Manual 831 E

MONARK
SPORTS & MEDICAL

Important

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

Contents

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 test bike!

Ergometer 831 E is a stable arm ergometer that satisfies the requirements for fitness and endurance testing for the upper body. A secure and user friendly bike that provides a constant workload independent of pedal speed. It is easy to control by external devices such as PCs and ECG. Monark's renowned pendulum system has been adapted for use in rehabilitation, sports medicine and medicine. Ideal for exercise from a wheel chair.

The ergometer is controlled by either a handheld control unit, an external PC or other external units. The bike can perform max and submax fitness tests and calculate the VO_2 max. The ergometer can also 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 in manual mode.

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.*

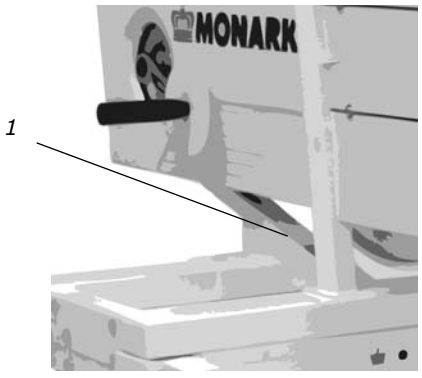


Fig: Serial number (1)

Facts

- Controlled digital by ECG or PC with RS232 cable.
- Well-balanced flywheel, 12 kg (27 lbs)
- Pendulum scale, easy to calibrate
- RPM independent
- Workload 0-1400W (depending on RPM)
- Rust protection and powder paint
- Wheels for easy transport
- Display that shows RPM
- Heart rate measured with telemetry or chest belt
- Optical metronome showing RPM or heart rate
- Warning signal for MAX heart rate limit

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

Width
700 mm (27½")

Length
1500 mm (59")

Height
1160 mm (45 2/3")

Weight
79 kg (174 lbs)

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

Technical data power adaptor
Input voltage: 110-240 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.

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 Ergomedic 831 Medical is adapted to ECG work tests it is set to measure the power on the crank.

When Ergomedic 831 E is adapted to fitness tests it is set to measure the power on the flywheel.

Operation of the ergometer

Ergomedic 831 E is built on a stable frame, a large well-balanced flywheel, a break belt and a pendulum weight which measures the force. Pedals / handles and a chain drive are provided to spin the flywheel as a tension device tightens the brake belt to regulate the braking force applied to the wheel. The pendulum indicates the applied force directly on the kp-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 / handle speed, the applied force and determines the test person's heart rate by a chest belt. 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 / handle speed to maintain a constant power workload. For information about how respective control units works, see respective sections.

The Monark Ergometer 831 E can be controlled externally from a hand held controller, 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 bike. 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 be switched off when connecting external components, but it is recommended to prevent transmission of incorrect data between devices over the connection. 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

Distance	**meter, miles**
Energy	**kcal**
Heart rate	**bpm**
Force	**Newton (N), kp**
Power	**Watts (W), kpm / min or VO_2 ml/min/kg**
Time	**min:sec**
Weight	**kilogram (kg), pounds (lbs)**

RPM display with optical pulse / metronome

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

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

Overspeed:
RPM is above the desired metronome rate 2, 4, 8, 16 or more depending which LED bar that indicates.

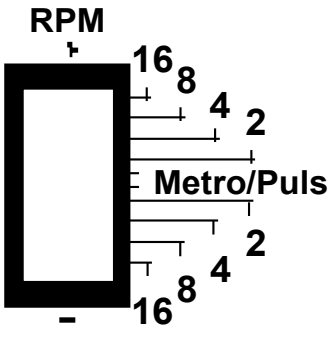


Fig: RPM display

Initial operation

Although all ergometers are calibrated at the factory, the user may wish to verify this by performing a mechanical kp-scale calibration. See section ”Calibration pendulum weight”. 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 "Electronical calibration”.

Test pedalling the ergometer. The 831 E Ergometer is now fully functional and ready to use.

Height adjustment of the table stand

The height of the table stand can be adjusted to get the ergometer at a desired level. Height adjustment is made by using a crank on the table frame. Pull out the crank crank it until the desired height is obtained. To lock the stand in this position, push in the crank again. See *Fig: Table stand*.

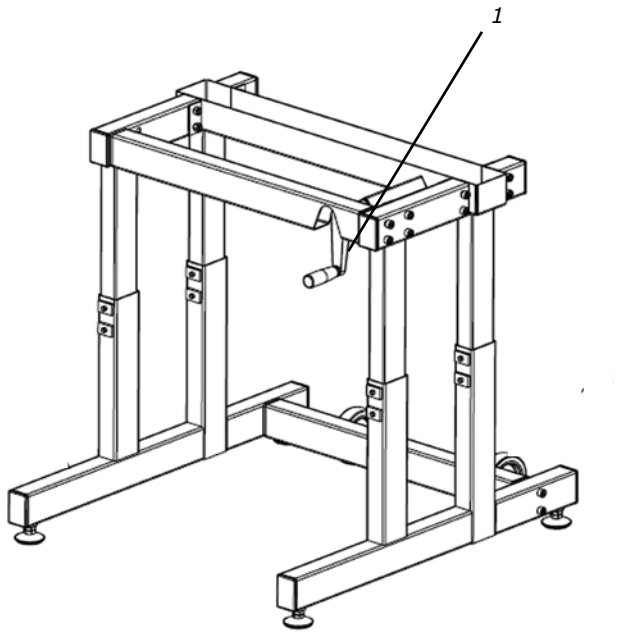


Fig: Table stand
Crank for height adjustment (1)

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 $1W=0{,}2388x10^{-3}$ 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.

