SPIROTIGER®

STSMART
Hardware User Guide

EN

Index Hardware User Guide

1 Information about the Hardware User Guide

Please read and become familiar with this Hardware User Guide prior to completely unpacking and operating the device.
This Hardware User Guide provides details on how to use, maintain, avoid problems or dangers in the use of the device.
The use of the device in combination with the device software is described elsewhere in the Software User Guide.

The pictures and figures used in this Hardware User Guide may vary slightly from the delivered device. This is due to product changes necessitated by technological requirements.

1.1 Storage

The Hardware User Guide is part of the device and should be kept accessible for all users. Upon resale of the device, the Hardware User Guide should be included.

1.2 Target audience

Details on user limitations can be found in the **Important safety instructions** chapter (page 6). The user must be familiar with the content of this hardware manual. Repairs should only be performed by Idiag-authorised specialists.

1.3 Further applicable documents

SpiroTiger® Software User Guide

1.4 User information

The Hardware User Guide is also available in PDF format. Hyperlinks and bookmarks allow a fast and effective retrieval of links. The search function allows a fast retrieval of keywords.

1.5 Used Symbols

Symbols in this Hardware User Guide

Warning!
Specifies a potentially dangerous situation. If not avoided, death or serious injury may result

.

Caution!
Specifies a potentially dangerous situation. If not avoided, slight injury or damage to property may result.

Hints
Information and tips, important for the optimal utilization of the device.

Bold type is used to indicate menu names, functions, commands and chapter names.

Symbols on the device

Device of Type BF (Protection against electric shock)

Attention! Consult the Hardware User Guide

Direct Current

Battery

2 Important Security Advice

WARNING

- The device should only be used for athletic, wellness and sport orientated purposes.
- Correct device setup is required for a successful training.
- Under the following conditions is training only allowed with the consent of a doctor:
  - If a recent sickness of the respiratory tract required treatment or medical attention.
  - If an individual has not performed any type of endurance sport for a long period of time or was unable to participate in athletic activity due to health restrictions.
  - If due to medical recommendation physical stress should be avoided.
  - During pregnancy
- idiag does not take responsibility for the effects of medical or therapeutic use (see point 1).
- Clean the device prior to the first training (see chapter **Cleaning and Disinfection**, page 29).
- Never use the device without the valve in place or an individual respiration bag. The bag size must be adjusted according to individual needs.
- Before use always check the training parameters.
- Never train without turning on the device, therefore without the electronic supervision.

- During training always hold the device on a horizontal line.
- During training only breathe through your mouth.
- Only use the device after you have read this Hardware User Guide and have understood its contents.
- Store this Hardware User Guide alongside the device.
- The transparent breathing bag with the SpiroTiger® logo and the transparent mouthpiece delivered by the SpiroTiger® manufacturer are made of silicone. Other breathing bags and mouthpieces may contain latex. Latex can provoke allergic reactions. In case of a latex allergy use only breathing bags and mouthpieces made of silicone.

WARNING

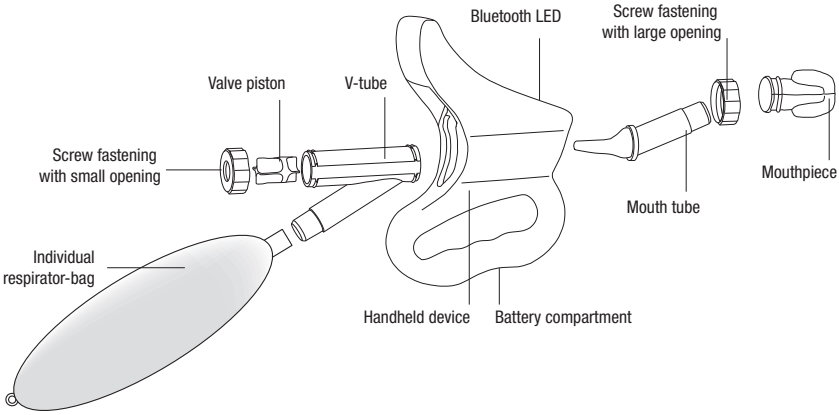
- A SpiroTiger® training can in some cases result in dizziness, loss of breath, light headedness, headache, and nausea. If any of these symptoms surface immediately stop the training. Contact a doctor or a SpiroTiger® centre for further information.
- The user accepts all responsibly for his or her training. Idiag is not liable for any side effects following SpiroTiger® training.
- The device should not be used near flammable gas mixtures of air, oxygen or nitrous oxide (i.e. anaesthetic).
- The device should not be used for the purpose of a hypoxic training. idiag is not liable for the consequences of such training.
- Training with the device may not be used with other physical trainings simultaneously.

CAUTION

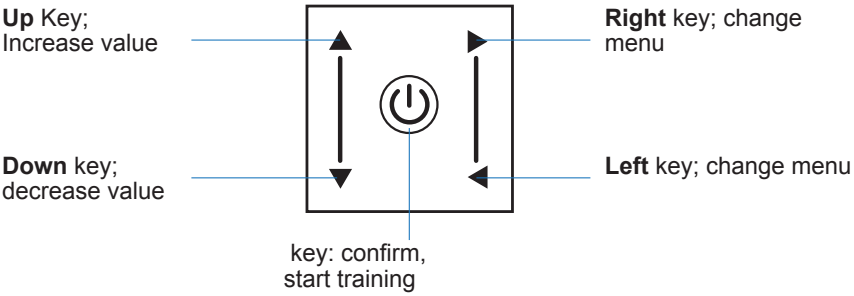
- Read the Hardware User Guide carefully before using the device.
- Do not expose the handheld unit of device to water or any other form of liquids. Like any electronic device, exposure to water or fluids will cause corrosion and damages the device.

Forward any question about the device and its accessories or equipment to the address on the last page of this User Guide. To facilitate immediate processing and a faster response, please include a complete return address and the serial number of the device involved.

3 Parts



Control Keys on the Hand Device



Package

- Handheld Device
- Air leading pieces
- Mouth Piece
- Respiration Bag
- Nose Clip
- 2 Batteries
- Hardware User Guide
- User‘s Quick Guide
- Case
- CD with PC software
- Software User Guide
- Bluetooth-Dongle
- Read me First letter

4 Introduction

The SpiroTiger® STSmart training device is an ergonomic, hand held device for the training of respiratory endurance. It was developed as a joint project with the Swiss Federal Institute of Technology Zurich and the Intercity Institute for Technology Bucks (NTB).

