



SmarTracks Diagnostics v.3.16 Installation Guide & User Manual

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1. Safety Instructions

ATTENTION!

Before using your SmarTracks Diagnostics, read all instructions on handling the device and timing gates, including the safety information.

1.1. Electronic Measuring Equipment

Non-compliance with this safety information may result in a fire, electric shocks or other injuries, or may lead to damage to the system components.

Do not drop the measuring equipment, and do not dismantle, open, break, bend, deform, drill through, crush, burn or paint it. Do not heat in a microwave and do not insert foreign objects into the device.

When attaching the sensor to your computer, we recommend using the provided USB extension cable to protect your computer from humidity and dirt. If you need to attach the sensor directly make sure there is no moisture or dirt on the sensor! Do not try to dry the sensor with an external heat source such as a microwave or a hot air gun.

Never try to repair the measuring equipment yourself.

1.2. Timing Gates



Timing gates contain powerful magnets. The magnetic field can damage e.g. mobile phones, TVs, laptops, computer hard drives, credit cards, data media, mechanical clocks, hearing devices, speakers, and the measuring sensor.

Therefore, these devices should never be kept in close proximity to the timing gates. A minimum distance of 50 cm must be maintained. Do not try to open the timing gates.

Always keep the sensor at a safety distance of at least 10cm from the timing gates.



ATTENTION!

Magnets may affect the function of pacemakers and implanted defibrillators. If you have such devices fitted, keep them at a sufficient distance from the magnets.

1.3. Charging the Measuring Device

To charge the sensor, always use the supplied USB cable with an adapter (power supply) or a high-power USB port on another device which is compatible with the USB 2.0 standard. If you use the adapter to charge the sensor, ensure that the power supply is fully assembled before connecting it to a plug socket. Then securely plug the adapter into the plug socket. Do not touch the adapter with wet hands! Always use an approved power supply to charge your sensor.

The adapter may become warm during normal use. Always ensure an adequate flow of air around the adapter and handle it with care.

1.4. Information on Disposal and Recycling

You must dispose of the measuring equipment properly according to the valid environmental directives and legislation. Since the sensor contains electronic components and a battery, the sensor may not be disposed of with normal domestic waste. If you want to dispose of your used sensor, you can consult your local authority regarding disposal and recycling options. The battery is removed and taken for environmentally friendly recycling.

2. Software Change Log

In SmarTracks Diagnostics v.3.16, the following software updates were made:

- Update to the format of stored measurements and sprint-intervals
- Improved Timing Gate detection
- Added option of checking for updates
- Location can be specified in Start Measurement dialogue
- Location can be detected with Windows locations API
- Minor bugfixes and interface improvements

3. Glossary of Technical Terms

Measurement	A measurement starts from the moment the sensor is disconnected from the computer and ends when the sensor is reconnected with the computer.
Assessment	An assessment is an evaluation of specific capacities of the athlete, such as agility, sprinting capacity, etc. Several assessments can be carried out during one measurement.
Test	A test is one specific action of an assessment, such as one jump, one run, etc. Several tests can be carried out during one assessment.
Measurement data	Measurement data is the raw data measured by the sensor. This data can be uploaded to a computer and analyzed by the SmarTracks Diagnostics software.
Test results	Test results are the analyzed data as they are displayed in the SmarTracks Diagnostics software.
Measurement window	The measurement window is the window shown during a measurement. It displays the measure events.
Measure event	A measure event is either the marking of an invalid attempt or changing athlete. The chronology of these events during a measurement is displayed in the measurement window.

4. Hardware

4.1. SmarTracks Sensor-Belt

The SmarTracks Sensor-Belt consists of a sensor and a belt.



Figure 1: DX3.5 sensor with and without USB cap

The DX3.5 sensor-belt consists of a DX3.5 sensor, a round clip, and a belt.



Figure 2: Clip (front) + DX3.5 sensor with USB cap

You can attach the sensor to the clip.
The clip can be attached to the belt with the black Velcro surface on the back (see figure 3 and 4).



Figure 3: Clip (back) + DX3.5 sensor with USB cap



Figure 4: DX3.5 sensor + clip attached to the belt

4.2. Timing Gates

IMPORTANT: Do not hold the sensor-belt closer than 10cm to the Timing Gates, since this could damage the sensor irreparably.

4.2.1. Timing Gates Mobile

The Timing Gates Mobile can be placed everywhere to conduct performance tests. The gates do not contain sensitive electronics and are tolerant against humidity and dirt.

To maintain the integrity of the integrated magnets, the magnetic rods (MCD's) should be well protected from falling or other severe shocks at any time.

A Timing Gate consists of two magnetic elements. A magnetic element consists of one cone and one magnetic rod (MCD), which is to be stuck into the hole of the cone (see figure 2).



Figure 1: Magnetic rod (MCD)



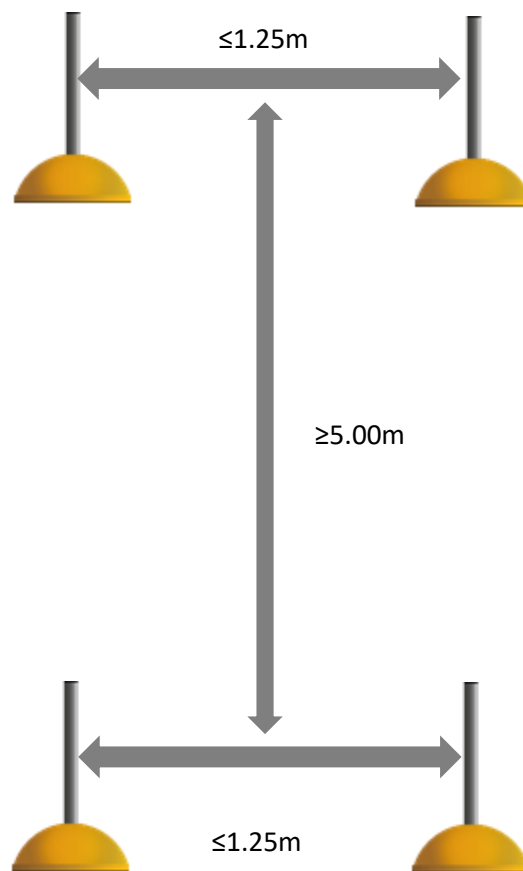
*Figure 2: Magnetic element
(Cone + magnetic rod (MCD))*

4.2.2. Placement of the Timing Gates Mobile

One timing gate consists of two magnetic elements.

The distance between **two elements of a timing gate** should **not be more than 1.25 m**.

The distance between **two timing gates** should **not be below 5 m** to avoid the merging of the magnetic fields that are generated by the gates.



Angled Timing Gates

The MCD can be set up straight (most common) or angled.

Angled setups are used for amplification or alignment of the magnetic field that is generated by our timing gates. In practice, the application is useful for smaller athletes (e.g. children) or for certain tests of agility.

The angled setup is done with the help of an angled mount, which is stuck in the hole of the cone. Rotate the black MCD holder to a **45 degree angle** and insert the MCD with the Humotion logo on the high end. (see figure 1, 2 and 3).



Figure 1: Angled mount



Figure 2: Angled magnetic element (Cone + angled mount + magnetic rod (MCD))

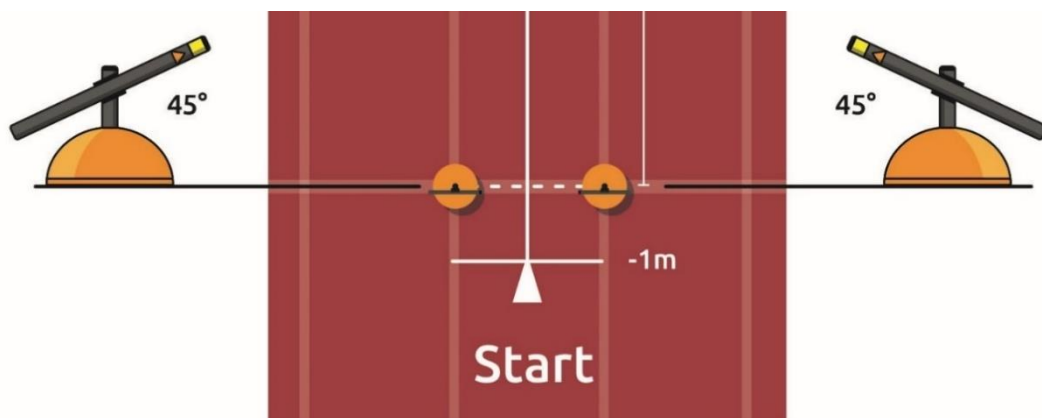


Figure 3: Angled magnetic element (Cone + angled mount + magnetic rod (MCD))

IMPORTANT: The Humotion logo on the rods (MCD's) should always face upwards. This applies for both the straight and the angled setup.

You can either place both magnetic elements angled, both magnetic elements straight, or one angled and one straight.

Example of an angled setup:



4.2.3. Timing Gates In-Ground

Timing Gates In-Ground are invisibly and permanently integrated into a track or turf field. These are so-called SmarTracks Locations.

With a SmarTracks Location, you do not need to set up any Timing Gates yourself.

Go to www.smartracks.run/locations for an overview of all the locations and their ground plans.