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 kp-scale mechanically so that 0-index on the kp-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?

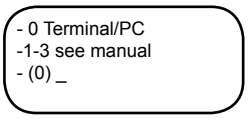
When power is turned on to the bike it will beep, and from the number of beeps the command type can be determined.

- 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.



   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 go back to main menu.

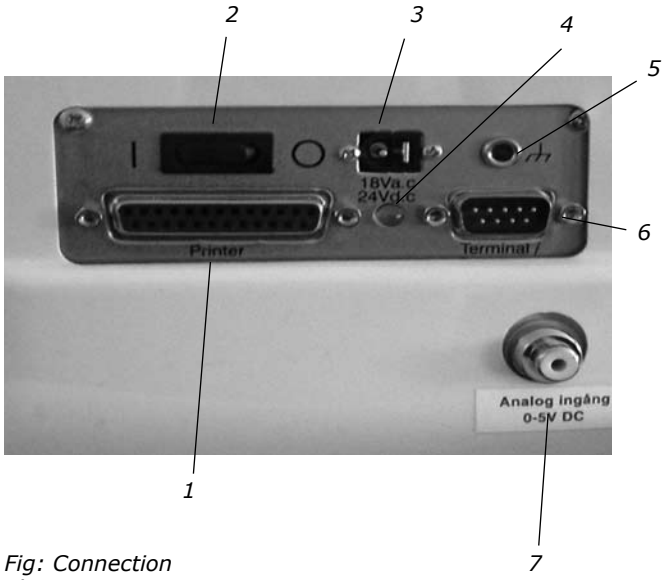


Fig: Connection
1) Printer connection
2) Power switch
3) Power input
4) LED
5) Chassis ground
6) Handheld controller / PC
7) Analog connection

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 the Monark Software (can be downloaded from our website: www.monarkexercise.se)
6. Connect the USB Adaptor to the Serial Cable and proceed with testing.

To control the ergometer use the supplied PC software that is common with models 839 E and 939 E, or other PC applications that are compatible with Ergomedic 831 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 bit
- 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 Start menu / Settings / Control Panel / System Hardware / Device Manager / Ports (COM & LPT).

Connect the 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 go back to control the ergometer with the handheld controller, type: env cmdtype=[enter] or env cmdtype=0[enter]

