



PROSKI Simulator TRAINING computer

User manual

Author: Uroš Končnik, Elektrina d.o.o.

Version: 0.95 (DRAFT)

Date: 14.10.2010

Table of contents

1	Introduction.....	5
1.1	PROSKI simulator device hardware	5
2	Theory of operation.....	6
2.1	Ski turn.....	6
2.2	Angles of footpads.....	6
2.3	Parallel intolerance of footpads	7
2.4	Assessment of ski turns	7
3	PROSKI simulator training computer usage	9
3.1	Idle mode.....	9
3.2	Title bar.....	9
3.3	User data screen.....	9
3.4	Difficulty select screen	9
3.4.1	Test mode	10
3.5	Training type screen	12
3.5.1	Tempo entry screen.....	12
3.6	Training mode screen	13
3.6.1	Turns count entry screen.....	13
3.6.2	Time entry screen.....	14
3.7	Info screen before training start	14
3.8	Main screen	15
3.8.1	Countdown	15
3.8.2	During the training	15
3.8.3	Alternative screens during the training.....	16
3.8.4	Tempo indicator	17
3.9	Statistics screen	18
4	Data storage on external USB disk	20
4.1	CSV files	20
4.1.1	Filename	20
4.1.2	Data format	21
4.2	Example of graphical analysis of data in MS Excel	22
5	Service mode	24
5.1	Screen setup	24

5.1.1	Touch screen calibration	25
5.2	Audio setup	25
5.3	Measure setup.....	25
5.4	Calibration	27
5.4.1	The calibration procedure	27
5.5	Language	28
5.6	Module info	28

1 Introduction

PROSKI simulator training computer is a sophisticated electronic device which provides critical assessment of training performed on PROSKI simulator of skiing. PROSKI simulator training computer uses state-of-the-art magnetic angle and position sensors which readings are processed with advanced decision algorithms, which were developed with the help of top level ski professionals and trainers to produce the most accurate results. PROSKI simulator training computer supports various difficulty levels enabling the usage for all ranges of users from ski beginners to ski professionals. The results provided by PROSKI simulator training computer can help improve ski technique and overall ski performance of users of all ages.

PROSKI simulator training computer features include:

- detection and assessment of correct and incorrect ski turns
- ski simulation statistics
- optional storage of ski simulation data onto external USB memory drive

This user manual provides basic information how to get started as well as detailed description of usage and various modes of operation. Last part of this manual describes USB memory drive storage file format and gives basic guidelines on how to import and process stored data on a PC.

1.1 PROSKI simulator device hardware

PROSKI simulator device consists of multiple mechanical and electrical parts which must be assembled in correct manner in order for device to function properly. The PROSKI simulator device can be used without the functions of PROSKI simulator training computer, depending on the version bought or the needs of the user.

The main part of the simulator device is a rigid steel frame. Frame must be assembled according to instructions which are provided in the package. The bottom part of the frame is shaped as half arc and this arc is the guide rail for the ski cart. The upper part of the frame is a steel rod used as a handle and as a position to mount the PROSKI simulator training computer.

The second part is a removable cart with two attachable foot pads. This part enables ski simulation movements and can be shipped with electronics box to work in conjunction with PROSKI simulator training computer main module. Cart is attached to rigid steel frame with multiple rubber bands (springs) which allow simulation of different ski disciplines such as slalom, giant slalom or custom selectable tempo.

In order for PROSKI simulation training computer to work accurately, the device must be assembled as instructed. The communication between the cart and the main training computer module uses IR (infrared) light. For the communication to work user must maintain uninterrupted visible field between the cart and the main module at all times of operation. The construction of the simulator device provides uninterrupted visible field by itself, the user must only make sure that no obstacles are present between the cart emitter IR diodes and the main module IR receiver.

2 Theory of operation

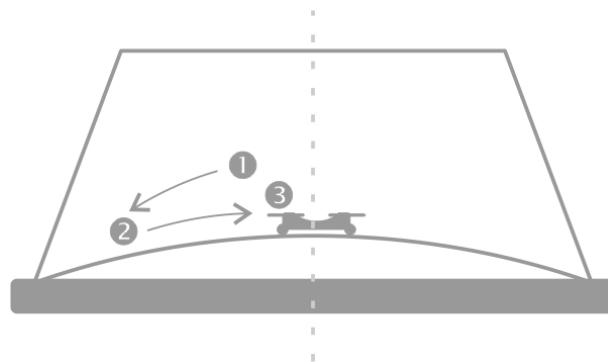
There are two main factors important for assessment of ski turns:

1. Angles of the footpads in relation to cart position
2. Parallel intolerance between left and right footpad

Both of these two factors are measured during the whole time of active training session. PROSKI simulator training computer uses advanced algorithms to provide as accurate assessment results as possible. Beside these two factors additional factors play a crucial role in the decision process, such as user's sex, weight, central ignore angle position, angle multiplier factor and parallel intolerance value.

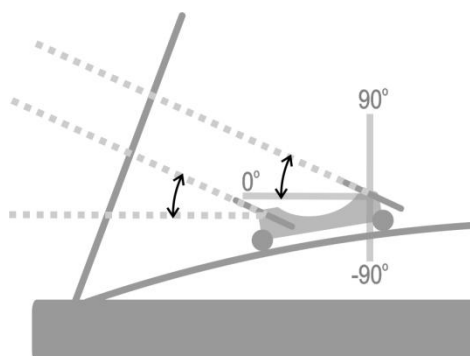
2.1 Ski turn

Ski turn is a basic assessment unit for the PROSKI simulator training computer. It is a simulated representation of one ski turn. One ski turn represents a movement of cart from its central position to either left or right side of the rail arc and back to the central position. Each turn is defined with an amplitude and speed. Amplitude depends on the maximum length moved, while the speed is determined with the time used for making one ski turn.



