into the wall outlet. Turn the power switch to on position. A green LED indicates power to the 839 E.

Perform the electrical calibration as specified in section "Electronic calibration". Test ride the ergometer. The 839 E Ergometer is now fully functional and ready to use.

## Cycle adjustments

Do not forget to remove the transport protections (the transportation bracket on the weight lever, the protection tape on the flywheel and the transport blocks above and below the flywheel).

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. To adjust the seat height loosen the lever (1) on the seat tube. See Fig: Adjustments.

The handlebar setting should be in a comfortable position when cycling. During longer exercise sessions it is recommended to occasionally change handlebar position. To adjust the handlebar, loosen the quick release lever (2). See Fig: Adjustments.

**NOTE!** The handlebar stem should be inserted into the frame tube at least 3 inches (about 8 cm). This measure is marked with "MAX" on the stem (3).

# Connection to controller

## Setting command type (PC or ECG device)

From program version R15

First check the brake belt tension. If the belt is too tight loosen it a little by moving the force indicator to about 4 kp and hold it there for a few seconds. Then the force-adjusting servo will loosen the belt tension. To be sure that indicator positions are correct, do a calibration. See section "Electronic calibration".

1. Turn off the power by turning the power switch (2), see *Fig: Connections*. Disconnect the cable from any connected external device
2. Adjust the scale mechanically so that 0-index on the scale and indicator are in line
3. Move the indicator to 6 kp and hold it there
4. Turn on the power again. The green LED (3) is lit when power is connected to the bike
5. Hold the indicator at 6 kp until two beeps are heard
6. Move the pendulum pointer to:
  - 0 = mode for use with PC or handheld controller
  - 1 = mode for Siemens Megacart ECG
  - 2 = mode for ECG, Ergoline compatible command set, requested load
  - 3 = mode for ECG, Ergoline compatible command set, current load value
7. Keep at the selected position until two signals can be heard. Then release the pointer to 0. The system will now restart in the selected mode.

## What command type is set?

When power is turned on to the bike it will beep, and from the number of beeps the command type can be determined.

- Command type 0: A long beep
- Command type 1: A long beep followed by a short beep
- Command type 2: A long beep followed by two short beeps
- Command type 3: A long beep followed by three short beeps

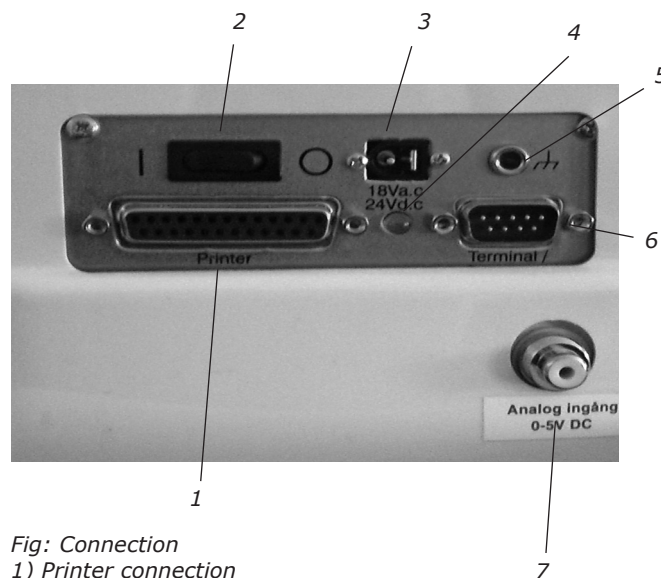
## Procedure when connecting to the handheld controller

When using a terminal (Art. No: 9339-51) do as follows:

1. Connect the handheld controller to the bike using the enclosed cable
2. Connect power to the bike
3. When the main menu is displayed on the LCD-screen press 99 and the hidden service menu appears
4. Press 6, "Settings"
5. Press ENTER (normally 13 times) until the display "Command type" appears:

- 0 Terminal/PC  
- 1-3 see manual  
- (0) \_

- a) Press 1 and ENTER if the bike is connected to a Siemens Megacart ECG device
  - b) Press 2 and ENTER if the bike is connected to a Siemens Megacart ECG device, alt. 1
  - c) Press 3 and ENTER if the bike is connected to a Siemens Megacart ECG device, alt. 2
  - d) Press 0 if the bike is connected to a PC or a handheld controller
6. After that press 0 twice to return to main menu



*Fig: Connection*  
1) Printer connection  
2) Power switch  
3) Power input  
4) LED  
5) Chassis ground  
6) Handheld controller / PC  
7) Analogue connection

## Connection to PC

To connect a PC to the bike, use a 0-modem cable (RS232) with 9-pin D-sub connector (female) at both ends. If no RS232 serial port is available on the computer use a USB serial converter to connect to an USB port on the computer instead.

Before installing the Monark Software for your ergometer, you must take the following steps.

1. Locate the USB adaptor
2. Inside the USB adaptor packaging, there is a mini-CD
3. Insert the mini-CD into the CD-ROM drive and install the driver software. If there is no CD drive on your computer, driver software is available for download from the website (<http://www.vscom.de/USB-CD>).
4. Finalize the driver software installation by inserting the USB adaptor
5. Install Monark software (can be downloaded from our website: [www.monarkexercise.se](http://www.monarkexercise.se))
6. Connect the USB adaptor to the serial cable and proceed with testing

To control the ergometer use the PC software (can be downloaded from our website: [www.monarkexercise.se](http://www.monarkexercise.se)) that is common with models 831 E and 939 E, or other PC applications that are compatible with Ergomedic 839 E.

From software version MEC3V11R14 and later can settings be made from a PC in terminal mode if the handheld controller is not available. Set PC in terminal mode. A terminal emulator is normally available in i.e. Windows under Accessories/Communication.

## In terminal mode do the following settings:

- 9600 baud
- 8 data bits
- 1 stop bit
- no parity
- no flow control
- set terminal emulation to VT100
- set the COM port number which is used

An USB serial converter is automatically assigned to a COM port number by Windows. This number is indicated under System / Hardware / Ports.

Connect Ergometer and PC with the 0-modem cable (normally used for the handheld controller).

Turn on power to the ergometer. The ergometer now identifies the type of device connected. When finished a message appears on the PC screen.

## Common commands:

- Calibration: type: cali, press ENTER and follow the instructions on the display
- Setting to control ergometer from external ECG devices: Siemens Megacart: type: env cmdtype=1, press ENTER
- Setting to control ergometer from external ECG devices: Various ECG devices: (most common setting) Siemens Megacart: type: env cmdtype=2, press ENTER

To returning to control via the bike's handheld controller, type: env = cmdtype, press ENTER or env cmdtype = 0, press ENTER.