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

Procedure for connection to external ECG, digital controlled

1. Connect the handheld controller via the supplied 0-modem cable (9-pol. D-sub female connector on each end) to the corresponding connector (5) in the front of the cycle.
2. Connect the included AC adaptor to an appropriate socket and to Ergometer 831 E and then turn on the power.
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' Settings (Service setup).
6. Press ENTER on the following settings until 'Command type' is shown.
7. In this windows shows:

```
- 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 Mega Cart (Ergomedic 940 compatible) is used. Set '2 'for other ECG devices that are compatible Ergoline (requested load) alt. a third '3 'for other ECG devices that are compatible Ergoline (current load) and then press' Enter'. Is the desired settings already in parenthesis, press ENTER.

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. The computer will start up again automatically after a few seconds.
9. Turn off the power and remove the terminal incl. the cable.
10. Insert an appropriate cable to the ECG deice (Megacart requires a special cable) between ECG device and ergometer.
11. The ergometer can now be controlled only from an external ECG device.

Reset the Ergometer to use with handheld controller / PC.

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

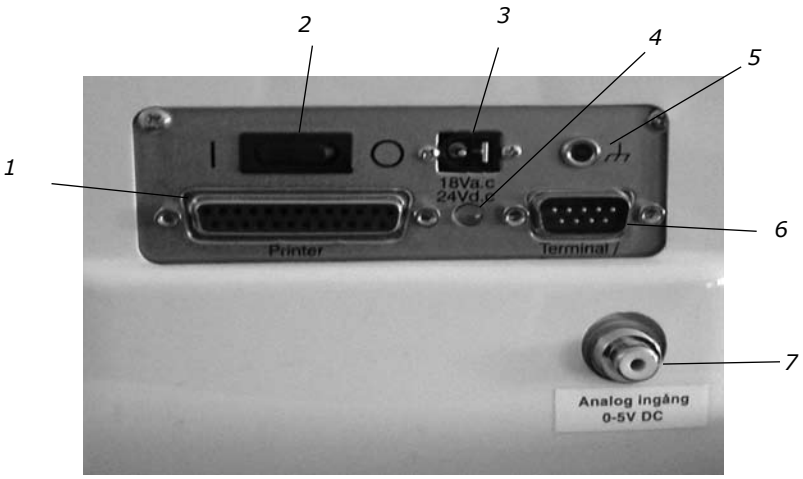


Fig: Connection
1) Printer connection
2) Power switch
3) Power input
4) LED
5) Chassis ground
6) Handheld controller / PC
7) Analog connection

Analog connection

The ergometer's work load can be controlled by external analog equipment such as ECG device (must be between 2 and 4 volts for properly function). 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 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 located on the front of the main unit 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.

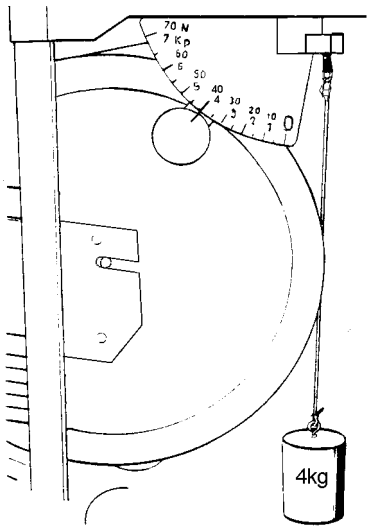
Calibration

The 831 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 kp-scale.
5. Hang the calibration weight in the spring, see *Fig: Calibration weight*.