Respiratory endurance training is an excellent way to optimize performance in individual sports. Scientific studies clearly indicate that the endurance of respiratory muscles and physical performance improves by using the SpiroTiger® Respiratory Endurance Trainer.

The device opens up a new yet unutilized training window. In many sports regular use of the device can lead to significant improvement in endurance. During time of injury ambitious amateurs or high performance athletes can sustain or improve the performance of their respiratory muscles completely independent of other trainings.

SpiroTiger® training improves the quality of life in terms of both wellness and health. In the case of snoring, for example, training of the pharynx muscles increases muscle tone and can thus prevent vibration of the upper respiratory tract. Snoring becomes less frequent or can disappear completely.

5 Description of the Functions

The device consists of a hand held unit with integrated monitoring electronics, air leading components, a respiration bag and the mouthpiece.
Personal training parameters (bag size, respiration rate) are programmed into the hand held device and aid in supervision and respiration rate specification of the training. The respiration rate is controlled via a moving light and a short sound.
Specific directions (arrows and sound) guide the user through training. In case of severe deviation from an ideal training the device will give an optical and acoustic warning.
The hand held device uses the valve technology and the respiration bag to protect the user from hyperventilation, hypoventilation, and dizziness (see chapter **Important Security References**, page 6).
The device saves the data gathered during training and can send data to a PC.

6 Starting the Device

6.1 Insertion of Batteries

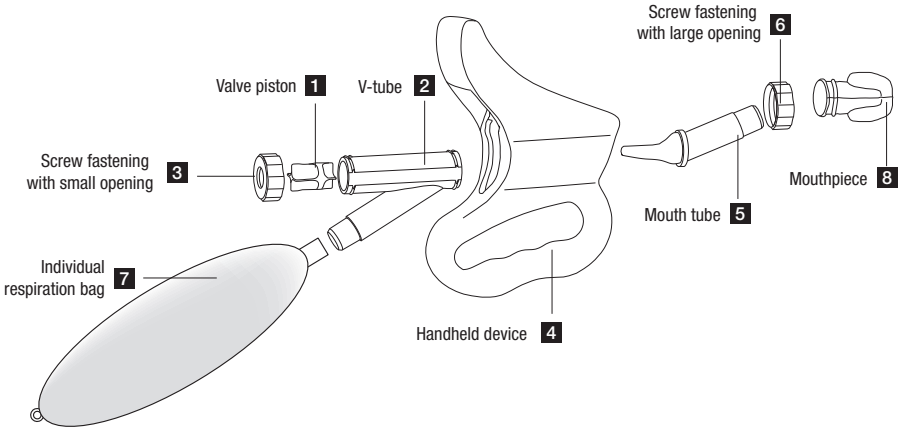
Wrong insertion of the batteries or the wrong alignment of the batteries' polarity may cause damage to the device and/or the batteries. Carefully check for correct polarity.

Procedure

- Open the lid on the underside of the device.
- Insert the batteries. Carefully check for correct polarity.
- Close the compartment.
- After the insertion of batteries do a function control test.
  See chapter **Functions Control**, page 13.

- Remove the batteries from the device if not used for extended period of time (several day or a few weeks).
- Batteries contain acrid liquid. Should they leak, prevent contact with skin, eyes and mouth. Irrigate affected body parts immediately for about 15 minutes with water and subsequently consult a physician. Do not inhale fumes or vapors. Clean the device or equipment immediately with soft cloth. Idiag does not take any responsibility for any injury or damage to persons or equipment that may result from or be a consequence of defective batteries.
- Never load rechargeable batteries.
- Preserve the environment and dispose of old or used batteries properly.

6.2 Assembly of Device

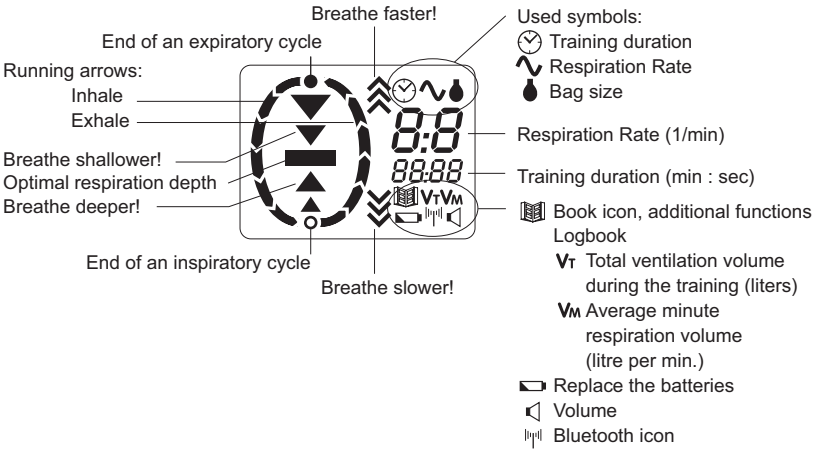


Lay the pieces on a table as shown above.

1. Place the valve 1 as shown in the illustration above into the V-tube 2 and secure its position with a screw clasp 3 (small opening).
2. Insert the V-tube 2 into the hand held device 4.
3. Insert the mouth tube 5 into the V-tube 2 and secure it with the second screw clasp 6 (large opening).
4. Place the respiration bag 7 over the open end of the V-tube 2 and the mouthpiece 8 over the open end of the mouth tube 5.

6.3 Turn On, Off

Press the **Enter** key ⏻ until the device turns on (at least 2 seconds), beeps and the display activates. The device is in the start menu.
By pressing the **Enter** key for 3 seconds the device turns off. If the device is not used for five minutes it automatically turns off to save power.



6.4 Functions Control

After the insertion of batteries and before every training complete a functions control test:

- By hand, ensure that the valve can move freely without any abnormal resistance.
- Press the **Enter** key until the device turns on and the display shows all segments.

CAUTION

Do not use the device if:
- the display does not turn on
- the display is weak or unclear
- strange symbols appear.

See chapter **Trouble Shooting** page 36.

WARNING

Clean the device prior and after each use (see chapter **Cleaning and Disinfection**, page 29).

7 Personal Adjustment

For device to optimally supervise your training, it must be programmed according to the user's parameters. Personal data must be entered and saved (bag size and respiration rate).