A variety of other settings can be made. For more information about this, see Technical manual MEC3V11Rn.

## Connecting an external ECG device with digital control

(if handheld controller is used)

1. Connect the terminal via the supplied 0-modem cable (9-pol. D-sub female connector on each end) to the corresponding connector (5) in the front end of the cycle, see *Fig: Connections*.
2. Connect the net adaptor to a suitable wall outlet and to the connection (3) on the bike and then turn power on
3. After a short while the main menu is shown on the terminal's display
4. Press '99' and the service menu comes up on the display
5. Press "6", for Service set-up
6. Press ENTER on the following settings until 'Command type' is shown
7. This says:
8. Return to main menu by pressing '0' and then press '0' again to finish. The computer will then save the settings in the memory before it turns off. Computer will start up again automatically after a few seconds.
9. Turn off the power and remove the terminal incl. the cable
10. Use a suitable cable between an ECG device and the bike (ECG Siemens Megacart requires a special cable)
11. The bike can now be controlled only from an external ECG device

- 0 Terminal/PC  
- 1-3 see manual  
- (0) \_

If a zero (0) is displayed at the 3rd line, the ergometer is in normal mode which means that the bike can not be controlled by an external ECG device. Press '1' if a Siemens Megacart with Ergomed 940 will be used. For use of other devices press '2' or '3' and then ENTER (see section "Setting command type"). If the desired settings already in parenthesis press ENTER.

### Reset the Ergometer to use with handheld controller / PC.

Follow the points 1 – 7. At point 7 press 0 and then ENTER. The bike can now be controlled via the handheld controller or external PC.

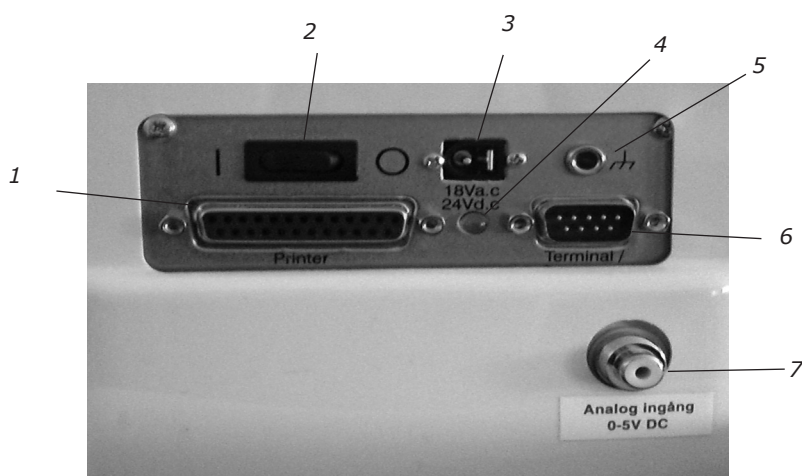


Fig: Connection

- 1) Printer connection
- 2) Power switch
- 3) Power input
- 4) LED
- 5) Chassis ground
- 6) Handheld controller / PC
- 7) Analogue connection

## Analogue connection

The ergometer's work load can be controlled by external analogue equipment such as ECG (must be between 2 and 4 volts to function properly). For settings on this, see the manual for the handheld controller or the manual for the computer program.

## Printer

A printer can be connected to print reports.

Start by connecting the printer to the parallel output (1) located on the front of the bike. The handheld controller or computer connects both through a serial data cable to a 9-pin D-sub connector (5) located on the front of the head at the parallel port, see *Fig: Connections*.

If the external device is a desktop printer it must be capable of emulating Epson alt. IBM Proprinter mode to operate. Verify that the System set-up have been set to enable automatic printout. If it has been disabled, no output will reach the device until it has been enabled. Also, the baud rate, 4800 baud, selected by the interface cable must match that of the device.

Paper must be in the printer and the choice of units must be made before the printer is in use (see user manual for the printer).

The automatic printout length is a pre-set to eleven inch pages for standard fanfold or zee-fold paper. At the top of the each page, a header designating the columns is printed. The time period between the printing of each line may be set as desire, from 0 (continuous output) to 255 seconds in one second increments. The standard setting is 15 seconds between printouts. This provides reasonable documentation while not wasting large quantities of paper.

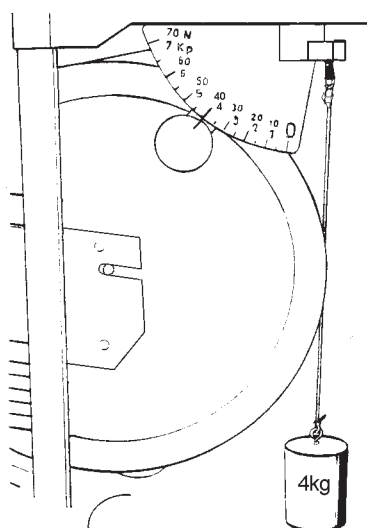
## Calibration

The 839 E is a mechanically weighted and braked ergometer, making performance validation a simple procedure. Calibration is necessary so that the electronic and the mechanical parts of the cycle conform. The work carried out on the bike is a result of the braking force (pendulum mode) and the number of pedal revolutions (= distance). Validation includes both mechanical and electronic procedures. For more detailed information, please see the manual for the handheld controller (Art. No.: 7950-301) or the computer software's user manual. If the ergometer fails to pass any section of the validation, proceed to the calibration and/or service menu (99 in the main menu).

Inspection of all mechanical components is suggested after any repair, or component service. The following validation should be performed annually:

1. Remove the cover from the flywheel.
2. Loosen the brake belt at the balancing spring.
3. Wait until the flywheel is no longer moving.
4. The pendulum weight index should be aligned with "0" on the scale.
5. Hang the calibration weight in the spring, see *Fig: Calibration weight*.
6. The known weight should match the value on the scale. If not see section "Calibration of Pendulum Weight".
7. Reattach the tension belt.
8. Reassemble the cover.

Then go ahead and perform the daily check which is also a part of the annual inspection.



*Fig: Calibration weight*

## Validation

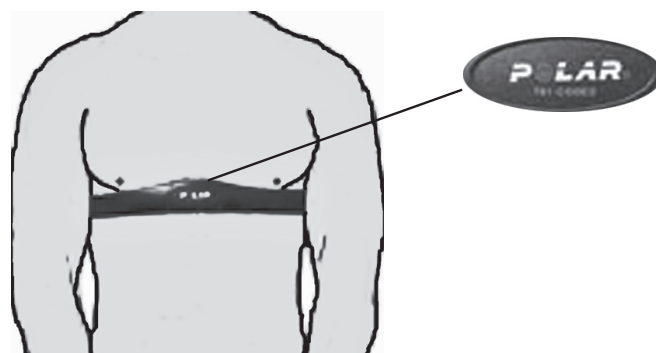
The following procedure will assure the user that the ergometer is performing properly on a daily basis.