6. The known weight should match the value on the kp-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.



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 braking force, see section.
- Pedal and check that it obtained a reasonable rpm - verify by a clock.
- Feel if the pedals move smoothly. Listen for any noise - fix if necessary.
- Check that the table height adjustable function works.
- Make sure the ergometer and tables are stuck together and that the table is stable. Tighten the screws if necessary.

If something unusual is found during the daily inspection and that you not can 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.

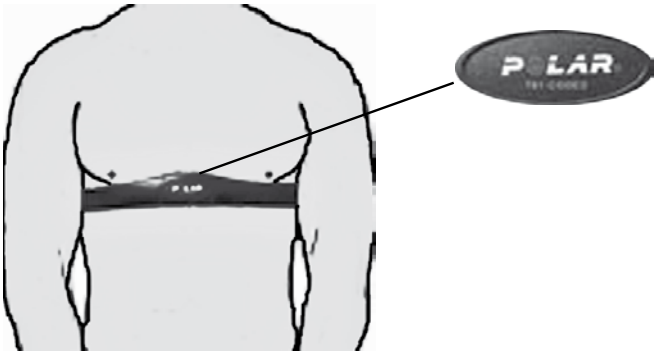


Fig: Placement of the chest belt

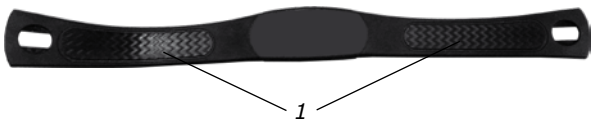


Fig: Electrodes on the back of the chest belt (1)

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 "Calibration electronics".

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).

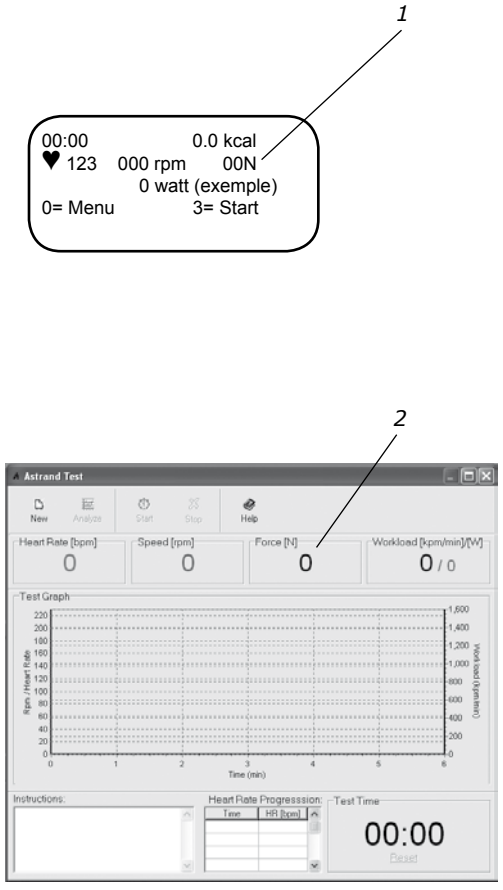


Fig: Force
1 Force in the display of the handheld controller
2 Force i the PC software

Calibration electronics

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: 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 kp-scale, see "Zero adjustment of kp-scale," so that the pendulum pointer is pointing at the 0-index of the kp-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: 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 kp-scale, see "Zero adjustment of kp-scale," so that the pendulum pointer is pointing at the 0-index of the kp-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. See also *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 kp-scale, see "Zero adjustment of kp-scale," so that the pendulum pointer is pointing at the 0-index of the kp-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

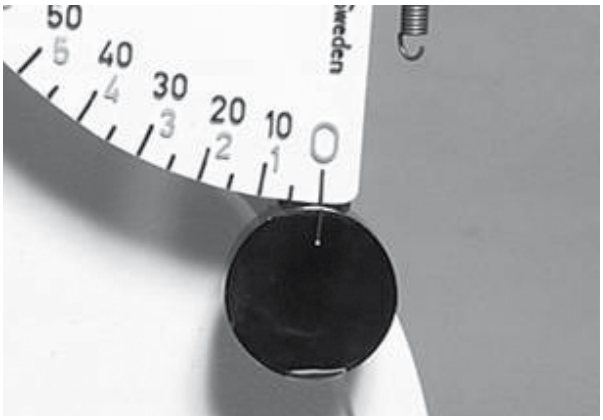


Fig: Zero position

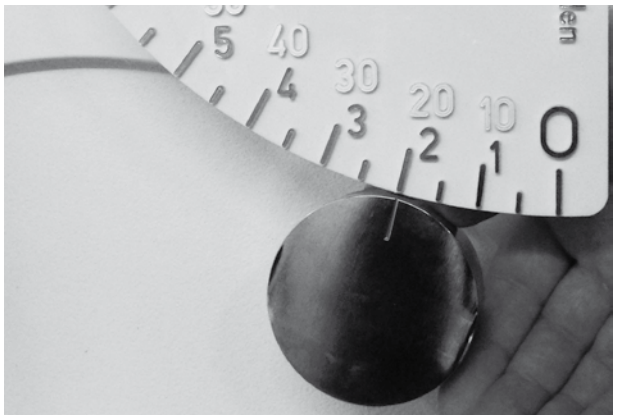


Fig: 2 kp.

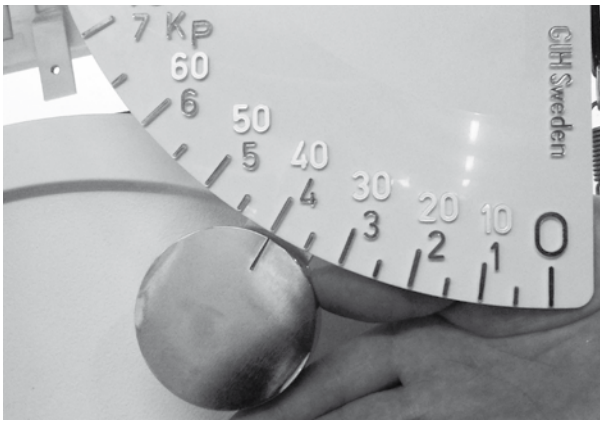


Fig: 4 kp.

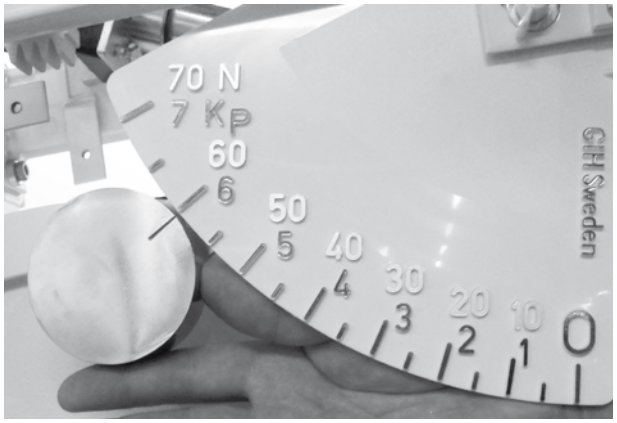


Fig: 6 kp.

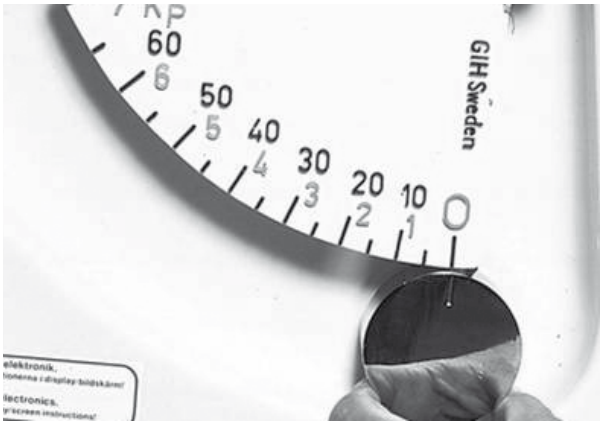


Fig: 0 kp.

Calibration

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

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

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