2.2 Angles of footpads

Angles of footpads are one of the main assessment factors for determination of correct or incorrect ski turn. Angles are measured for each footpad separately against device floor level. Angles are measured in degrees in range from -90 degrees to +90 degrees. The angle where the cart is on the right side of the arc and the user is leaned towards left side is measured with a positive angle, while the angle where the cart is on the left side of the arc and user is leaned towards right is measured with a negative angle. Each cart position has a predefined value of a minimum angle of footpads to allow the ski turn to be assessed as correct (other factors play a role in decision too).

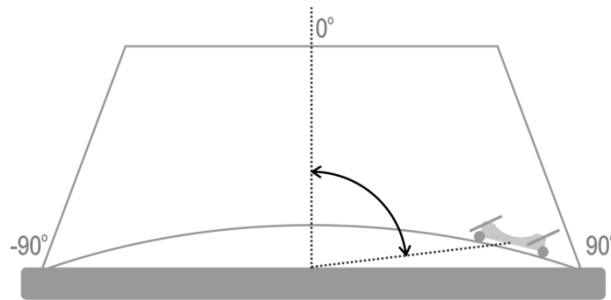


2.3 Parallel intolerance of footpads

Parallel intolerance of footpads is defined as the absolute difference in degrees between the angle of left and the angle of right footpad. There is a maximum intolerance (difference) defined in the algorithm and if the intolerance is larger the move is assessed as incorrect.

2.4 Cart position

Cart position is measured as angle from the bottom centre of the PROSKI simulator machine to the cart centre. It is measured in range -90 to 90 degrees.



2.5 Assessment of ski turns

Ski turn can be assessed (classified) as:

1. **Correct turn** (represented with a green number) – all factors were within allowable limits
2. **Turn with an insufficient angle** (represented with a purple number) – the difference between angles of left and right footpads are within tolerable levels, but the angles are not sufficient
3. **Turn with an uneven angle** (represented with a red number) – the difference between angles of left and right footpads are outside tolerable levels

Algorithm is deciding according to measurements which are received via IR connection from the cart approximately 10 times per second. The turn is assessed according to sampled measurements, when it is completed.

3 PROSKI simulator training computer usage

Before starting the exercise PROSKI simulator training computer needs to obtain some information about the user, training type, mode and some additional parameters to satisfy user needs.

3.1 Idle mode

When PROSKI simulator training computer is not active the screen is in screensaver mode, which cycles two full screen pictures. PROSKI simulator training computer enters idle mode after 60 seconds of inactivity either on touch screen or via IR communication. When user touches the screen or cart begins to transmit data, the training computer automatically exits idle mode and enters into weight and sex entry screen.

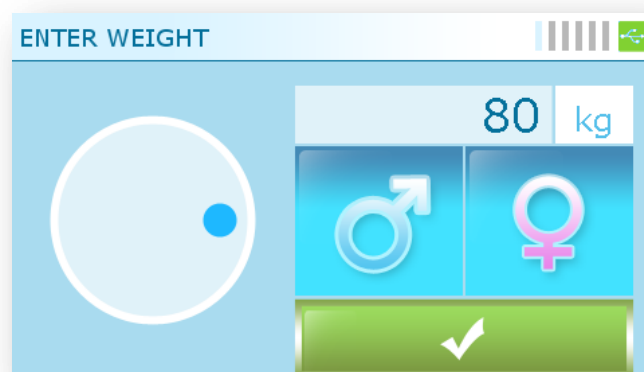
3.2 Title bar

Title bar is common to all screens and it contains data related to system. Left side of the title bar displays title of the current screen. Left side is composed of USB attached icon and progress bar. USB attached icon is grey when no USB is present and it is colored green when USB storage media is recognized and ready for use. Progress bar is a graphical representation of steps until training start.



3.3 User data screen

User must enter his or her weight and sex. Weight can be entered either in kilograms or in pounds depending on the system settings with turning the virtual scroll wheel clockwise or counter-clockwise. Sex is selectable with two buttons containing international symbols (♂ - male, ♀ - female). User must select sex or the OK button will not be enabled. The default value for weight is 70 kg (154 lbs).



This data is used by the PROSKI training computer for the calculation of the number of needed springs.

3.4 Difficulty select screen

This screen provides a selection of difficulty level. User can select two predefined difficulty levels and a test mode. The two predefined difficulty levels are **basic**, selectable with a blue button, and

advanced, selectable with a red button. The third, black button enters the test mode, where user must perform ten ski turns and PROSKI simulator training computer assesses the knowledge of the user. If the user is extremely good, the **professional** difficulty level is also available.

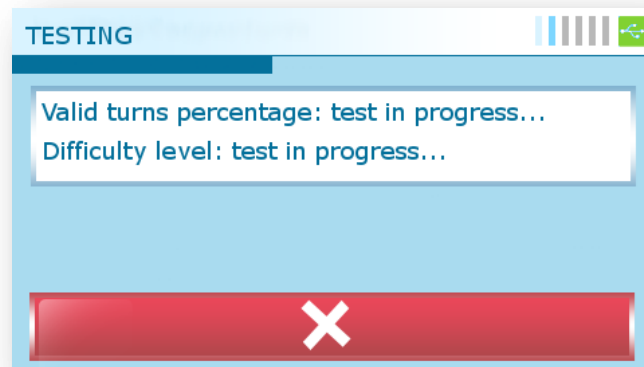


Difficulty levels are defined regarding the value of maximum parallel intolerance of footpads. The higher the difficulty level, the lower the intolerance value is. Professional difficulty level is accessible only by test mode.