7.1 Choosing Bag Size

Determine the Vital Capacity (VC) of your lungs at a qualified location. The VC can be measured by a lung function test or calculated with the help of the attached formulas (page 40). The bag volume can then be calculated by multiplying the measured VC by a factor of 0.5.

Bag Size = 0.5 * VC [liter]

According to the physical assessment choose a bag size. A good physical assessment should select one standard bag size larger and a poor assessment should select one standard bag size smaller.

Standard Bag Sizes (liter): 1.5 / 2.0 / 2.3 / 3.0 / 3.5 / 5.0

Choosing the wrong bag size can result in Hyper or Hypoventilation, dizziness, and balancing problems.

7.2 Calculating Respiration Rate

Optimal training requires a respiration rate of 20 and 40 breaths per minute. If possible have an expert determine your breathing frequency. The breathing frequency can also be calculated with the help of the attached formulas (page 40).

8.1 Enter Duration, Respiration Rate, and Bag Size

After turning on the device, choose the **Right** key until the desired symbol starts to blink:

WATCH for Training Duration

FREQUENCY for Respiration Rate

BAG for Bag Size

Using the **Up** and **Down** keys, choose the desired values. Confirm each value by pressing the **Enter** key ⏻.

Training Duration: 0 – 99 min;
by selecting 0 (zero) no time limit is set

Respiration Rate: 15 – 60 Breathes per Minute;
by selecting 0 (zero) no respiration rate is indicated (free breathing)

Bag Size: 1.5 to 5.0 liter; the bag size is shown on the bag

The Bag has to be chosen according to the individual requirement (see chapter **Choosing Bag Size**, page 14).

8.2 Setting the volume

After turning the device on press the **Right** key until the 🔊 loudspeaker symbol blinks.
Select the desired volume with the **Up** and **Down** keys and confirm it with the **Enter** key ⏻.

- With **Left** and **Right** keys you can change the sound volume of the beep tone during the training.
- Volume 0 (zero): no sound
  When an alarm starts no acoustic warning is issued, however a warning appears on the display. If nevertheless training continues, an acoustic warning will sound at the highest volume.

8.3 Longer exhalation sequence

The time between inhalation and exhalation can be set to intervals of 0.1 between 1:1 (normal) and 1:4:

Interrupt the training using the **Enter** key, then press the **Left** (**Right**) key to move over to the BOOK symbol.

Press **Enter** ⏻ to confirm the selection.

Choose with the **Up** or **Down** key the Cycle Timing (Ct) symbol.

Press **Enter** ⏻ to confirm the selection.

Choose the desired time between inhalation and exhalation with the **Up** and **Down** keys (e.g. 1:10 for 1:1.0).

Pressing **Enter** confirms the desired pattern. You can navigate to the start menu using the **Right** or **Left** key.

At the same frequency the time available for inhalation decreases.

8.4 Choice of training profile

There are 2 pre-programmed training profiles (P1 and P2) to choose from.
The default setting P0 allows you to train without setting a training profile (training profile deactivated). You will find further information on training profiles in the chapter **Training profile**, page 18.

Interrupt the training using the **Enter** key, then press the **Left** (**Right**) key to move over to the BOOK symbol.

Press **Enter** ⏻ to confirm the selection.

Choose with the **Up** or **Down** key the profil symbol (Pr).

Press **Enter** ⏻ to confirm the selection.

Select with the **Up** / **Down** key the a training profil.

Press **Enter** to confirm the selection.
You can navigate to the start menu using the **Right** or **Left** key.

8.5 Establishing of a Bluetooth connection

Note
The device can interface with a PC using Bluetooth technology.
The available functions are described in the **Software User Guide**.

A Bluetooth connection between this device and a PC is only possible after installation or activation of the PC Bluetooth software. You will find more detail in the **Software User Guide**.

Procedure
Press the **Right** or **Left** key on the start menu (e.g. after turning on the device) until the Bluetooth symbol blinks.
Press the **Up** key (on) and then the **Enter** key ⏻. The device will now try to connect (the Bluetooth symbol and LED will blink).
After a successful connection the Bluetooth LED remains lit.
If a connection cannot be established within 3 minutes or an existing Bluetooth connection is interrupted, the Bluetooth LED turns off.

The Bluetooth connection can be manually terminated at any time (on the start menu press the **Right** key until the Bluetooth symbol blinks, then select “off” by pressing the **Down** key and then confirm by pressing the **Enter** key).

9 Training profile

A training profile is a sequence of individual training segments which are executed consecutively during the training. For each training segment there is a breathing frequency and a duration.

There are 2 pre-programmed training profiles (P1 and P2) to choose from.
The default setting P0 allows you to train without setting a training profile (training profile deactivated).

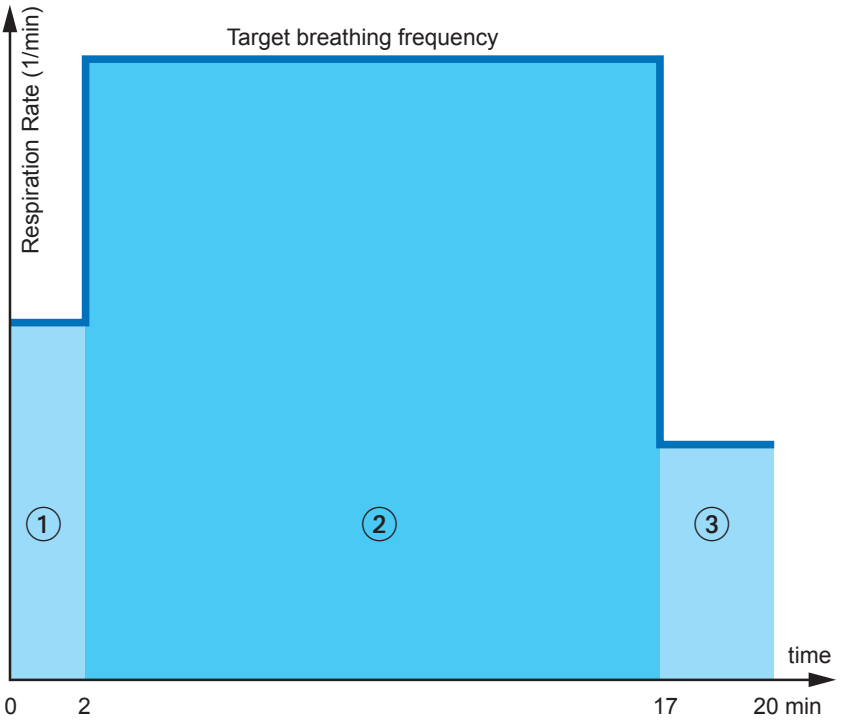
The chapter **Choosing a training profile** (page 16) describes how to choose a training profile.