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 kp-scale. Would there be a deviation adjust the pendulum to the right position on the kp-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.

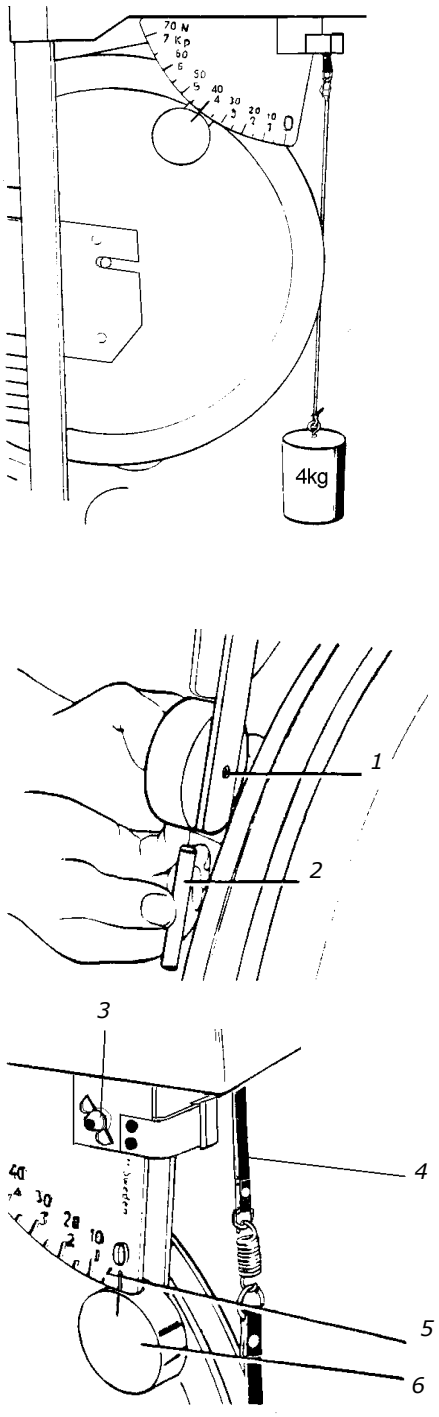


Fig: Calibration
1) Locking screw
2) Adjustment weight
3) Locking nut
4) Brake belt
5) Kp-scale
6) Pendulum weight

Zero adjustment of kp-scale

Check the 0-index of the kp-scale (5) is in line with the index of the sinker. 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*.

Testing with Ergomedic 831 E

The versatility of the 831 E/839 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, whether in a clinical laboratory or a health club, the subject may be exercised quite strenuously, depending on workloads which have been selected. 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 test person shall also have the appropriate clothing for a work test. Training suit or loose-fitting clothing is best. It may be appropriate that the test manager gives some advice on technique and setting of the ergometer height. It should be comfortable to ride

The operation of the speed metronome and over/ under display should be reviewed.

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 / minute
2 kp force makes 2 x 300 = 600 kpm/min

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

(watt = rpm x kp)

Additional information regarding submaximal tests with an arm ergometer is available on our website, www.monarkexercise.se.

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. 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.

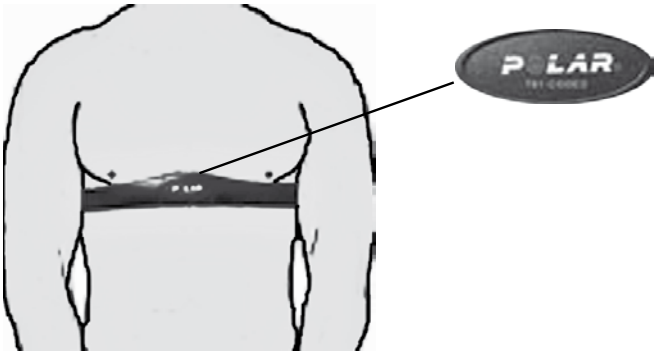


Fig: Placement of the chest belt

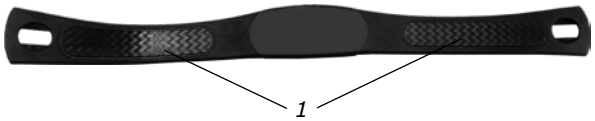


Fig: Electrodes on the back of the chest belt (1)

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 subject person's appearance and heart rate. The testing should be stopped immediately if the test person reports chest pain, difficulty 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.

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 person 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 bicycle exercise and those individuals who are less fit, are more likely be less efficient than those who ride bicycles 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.