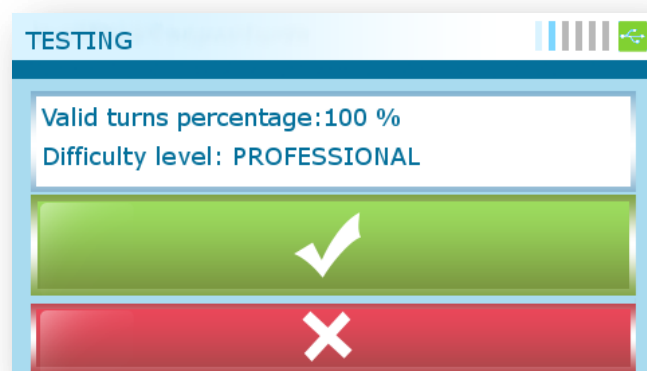
3.4.1 Test mode

When user enters test mode by pressing the grey button from difficulty select screen, the test mode starts. In this mode PROSKI simulator training computer awaits user to do ten ski turns. Current progress of test is shown on progress bar.

The screen below show test mode which is 40% complete:



When the test is over, percentage of correct moves is displayed along with suggested difficulty level:



If the user confirms the suggested difficulty setting, the difficulty level is used in the training session.

The assessment of difficulty settings is performed according to the following criterion:

Percentage of correct turns	Difficulty level
< 40 %	BASIC
< 95 %	ADVANCED
> 95 %	PROFESSIONAL

3.5 Training type screen

This screen enables user to select training type. The main parameter which determines the training type is tempo. User can choose between slalom, giant slalom or custom tempo training. Tempo defines the speed of performing ski turns and it is given as **number of turns per minute**. Slalom (single flags) and giant slalom types (double flags) have a predefined value of tempo, while the tempo button (yellow markings with a stopwatch button) allows user to chose his/her own tempo.

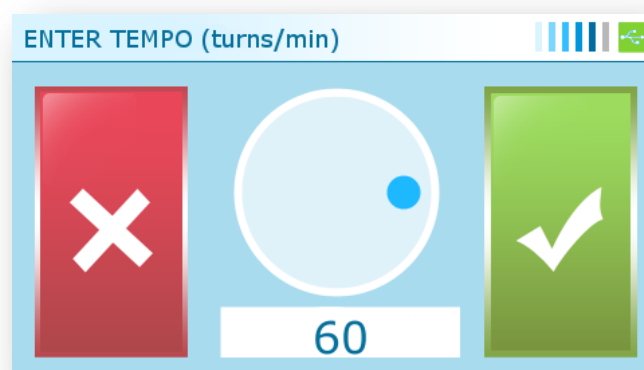


Predefined tempo values:

Training type	Tempo (turns/minute)
SLALOM	80
GIANT SLALOM	70

3.5.1 Tempo entry screen

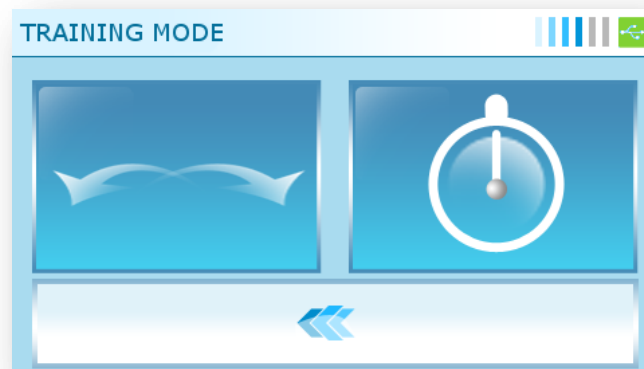
Tempo entry can be done with clockwise or counter-clockwise turning of a virtual scroll wheel. The unit of tempo is ski turns per minute. Entry is confirmed by pressing the green button or canceled by pressing the red button. Default value for custom tempo entry is 60.



3.6 Training mode screen

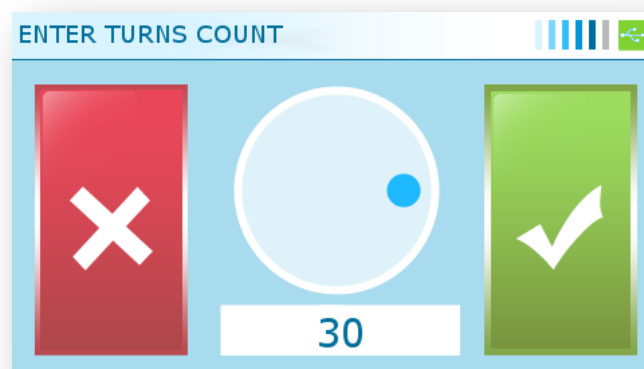
Screen enables user to select training mode. PROSKI simulator training computer supports two training modes:

- 1) **Turns (arrows icon)** – in this mode the training is orientated to number of correct ski turns. User selects wanted number of **correct ski turns** and PROSKI training computer measures time needed to perform desired number of correct ski turns.
- 2) **Time (stopwatch icon)** – in this mode the training is oriented to duration of training. The training is finished when desired time expires and PROSKI training computer reports number of correct turns performed in desired training time.