The chosen training profile will be displayed after turning it on and for a few seconds after the training begins.
The breathing frequency entered on the device corresponds to the target breathing frequency. The target breathing frequency can be changed during the training session with the **Up** and **Down** keys.
The breathing frequency indicator starts blinking 5 seconds before it switches to the next training segment.

9.1 Description of the training profile

P1 continuous training
The P1 training profile consists of 3 training segments whose duration cannot be changed. The breathing frequency of the first training segment is 5 breaths per minute below the target breathing frequency, that of the second training segment corresponds to the target breathing frequency and the breathing frequency of the last training segment is 8 breaths a minute below the target frequency.

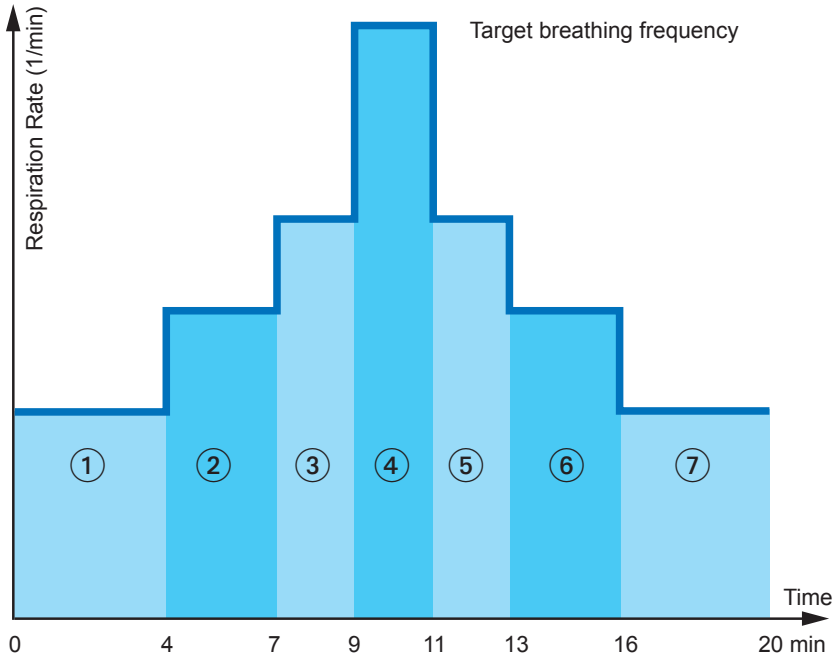
Training segment	Duration (minutes)	Respiration Rate
1	2	Target breathing frequency - 5
2	15	Target breathing frequency
3	3	Target breathing frequency - 8



P2 Pyramid training session

Training Profile P2 consists of 7 training segments whose duration cannot be changed.

Training segment	Duration (minutes)	Respiration Rate
1	4	Target breathing frequency - 8
2	3	Target breathing frequency - 6
3	2	Target breathing frequency - 4
4	2	Target breathing frequency
5	2	Target breathing frequency - 4
6	3	Target breathing frequency - 6
7	4	Target breathing frequency - 8



WARNING

To ensure that the device optimally supports a training session and reports any dangerous situations, the proper personal data's (bag size and respiration rate) must be entered into the device.

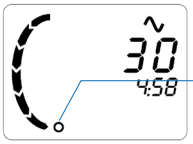
Switch on the device and start the training using the **Enter** key.

The device indicates every transition from inhalation and exhalation with a short sound and by changing the side of the running arrows.

Place the mouthpiece in your mouth, take a deep breath and start to exhale, continue until the running arrows reach top of the display screen.

Exhalation

End of an exhalation cycle



Inhalation

End of an inhalation cycle

Try to breathe consistently and equally. As soon as the arrows reach the top or the bottom of the display screen the respiration sequence should change.

To aid in the respiration flow the device indicates the end of an inhalation or exhalation cycle with a small circle. Make sure that the small circles meet with the running arrows at the upper and lower end.

Breathe according to the selected respiraton rate.

- During breathing you should hear a mechanical “clack” sound. This sound is made by the movement of the valve.
- During training always hold the device on a horizontal line.

10.1 Changing the Respiration Rate and sound volume during a training

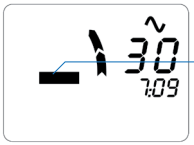
With the **Up** and **Down** arrows you can change the Respiration rate (pace) during your training.

If you want to breathe at your own pace, without using a pre-selected respiration rate, select respiration rate 0 (zero). The inhalation and exhalation circles will still be displayed. The training supervision is active.
The average respiration rate and total ventilation volume are displayed at the end of the training.

With **Left** and **Right** keys you can change the sound volume of the beep tone during the training.

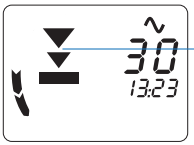
10.2 Display and Warnings during Training

During training the system controls the respiration depth. An optimal respiration depth for the current device setup is represented on the display with the black beam in the middle of the respiration circle:



Optimal respiration depth

If the respiration is too deep arrows will appear of the display accordingly:



Breath shallower

In case you do not correct the respiration depth, the tone indicating the pace will be replaced by a double tone. This is the last warning occurring before a possible training interruption by an “alarm” event (AL).

Try to breathe shallower. An alternative option is to increase the respiration rate using the **Up** arrow. Increase the bag size if the arrows „Breath shallower“ remains during several trainings.

If the respiration is to shallow, arrows will appear on the bottom half of the screen as seen below:

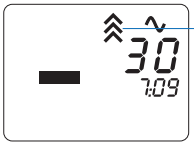
Breath deeper

In case you do not correct the respiration depth, the tone indicating the pace will be replaced by a double tone. This is the last warning occurring before a possible training interruption by an “alarm” event (AL).

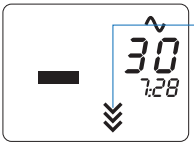
Try to breathe deeper. An alternative option is to reduce the respiration rate using the **Down** arrow.
Decrease the bag size if the arrows „Breath deeper“ remains during several trainings.