Figures 1 and 2 below illustrate a track setup where Timing Gates are integrated into the 100m sprint lane (lane 9) and the 400m lane (lane 1).

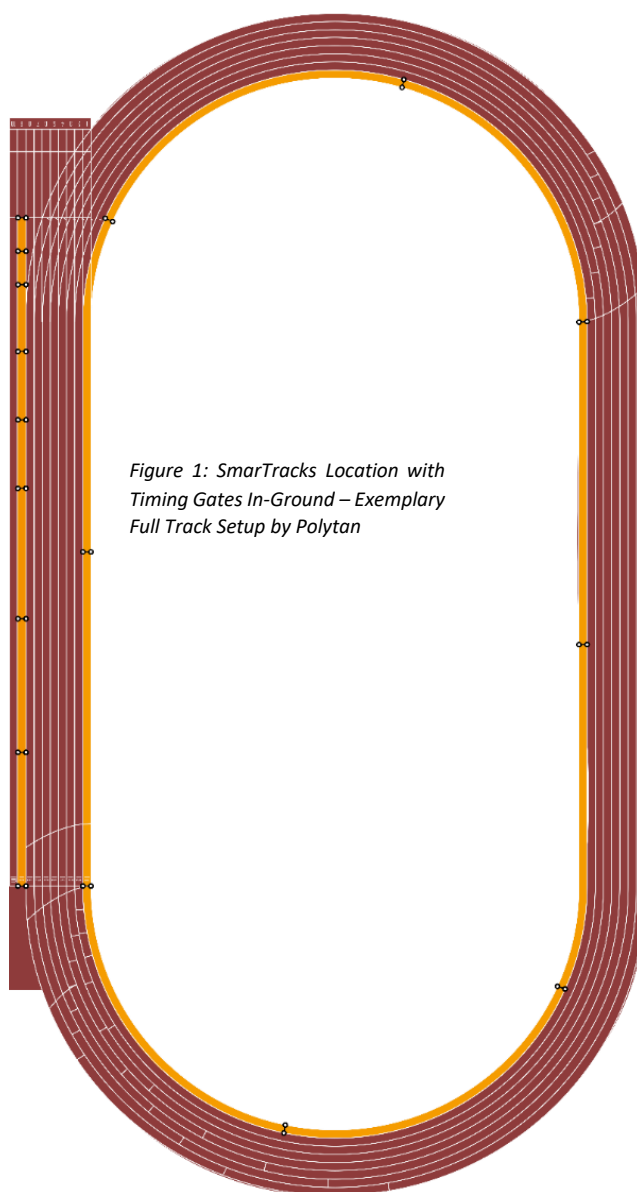


Figure 1: SmarTracks Location with Timing Gates In-Ground – Exemplary Full Track Setup by Polytan

In this example track, the Timing Gates In-Ground are placed in the following intervals:

Lane 9: 0m-5m-10m-20m-30m-40m-60m-80m-100m

Lane 1: 0m-50m-100m-150m-200m-250m-300m-350m-400m

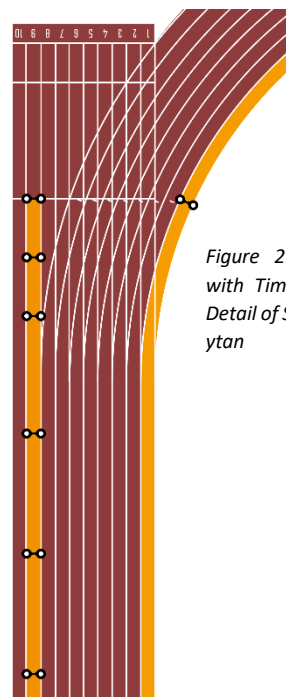
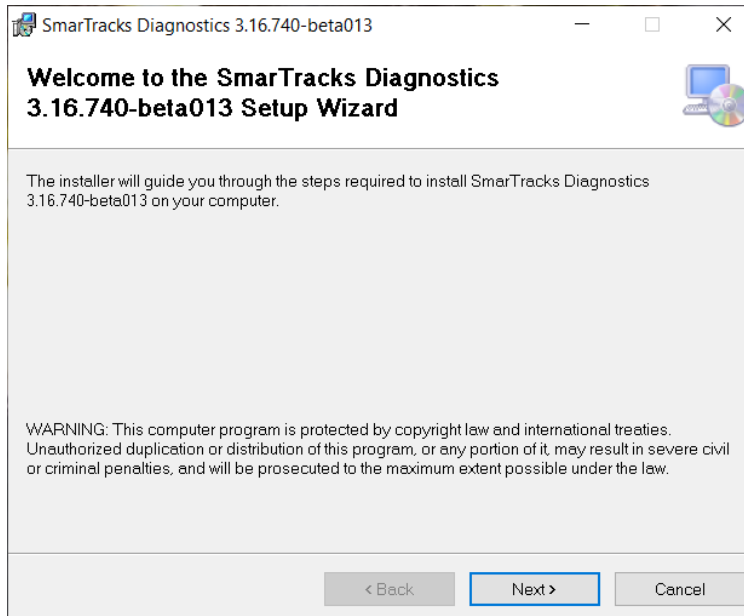


Figure 2: SmarTracks Location with Timing Gates In-Ground – Detail of Sprint Lane Setup by Polytan

5. Software Installation

5.1. How do I install the SmarTracks Diagnostics software?

The SmarTracks Diagnostics software is either supplied on a USB stick, or you will be given download details.



Installation instructions when the software is supplied on a USB stick:

STEP 1: Connect the supplied USB stick.

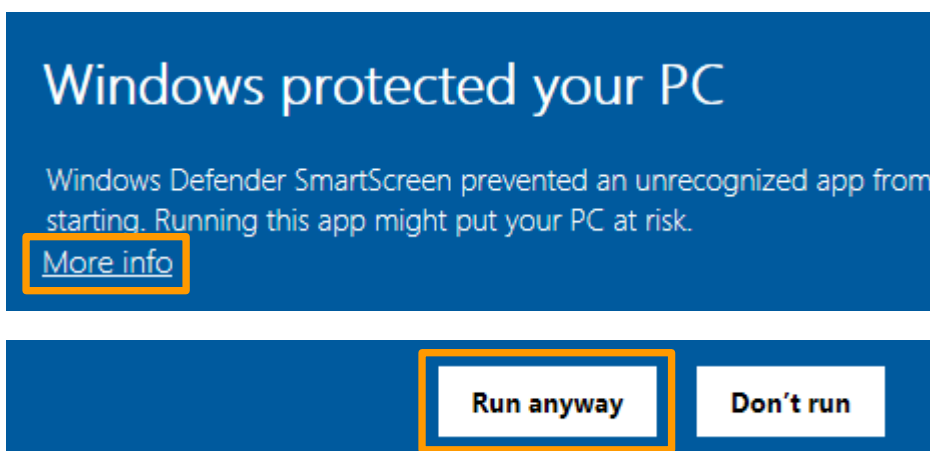
STEP 2: Open the "SetupSmarTracks.msi" file.

STEP 3: Select "Next" and follow the rest of the instructions.

Installation instructions when the software is downloaded:

STEP 1: Download the setup file.

STEP 2: Depending on your operating system, you can get a notification screen about running an unrecognized app. (Example shown with Windows 10, this may differ per operating system.)

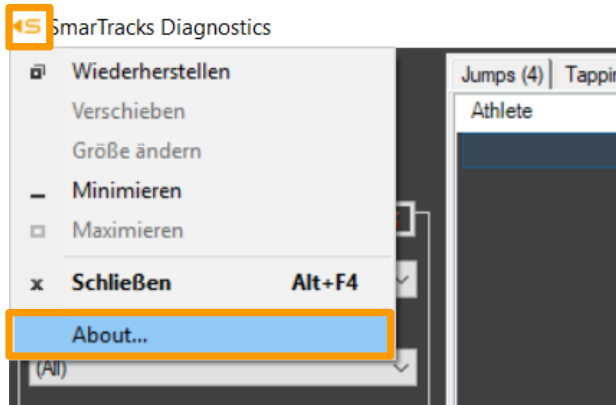


STEP 3: Click "More info".

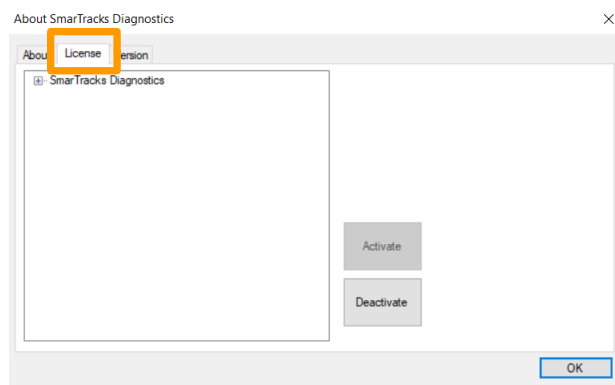
STEP 4: Click "Run anyway" and follow the rest of the instructions.