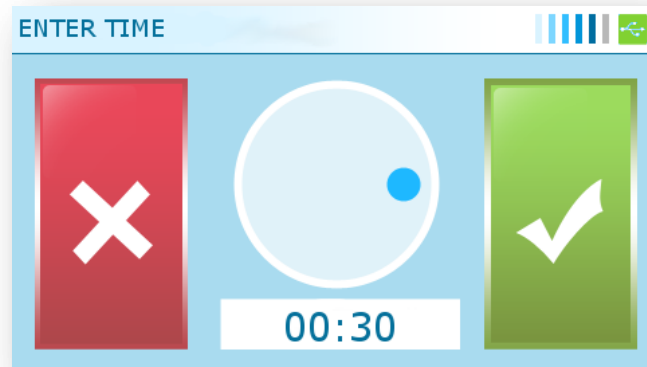
3.6.1 Turns count entry screen

Screen is used for entry of number of turns. Number of turns is entered with virtual scroll wheel »turning« clockwise or counter-clockwise. The default value is 30. Green button confirms the entry, the red button cancels it.



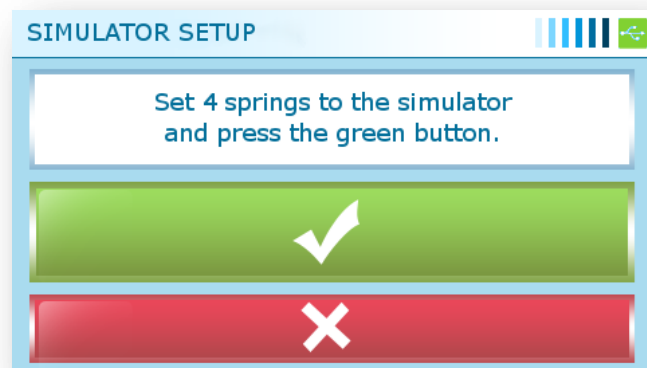
3.6.2 Time entry screen

Screen is used for entry of time of training. The time of training is entered with virtual scroll wheel »turning« clockwise or counter-clockwise. The time is in form mm:ss (minutes : seconds), the default value is 00:30 (30 seconds). Time value is incremented or decremented by 5 seconds. Green button confirms the entry, the red button cancels it.



3.7 Info screen before training start

Screen is displayed last before actual training starts. Screen displays important information about the necessary number of springs to be placed on the cart. The number of springs is calculated according to the sex and weight of the user and training type. **The user must place the requested number of springs onto PROSKI simulator cart before the training or the training will not have the desired effect!** After the springs have been placed the training starts with pressing the green button.

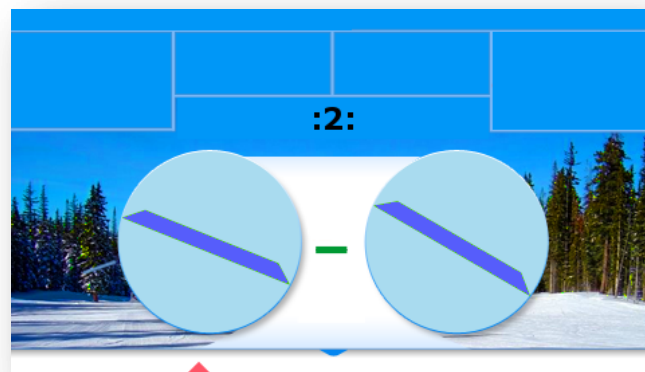


3.8 Main screen

During the active training PROSKI simulator training computer displays graphic representation of measured values (cart position and angles of both footpads).