Speed arrows

If the given pace is not maintained, the speed arrows appear:



Breathe faster!
Try to breath faster until the speed arrows disappear.



Breathe slower!
Try to breath slower until the speed arrows disappear.

If the training-instructions are continually ignored, the device will stop the training (see chapter **Failure notices / Alarm**, page 27).

With a breathing frequency of 0 (no pace) no speed arrows appear.

Pause

If the valve does not move for more than 10 – 15 seconds the device will switch to **P** (Pause) mode. This means the training has been interrupted. Reasons for this could be: the respiration is to shallow or the respiration bag is too big. To continue the training, just start breathing into the device again. If the training is not continued within 5 minutes, the device interrupts the training and returns to the start menu.

10.3 Training conclusion / Saving Data / Logbook

The following data is given after the completion of a given training duration, a stopped training (by pressing the **Enter** key), or after a failed training:
Press the **Right** key to display next training data.

Number of training (large flashing number)

- Training Duration (min : sec)
- Average Respiration Rate (RR per minute)
- Bag Size (BS in liter)
- Total Ventilation Volume during the training (VT in liter)
- Average Minute Respiration Volume (VM, liter per minute)
- Training profile (Pr)
- Time between inhalation and exhalation (Ct)

All of this data is saved to the **Logbook** under a given training number (page 26).

11 Logbook

Using the **Left** or **Right** arrow key scroll over to the Book icon.

Using **Enter** confirm the selection.

Then with the **Up** or **Down** arrow key select the icon for logbook (**Lo**).

Open the **Logbook** with **Enter**.

Navigate through the logbook using the **Left** and **Right** keys.

Using the **Up** or **Down** keys to change to next training.

By pressing the **Right** key, the logbook shows the training values in the following order:

Number of training (large flashing number)
- Training Duration (min : sec)
- Average Respiration Rate (RR per minute)
- Bag Size (BS in liter)
- Total Ventilation Volume during the training (VT in liter
- Average Minute Respiration Volume (VM, liter per minute)
- Training profile (Pr)
- Time between inhalation and exhalation (Ct)

Use the **Enter** key followed by either the **Left** or the **Right** key to leave the logbook.

The training is entered in the logbook if the training duration is longer than 30 seconds. The logbook saves up to 99 training sessions. The oldest data is stored under training number 1.

12 Failure notices / Alarm

In a case of repeated disregard of training notices (see chapter **Display and Warnings during Training**, page 23) the device will automatically shut off and displays „AL“ as an abbreviation of „alarm”.

Disregarding the alarm may lead to hyperventilation or hypoventilation, dizziness, equilibrium problems and nausea.
You have to stop your training if the device shuts down due to an alarm.

- After 30 seconds the device resumes the training automatically.
- In case the device consistently shuts down due to alarms, then a possible device set-up change may have to take place.
- The acoustic alarm can be turned off by pressing the **Enter** key.

Possible reasons for alarms:

- No respiration taking place
- Respiration to deep
- Respiration to shallow
- Wrong bag size
- Wrong personal adjustment
- No valve movement
- Valve malfunction
- Valve no present or stuck, air leading pieces not properly mounted

For further information see chapter **Display and Warnings during Training**, page 23.

13 Maintenance

Prior to every training manually check the device to ensure it is in proper functioning condition. If any problems arise immediately send the device to the nearest retailer. Repairs should only take place through idiag or an authorized dealer. Defective or damaged parts should only be replaced with original replacement parts.

- Clean the device prior to the first training as stated in the chapter **Cleaning and Disinfection**, page 29.
- Check device prior to every training.
- Never use a non-functioning or faulty device.
- Never use a damaged device.
- Never use a device that contains batteries which are losing fluids.
- Never open the device, with exception of the battery compartment.
- The following checks have to be done prior to every training:
  - Check the controls and functions.
  - Manually check if the valve has frictionless mobility.
  - Make sure that the device is in a clean and hygienic condition (see chapter Cleaning and Disinfection, page 29).
  - Make sure that the respiration bag and the mouthpiece do not have any tears and that the seal is not broken
  - Check the device for defects.
  - Make sure that the device is unable to injury anyone.

14 Cleaning and Disinfection

14.1 Hygiene Overview

Unhygienic devices can lead to health problems. Obey the instructions of this Hardware User Guide.

Clean the device prior to the first training!

The handheld device may not be exposed neither to flowing nor standing water. Liquid causes corrosion damages and short-circuits.

- Clean the air leading pieces – especially the respiration bag – after every training. Make sure the pieces can adequately dry. Always hang the respiration bag with the opening facing downwards while drying.
- Clean the handheld device after 50 trainings.
- Clean the device at least once a month.
- Check the respiration bag and the mouthpiece regularly for tears or cracks in the seal. Replace leaky parts immediately with original replacement parts.
- Respiration bag and mouthpiece must be regularly replaced as a hygienic safety precaution.
- Replace damaged parts immediately with original replacement parts.

14.2 Device and Multiple Users

- For hygienic reasons we suggest the use of a personal mouthpiece and respiration bag or the use of a completely personalized user-set.
- Disinfect the training device after a different person has used it.
- Sterilize the air leading pieces if the device was used by a different person.

14.3 Disinfection

All the device parts can be disinfected considering the rules below.

Important Points to Disinfecting:

- Remove the batteries when cleaning the device.
- Make sure no fluids penetrate the device (corrosion, short circuit damage).
- Do not use any toluol based solvents.
- Cleaning products with certain additives like alcohol leave material dull or brittle.
- Never use corrosive or abrasive disinfectants.

The disinfection must coincide with general rules and guidelines in regard to explosion safety.

If a disinfectant is used that produces an explosive gas mixture, ensure that the fluid has completely evaporated before turning on the device.

- Never place the device in a disinfectant containing alcohol for more that five minutes.
- Never place the handheld device in a disinfectant.
- The handheld device can only be disinfected through a wipe down of the outlying surface area.
- The use of a spray is not recommended for the disinfectant may then be able to penetrate the surface and damage the device.
- The 100% silicon respiration bag can be sterilized or boiled in water.

The device can be used by several persons. If the device is used by an other person, you have to disinfect the handheld device. Use a plastic compatible disinfectant. Use a fiber/lint free towel moistened with an appropriate disinfectant.