5.2. How do I activate my SmarTracks Diagnostics license?

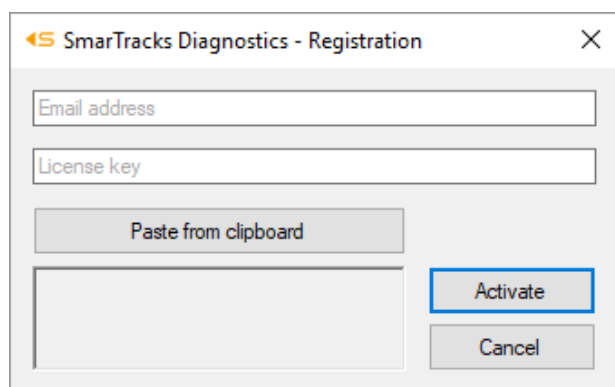
After installing SmarTracks Diagnostics, you need to register the product by activating your license.



STEP 1: Click on the logo in the upper left corner and choose "About...".



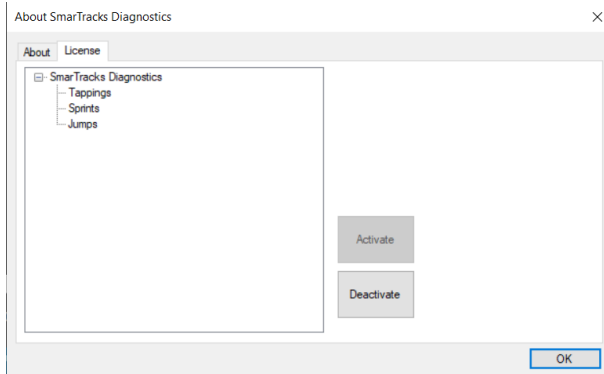
STEP 2: Go to the license tab and click "Activate"



STEP 3: Please enter your email address and the license key provided to you by Humotion.

STEP 4: Click "Activate".

5.3. How do I know what modules my license contains?

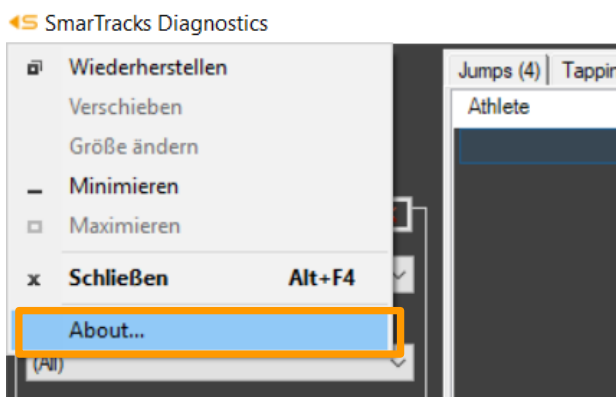


STEP 1: Click on the logo in the upper left corner and choose “About...”.

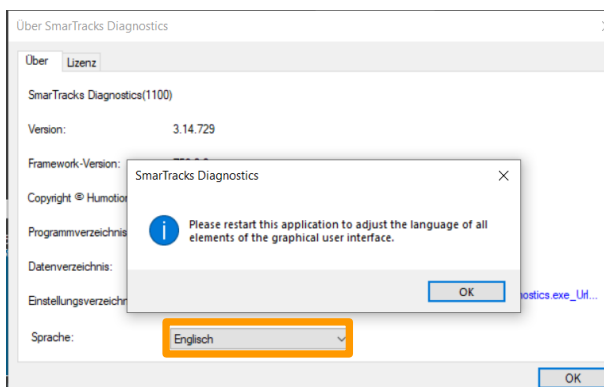
STEP 2: Go to the License tab and tap the unfold button (+) next to SmarTracks Diagnostics.

STEP 3: Your modules are now visible underneath SmarTracks Diagnostics.

5.4. How do I change the language settings?



STEP 1: Click on the logo in the upper left corner and choose “About...”.



STEP 2: Select the language in the drop-down menu and click “OK”.

The changes will take effect after you restart SmarTracks Diagnostics.

6. Performing a Measurement

6.1. How do I charge the sensor?

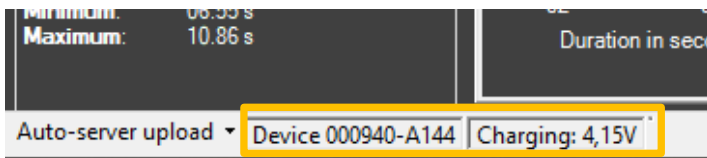
You can only start a measurement when the sensor has been loaded to at least 3,80V.



Figure 1: DX3.5 sensor + Clip + Attached USB cable

STEP 1: Start the SmarTracks Diagnostics software.

STEP 2: Connect the sensor to your PC using the USB cable.



STEP 3: The device, as well as the charge status of the battery, is displayed bottom left.

When the charge status reaches 4,20V, it is fully charged.

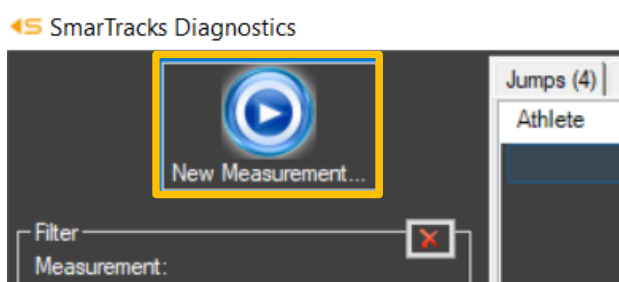
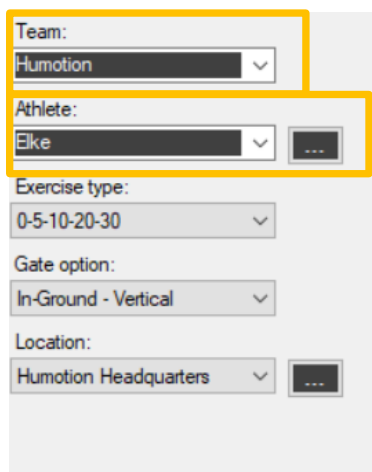
6.2. How do I enter an athlete's name?

STEP 1: Start the SmarTracks Diagnostics software.

STEP 2: Connect a sensor to your PC using the USB cable.

NOTE: It does not matter which sensor you connect to the PC, the names are saved centrally on the software.

STEP 3: Click on "New Measurement".

STEP 4: The window "Start New Measurement" opens. Here you can:

- Enter a team name (obligatory)
- Enter an athlete's name (obligatory)

You can enter one or several teams under "Team". The entries will be saved for future measurements.

You can add one or several athletes to a team by clicking on the small square box on the right under "Athlete". The entries will be saved for future measurements.

STEP 5:

- If you do not wish to perform a measurement immediately, press "Cancel". The entered team and athlete names are saved for future measurements.
- If you wish to perform a measurement immediately, see 6.3. How do I start a measurement?, STEP 4.

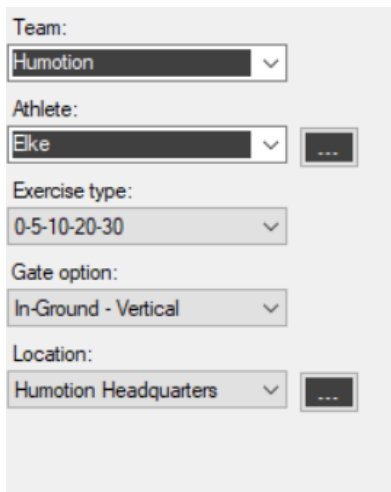
6.3. How do I start a measurement?

STEP 1: Start the SmarTracks Diagnostics software.

STEP 2: Connect the sensor-belt to your PC using the USB cable.



STEP 3: Click on the “New Measurement” button to start a measurement.

The image shows a 'Start New Measurement' dialog box with several fields and dropdown menus. The fields are: 'Team:' with a dropdown menu showing 'Humotion'; 'Athlete:' with a dropdown menu showing 'Elke' and a button with three dots; 'Exercise type:' with a dropdown menu showing '0-5-10-20-30'; 'Gate option:' with a dropdown menu showing 'In-Ground - Vertical'; and 'Location:' with a dropdown menu showing 'Humotion Headquarters' and a button with three dots.

STEP 4: The window “Start New Measurement” opens. Here you can:

- Enter/select a team name (obligatory)
- Enter/select the first athlete’s name (obligatory)
- Select the Exercise type (optional) (highly recommended if you only wish to perform runs of one type). For more information on the running type list, see 8.1. Sprint.
- Gate option (optional)
- Select the location (obligatory)

Gate option describes the options of timing gates: “Mobile”, “In-Ground – Vertical” or “In-Ground – Horizontal”.

Athlete:

Exercise type:

Gate option:

- Mobile
- Mobile
- In-Ground - Vertical
- In-Ground - Horizontal

- If you are using SmarTracks Diagnostics with mobile timing gates, select “Mobile”.
- If you are on a SmarTracks Location with Timing Gates In-Ground, select “In-Ground – Vertical”.
NOTE: If you are on one of the following locations, select “In-Ground – Horizontal”:
 - Kleve (Germany), Allround Sports Kleve
 - Dortmund (Germany), Helmut-Körnig-Halle, only for the round lanes
 - Münster (Germany), Leichtathletikhalle, only for the round lanes

Location describes your position in the global earth magnetic field. It is necessary for correct magnetic gate detection.