- Check the pulse function, see section.
- Check the brake force, see section.
- 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. Fix if necessary.
- Check / adjust handlebars and seat and check they are secure.
- Make sure the support legs are in position by rocking the bike. Tighten if necessary.

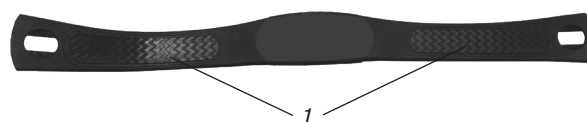
If something unusual is found during the daily inspection that you cannot resolve, please call customer service.

## Checking the pulse function

While the patient rests, with the chest belt on, the pulse indicator flashes once per heart beat. The flashing heart rate must be consistent with the manually recorded pulse. If it does not correspond, check the chest belt contact area and moisten if necessary the electrode surfaces with water. See *Fig: Placement of the chest belt* and *Fig: Electrodes on the back of the chest belt*. If this fails, call customer service.



*Fig: Placement of the chest belt*



*Fig: Electrodes on the back of the chest belt (1)*

## Validation of force

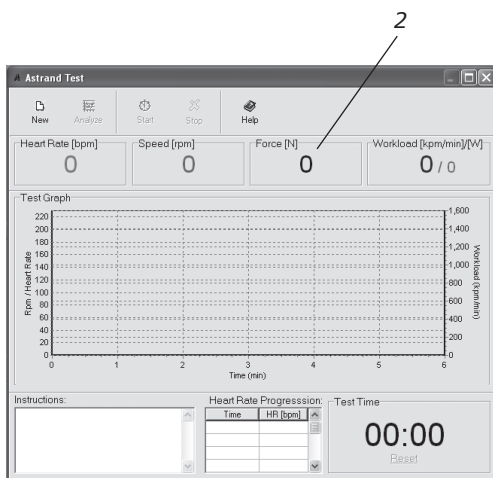
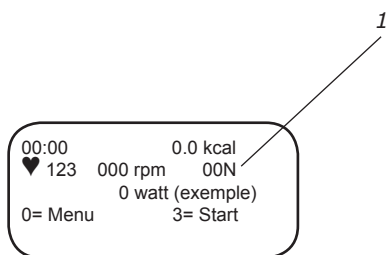
From main menu choose any test and go to the start display where the braking force in N appears. See *Fig: Force*.

1. With the pendulum pointer at 0, the display should read "00N".
2. Move the pendulum weight to the 4 kp position and the display should read "39" Newtons.

If the braking force is not displayed correctly, an electronic calibration must be done. See section "Electronic calibration".

### NOTE!

After this verification, the brake belt will be loose, which means that it takes about 15 seconds before the regulating device has tense the brake belt to normal again (5 N).



*Fig: Force*  
1 Force in the display of the handheld controller  
2 Force in the PC software

## Electronic calibration

A daily inspection of the pendulum viewing against the electronics should be done. If these do not match you should recalibrate cycle. The values are saved even if you turn off the power, if you physically move the bike. Usually it is not necessary to recalibrate the cycle electronically, but it should be done after each service, change of electronic part, movement, if you adjusted the 0-index, or after you have programmed the "Reset" by default settings. (Handheld controller: alt. 99 in the main menu and then alt. 3 in the service menu.)

The following steps show how electronics are calibrated against the pendulum.

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.

A check of the electronic calibration can be done in the PC software. Choose any test. In the dialog box that appears, you can read "Force [N]." If a handheld controller is used, choose any test. In the display you can see the force at the N in the display. See *Fig: Force*.

### NOTE!

After this verification, the brake belt will be loose, which means that it takes about 15 seconds before the regulating device has tense the brake belt to normal again (5 N).

## Electronic calibration - with handheld controller

1. Check at the bottom of the flywheel that the brake belt is loose, see *Fig: Control loose brake belt*. If not, move the pendulum pointer to 4 kp and hold it there for a few seconds. Move the pendulum pointer to 0 again, and check again that the brake belt is loose.
2. Adjust the scale, see "Zero adjustment of scale," so that the pendulum pointer is pointing at the 0-index of the scale, see *Fig: Zero position*.
3. Press alt. 5 in the main menu (calibration) and follow the instructions in the display. Hold the pendulum pointer in 0 position and wait for a beep, see *Fig: 0 kp*. NOTE! The pendulum must remain stationary.
4. Move the pendulum to 2 kp and wait for a beep, move the pendulum to 4 kp and wait for a beep. Finally move the pendulum to 6 kp and wait for two beeps shortly after each other. See *Fig: 2 kp*, *Fig: 4 kp*, *Fig: 6 kp* and *Fig: 0 kp*.
5. Lower the pendulum back to standby mode (0-index).

The calibration is complete.

**NOTE!** The pendulum must be kept still at the different positions.

## Electronic calibration - PC

1. Check at the bottom of the flywheel that the brake belt is loose, see *Fig: Control loose brake belt*. If not, move the pendulum pointer to 4 kp and hold it there for a few seconds. Move the pendulum pointer to 0 again, and check again that the brake belt is loose.
2. Adjust the scale, see "Zero adjustment of scale," so that the pendulum pointer is pointing at the 0-index of the scale, see *Fig: Zero position*.
3. Start the "Monark 839E Analysis Software" in your PC.
4. In the menu "Monark 839E", select "Check calibration ...".
5. Follow the instructions displayed on the screen. Also see *Fig: 2 kp*, *Fig: 4 kp*, *Fig: 6 kp* and *Fig: 0 kp*.

The calibration is complete.

**NOTE!** The pendulum must be kept still at the different positions.

## Electronic calibration - with the pendulum

From program version R15

1. Check at the bottom of the flywheel that the brake belt is loose, see *Fig: Control loose brake belt*. If not, move the pendulum pointer to 4 kp and hold it there for a few seconds. Move the pendulum pointer to 0 again, and check again that the brake belt is loose.
2. Adjust the scale, see "Zero adjustment of scale," so that the pendulum pointer is pointing at the 0-index of the scale, see *Fig: Zero position*.
3. Turn off the power to the bike and move the pendulum pointer to 4 kp, as shown in *Fig: 4 kp*.
4. Hold the pendulum pointer at 4 kp and turn the power on the bike again and wait for a beep. Move the pendulum pointer to 0, see *Fig: 0 kp*. Wait for a beep.
5. Move the pendulum pointer to 2 kp, see *Fig: 2 kp*. Wait for a beep.
6. Move the pendulum pointer to 4 kp, see *Fig: 4 kp*. Wait for a beep.
7. Move the pendulum pointer to 6 kp, see *Fig: 6 kp*. Wait for two beeps. Move the pendulum to 0 again.