14.4 The Home Cleaning Tips

Cleaning with warm water

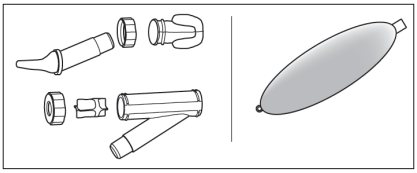
Clean the air leading pieces and the respiration bag thoroughly for 5 min. using warm water (approx. 40°C). Possibly use detergent (check the manufacturer's directions). After detergent use thoroughly rinse all air leading pieces and respiration bag under hot water to ensure that no detergent remains. Dry all the pieces as described in the text "Drying".

Cleaning in the dishwasher

For the personal use the air leading parts, with exception of the breathing bag, can be cleaned in the dishwasher. The handheld device must not be cleaned in the dishwasher. Choose at least a 50°C washing cycle. Place the disassembled air leading pieces in the eating utensil slots.

Cleaning in boiling Water

The following pieces may be boiled in water:



Place the air leading pieces and the respiration bag in boiling water for approx. 10 minutes. Ensure that enough water has been placed in the pot so that the air leading pieces and the respiration bag do not come in contact with the bottom of the pot. A small amount of vinegar can be added to the water to strengthen effect if desired.

Cleaning in vaporizer / sterilizer

CAUTION	Temperatures over 100°C may lead to damages or color modifications! Make sure to check the vaporizer/sterilizer user manual.

Disinfection
Disinfect the air leading pieces and the respiration bag following the recommended cleaning processes.

Drying
Important for hygiene at home, the cleaned pieces must be carefully dried off. Individual pieces should be air dried or by using a fiber/lint free towel. If air dried place all pieces on a clean absorbing surface and do not cover. During drying the parts may not be covered.

Make sure to allow sufficient drying time. Always hang the respiration bag with the opening facing towards the ground.

14.5 Additional Maintenance and Care

Besides the regular user checks and cleaning of the device, no further maintenance or calibration is needed.

14.6 Storage

Place the air leading pieces and respiration bag between use, especially between longer training absences, into a clean fiber/lint free towel (i.e. dishtowel) and store in a dry, dust free area.

15 Important Training Tips

- In the beginning training requires good coordination and patience. Numerous trainings are required to grasp the concept and the flow of a training.
  At the beginning just focus on a regular respiratory frequency. Once you are successful in holding the pace try to adjust the respiration depth.

- To simplify the first training sessions we recommend to choose the setting without fixed respiratory frequency (RF = 0). This training mode allows unrestricted respiratory frequency; as you like you may breathe fast or slow. Automatic monitoring of the training is still guaranteed. In order to increase the training load you may thereafter enter a fixed respiratory frequency. Typical respiratory frequencies lie between 20 and 40 breaths per minute.

- To optimize the training intensity, training sessions should be considered strenuous, if not increase the respiration rate.

- If it is not possible to complete a training session at a selected intensity we recommend reducing the respiration rate until the desired duration can be reached.

- Recommended are training sessions between 15 and 30 minutes per day.

- Two to five training sessions are recommended per week depending on personal goals. To maintain performance at least two training sessions per week are required.

- During training only breathe through the mouth. If nasal respiration occurs use the given nasal clamp.

16 Working, Storage, and Transportation Conditions

16.1 Recommendations for Transportation and Storage

- The device registers data through a sensitive electronic system. Shocks or blows can damage the device.
- Handle with caution and do not drop.
- Do not expose to extreme temperatures or direct sun light.
- Avoid contact with water or other fluids.
- Remove batteries for transportation and storage.
- Hang respiration bag with opening facing down.

16.2 Working Conditions

- Temperature: 0°C to +40°C
- Humidity: 30% to 75%, without condensation
- Air Pressure: 700 hPa to 1060 hPa
- Typical Environment of use: Indoor, office etc.
- Further information: see chapter **Recommendations for Transportation and Storage**, page 34

The device should not be used near flammable gas mixtures of air, oxygen or nitrous oxide (i.e. anesthetic).

16.3 Transportation Conditions

- Temperature: 0°C to +70°C
- Humidity: 10% to 90%, without condensation
- Air Pressure: 500 hPa to 1060 hPa
- For transportation use original packaging.
- Do not store heavy objects on top of the device.
- Remove batteries.
- Further information: see chapter **Recommendations for Transportation and Storage**, page 34

16.4 Storage Conditions

- Temperature: 0°C to +70°C (Respiration Bag: max. 25°C)
- Humidity: 10% to 90%, without condensation
- Air Pressure: 500 hPa to 1060 hPa
- Store the device in dust free, environments.
- Store using the original packaging
- Store Respiration bag in dark areas.
- Further information: see chapter **Recommendations for Transportation and Storage**, page 34

17 Trouble Shooting

Problem	Solution
Device turns on and then immediately off again.	To turn on the device press the **Enter** key for at least two seconds.
Nothing appears on the display or something out of the ordinary.	Check the batteries and replace if needed.
The device shuts down the training without evident reason (alarm, AL)	See chapter **Failure notices / Alarm**, page 27
No training data's appear in the **Logbook**.	The training sessions were shorter than 30 seconds. No training data has been saved under this training number.
Device Freeze	Press the **Enter** key for at least three seconds and restart the device. In addition: Remove the batteries for a short period of time and then insert them again.
Valve piston jams	Clean the valve piston and the v-tube. If the valve piston is damaged, you have to replace it.

If the problems still continue or for other questions contact your SpiroTiger® retailer or idiag directly.

Electromagnetic disturbances

The existing device has been tested and corresponds with the EMV-Guidelines. The device does not cause any electromagnetic damages under pertinent use. However, it is possible for the device to receive electromagnetic interferences causing undesired side effects. The source of interference (i.e. Mobil telephone) can be determined by turning on and off the device. The cause can be removed by increasing distance between source and user or by contacting a technician.

18 Technical Data

Measurements:	Handheld Device :	Approx. 14 x 24 x 6,2 cm
Weight:	Handheld Device:	Approx. 310 g (with Batteries)
	User-set:	Approx. 200 g (with bag)
Batteries:	2 Alkaline Batteries, R6P, AA, 1.5 V Battery life by 30 min. training per day: Approx. 6 months	
Current Training Time:	Display: max. 99 min., resolution: 1 Second	
Training Duration:	0 to 99 minutes	
Mode of Operation:	Continuous	
Classification:	Protection against Power Surge: Typ BF Protection class regarding water penetration: IPXO not classified.	

Technical changes reserved!