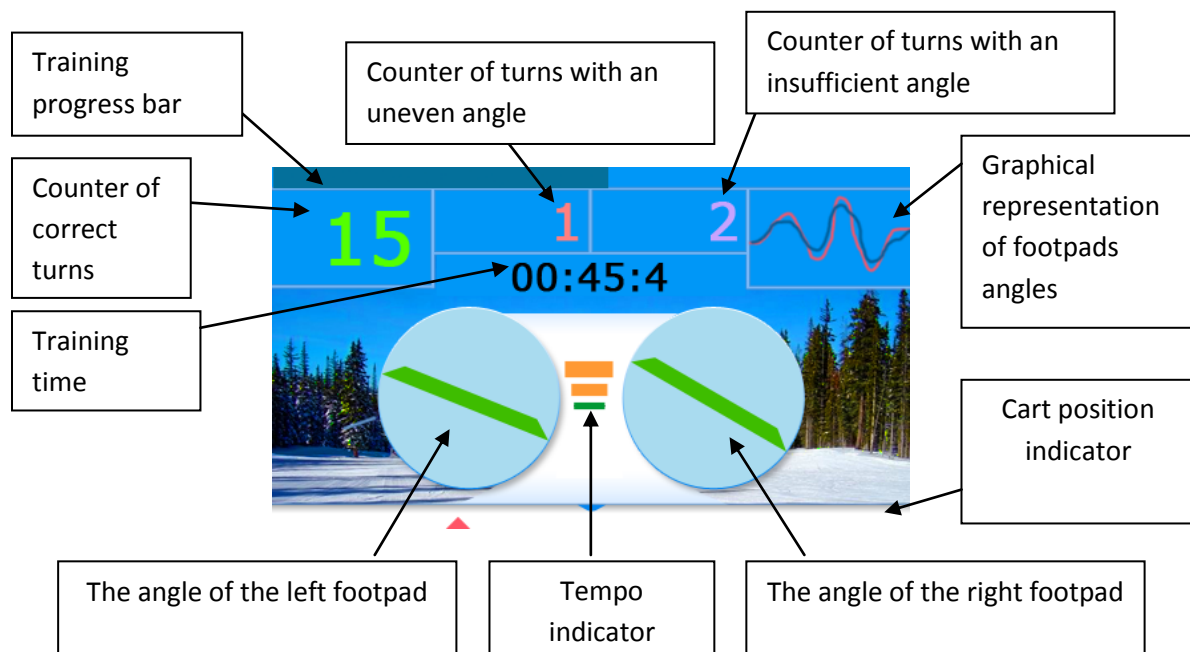
3.8.1 Countdown

Before the actual training begins, the countdown to start is performed. This allows the user to prepare for the start. **Because of the hardware design (the cart has its own motion induced power source) the user must start moving the cart during the countdown period until the two blue indicators and a red marker start to move.** This indicates that the cart has powered up and the training can begin. The two blue lines represent angles of each of the footpad, while the red marker at the bottom of the screen indicates the position of the cart on the arc.



3.8.2 During the training

During the active training PROSKI simulator training computer displays all the measured values and all the calculated values of the training.



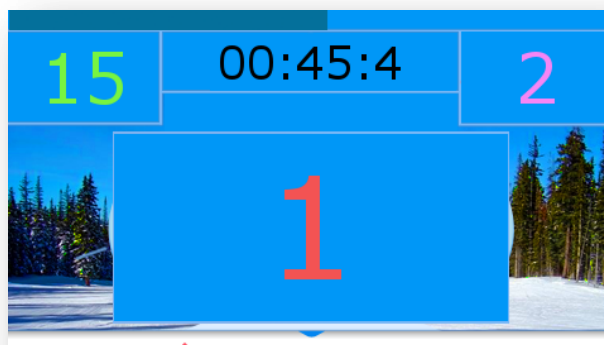
3.8.3 Alternative screens during the training

During the active training user can press the desired area of the screen to enlarge the display of the single parameter.

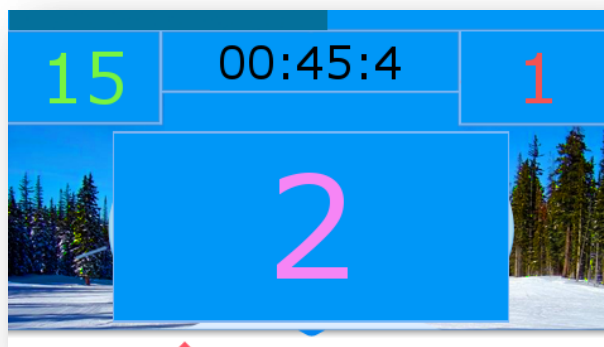
Mode with the enlarged counter of correct turns is activated by pressing the counter of correct turns:



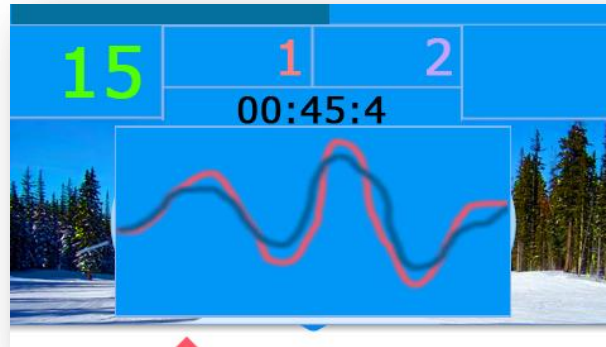
Mode with the enlarged counter of uneven angle turns is activated by pressing the counter of uneven angle turns:



Mode with the enlarged counter of insufficient angle turns is activated by pressing the counter of insufficient angle turns:



Mode with enlarged graphical display of footpad angles is activated with pressing the area where graphic display is shown. The red line represents the angle of the right footpad and the blue line represents the angle of the left footpad. Angle is drawn in range from -90 to 90 degrees where angle 0 is in the middle.

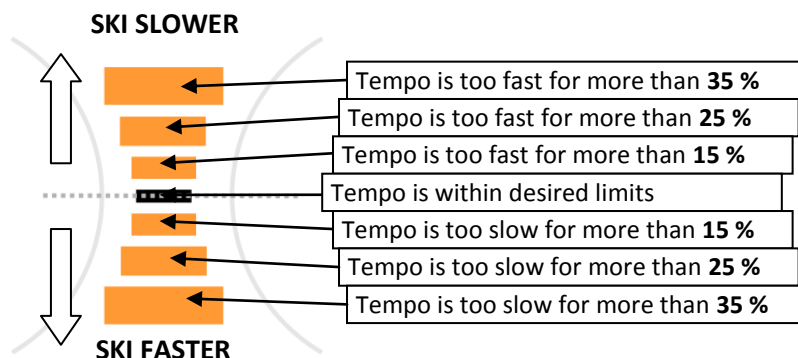


The transition between alternative screens during training is always possible by pressing the desired area of the current screen to be enlarged.

The return to main screen (see chapter 3.8.2) is possible by pressing the main area of the currently shown screen (the area with the large number or area with the large graph).