The calibration is complete.

**NOTE!** The pendulum must be kept still at the different positions.



Fig: Control loose brake belt

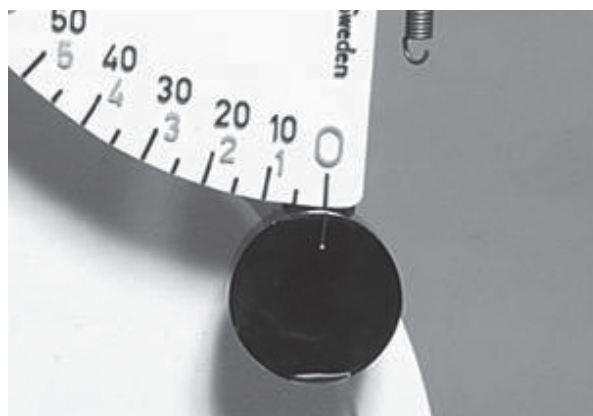


Fig: Zero position

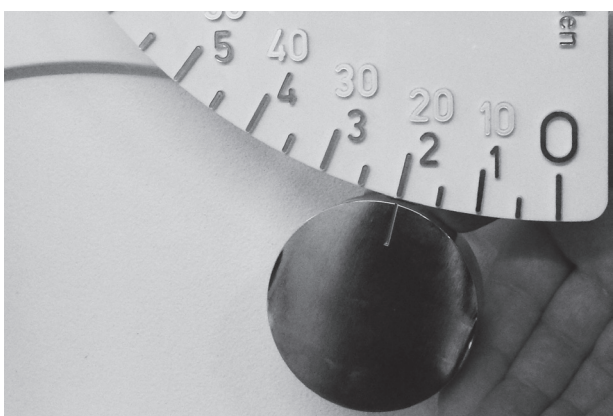


Fig: 2 kp

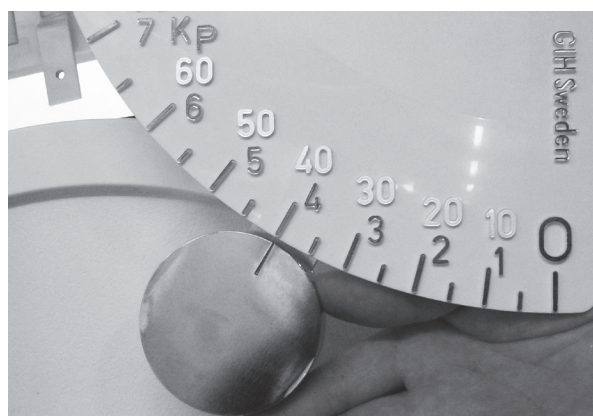


Fig: 4 kp

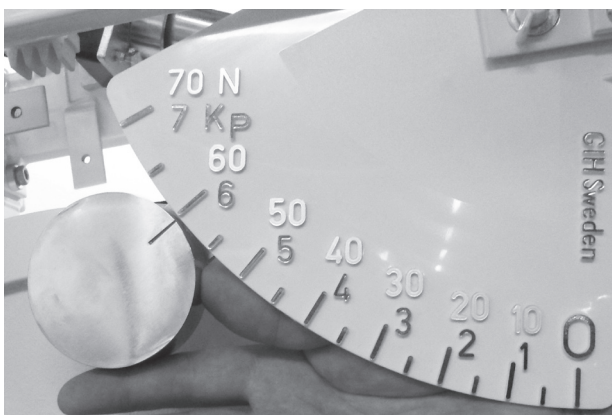


Fig: 6 kp



Fig: 0 kp

## Calibration

Although all Ergometers are calibrated at the factory, the user may wish to verify this by performing a mechanical scale calibration. If so please do the following.

Remove the cover over the flywheel. Loosen the spring from the brake belt. Check that scale 0-index is in line with the index of the pendulum. If adjustment is required, first loosen the locknut. Then change the scale so that the index of the sinker is consistent with 0-index of the scale. Retighten the lock nut after adjustment.

A known weight, calibration weight 4 kg (Art. No.: 9000-211), is hung in the spring.

### NOTE!

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

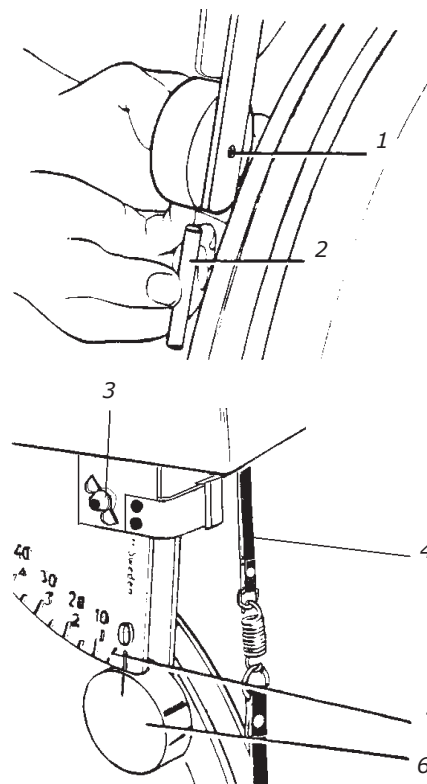
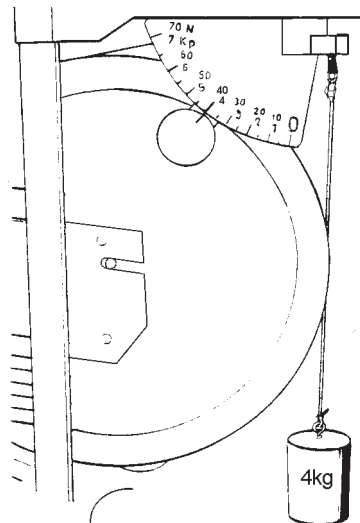
This weight (4 kg) can, when properly adjusted, be read at the corresponding point on the scale. If there is a deviation, adjust the pendulum to the right position on the scale by adjusting the weight inside the pendulum. To change the position of the adjusting weight, loosen the lock screw. If the pointer 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.

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

Attach the flywheel cover.

## Zero adjustment of scale

Check the 0-index of the meter scale (5) is in line with the index of the pendulum. If adjustment is necessary, first loosen the locknut (3) and then change the position of the board. Tighten the locknut after the adjustment. See *Fig: Calibration*.