19 Waste disposal

Protect the environment!
When disposing of this unit, or the batteries it uses, do so in an environmentally friendly
way. The unit must not be placed in the normal household waste or trash. Return old products to an appropriate collection point or to idiag according to EU Directive 2002/96/EC.

20 Limited Warranty

Dear Customer,

We would like to congratulate you for the purchase of your own SpiroTiger® STSMART and we would like to thank you for your confidence. The SpiroTiger® STSMART training device was developed with the most advanced modern technology in mind and is produced and assembled in this manner.
If your SpiroTiger® STSMART requires warranty services please contact a SpiroTiger® retailer according to the information on the accompanying envelope.

20.1 Terms of Warranty

The company idiag grants 1 year of warranty, starting as of sales date, on production errors and material defects. Guaranteeing can be only furnished, if the device is returned in the original package and together with the original invoice.

20.2 Guaranteeing

The guaranteeing extends to the free repair of the equipment. The purchaser bears the costs for dispatch, packing, insurance and other.

Exempted from warranty:

- Batteries, respiration bag and mouthpiece.
- Regular inspection, maintenance, repairs and exchange of pieces considered to be normal wear items.
- Transport costs and risks, directly or indirectly associated with this warranty.
- Damage to the device caused by:
  - Misuse, especially if the device is used for another purpose other than its given one.
  - By disregard of user manual and directions.
  - Independent manipulation or alteration of hardware or software. Repairs should only be conducted by authorized retailers and customer service officers.
  - Idiag is not responsible for accidents involving increased force, water, fire, manipulation, alteration, and acid release from batteries.
- The warranty conditions only extend themselves to devices sold by the company idiag or by a qualified sales location.

- This warranty does no restrict the legal rights of the customer. As long as applicable law does not say other wise the customer’s rights are limited to this warranty and idiag is not liable for any direct or indirect damages.

21 Appendix

The formulas are only approximations and are only valid within the scope of application provided. Please see the training references for further information.

21.1 Determining the Vital Capacity (VC)

The vital capacity can be determined either though direct measurement or using the following formula. Using the vital capacity the bag size can be determined.

Vital Capacity VC_{Man} = (0,0576 * H) – (0,026*A) – 4,34 [Liter]
Vital Capacity VC_{Woman} = (0,0443 * H) – (0,026*A) – 2,89 [Liter]
H = Height in centimeters / A = Age in years

Scope of application of VC formulas:
Height: Men: 155-195 cm, Women: 145-180 cm
Age: 18-70 years (18-25 years of age must input age 25).
The formulas are only valid for healthy non-smokers and persons of European origin.

21.2 Determining the Maximum Breathing Capacity (MVV)

Maximum Breathing Capacity MVV_{Man} = VC_{Man} * 34 [Liter / Min.]
Maximum Breathing Capacity MVV_{Woman} = VC_{Women} * 32 [Liter / Min.]
H = Height in meters / A = Age in years

21.3 Determining the Minute Ventilation (AMV)

$AMV_{Competitive\ athlete}$ recommended for training = 0.7 * MVV [Liter / Min.]
AMV_{Normal} recommended for training = 0.5 * MVV [Liter / Min.]

21.4 Calculating the Respiration Rate

Respiration rate = AMV / (Bag size * 1,2) [1 / Min.]
Optimal training lies between a respiration rate of 20 and 40 breathes per minute.

22 Electromagnetic Compatibility (EMC) (EMV), IEC 60601-1-2)

SpiroTiger® Smart needs to be installed and put into service according to the EMC information stated as follows.
Use of portable phones or other radio frequency (RF) emitting equipment near a SpiroTiger® Smart, may cause unexpected or adverse operation.

Compliant Cables and Accessories

SpiroTiger® Smart has no accessories which affect EMC compliance.

Guidance and Manufacturer's Declaration – Electromagnetic Emissions		
The SpiroTiger® Smart is intended for use in the electromagnetic environment specified below. It is the responsibility of the customer or user to ensure that the SpiroTiger® Smart is used in such an environment.		
Emissions Test	**Compliance**	**Electromagnetic Environment – Guidance**
RF emissions CISPR 11	Group 1	SpiroTiger® Smart uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class B	SpiroTiger® Smart is suitable for use in all establishments inclusively in domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic Emissions IEC 61000-3-2	Not applicable	
Voltage fluctuations/ Flicker emissions IEC 61000-3-3	Not applicable	

Caution!

SpiroTiger® Smart should not be used adjacent to, or stacked with, other equipment. If adjacent or stacked use is necessary, SpiroTiger® Smart or system should be tested to verify normal operation in the configuration in which it is being used.

Guidance and Manufacturer's Declaration – Electromagnetic Immunity			
SpiroTiger® Smart is intended for use in the electromagnetic environment specified below. It is the responsibility of the customer or user to ensure that the SpiroTiger® Smart is used in such an environment.			
Immunity Test	**IEC 60601 Test Level**	**Compliance Level**	**Electromagnetic Environment – Guidance**
Electrostatic discharge (ESD) IEC 61000-4-2	± 6 kV contact ± 8 kV air	± 6 kV contact ± 8 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/ burst IEC 61000-4-4	Not applicable		
Surge IEC 61000-4-5	Not applicable		
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	Not applicable		
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristics of a typical location in a typical commercial or hospital environment.
NOTE U_T is the AC mains voltage prior to application of the test level.			

Essential performance

Respiration rate
Supervision of the training

Guidance and manufacturer's declaration – electromagnetic immunity

SpiroTiger® Smart is intended for use in the electromagnetic environment specified below. The customer or the user of the SpiroTiger® Smart should assure that it is used in such an environment.

Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment – guidance
			Portable and mobile RF communications equipment should be used no closer to any part of the SpiroTiger® Smart, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. **Recommended separation distance:**
Conducted RF IEC 61000-4-6	3 V_{rms} 150 kHz to 80 MHz	3 V	$d = 1{,}2\sqrt{P}$
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2,5 GHz	3 V/m	$d = 1{,}2\sqrt{P}$ 80 MHz to 800 MHz
			$d = 2{,}3\sqrt{P}$ 800 MHz to 2,5 GHz
			where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in metres (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey,[a] should be less than the compliance level in each frequency range.[b] Interference may occur in the vicinity of equipment marked with the following symbol. 

NOTE 1 At 80 MHz and 800 MHz, the higher frequency range applies.

NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

a Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the SpiroTiger® Smart is used exceeds the applicable RF compliance level above, the SpiroTiger® Smart should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the SpiroTiger® Smart.

b Over the frequency range 150 kHz to 80 MHz, field strengths should be less than [U_1] V/m.

Recommended separation distances between portable and mobile RF communications equipment and the SpiroTiger® Smart

SpiroTiger® Smart is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the SpiroTiger® Smart can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the SpiroTiger® Smart as recommended below, according to the maximum output power of the communications equipment.

Rated maximum output power of transmitter **W**	**Separation distance according to frequency of transmitter** **m**		
	150 kHz to 80 MHz $d = 1{,}2\sqrt{P}$	80 MHz to 800 MHz $d = 1{,}2\sqrt{P}$	800 MHz to 2.5 GHz $d = 2{,}3\sqrt{P}$
0.01	0,12	0,12	0,23
0.1	0,38	0,38	0.73
1	1,2	1,2	2,3
10	3,8	3,8	7,3
100	12	12	23

For transmitters rated at a maximum output power not listed above, the recommended separation distance d in metres (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

NOTE 1 At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

Bluetooth

Frequency range: 2402 .. 2480 MHz
Initial Carrier Frequency: -75 .. +75 kHz

Caution!

SpiroTiger® Smart can be disturbed by other devices, even if these other devices meet the CISPR emission requirements.

Bluetooth

Frequency range: 2402 - 2480 MHz
Initial Carrier Frequency: -75 +75 kHz
Modulation characteristics: dF1/F0: M1= 140 - 175 kHz
Modulation characteristics: dF2/AA: M4= 115 kHz
Effective radiated power (ERP): < 4dBm

23 CE Declaration of conformity

EG-KONFORMITÄTSERKLÄRUNG
EC-DECLARATION OF CONFORMITY
CE-DÉCLARATION DE CONFORMITÉ
CE-DICHIARAZIONE DI CONFORMITÀ

Wir/We/Nous/Noi

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erklären in alleiniger Verantwortung, dass das Produkt
declare under our sole responsibility that the product
déclarons sous notre seule responsabilité que le produit
dichiariamo sotto la nostra esclusiva responsabilità che il prodotto

SpiroTiger® GO, SpiroTiger® smart

auf das sich diese Erklärung bezieht, mit den folgenden Normen übereinstimmt.
to which this declaration relates is in conformity with the following standards.
auquel se réfère cette déclaration est conforme aux normes.
al quale si riferisce la presente dichiarazione é conforme alle norme

EN 60 601-1-2:2007

gemäss den Bestimmungen folgender Richtlinien
following the provisions of Directives
conformément aux disposition des Directives
conformemente alle disposizioni e Direttive

2004/108/EC (EMC)

Fehraltorf, 6th of February, 2014 Kurt Glaus, CEO

(Ort und Datum der Ausstellung) (Name, Unterschrift und Funktion des Befugten)
(Place and Date of issue) (Name, signature and function of authorized person)
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Fehraltorf, 6th of February, 2014 Anja Trepp, CTO

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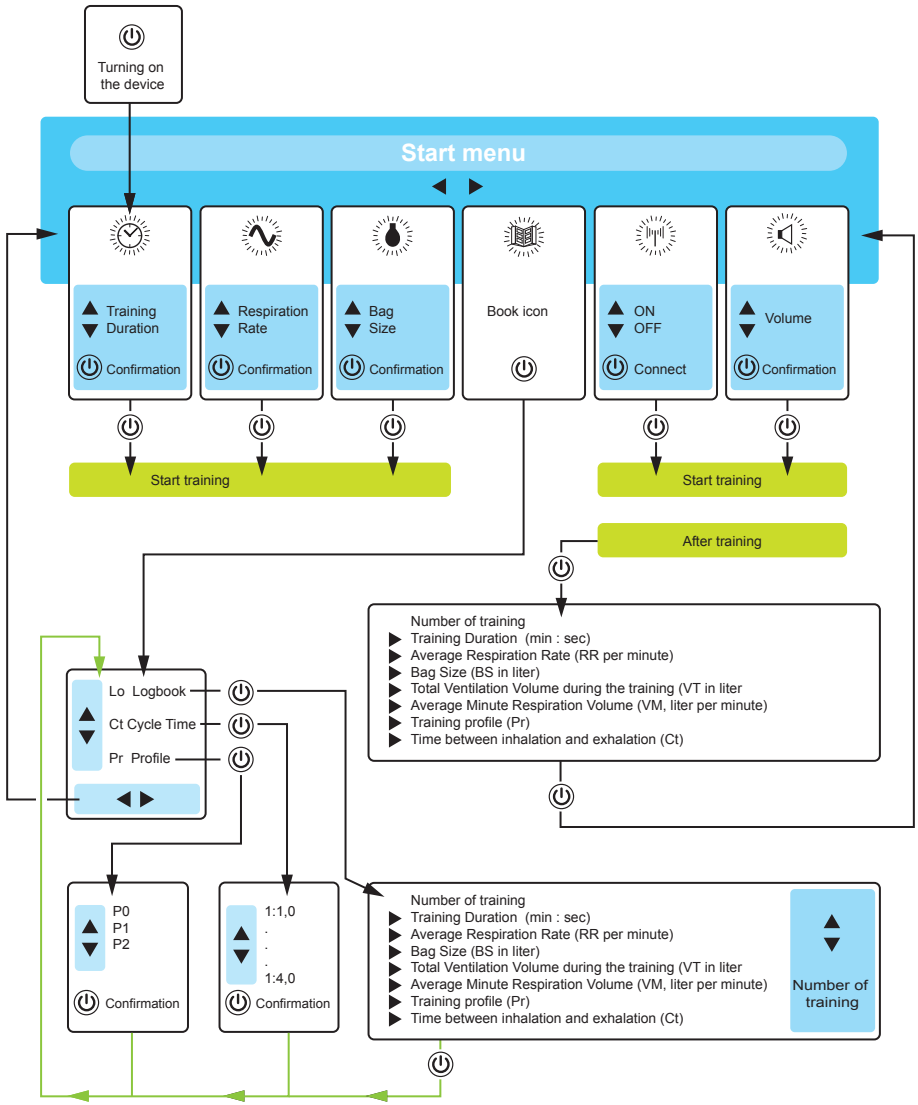
Notes

24 Operating procedure



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