Gate option:

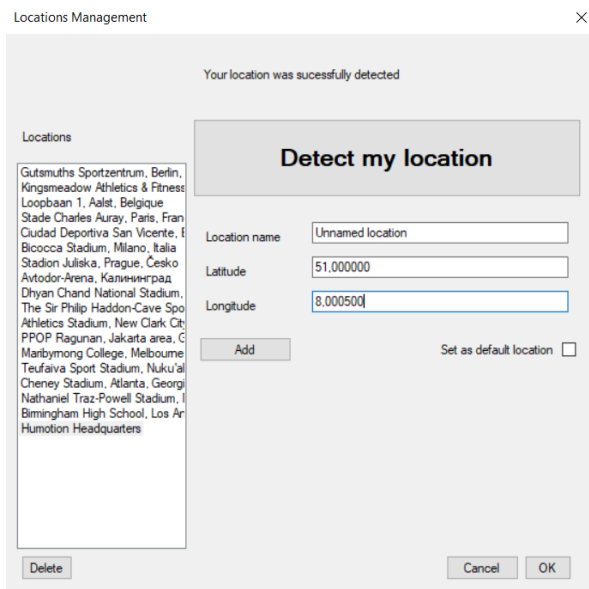
In-Ground - Vertical

Location:

Humotion Headquarters

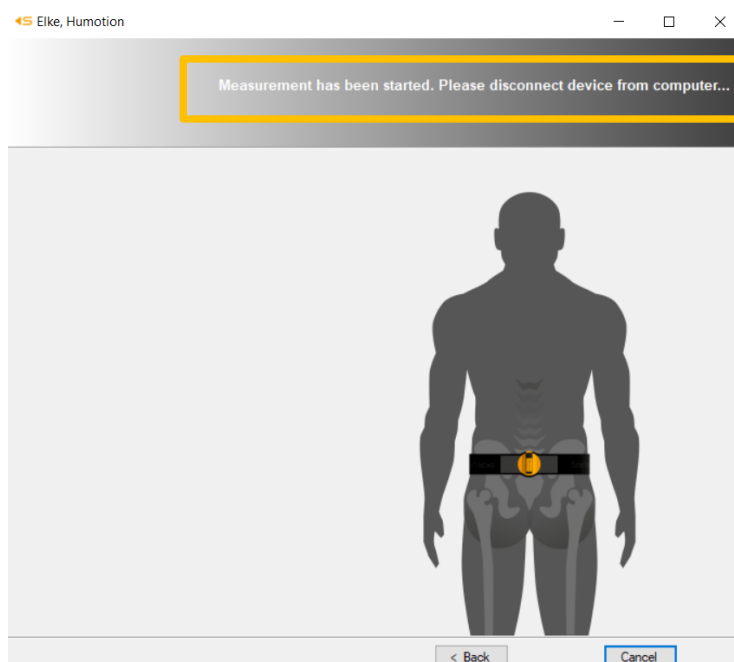
To detect your location:

- Click the small square box on the right under “Location”.



- Click “Detect my location” in the Locations Management screen.
Make sure the location detection on your laptop is enabled.
- Enter the desired Location name and click “Add”.
- Click “OK”.

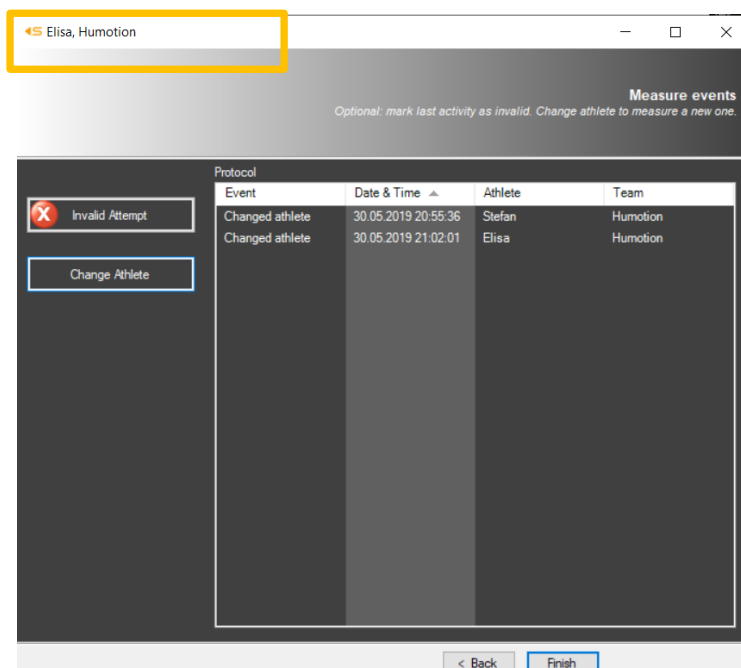
STEP 5: When everything is set, click “Next”.



STEP 6: Remove the sensor from the PC.

The sensor is now activated.

Do not press “Cancel”.



STEP 7: A measurement window is opened.

The window carries the name of the athlete and team that is currently in action.

Here you can record measure events, such as a change of athlete or a deletion of an incorrectly performed test.

The first measure event is always "Changed Athlete", which shows the time when the first athlete put on the sensor-belt.

Do not press "Finish".

STEP 8: The athlete can now put on the sensor-belt.

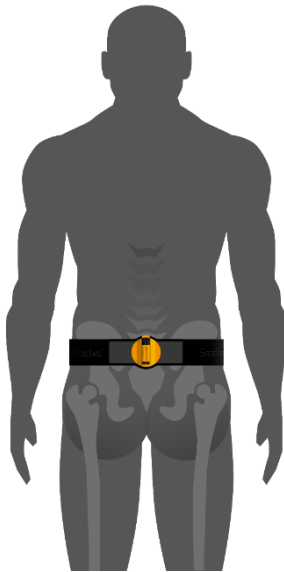
6.4. How do I know the sensor is measuring?

During a measurement, the sensor shows a **red blinking light**.

The measurement is started from the moment the sensor is disconnected from the computer.

To stop the measurement, connect the sensor to the computer using the USB cable.

6.5. How do I put on the sensor-belt?



When putting on the sensor-belt, make sure the black USB cap points upwards, and the sensor is aligned with the spine.

The sensor-belt should cross the L4/L5 vertebrae.

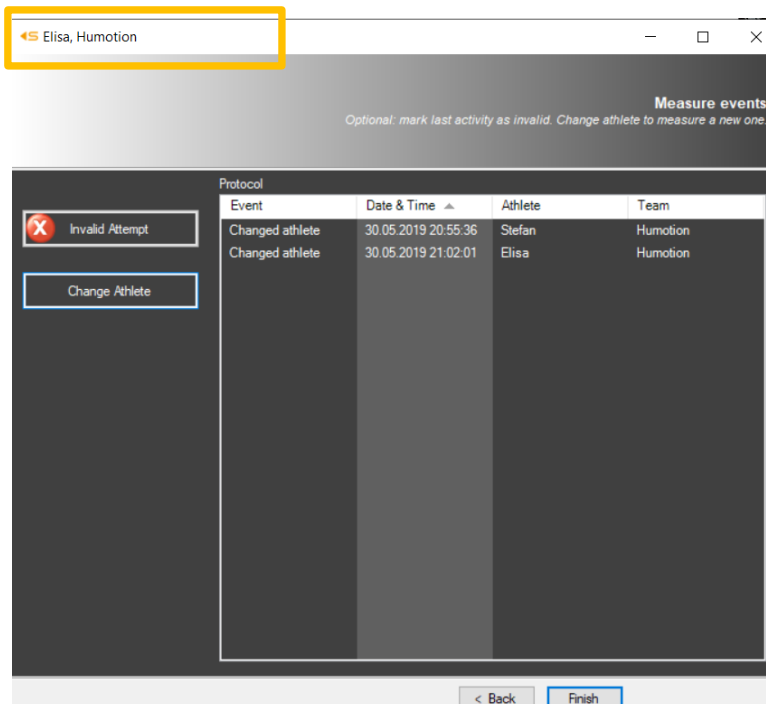


IMPORTANT: Do not hold the sensor-belt closer than 10cm to the MCD's, since this might damage the sensor irreparably.

The athlete can now start performing the assessments.

6.6. How do I start multiple measurements simultaneously?

To perform two or more measurements simultaneously, carry out the instructions under 6.3. How do I start a measurement? successively with each sensor.



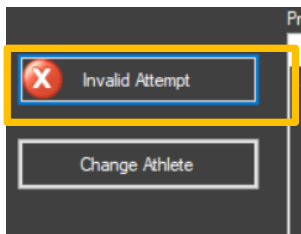
NOTE: Each sensor has its own measurement window. The window carries the name of the athlete and team last entered.

6.7. Can I do multiple assessments while measuring?

The athlete can do several assessment (e.g. first agility, then tappings, then sprints), while wearing the sensor. You do not need to start a new measurement or reconnect the sensor in-between. The athlete can just perform all assessments consecutively.

After the measurement data is uploaded, the software automatically recognizes the different assessments.

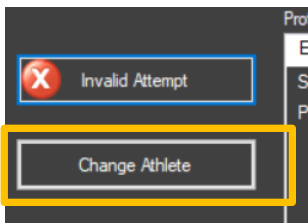
6.8. How do I remove an incorrectly performed test during measurement?



We recommend to always evaluate the correct execution of the test that has been performed.