*Fig: Calibration*  
1) Locking screw  
2) Adjustment weight  
3) Locking nut  
4) Brake belt  
5) Kp-scale  
6) Pendulum weight

# Testing with Ergomedic 839 E

The versatility of the 839 E/939 Medical Ergometer enable 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. The backgrounds of both the individuals being tested and those administering the test may be vastly different in these widely varying testing situations.

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 subject, explaining the work which will be required and the duration of the procedure. A system of communicating fatigue, chest pain or other abnormal physical response to the exercise should be discussed.

The test subject 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. The test subject may need some general education concerning the pedalling of the ergometer. The saddle and the handlebars should be adjusted for comfort and proper mechanical distance. 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.

Explain how the metronome shows "over-", respectively. "sub-" RPM relative to the set value.

The maintenance of the proper speed should be practiced at a low workload.

Finally, put the chest belt on. 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. The test subject should exhibit a relatively stable resting heart rate prior to starting the protocol.

## Power calculation

1 rpm = 6 m on the flywheel brake surface.

50 rpm = 300 m

2 kp force makes  $2 \times 300 = 600$  kpm/min

100 rpm = 600 m

1 kp force makes  $1 \times 600 = 600$  kpm/min

(watt = rpm x kp)

## Heart Rate (telemetry)

The test subject's heart rate can be monitored by chestbelt telemetry system. The chest belt is standard equipment.

The chest belt should be secured at a comfortable tension around the mid section, just below the breast muscle. Moisten the electrodes before use. Heart rate monitoring, free from artifact, requires good electrode contacts and adequate skin preparation. To make sure that you have found the correct position the logo should have been placed in the center of chest and also be readable by another person. Prior to placing the electrodes, the test subject's skin at the electrodes sites, should be cleaned with a commercial skin prep solution. After the chestbelt is placed the heart rate will be displayed and the heart will verify each beat. To make contact with the HR receiver on the bike, the distance should not be more than 100 cm / 39 1/3". It is especially important when first used to identify the chest belt with the sensor, by standing close to get the HR (maximum 60 cm). Applies particularly Polar chest belts.

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

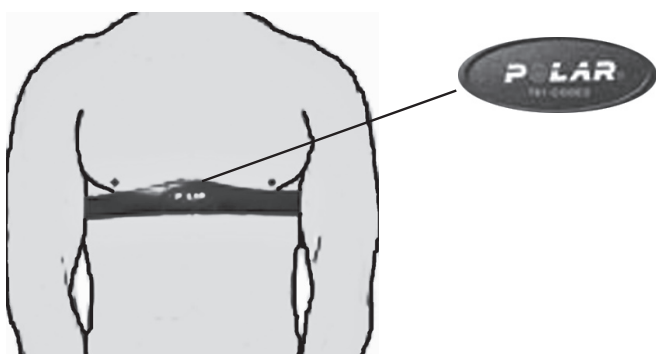


Fig: Placement of the chest belt

## 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. Test person's reactions during the test can be observed and any necessary help can be given during the test. 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 show difficulty in regulating the speed of the ergometer. This is of minor importance (except in cases where the program is based on braking force because the effect is automatically adjusted to the correct value, as long as the rpm is 30 rev / min.

In addition, some test persons may become sensitive to the display on the handheld controller. If this is suspected, the controller may be removed from its cradle and located out of view. Similarly, the pulse LED may disturb the test subject and may be disabled.

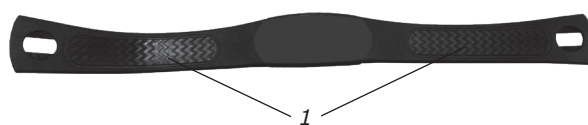


Fig: Electrodes on the back of the chest belt (1)

## Reviewing results

The maximum oxygen uptake is the standard measurement of cardiopulmonary fitness. 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 Åstrand protocols estimate the maximum oxygen consumption, based on a submaximal workload while all others report the oxygen consumption required by the final workload. The Bruce and Naughton protocols require that the test subject exercise at a workload level for a minimum of one minute to establish the oxygen consumption. If less than one minute is observed, the previous workload value is used.

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 to 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.

A relative fitness index can be obtained from the following tables:

<i>Fitness Rating Index - Males</i> <i>Maximum Oxygen Consumption ml/kg/min</i>				<i>Fitness Rating Index - Females</i> <i>Maximum Oxygen Consumption ml/kg/min</i>			
<i>Rating</i>				<i>Rating</i>			
	<i>-36 yrs</i>	<i>36-45 yrs</i>	<i>45- yrs</i>		<i>-36 yrs</i>	<i>36-45 yrs</i>	<i>45- yrs</i>
<i>Excellent</i>	54	53	43	<i>Excellent</i>	55	49	46
<i>Good</i>	49	45	38	<i>Good</i>	45	43	38
<i>Above Average</i>	46	39	34	<i>Above Average</i>	39	37	32
<i>Average</i>	36	33	30	<i>Average</i>	34	33	27
<i>Below Average</i>	32	29	27	<i>Below Average</i>	30	29	24
<i>Fair</i>	28	25	24	<i>Fair</i>	26	26	20
<i>Poor</i>	24	23	20	<i>Poor</i>	20	22	18

See also table 7 in “ Work tests with the Bicycle Ergometer“ by P O Astrand.