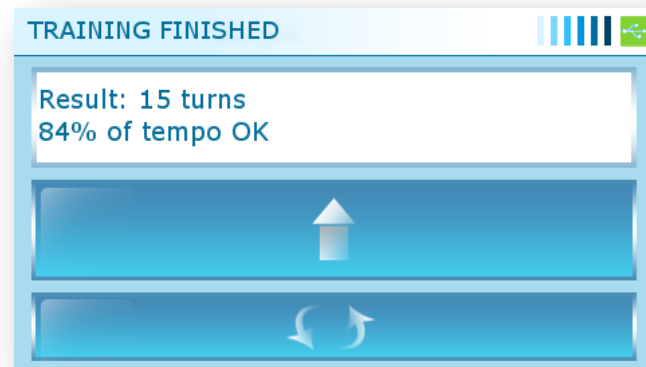
3.8.4 Tempo indicator

Tempo indicator is drawn in between the two circles displaying footpad angles. Tempo indicator is basically a progress bar showing how the training is following the desired tempo. If the tempo is faster than desired, the upper three bars are drawn, depending on how much too fast the tempo is. The similar rule applies for too slow tempo, where lower three bars are drawn.



3.9 Statistics screen

After the training session is complete, this screen is displayed. The results displayed on this screen are dependent on training mode. In case of “turns” mode, the screen displays the number of correct turns. In case of time mode, the screen displays the time of the training. The next line shows the percentage of time the tempo was in desired limits, according to training mode. This screen allows user to restart the training with the same settings with the press on the lower button (arrows icon) or the start of a complete new training with the press on the higher button (home icon).



4 Data storage on external USB disk

PROSKI simulator training computer allows data storage of measured and calculated values on external USB disk. User can execute further analysis of ski training data on a personal computer.

WARNING: PROSKI simulator training computer supports only USB disk of size 2GB or smaller formatted with FAT16 or FAT32 file system. Other file systems and larger USB disks are not supported and will not be recognized!

Data is stored in a format of a comma separated value file (CSV file). CSV file is ordinary text file where each value is written in a human readable form. Values are separated with a special predefined character, most commonly a comma. CSV files are recognized and opened by most of the database table editing software.

For successful training data storage the user must insert the USB disk BEFORE the training starts and USB disk must be inserted until the training has been finished!

Successfully recognized USB storage disk is signaled with a green USB icon in the top right corner of menu screen or with a green USB icon on the left side of time field of main screen.



4.1 CSV files

4.1.1 Filename

PROSKI simulator training computer stores training data in CSV files with filenames in form of SKIxxxxx.CSV, where xxxxx represents sequential number of file. The number of the newest file is incremented by one from the largest number of the file present on the USB disk. If there is no SKIxxxxx.CSV files present on the system the data is stored in filename SKI00000.CSV. All other files that might be on the USB disk are ignored and are not changed, although it is recommended to have a dedicated USB disk for PROSKI computer only.

Example of a few files stored on a USB disk:

SKI00000.CSV
SKI00001.CSV
SKI00002.CSV
SKI00010.CSV

In the case above, the next file will be named **SKI00011.CSV**.

4.1.2 Data format

CSV file contains one record per line, and each data value of the single record is separated from others with a comma (,).

Example of a general record stored in a CSV file:

```
field1, field2, field3, field4, field5
```

CSV files written by a PROSKI computer are composed of a header and a data segment. Header segment is stored in the first two lines of a file and the other part of the file contains data.

4.1.2.1 Header segment

First record in header segment contains following fields:

#	field	decription
1	training type	Selected training type (chapter 3.5). Valid values: »slalom«, »giantslalom« or »tempo«.
2	tempo	Tempo in turns/minute, if slalom or giant slalom is selected then predefined value will be written (chapter 3.5).
3	training mode	Valid values: »time«, »repetitions« (for »turns« mode)
4	target parameter	Parameter user must achieve to end the training session. If selected training mode was »time« this parameter contains target time in 1/100 of a second. (eg. 100 = 1s, 1000 = 10s). If selected training mode was »turns« this parameter contains desired number of turns.
5	sex	Entered sex of the user. Valid values: »male« or »female«.
6	weight	User weight in kg (regardless of metric or imperial setting).
7	difficulty level	Difficulty level of training: »basic«, »advanced« or »professional«.

Example of the first record:

```
slalom,75,time,3000,male,70,basic
```

Second record in header segment contains description of data columns and it is always constant:

```
time,car, leftfoot, rightfoot, OKcnt, DIFcnt, ANGcnt
```

4.1.2.2 Data segment

Data segment contains values recorded during training session. Column description is written in the second record of header segment.

#	Name	Description
1	<i>time</i>	Measurement time (in 1/100 of a second).
2	<i>cart</i>	Cart position on the arc (in range from -90 to 90).
3	<i>leftfoot</i>	Left foot angle (in range from -90 do 90).
4	<i>rightfoot</i>	Right foot angle (in range from -90 do 90).
5	<i>OKcnt</i>	Number of correct turns.
6	<i>DIFcnt</i>	Number of turns with an uneven angle.
7	<i>ANGcnt</i>	Number of turns with an insufficient angle.