If a test was performed incorrectly, click on “Invalid Attempt” after the test and it will not show up in the test results. The athlete can then perform a new test.

6.9. How do I change athlete during a measurement?



STEP 1: Click the “Change Athlete” button.

STEP 2: Select the next athlete.

- If you registered the athlete before/ during starting the measurement, select the athlete from the drop-down menu.
- If you did not register the athlete before/ during starting the measurement, enter the athlete's name in the box manually. The athlete's name will not be saved for later measurements.

STEP 3: Hand over the sensor-belt to the next athlete.

6.10. How do I stop a measurement?

Reconnect the sensor to the PC using the USB-cable. The sensor now stops measuring and all measurement data is analyzed.

7. Data Analysis

7.1. How do I upload the measurement data?

STEP 1: After completing the tests, reconnect the sensor to your PC via the USB cable.

STEP 2: The data is analyzed automatically. The test results are displayed in the software.

7.2. Where can I see the test results?

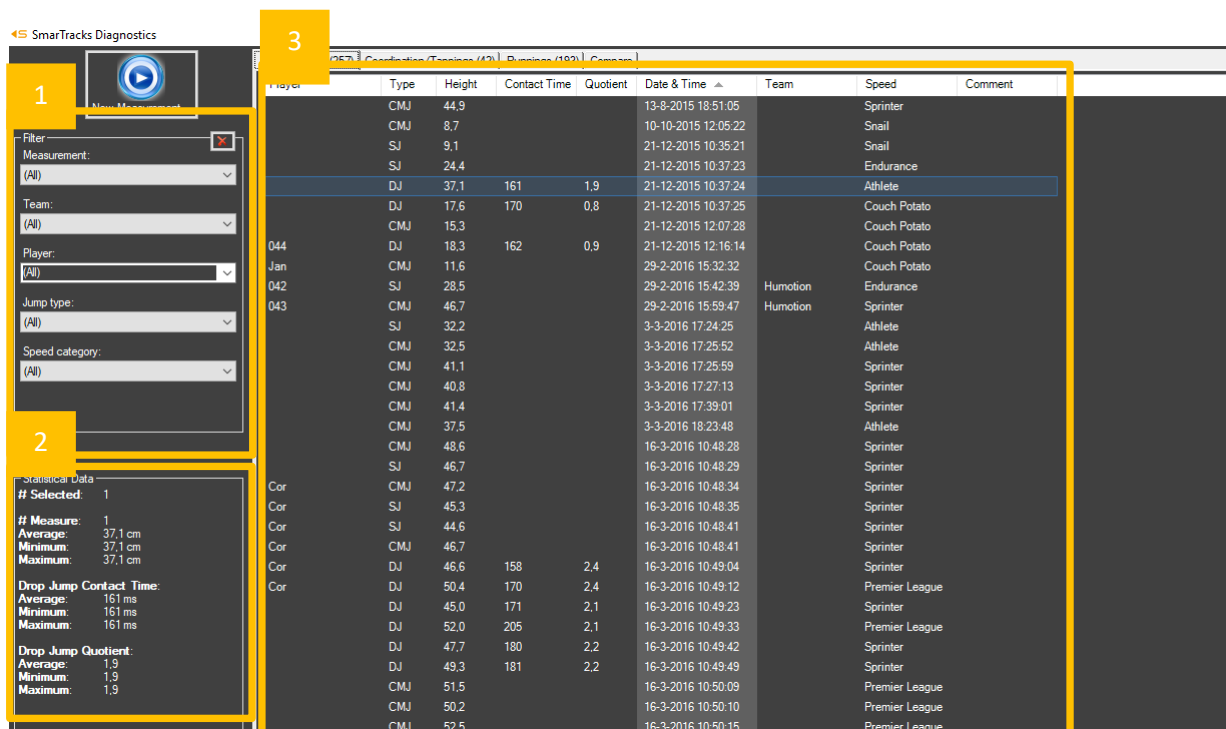
After the measurement data has been analyzed, the test results are automatically sorted over three tabs:

Jumps	Tappings	Runs
Squat Jump (SJ)	Tappings	Speed
Drop Jump (DJ)		Endurance
Countermovement Jump (CMJ)		Agility

7.2.1. Jumps

Under the “Jumps” tab, you can find the test results for:

- Squat Jump
- Drop Jump
- Countermovement Jump



Player	Type	Height	Contact Time	Quotient	Date & Time	Team	Speed	Comment
	CMJ	44.9			13-8-2015 18:51:05		Sprinter	
	CMJ	8.7			10-10-2015 12:05:22		Snail	
	SJ	9.1			21-12-2015 10:35:21		Snail	
	SJ	24.4			21-12-2015 10:37:23		Endurance	
	DJ	37.1	161	1.9	21-12-2015 10:37:24		Athlete	
	DJ	17.6	170	0.8	21-12-2015 10:37:25		Couch Potato	
	CMJ	15.3			21-12-2015 12:07:28		Couch Potato	
044	DJ	18.3	162	0.9	21-12-2015 12:16:14		Couch Potato	
Jan	CMJ	11.6			29-2-2016 15:32:32		Couch Potato	
042	SJ	28.5			29-2-2016 15:42:39	Humotion	Endurance	
043	CMJ	46.7			29-2-2016 15:59:47	Humotion	Sprinter	
	SJ	32.2			3-3-2016 17:24:25		Athlete	
	CMJ	32.5			3-3-2016 17:25:52		Athlete	
	CMJ	41.1			3-3-2016 17:25:59		Sprinter	
	CMJ	40.8			3-3-2016 17:27:13		Sprinter	
	CMJ	41.4			3-3-2016 17:39:01		Sprinter	
	CMJ	37.5			3-3-2016 18:23:48		Athlete	
	CMJ	48.6			16-3-2016 10:48:28		Sprinter	
	SJ	46.7			16-3-2016 10:48:29		Sprinter	
Cor	CMJ	47.2			16-3-2016 10:48:34		Sprinter	
Cor	SJ	45.3			16-3-2016 10:48:35		Sprinter	
Cor	SJ	44.6			16-3-2016 10:48:41		Sprinter	
Cor	CMJ	46.7			16-3-2016 10:48:41		Sprinter	
Cor	DJ	46.6	158	2.4	16-3-2016 10:49:04		Sprinter	
Cor	DJ	50.4	170	2.4	16-3-2016 10:49:12		Premier League	
	DJ	45.0	171	2.1	16-3-2016 10:49:23		Sprinter	
	DJ	52.0	205	2.1	16-3-2016 10:49:33		Premier League	
	DJ	47.7	180	2.2	16-3-2016 10:49:42		Sprinter	
	DJ	49.3	181	2.2	16-3-2016 10:49:49		Sprinter	
	CMJ	51.5			16-3-2016 10:50:09		Premier League	
	CMJ	50.2			16-3-2016 10:50:10		Premier League	
	CMJ	52.5			16-3-2016 10:50:15		Premier League	

1 In the **Filter menu**, you can filter the test results you wish to view.

2 **Statistical data** of the selected athlete(s):

- For the Squat Jump (SJ) and Countermovement Jump (CMJ) you see the
 - average, minimum and maximum jump height.
- For the Drop Jump (DJ) you see the
 - average, minimum and maximum jump height
 - ground contact time (“Drop Jump Contact Time”)
 - reactive strength index (“RSI”).

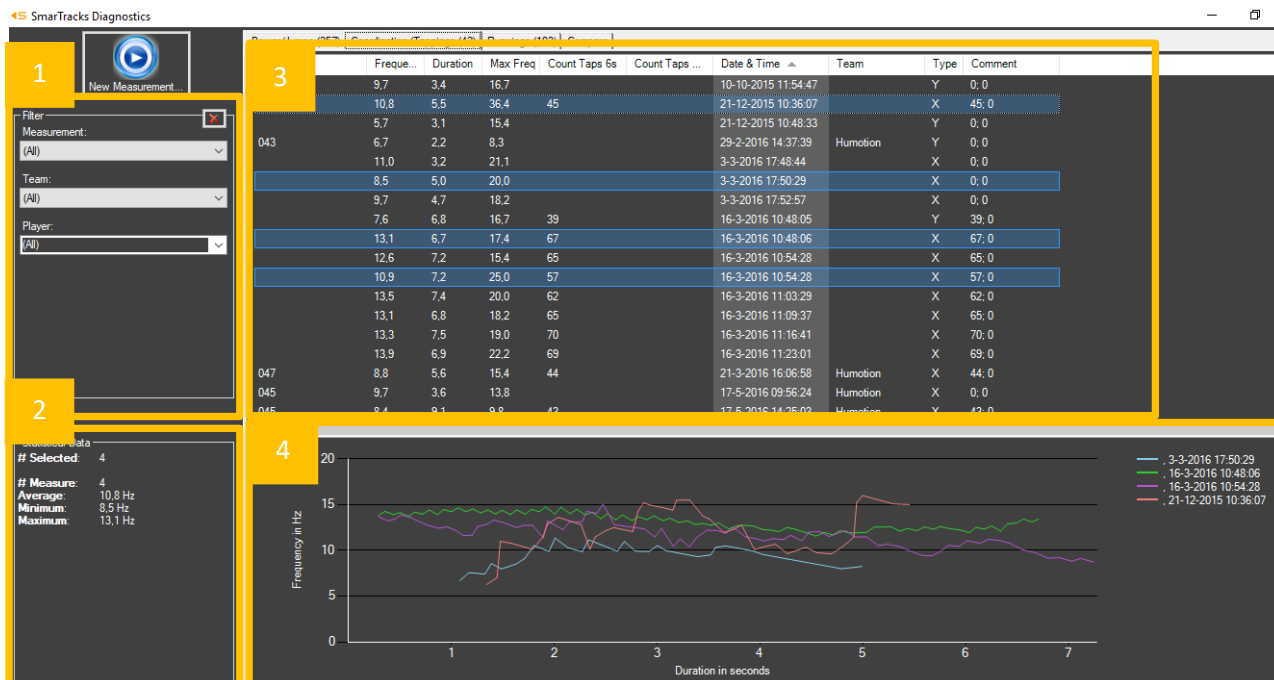
3

In the **Results table**, the following results are shown:

Type	Squat Jump (SJ), Drop Jump (DJ), or Countermovement Jump (CMJ).
Height	Jump height [cm]
Contact time (only for DJ)	Ground contact time [ms] If the contact time exceeds 250ms, the contact time will be displayed in orange.
RSI (only for DJ)	Reactive strength index (Jump height [cm]/ Ground contact time [s])
Speed	Categorizes the test result according to: Height>70: Ski jumper height>60: Champions league height>50: Premier league height>40: Sprinter height>30: Athlete height>20: Endurance height>10: Couch potato height>1: Snail Contact time > 250ms: No reactive force

7.2.2. Tappings

In the “Tappings” tab, you can find the test results for tappings.



1 In the **Filter menu**, you can filter the test results you wish to view.

2 The **Statistical data** shows you the average, minimum and maximum tap frequency of the selected athlete(s).

3

In the **Results table**, the following results are shown:

Frequency	Average number of contacts with the ground per second [Hz]
Duration	Duration of tapping test
Max frequency	Maximum number of contacts with the ground per second [Hz]
Count taps 6s	Shows the number of taps in the first 6 seconds if duration was 6 seconds or more.
Count taps 15s	Shows the number of taps in the first 15 seconds if duration was 15 seconds or more.
Type	X or Y

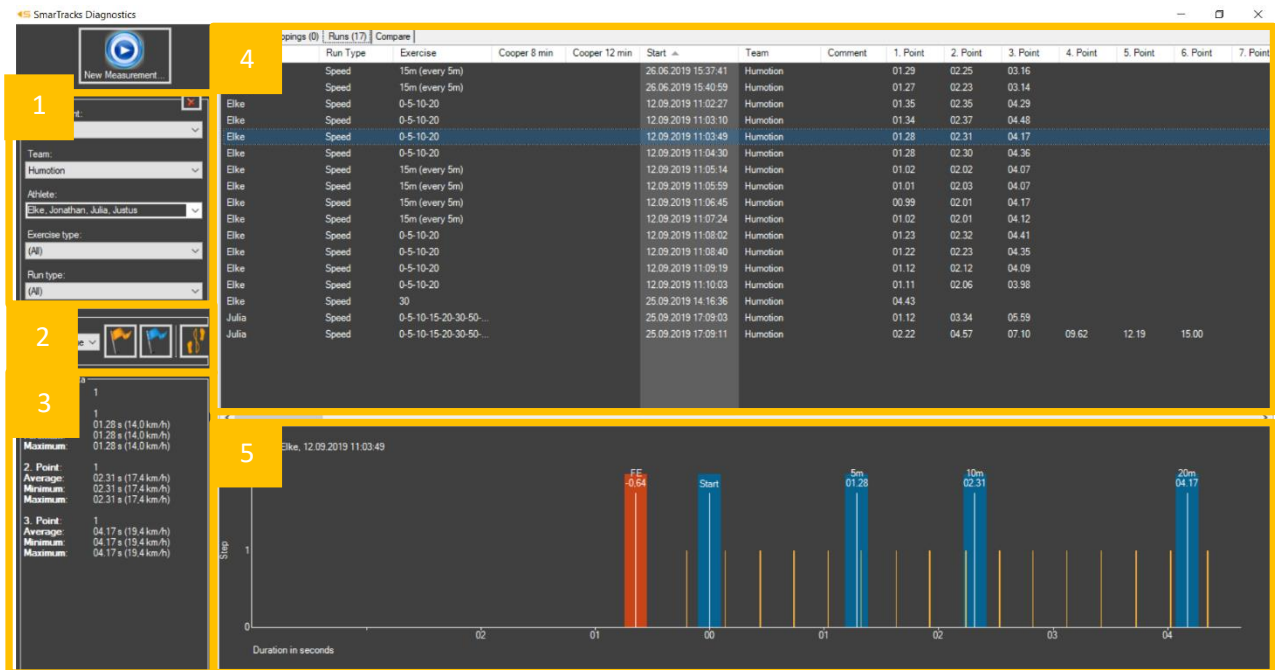
4

The **Chart** shows the selected athlete's tap frequency (Hz) for the duration of the test.

When you click on the chart, the chart shows each individual ground contact for the duration of the test.

7.2.3. Runs

In the “Runs” tab, you can find the test results for speed, endurance and agility tests.



1 In the **Filter menu**, you can filter the test results you wish to view.

2 The **Export menu** allows you to export test results. For more information on exporting test results, see 7.6 How do I export tests results?

3 The **Statistical data** shows you the following data of selected athlete(s):

- the average, minimum and maximum running time at each point [s]
- the speed at each point [km/h].

4

In the **Results table**, the following results are shown:

Cooper 8 min	If the running time was 8 minutes or more, a Cooper value is shown here.
Cooper 12 min	If the running time was 12 minutes or more, a Cooper value is shown here.
1./2./3./... Point	<p>Time when each respective point was reached [s]</p> <p>Each point represents:</p> <ul style="list-style-type: none"> ▪ When no running type exercise has been selected: a timing gate ▪ When a running type exercise has been selected: a measurement point of the running type exercise

5

The **Chart** shows the selected athlete's steps for the duration of the test. It shows

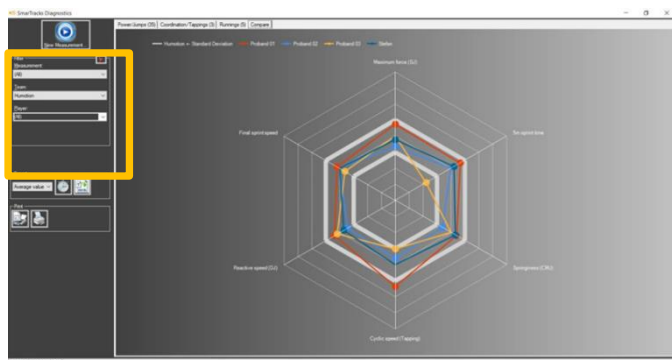
- at what point in time the Force Explosion took place (orange column)
- at what point in time a step was made (orange stripe)
- at what point in time a timing gate was passed (blue column).

NOTE: If multiple athletes are selected, it only shows the chart of the athlete that was selected first.

7.2.4. Comparing via the spider diagram

Under the “Compare” tab, you can see a spider diagram. This diagram allows you to compare the following results of different athletes:

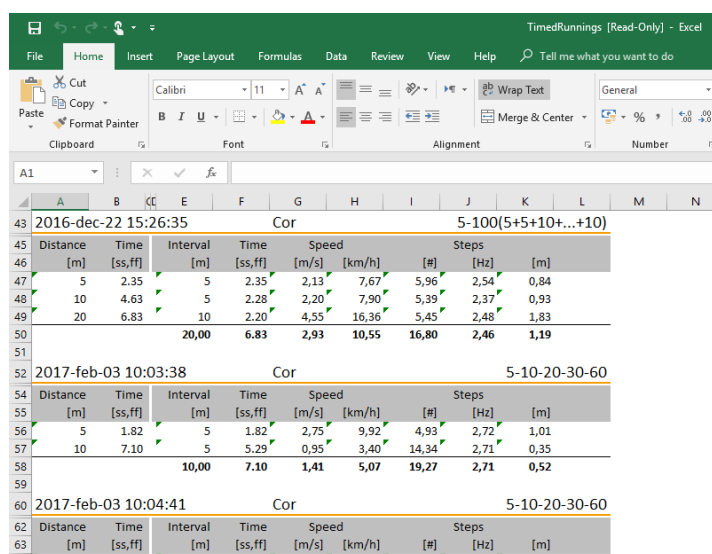
- Maximum force (SJ)
- 5m sprint time
- Springiness (CMJ)
- Cyclic speed (Tapping)
- Reactive Strength Index (DJ)
- Final sprint speed



STEP 1: Select the athletes you wish to compare via the Filter menu.

STEP 2: The results for the selected athletes are shown in the spider diagram.