# Troubleshooting guide

Symptoms	Probable Cause / Corrective Action
LED does not light up	<ul style="list-style-type: none"> <li>No current in the outlet. Check the fuses.</li> <li>Right AC adaptor? Check that the information in section "Facts" is in accordance with the AC adaptor used.</li> </ul>
No connection to PC	<ul style="list-style-type: none"> <li>Check cables.</li> <li>Right COM port?</li> <li>Drivers missing when using the USB-serial adaptor. CD with drivers is included.</li> <li>Is the right type cmd set?</li> </ul>
No workload	<ul style="list-style-type: none"> <li>Pendulum stuck. Contact service centre for action / replacement.</li> <li>Check that the pedal speed is higher than 30 rpm. No workload is put on if the actual pedal speed is lower than 30 rpm. See "Service menu" pedal reference. The default setting is 30 rpm but can be adjusted to the desired value.</li> <li>Check calibration.</li> </ul>
No heart rate	<ul style="list-style-type: none"> <li>Check the chestbelt (battery). Wet the thumbs and place them on the electrodes. A low clicking sound will appear near battery lid while you click on the electrodes with one thumb. Use another external HR monitor to check the belt.</li> <li>Check that the chest belt is positioned correctly on test person and tight enough. Check that the electrodes are wet, in difficult cases it is necessary to use a contact gel or a mixture of water with a few drops of washing-up liquid. Pulse signal strength varies from person to person. Try the belt with a person known to have a good pulse wearing a chest belt.</li> <li>Check for loose cables or jack if you have a plug-in receiver. Use another HR receiver (HR watch or test bike monitor) to check the chest belt.</li> <li>Check that it is the correct receiver and that it is in the correct place. If it has a round Polar-sticker it should be placed straight.</li> </ul>
No rpm reading	<ul style="list-style-type: none"> <li>Check that the cable is connected properly.</li> </ul>
Unable to calibrate force	<ul style="list-style-type: none"> <li>Potentiometer belt may be slipping or broken. Replace if damaged. The potentiometer is misadjusted. Reboot memory from service menu (99). Set default (3). Then calibrate the electronics again.</li> </ul>
Uneven heart rate	<ul style="list-style-type: none"> <li>Use an external unit, for example a HR watch, to check if it also indicates an irregular pulse. If this is the case, there is probably disturbance in the room. The disturbance may be electronic fields from power cables, elevators, lamps etc. or other electronic devices which are too close (eg. cell phones). Move the bike to a different location in the room or change rooms. If an irregular HR remains it should be checked manually. If the HR remains irregular at work the person's health should be examined.</li> </ul>
There is a click noise when pedalling (increases with the weight)	<ul style="list-style-type: none"> <li>The pedals are not tight. Tighten them or change pedals.</li> <li>The crank is loose. Check, tighten.</li> <li>The base bearing is loose. Contact your dealer for service.</li> </ul>
Scratching sound is heard when pedalling	<ul style="list-style-type: none"> <li>Check that the carriage block is taken off and that none of the covers is scratching.</li> </ul>
There is a click noise and a squeak noise when pedalling	<ul style="list-style-type: none"> <li>Loosen the chain.</li> </ul>
Any problems with the computer software	<ul style="list-style-type: none"> <li>Send an email to the software developer HUR labs support: <a href="mailto:software@hur.fi">software@hur.fi</a></li> </ul>

## Error message

<b>Message</b>	<b>Cause</b>
"Test is aborted"	An automatic test program has been stopped before it is finished. No test results can be obtained.

## Operation interferences

It is normally considered that about 70 % of all shutdowns on small computers are caused by mains interferences, i.e. at short over voltage. These interferences can often be caused by different machinery, which is started or stopped. The processor in the computer is then reacting incorrectly or is not working at all. The problems can be solved by means of a mains interference protector, which is connected between the wall outlet and the AC adaptor. .

## Where to obtain additional information

The user may require more information concerning several areas of the ergometer usage. This manual was intended to instruct the reader primarily in the operation of the ergometer. References are made to related topics in the discussions concerning the testing procedures and the protocol operation sections. The following literature may provide some greater insight to ergometer-based testing without confusing the reader with technical medical terms.

- Åstrand P-O, "Ergometri - konditionsprov", Monark, Sverige.
- Golding L. A, Myers C. R, Sinning W. E, Y's way to physical fitness", YMCA of the USA, Rosemont, IL, 1982

For more technical details, see the section entitled "Reference".

## References

1. Astrand I, "Aerobic work capacity in men and women with special reference to age", Acta Physiol Scand. 49 (suppl. 169), 1960
2. Åstrand P-O, "Experimental studies of physical working capacity in relation to sex and age", Munksgaard, Köpenhamn, 1952.
3. Åstrand P-O, Rodahl K, "Textbook of Work Physiology", McGraw-Hill, New York, 1970.
4. Bruce RA, Kusumi F, Hosmer D, "Maximal oxygen intake and nomographic assessment of functional aerobic impairment in cardiovascular disease", Am Heart J 85:546-562,1973.
5. Naughton J, "Exercise Testing and Exercise Training in Coronary Heart Disease", Academic Press, New York, 1973.
6. Golding LA. Myers CR, Sinning WE, "Y's way to physical fitness" YMCA of the USA, Rosemont, IL, 1982
7. Wilson P. K, Bell C. W, Norton A. C, "Rehabilitation of the heart and lungs", Beckman instruments, 1980.
8. Åstrand P-O, "Ergometri - konditionsprov", Monark, Sverige.

## Service

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

### Warning

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 for 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 as above 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.

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.
- Always keep the bike clean and well lubricated (once a week).
- Periodically wipe the surface with a rust preventative, especially when it has been cleaned and the surface is 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. Also check that pedal arms are firmly tightened on the crank axle, tighten if necessary. 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.

## 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.

Alt. 1: 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.

Alt. 2: 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.

Alt. 3: 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 section "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".

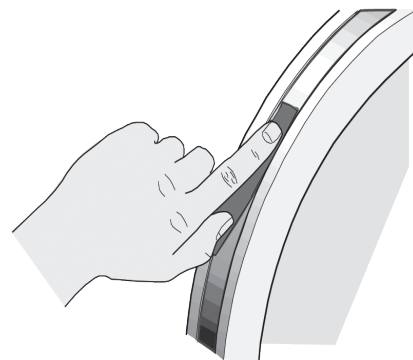
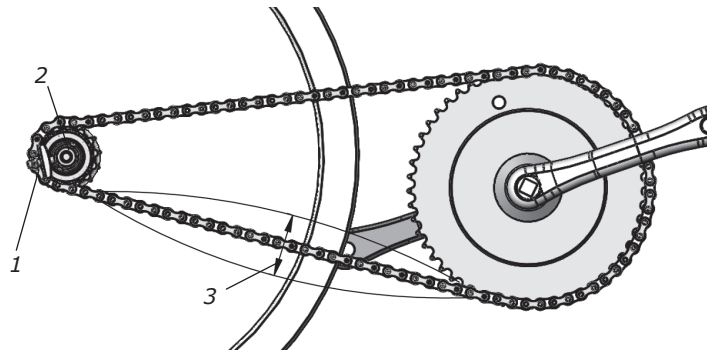


Fig: Brake belt contact surface

## Chain 1/2" x 1/8"

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 (3) 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 (1) when needed.



*Fig: Chain adjustments*

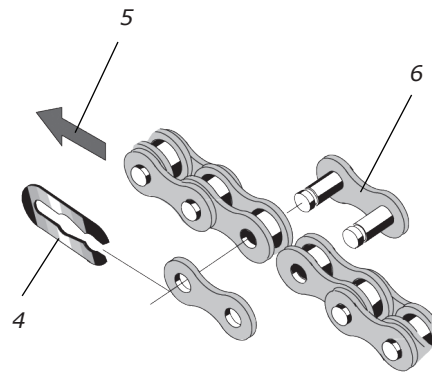
- 1) Chain adjuster
- 2) Axle nut
- 3) Chain play

When the chain has become so long that it can no longer be tightened with the chain adjusters it is worn out and shall 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 a pair of tongs for dismantling spring. 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. Use a pair of tongs for dismantling and assembling the spring (4). See *Fig: Chain replacement*.