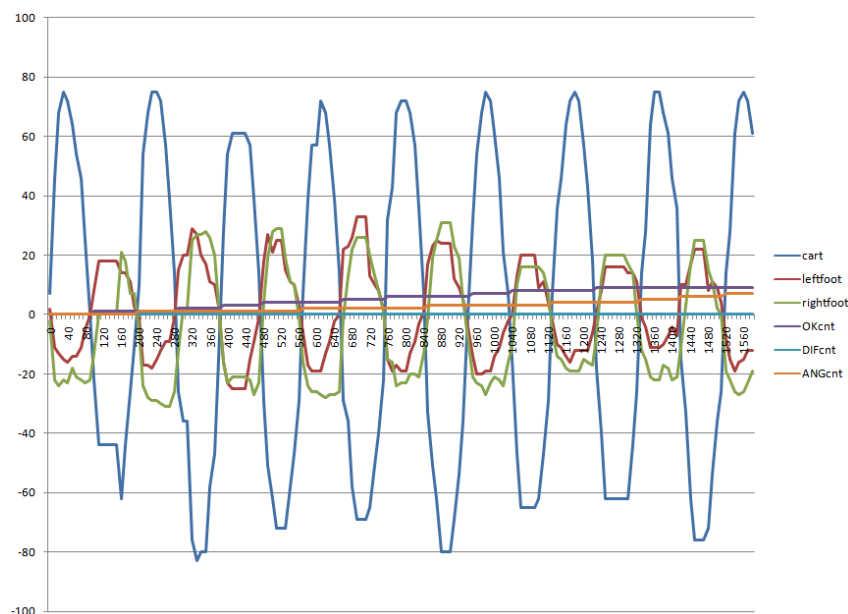
Example of a small data segment (1 second long):

```
0,7,2,-2,0,0,0
10,46,-11,-22,0,0,0
20,68,-13,-24,0,0,0
30,75,-15,-22,0,0,0
40,72,-16,-23,0,0,0
50,64,-14,-18,0,0,0
60,54,-14,-21,0,0,0
70,46,-11,-22,0,0,0
80,25,-5,-23,0,0,0
90,0,0,-22,0,0,0
100,-22,8,-13,1,0,0
```

The number of record is depending on training length. Records are stored in a 1/100 ms interval, which means that **every second 10 records are written**.

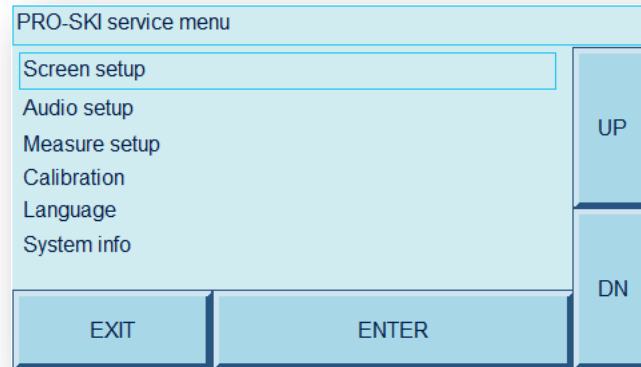
4.2 Example of graphical analysis of data in MS Excel

User can import CSV file into Microsoft Office Excel and makes a graphical representation of measure values. User can learn more about making graphical representation in Microsoft Office Excel in the user's guides available widely as books or online.



5 Service mode

The service mode is started by pressing the hidden button on the back of the PROSKI simulator training computer. Every parameter set in this menu is stored and it is kept even if training computer is powered off.



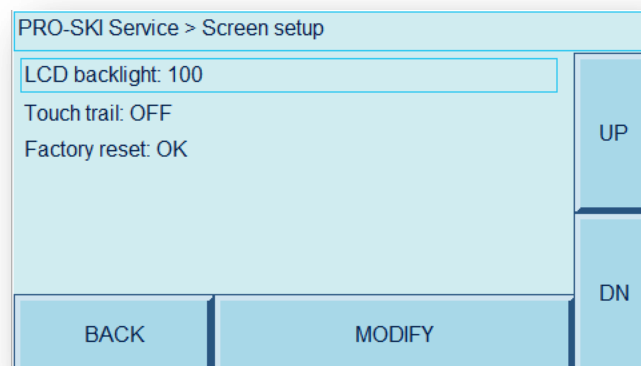
User can navigate through service menus with four buttons:

- 1) UP – move selection up
- 2) DN – move selection down
- 3) ENTER/MODIFY – entry in menu or confirmation of value
- 4) EXIT/BACK – exit from the menu or return to menu one level up

5.1 Screen setup

User can set:

- 1) **LCD backlight:** The intensity of LCD screen backlight power.
- 2) **Touch trail:** Touch trailing feature allows user to track the touches with the help of graphical representation (green dot is drawn on the screen where user touches the screen).
- 3) **Factory reset:** Factory reset of the module. All data stored is erased. The module resets automatically after confirming this selection.



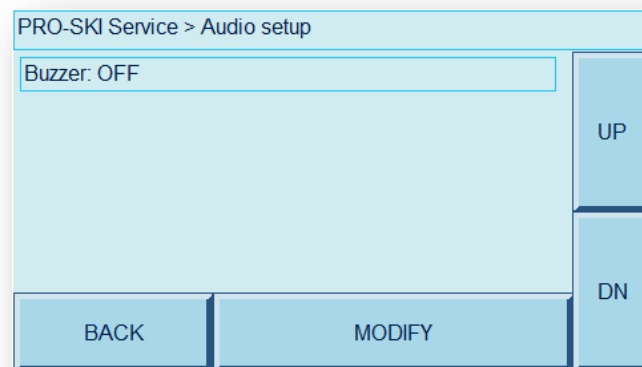
5.1.1 Touch screen calibration

When the module is powered up for the first time or after factory reset, touch screen calibration procedure starts. User must follow the directions printed on the screen and complete the calibration. Once the calibration is stored, another calibration can be executed only with a factory reset.

5.2 Audio setup

Audio setup enables user to turn the buzzer on or off.

- 1) If the buzzer is on, PROSKI computer beeps on every screen touch and release and every time user makes a correct turn in active training mode.