7.2.5. Comparing via Excel files



Distance [m]	Time [ss,ff]	Interval [m]	Time [ss,ff]	Speed [m/s]	[km/h]	[#]	Steps [Hz]	[m]
2016-dec-22 15:26:35 Cor 5-100(5+5+10+...+10)								
5	2.35	5	2.35	2.13	7.67	5.96	2.54	0.84
10	4.63	5	2.28	2.20	7.90	5.39	2.37	0.93
20	6.83	10	2.20	4.55	16.36	5.45	2.48	1.83
20,00 6.83 2.93 10,55 16,80 2,46 1,19								
2017-feb-03 10:03:38 Cor 5-10-20-30-60								
5	1.82	5	1.82	2.75	9.92	4.93	2.72	1.01
10	7.10	5	5.29	0.95	3.40	14.34	2.71	0.35
10,00 7.10 1,41 5,07 19,27 2,71 0,52								
2017-feb-03 10:04:41 Cor 5-10-20-30-60								
5	1.82	5	1.82	2.75	9.92	4.93	2.72	1.01
10	7.10	5	5.29	0.95	3.40	14.34	2.71	0.35
10,00 7.10 1,41 5,07 19,27 2,71 0,52								

With the export function, you can create Excel files to compare:

- Speed, Endurance, Agility
- Jumps, Tappings, Sprints

For more information on creating Excel files, see 7.5. How do I export test results?

7.3. How do I filter or select test results?

7.3.1. Filtering results

In the upper right corner, there is a **Filter menu**, which allows you to filter results according to:

- **Measurement:** You can select “All” to view the results of all measurements made, or you can select one specific measurement.
- **Team:** You can select one or all teams.
- **Athlete:** You can select all, one or more athletes.

In the “Jumps” tab, you have additional filters in the Filter menu for:

- **Jump type**
- **Speed category**

In the “Runs tab”, you have additional filters in the Filter menu for:

- **Exercise type**
- **Run type**

To clear all filters, click the red cross button in the top right corner of the filter menu.

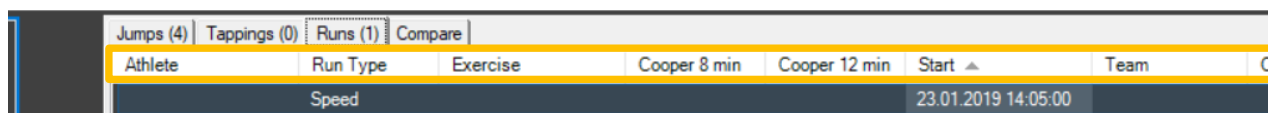
7.3.2. Selecting specific test results

- To select a **specific test result**, click on the test result.
- To select **multiple test results** simultaneously, hold the CTRL key and click the test results you wish to select.
- To view **all test results**, right-click on any test results line, and click “Select all”.

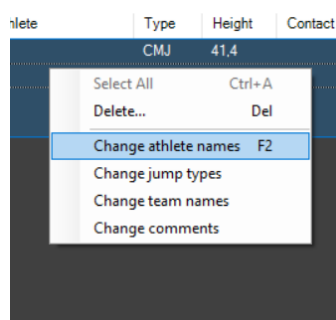
The Statistical Data menu in the lower left corner shows you how many test results you have selected.

7.3.3. Sorting test results

To sort the test results, click on the table tab according to which you wish to sort the test results.



7.4. How do I edit test results?



STEP 1: Right-click on the test result line you wish to edit.

STEP 2: Choose the item you wish to change from the drop-down menu.

7.4.1. Entering/changing the jump type

Type	Height
SJ	28,5
CMJ	46,7
SJ	34,4
DJ	38,6
-	46,8
CMJ	48,0
DJ	54,1
SJ	47,6
CMJ	45,7
CMJ	45,1
SJ	47,0

STEP 1: Go to the "Jumps" tab.

STEP 2: Double-click on the field you wish to change under Type.

STEP 3: Choose the jump type from the drop-down menu.

7.4.2. Entering/changing the run type

type	Exercise	Cooper 8 min
	100m (5+5+10+...+...)	
	100m (5+5+10+...+...)	
ance	50-10000m (every 5m)	
ance	5-20	
	5-30	
	5-15m (every 5m)	
	5-10-20	
	5-10-30	
	5-10-20-30	
	5-30m (every 5m)	
	5-10-15-20-30-40-50-60	
	5-10-20-60-100	
	5-10-15-20-30-50-75-100	
	5-10-20-30-60-90-100-110	
	10-110m (every 10m)	
	50-10000m (every 50m)	

STEP 1: Go to the “Runs” tab.

STEP 2: Double-click on the field you wish to change under Exercise.

STEP 3: Choose the exercise type from the drop-down menu.

NOTE: If you cannot find the run interval you need, see 8.1.1. Selecting the sprint interval.

NOTE: You cannot manually enter the Cooper Test. The software automatically recognizes each run that lasts for at least 8 or 12 minutes as a Cooper test and displays the Cooper value accordingly.

7.4.3. Changing an athlete’s name or a team name after measurement

045	CMJ	34,1
045	CMJ	47,6
045	CMJ	45,7
045	CMJ	45,1
045	SJ	47,0
042	CMJ	46,1
043	CMJ	46,6
044	CMJ	45,0
045	CMJ	45,0
047	CMJ	43,3
080	CMJ	41,8
106	CMJ	39,7
107	CMJ	30,9
108	CMJ	36,1
109	SJ	30,9
110	CMJ	36,1
111	CMJ	36,1

STEP 1: Double-click on the name you wish to change.

STEP 2:

- Option 1: Select a name from the drop-down menu. (recommended)
- Option 2: Type a name in the empty field and press ENTER.

NOTE: With option 2, the name will not be saved for future measurements.

7.4.4. Annotating test results

Date & Time ▲	Team	Speed	Comment
14.06.2017 15:53:03	Humotion	Athlete	
14.06.2017 15:53:14	Humotion	Athlete	
14.06.2017 15:53:22	Humotion	Endurance	

The comment section in each test result line allows you to make notes for specific test results.

STEP 1: Go to the test result for which you want to make notes.

STEP 2: Double-click on the field under Comment.

STEP 3: Enter any notes or comments you may have.

NOTE: You can sort test results according to comments.

7.4.5. Deleting test results

To delete test results in the SmarTracks Diagnostics software:

STEP 1: Right-click on the test result line you wish to delete.

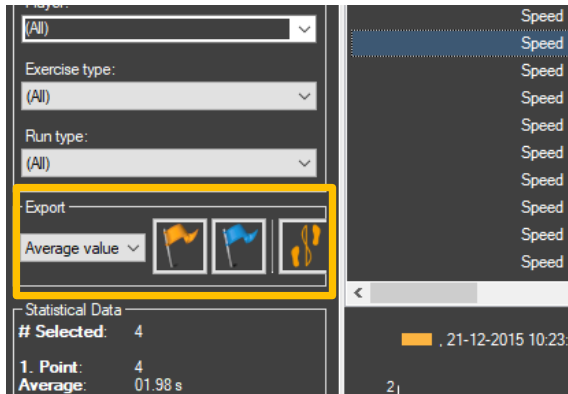
STEP 2: Click “Delete...”.

7.5. How do I export test results?

You can export test results from the SmarTracks Diagnostics software for personal storage, presentation or distribution.

You can only export test results via the “Runs” tab or the “Compare” tab.

7.5.1. Exporting speed, endurance or agility test results



STEP 1: Go to the “Runs” tab.

STEP 2: Filter the test results you wish to export using the Filter menu.

STEP 3: Go to the Export menu in the left column. Here you can select which data you wish to export.

The drop-down menu shows three options:

- All values: Export all values per athlete.
- Average values: Export only the average time per athlete.
- Best values: Export only the best time per athlete.

STEP 4: Click one of the export buttons. There are three export buttons:



Export absolute time values of selected runs.



Export relative time values of selected runs.



Export absolute time values of selected runs.

The test results are exported to an Excel file.

STEP 5: Save the exported test results in the desired format, e.g. Excel, HTML, etc.

7.5.2. Exporting jumps, tappings and sprints test results

File

Home

Insert

Page Layout

Formulas

Data

Review

View

Help

Tell me what you want to do

Clipboard

Cut

Copy

Format Painter

Font

Calibri

10

B

I

U

Alignment

Wrap Text

Merge & Center

Number

General

%

Conditional Formatting

Normal

Bad

Good

Neutral

Insert

Delete

A1

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
4	Surname	First Name	Start	End	Linear Sprint				Tapping			Squat Jump		CM Jump		Drop Jump					
						1. Point [sec]	2. Point [sec]	3. Point [sec]	4. Point [sec]		Average [Hz]	Maximum [Hz]	Duration [sec]		Height [cm]		Height [cm]		Height [cm]	Contact time [ms]	(Flight time)² / Contact time
5	1	Sensor	25.09.2019 14:49	25.09.2019 14:50		4.72					10.4	11.8	6.1								
6	10	Sensor	25.09.2019 14:54	25.09.2019 14:55		4.11					10.1	11.3	7.1				42.6				
7	2	Sensor	25.09.2019 14:49	25.09.2019 14:50		5.15					10.2	11.5	6.5				30.1				
8	3	Sensor	25.09.2019 14:49	25.09.2019 14:50		4.77					9.7	10.5	6.2				33.1				
9	4	Sensor	25.09.2019 14:49	25.09.2019 14:50		4.8					11.7	12.9	6.4				26.2				
10	5	Sensor	25.09.2019 14:49	25.09.2019 14:50		5.04					10.8	11.5	6.6				26.2				
11	6	Sensor	25.09.2019 14:54	25.09.2019 14:57		4.26					10.2	12.1	7.2				46.3				
12	7	Sensor	25.09.2019 14:53	25.09.2019 14:55		4.25					12.2	13.8	6.6				35				
13	8	Sensor	25.09.2019 14:54	25.09.2019 14:55		4.34					10.3	12.5	7.3				34.4				
14	9	Sensor	25.09.2019 14:53	25.09.2019 14:55		4.35					9.8	12	6.8				27.5				
16																					
17	Team Statistics																				
18	Average					4.58					10.6	12	6.7				33.5				
19	Standard Deviation					0.34					0.8	0.9	0.4				6.7				
20	Best					4.11					12.2	13.8	7.3				46.3				
21	Worst					5.15					9.7	10.5	6.1				26.2				
22	Range					1.04					2.5	3.3									

STEP 2: Filter the test results you wish to export using the Filter menu.