NOTE!
The Astrand test is developed for leg ergometer. Therefore, these tables are not directly compared to when the test is performed on arm ergometer.

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

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

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

Trouble shooting guide

Symptoms	Probable Cause / Corrective Action
LED does not light up	• No current in the outlet. Check the fuses. • Right AC adaptor? Check so that the trafo information in section “Facts” is in accordance with the trafo used.
No connection to PC	• Check cables. • Right COM port? • Drivers missing when using the USB-serial adaptor. CD with drivers is included. • Is the right "cmd type" set?
There will be no work load	• 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. Check calibration.
No heart rate is displayed	• 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. • Check that the chest belt is positioned correct on test person and tight enough. Check that the electrodes are wet, in hard cases it is necessary to use a contact gel or a mixture of water with a few drops of washing-up liquid. The level for HR signal can vary from person to person. Put chestbelt on another known person who has a good pulse rendering. • 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 chestbelt. • 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.
No rpm reading	• Check cable.
Unable to calibrate force	• 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.
Uneven heart rate	• Use an external unit for example a HR watch to check if it also indicates irregular pulse. If this is the case, there is probably disturbance in the room. Magnetic fields from high voltage cables, elevators, fluorescent tube etc. can cause the disturbance. Other electronic equipment could be placed too close. 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.
There is a click noise with every pedal revolution (increases with the weight)	• The pedals are not tight. Tighten them or change pedals. • The crank is loose. Check, tighten. • The base bearing is loose. Contact your dealer for service.