5.3 Measure setup

This setup enables user to change parameters of the ski turn decision algorithm. User can also choose between metric or imperial units.

Parameters of the ski turn decision algorithm are:

- 1) **Angle factor:** This is factor of the minimal required angle of footpads in relation to cart position. The higher the number the larger the minimal required angle is. In other words, the larger the angle factor is the harder is to perform a correct turn as the larger minimal angle requires lower position of the skier. This setting determines the boundary for the turn with an insufficient angle.
- 2) **Tolerance:** This is the maximum tolerance of the absolute difference between left and right footpad angle. The larger the number is the bigger can difference. This setting determines the boundary for the turn with an uneven angle.

PRO-SKI Service > Measure setup

Angle factor: 0.4

Tolerance: 25

Unit type: Metric

UP

DN

BACK

MODIFY

NOTE: The entry of the angle factor is in multiplier of 10. (eg. enter 12 for factor 1.2, enter 7 for factor 0.7).

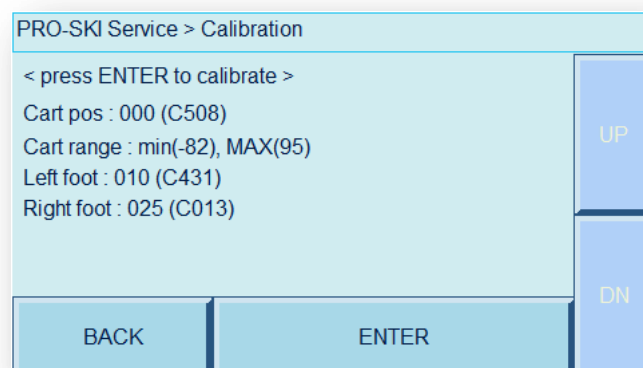
User can also set desired unit types and can choose between *Metric* (kg, m) and *Imperial* (lbs, ft) units.

5.4 Calibration

Calibration of the PROSKI simulator training computer is a necessary procedure that must be carried out on a newly assembled machine or when an error or inconsistency occurs in measured values.

IMPORTANT: If the calibration procedure is not carried out or is done incorrectly the PROSKI simulator training computer will not get the correct measurements! This means that the results of the trainings will also be invalid!

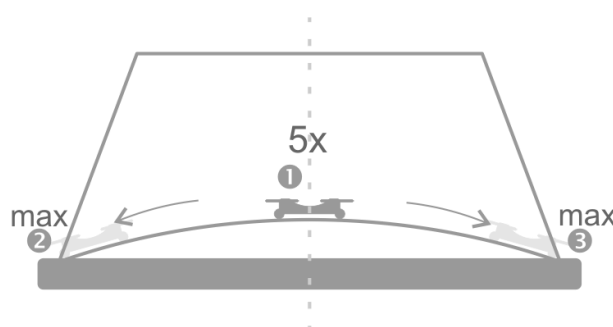
The calibration screen displays the values of parameters received from the cart via IR connection.



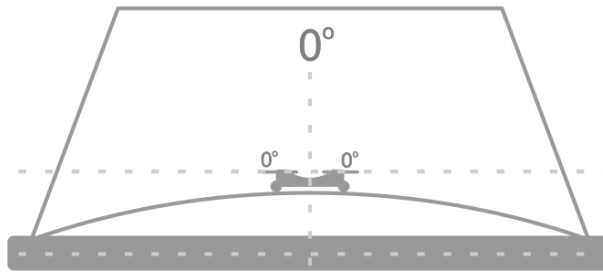
5.4.1 The calibration procedure

User must set the machine with a suitable number of springs that will enable easy movement of cart to extreme positions on both sides of the arc. Calibration is then carried out in three steps:

- 1) **Determining maximum cart range:** Maximum cart range is measured with five sequential moves from one extreme position to the other extreme position. It is important that the cart is moved all the way possible to the left and right side. The extremes are displayed on the screen in row *Cart range*.



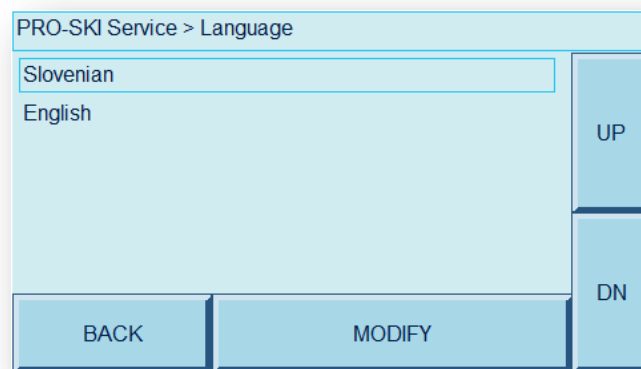
- 2) **Determining the zero position of the cart and both footpads:** For the storage of the zero positions the user must step down of the cart and ensure that both footpads and the cart itself are holding stable zero positions. The leveling of footpads it is recommended to be done with the help of a ski pole or other straight object. **Because the cart is self powered the user must perform this step as quickly as possible before the cart turns off. The user has 5 – 10 seconds depending on the power that was stored inside the cart during the first step of the calibration.**



- 3) **Confirmation:** After the zero positions have been properly set, the user must confirm the values with pressing the ENTER button on the calibration screen. It is recommended that test training is done after calibration procedure to confirm the successful calibration. If there is apparent wrong measurement visible on the screen during training the calibration procedure must be repeated.

5.5 Language

User can choose between different languages of the user interface.



5.6 Module info

Menu displays the current software versions and serial number of the product.