*Fig: Chain replacement*

- 4) Lock spring
- 5) Movement direction
- 6) Chain lock

**NOTE!** At assembly the flywheel has to be parallel 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. Remove the chain according to section "Chain 1/2" x 1/8".

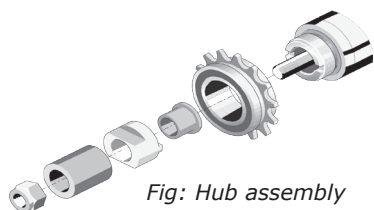
Loosen the axle nuts and lift off the flywheel. Remove the axle nut, washer, chain adjuster and spacer on the freewheel side. Replace sprocket-adaptor and assemble the new parts in reverse order according to the above.

NOTE! Do not tighten the axle nut completely. It must be possible to loosen the sprocket-adaptor half a turn.

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*.

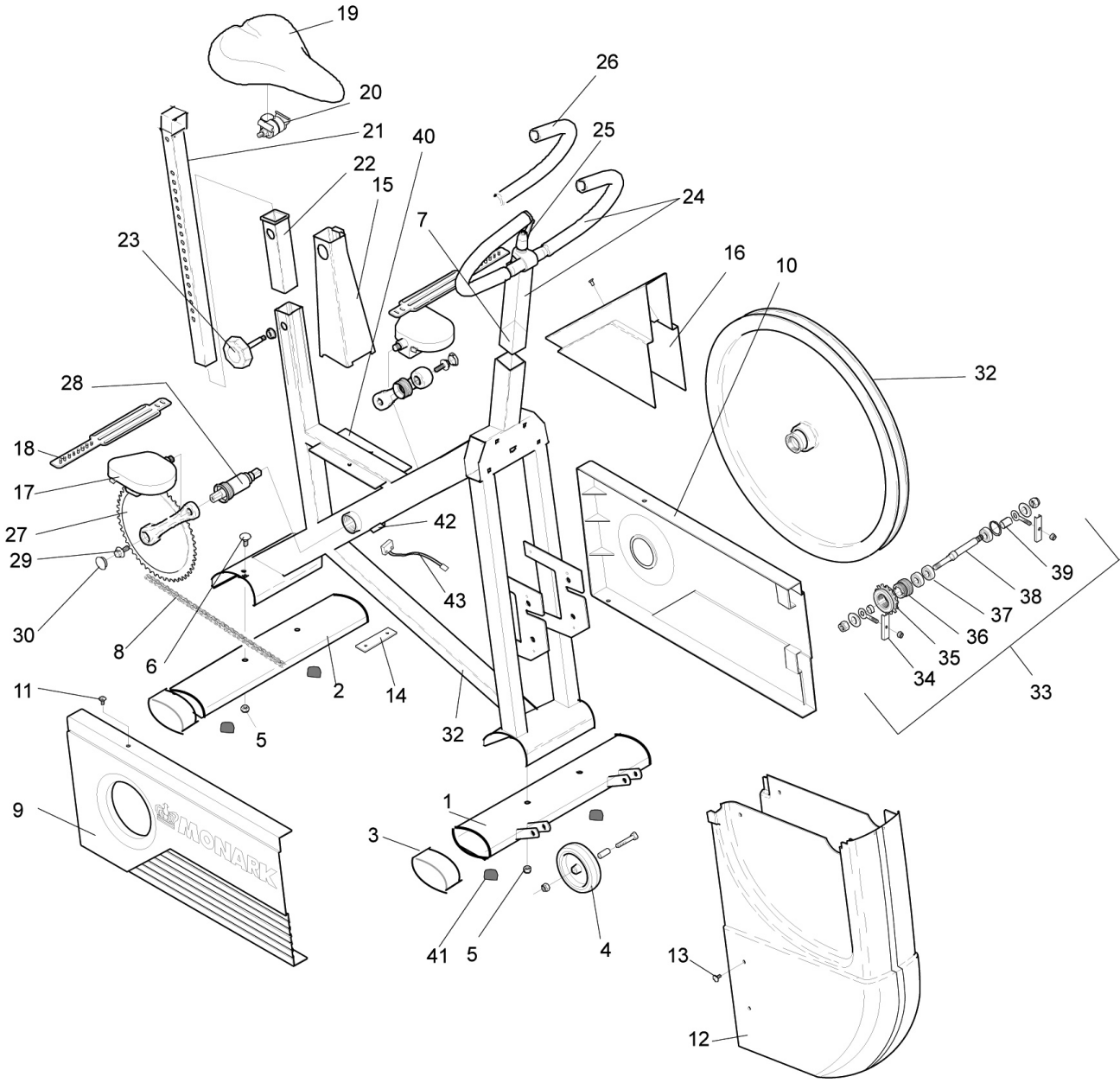


*Fig: Lubrication*



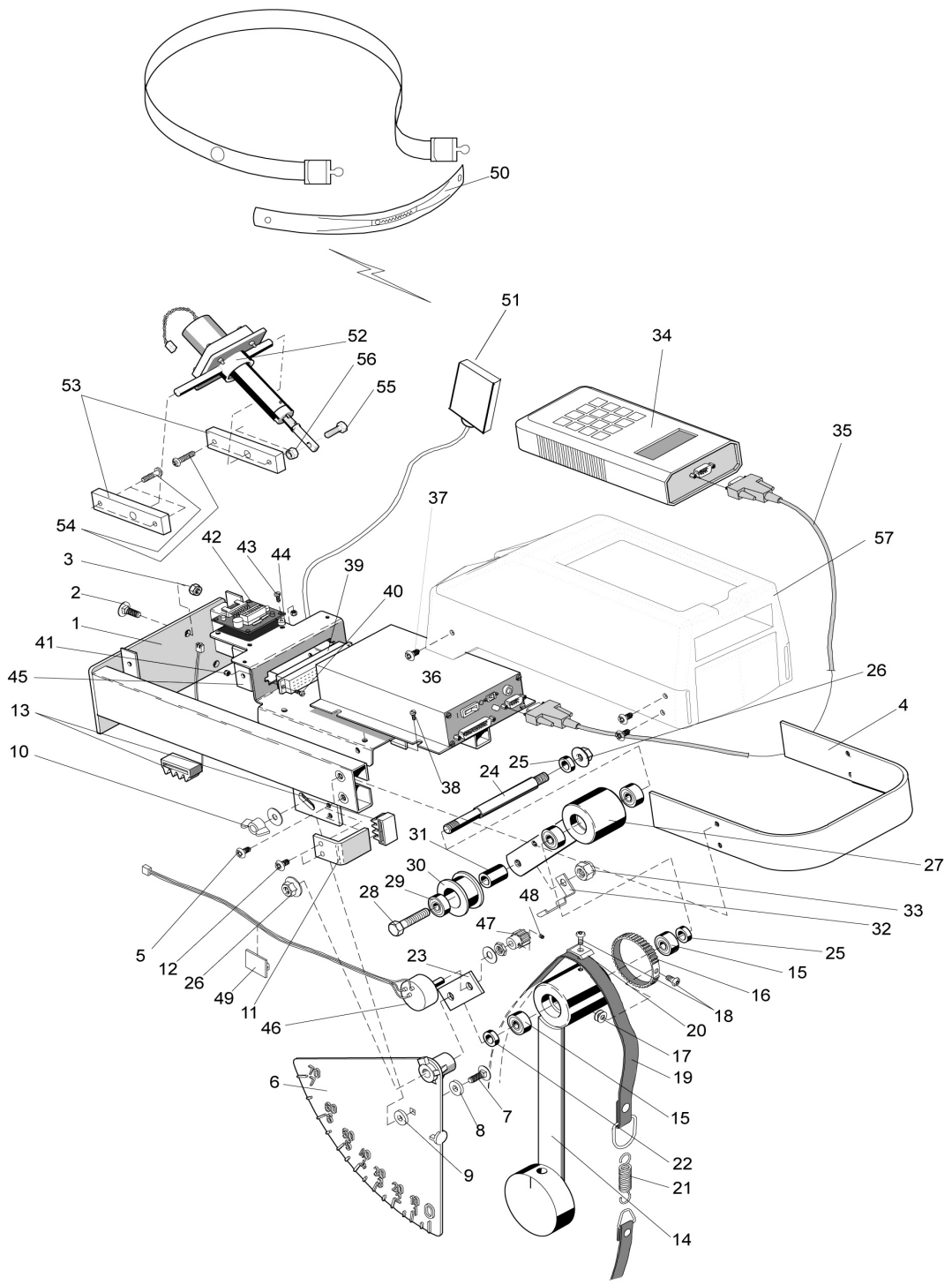
*Fig: Hub assembly*

# Spare parts list



From serial no: WBK285907H

Pos.	Qty.	Art. No.	Description	Pos.	Qty.	Art. No.	Description
1	1	9301-15	Support tube, front	23	1	9300-131	Locking knob, complete
2	1	9301-16	Support tube, rear	24	1	9300-280	Handlebar, complete
3	4	9328-51	Plastic cap, blue	25	1	9100-180	-Screw
4	2	9000-37	Transport wheel	26	1	9126-72	-Handgrip, blue (pair)
5	6	5845	Locking nut M8	27	1	9300-432	Steel crank set, complete with magnets
6	2	9300-12	Screw MVBF M8x16 mm	28	1	9300-340	BB cartridge bearing
7	1	9300-291	Expander wedge M10	29	2	8523-115	Screw M6S 8.8 M8 x 20 FZB
8	1	9300-55	Chain 1/2 x 1/8", 116 l	30	2	8523-2	Dust cover
9	1	9300-50	Chain guard	31	1	9301-5	Frame
10	1	9300-52	Side guard	32	1	9300-3	Flywheel 20 kg, complete
11	2	5675-9	Mounting screw LKT-TT 5x6.5mm	33	1	9300-24	Wheel suspension, complete set
12	1	9339-55	Wheel cover	34	1	9000-12	-Chain adjuster
13	2	9304-32	Screw M5x25 mm	35	1	9106-13	-Sprocket
14	1	9300-53	Holder for guard	36	1	9106-14	-Connection
15	1	9300-56	Cover for saddle	37	3	19001-6	-Bearing 6001-2z
16	1	9300-57	Cover for frame	38	1	9300-18	-Axle
17	1	9300-220	Pedal (pair)	39	1	9300-17	-Bush, 23 mm