Scratching sound is heard when pedalling.	• Check that the carriage block is taken off and that none of the covers is scratching.
There is a click noise and a squeak noise when pedalling	• Loosen the chain.

Error message

Message	Cause
"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, Sweden.
- 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 ofWork 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. I.e. 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.

Crank bearing

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

Flywheel bearing

The bearings in the flywheel are lifetime greased and require normally no maintenance. 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 of the knot in the other end of the cord and then remove the hole 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 ”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”.

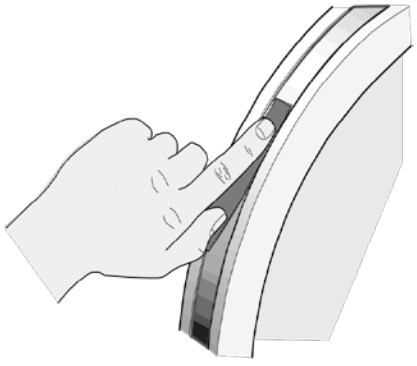


Fig: Brake belt contact surface

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 little a possible. Loosen the hub nut(2) on both sides and tens the chain with the chain adjuster(1) when needed.

When the chain has become so long that it can n longer be tightened with the chain adjusters it is wor out and shall be replaced with a new one.

To adjust or replace the chain, remove covers i 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*.

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

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

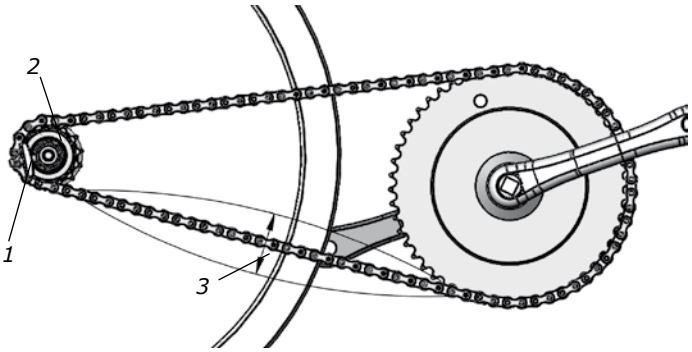


Fig: Chain adjustments
1) Chain adjuster
2) Axle nut
3) Chain play

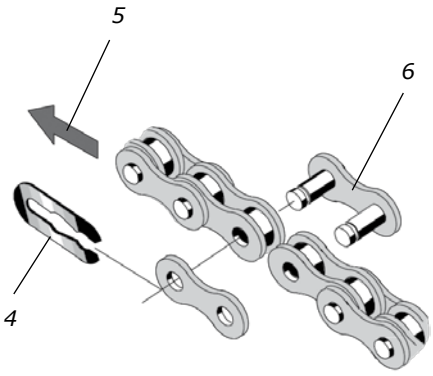


Fig: Chain replacement
4) Lock spring
5) Movement direction
6) Chain lock

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-adapter 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 adapter-sprocket 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*.

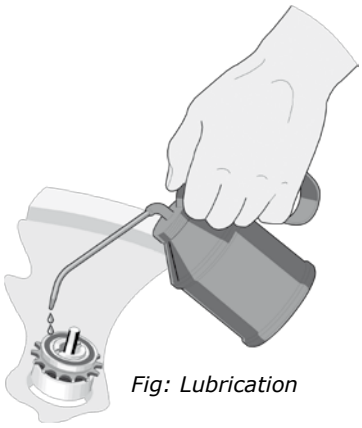


Fig: Lubrication

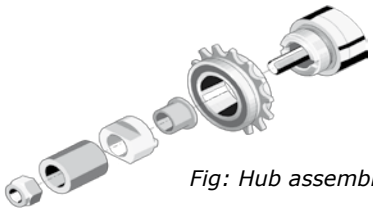
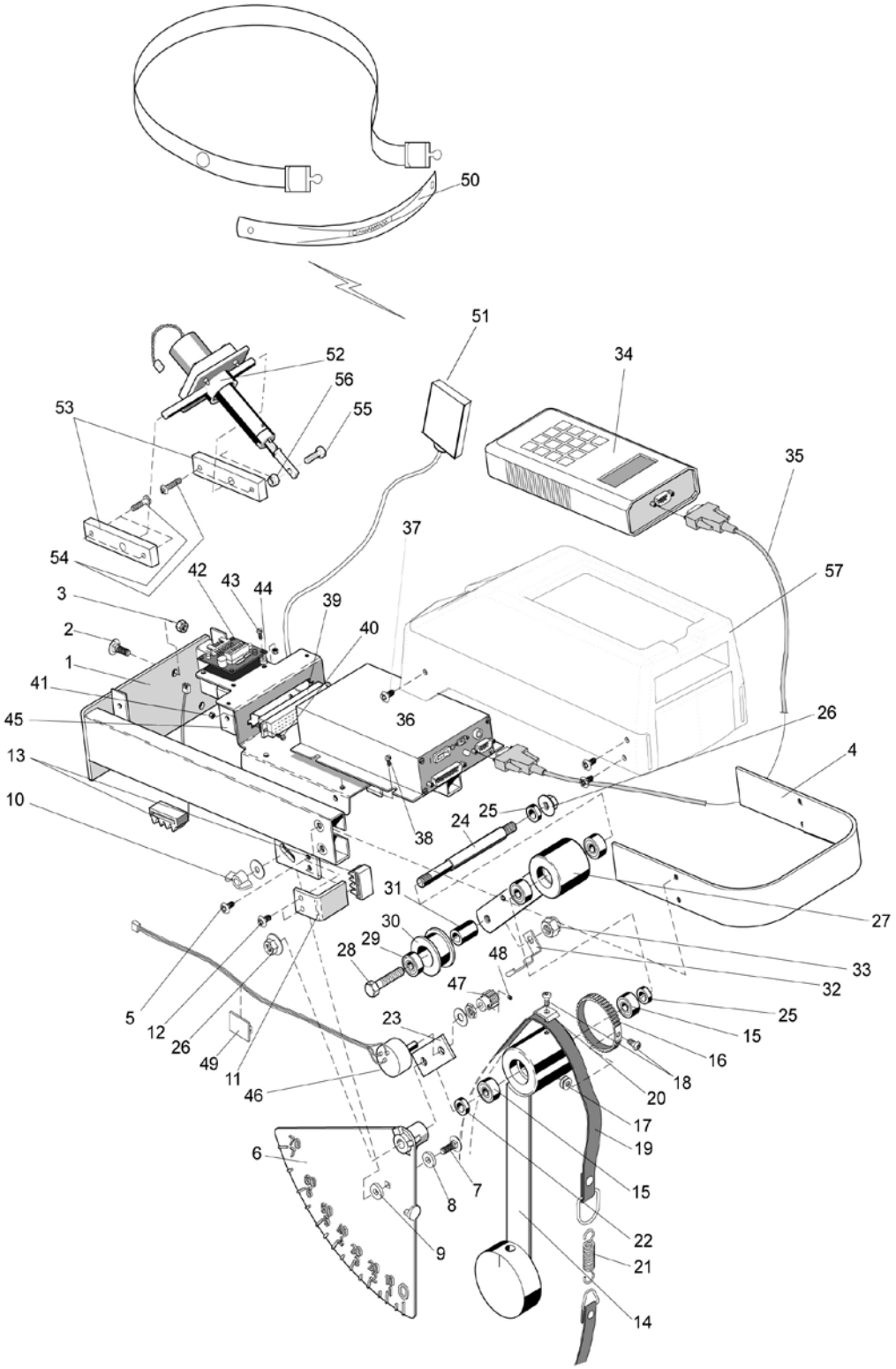


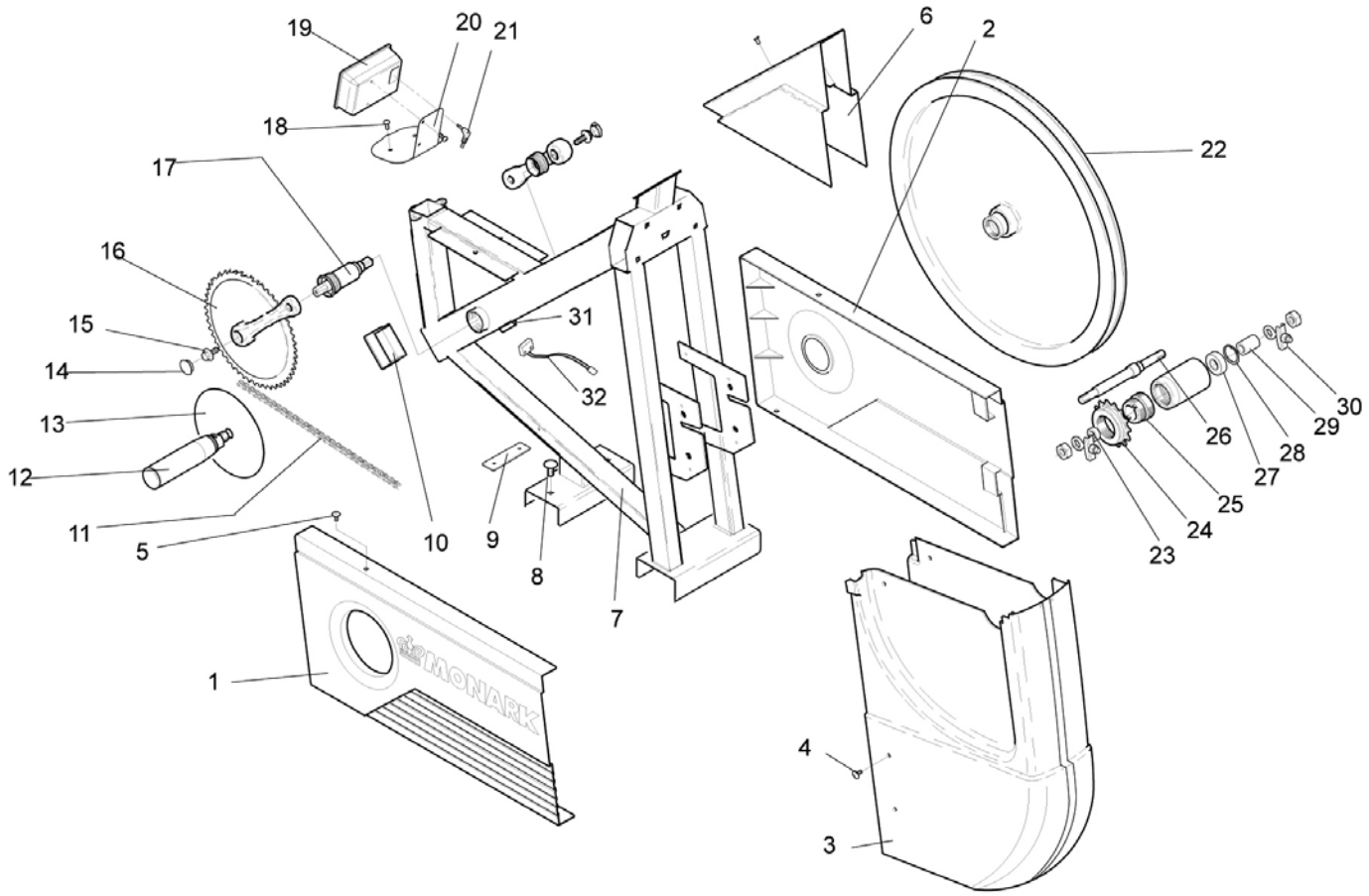
Fig: Hub assembly

Spare parts list



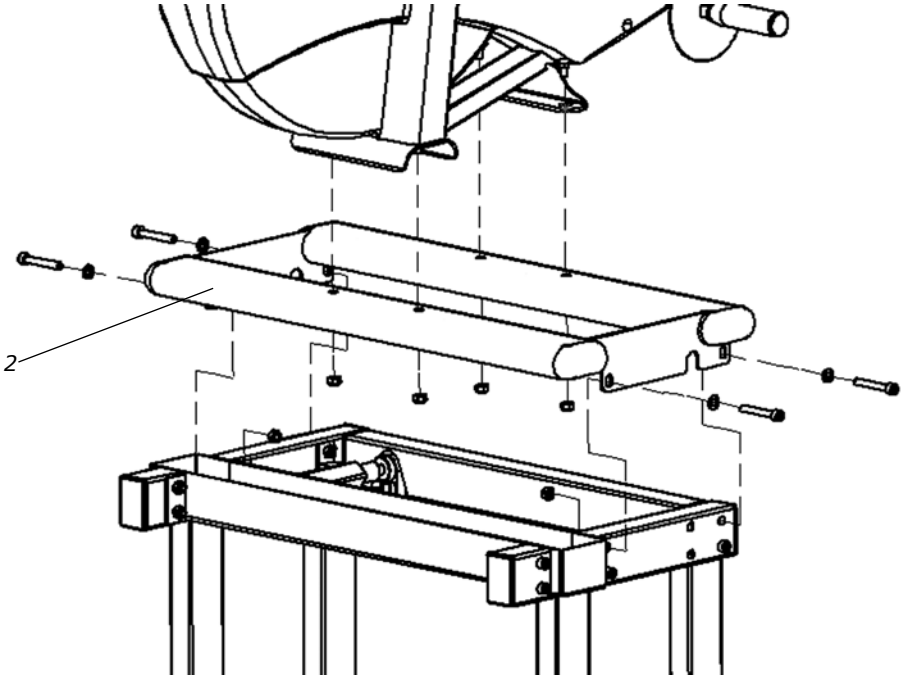
From serial no: WBK285907H

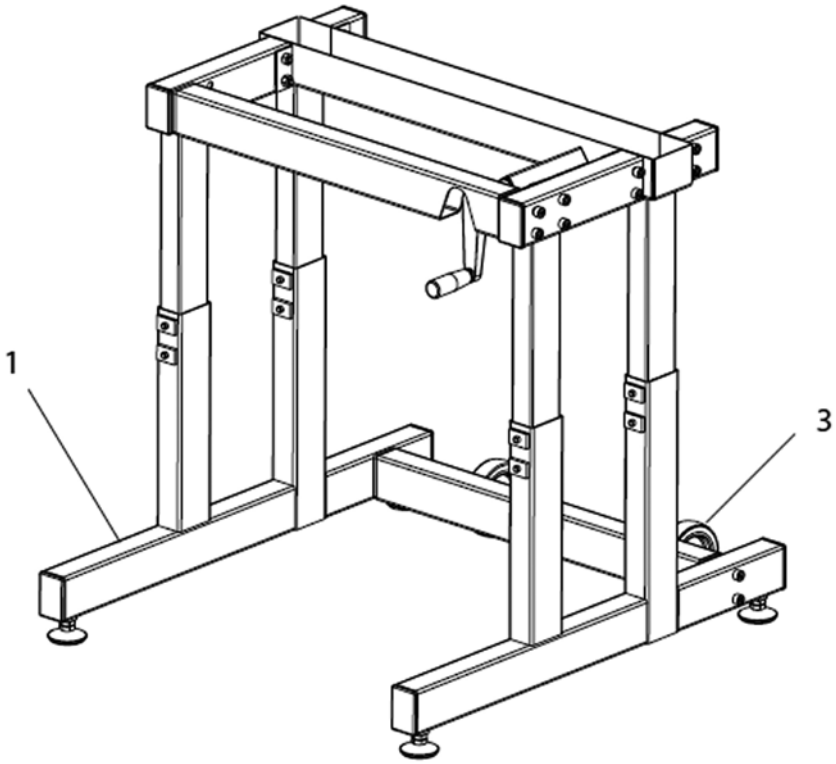
Pos.	Qty.	Art. No.	Description	Pos.	Qty.	Art. No.	Description
1	1	9339-38	Frame for equipment	34	1	9339-51	Terminal
2	4	9300-21	Screw MVBF 6x16 mm	35	1	9339-27	Cable
3	4	5843-9	Nut M6	36	1	9339-52	Base unit
4	1	9339-59	Handles	37	6	5673-9	Screw M5x12
5	4	5673-9	Screw M5	38	4	5675-9	Screw M5x6,5
6	1	9339-100	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	9339-39	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				



From serial no: WBK285907H

Pos.	Qty.	Art. No.	Description	Pos.	Qty.	Art. No.	Description
1	**1**	**9300-50**	**Chain guard**	**19**	**1**	**9391-70**	**Digital meter**
2	**1**	**9300-52**	**Side guard**	**20**	**1**	**9391-26**	**Meter holder**
3	**1**	**9339-55**	**Wheel cover**	**21**	**1**	**9326-263**	**Cable**
4	**2**	**9304-32**	**Screw M5x25 mm**	**22**	**1**	**9391-3**	**Flywheel with freewheel sprocket**
5	**2**	**5675-9**	**Mounting screw LKT-TT 5x6.5mm**	**23**	**1**	**9000-17**	-Spacer 5 mm
6	**1**	**9300-57**	**Cover for frame**	**24**	**1**	**9106-13**	-Sprocket, 14t
7	**1**	**9391-1**	**Frame**	**25**	**1**	**9106-14**	-Connection
8	**2**	**9300-12**	**Screw**	**26**	**1**	**9300-18**	-Axle, length 132 mm
9	**1**	**9300-53**	**Holder for guard**	**27**	**2**	**19001-6**	-Bearing 6001-2z
10	**1**	**9391-55**	**Plastic cap, black**	**28**	**1**	**9000-15**	-Locking ring SgH 028
11	**1**	**9300-55**	**Chain 1/2 x 1/8", 116 l**	**29**	**1**	**9300-17**	-Spacer 23 mm
12	**1**	**9145-71**	**Handle, pair**	**30**	**1**	**9000-12**	-Chain adjuster, pair
13	**2**	**9371-71**	**Handcover**	**31**	**1**	**9326-166-1**	**Holder for sensor**
14	**2**	**8523-2**	**Dust cover for crank**	**32**	**1**	**9326-169**	**Sensor with cable**
15	**2**	**8523-115**	**Screw**		**1**	**9000-211**	**Calibration weight, 4 kg**
16	**1**	**9300-462**	**Steel crank set, complete with magnets**				
17	**1**	**8966-175**	**BB cartridge bearing**				
18	**4**	**5673-9**	**Screw**				





Pos.	Qty.	Art. No.	Description	Pos.	Qty.	Art. No.	Description
1	1	9391-83	Table stand, complete, height adjustable	3	2	9000-29	Transport wheel, complete
2	1	9391-95	Upper part		1	9391-8-10	Screw set

MONARK EXERCISE AB

Version 1402
Art. No: 7950-298

CE 0402

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