18	1	9300-207	Pedal strap (pair)	40	2	9300-58	Holder for chain guard
19	1	4994-5	Saddle	41	4	9328-26	Rubber foot
20	1	9300-114	Seat clamp	42	1	9326-166-1	Holder for sensor
21	1	9300-138	Saddle post	43	1	9326-169	Sensor with cable
22	1	9300-115	Bushing for saddle post		1	9000-211	Calibration weight, 4 kg



From serial no: WBK285907H

Pos.	Qty.	Art. No.	Description	Pos.	Qty.	Art. No.	Description
1	1	9339-38	Frame for equipment	34	1	9339-51	Terminal
2	4	9300-21	Screw MVBF 6x16 mm	35	1	9339-27	Cable
3	4	5843-9	Nut M6	36	1	9339-52	Base unit
4	1	9339-59	Handles	37	6	5673-9	Screw M5x12
5	4	5673-9	Screw M5	38	4	5675-9	Screw M5x6,5
6	1	9339-100	Kp-scale	39	1	9339-25	Connection device
7	1	9339-21	Screw M6	40	2	9305-42	Screw MCS M3x30 fzb
8	1	5880	Washer	41	2	5840	Nut M3
9	1	5862	Washer	42	1	9339-56	Card for metronome
10	1	9000-102	Wing nut	43	4	9339-49	Screw MCS M3x10 fzb
11	1	9300-94	Stop	44	4	9339-33	Distance
12	2	5671-9	Screw M5	45	1	9339-24	Cover
13	2	9300-99	Plastic stop	46	1	9339-62	Potentiometer
14	1	9300-88	Weight lever with bearing	47	1	9303-52	Pulley
15	2	19001-6	Ball bearing 6001-2z	48	1	9305-44	Locking screw
16	1	9303-54	Belt 55T	49	1	9300-66	Holder for cable
17	2	5861	Washer	50	1	9339-89	Chestbelt Polar Wear-link
18	1	5673-9	Screw M5	51	1	9338-21	Receiver Polar
19	1	9339-61	Brake belt	52	1	9339-57	Tension device, complete
20	1	9300-92	Bracket	53	2	9339-40	Bracket for tension device
21	1	9008-124	Spring	54	4	5671-19	Screw M5
22	1	9339-87	Spacer	55	1	14324-9	Screw M6
23	1	9303-51	Holder for potentiometer	56	1	5843-9	Nut M6
24	1	9339-86	Axle	57	1	9339-80	Instrument cover
25	2	9000-17	Spacer		1	9339-67	Power adaptor
26	2	5799	Nut		1	9338-20	USB serial adaptor
27	1	9339-22	Tension lever		1	9339-27	Communication cable, 1.8 m
28	1	14359	Screw M8		1	9339-39f	Communication cable, 3 m (accessory)
29	1	19088-6	Bearing				
30	1	9100-21	Tension cylinder				
31	1	9339-32	Spacer				
32	1	9339-23	Belt control				
33	1	5844	Nut M8				



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