STEP 3: Select which data you wish to export in the Export menu.

The drop-down menu shows three options:

- All values: Export all values per athlete.
- Average values: Export only the average time per athlete.
- Best values: Export only the best time per athlete.

STEP 4: Click one of the export buttons. There are two export buttons:



Export key attributes of a measurement.



Export all attributes of a measurement.

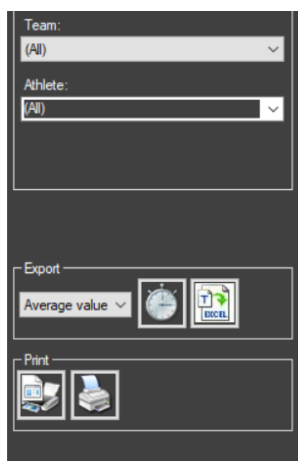
The test results are exported to an Excel file.

The exports are designed to compile the data reflected in the spider diagram. We recommend to only use it with the assessments of the diagram's predefined test battery. This includes:

- Linear sprinting of at least 5m
- Tapping test of at least 6 seconds
- At least one jumps type

STEP 5: Save the exported test results in the desired format, e.g. Excel, HTML, etc.

7.5.3. Printing the spider diagram



STEP 1: Go to the "Compare" tab

STEP 2: Filter the test results you wish to export using the Filter menu.

STEP 3: Go to the Print menu in the left column.

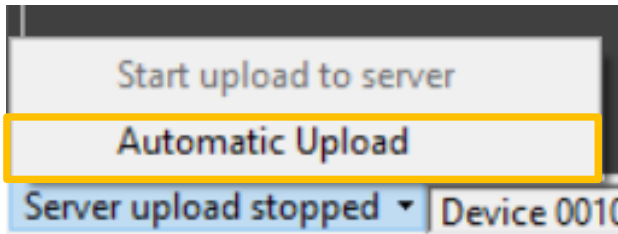


You can preview the document by clicking on the "Print preview" button.



You can directly print the document by clicking on the "Print chart" button.

- 7.6. How do I enable the automatic upload of measurement data to Humotion servers?



To enable the automatic upload of measurement data to Humotion servers, click on the “Automatic upload” button.

8. Assessments

8.1. Speed

You can measure any running distance, depending on where the Timing Gates are placed.

If you are running on a SmarTracks Location with integrated timing gates, you can start at any gate.

If you are using Timing Gates Mobile, we recommend starting at the 100m finish line or any other fixed point on your track. From there, place the mobile gates at the desired intervals.

Before and after each run the athlete should stand still for at least 1 second.

Test results

The test results are shown under the “Runs” tab.

8.1.1. Selecting the sprint interval

If you did not select a sprint interval for the measurement, the software will assign appropriate intervals automatically when analyzing the data. If desired, the intervals can always be changed manually.

- If you are using Timing Gates In-Ground, the gate pattern depends on your SmarTracks location. If you are unsure about the gate pattern of your location, you can check it in the free SmarTracks Athlete app under “Track Details” or on www.smartracks.run/locations.
- If you are using Timing Gates Mobile, please strictly adhere to the given intervals. For example, if you set the interval to 20m (every 5m), then you have to place Timing Gates at 0m, 5m, 10m, 15m, and 20m.

The intervals in our list are read as follows:

Interval list type 1: 0-5-20; 0-5-10-20; 0-5-10-20-60-100

This is a simple list of the respective intervals, which are always separated by a minus.

For example:

- 0-5-20: There is a timing gate at 0m, 5m and 20m.
- 0-5-10-20: There is a timing gate at 0m, 5m, 10m and 20m.
- 0-5-10-20-60-100: There is a timing gate at 0m, 5m, 10m, 20m, 60m and 100m.

Interval list type 2: 0-5-30m (every 5m); 0-10-110m (every 10m); 0-10000m (every 50m); 0-10000m (every 100m)

To avoid long lists of intervals, we summarize the intervals if the distance between stays equal, e.g. every 10m. In this case, only the first and last measurement point are mentioned with the consistent distance between each point following in brackets.

For example:

- 0-5-30m (every 5m): There is a timing gate 0m, 5m, 10m, 15m, 20m, 25m and 30m.
- 0-10000m (every 50m); There is a timing gate 0m, 50m, 100m, 150m, 200m, etc.
- 0-10000m (every 100m): There is a timing gate at 0m, 100m, 200m, 300m, etc.

Interval list type 3: 0-5-100m (5+5+10+...+10); 0-10-110m (10+5+5+10+...+10)

This kind of list is used if you have irregular gate patterns. You can see in the example that a few gates are just 5m apart instead of 10m. The irregular gates will be listed with individual distance of the interval and will be divided by '+'. The regular gates will be summarized by '...'.

For example:

- 0-5-100m (5+5+10+...+10): There is a timing gate at 0m, 5m, 10m, 20m, 30m, 40m, 50m, 60m, 70m, 80m, 90m, and 100m.

- If your desired interval is not listed in the Diagnostics software, you can manually add the interval to the list:

STEP 1: Close the SmarTracks Diagnostics software

STEP 2: Go to "...\\Documents\\SmarTracks Diagnostics\\Data\\"

STEP 3: Open the text-file "SprintIntervals.txt"

STEP 4: Manually add your desired sprint interval

```
30
FE-5-10-20-40
FE-10-100(10)
FE-5-100(5+5+10+...+10)
```

STEP 5: Re-open the SmarTracks Diagnostics software

STEP 6: The added interval should be visible in the drop-down list

8.1.2. Selecting the start point of the measurement

You can choose to have your start point (0 meters and 0 seconds) for the measurement:

- at moment the athlete takes off (so-called Force Explosion (FE)); or
- at the first timing gate

"Force Explosion" (FE) allows you to start the measurement from the moment the athlete takes off. Instead of the first detected timing gate, the sharply increasing kinetic energy is used as trigger for a measurement.

Different standard values and scientific publications often use the 1m distance to the start, while some measurements are made directly at the start of the run. With our system, you can choose which start parameter you want, depending on the desired data.

1. When **you want the start point to be at the moment the athlete takes off:**

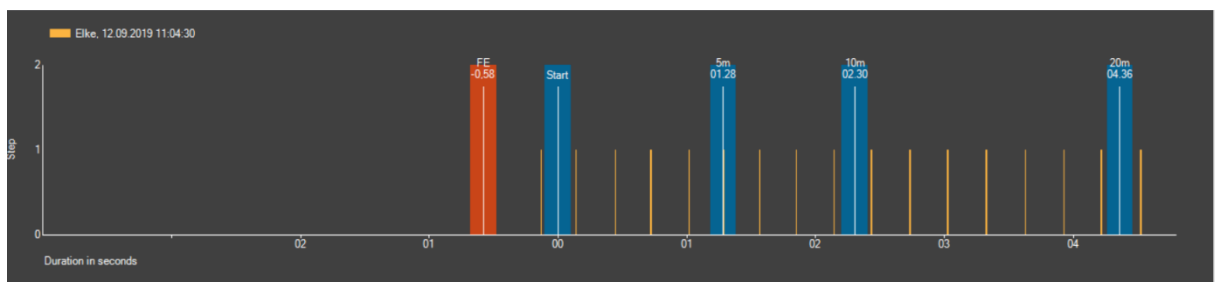
- Select an interval with FE as the start point (instead of 0), followed by the timing gates at their respective distances
 - Example: FE-5-10-20
FE-5-30m (every 5m)
FE-5-100m (5+5+10+...+10)

NOTE: If your start point is at a point with Timing Gates, then enter FE(0) as the start point

- Example: FE(0)-5-10-20
FE(0)-5-30m (every 5m)
FE(0)-5-100m (5+5+10+...+10)
- The zero point of time and distance measurement is the point where the athlete starts the run

2. When you want the measurement to start at the first Timing Gate:

- Select an interval **without** an “FE”-prefix, where all entries represent a timing gate with their respective distances
 - Example: 0-5-10-20
- The athlete starts at least 1m before a timing gate. (Starting closer than 1m to the timing Gate would possibly prevent the sensor from detecting the timing gate.)
- The zero point of time and distance measurement is the first timing gate.



8.2. Endurance

Cooper test

The Cooper Test is a test to determine aerobic endurance capacity. The aim of the test is to cover the maximum distance possible in 12 minutes. Conducting this test on a standardized running track, i.e. 400 m lap outdoors or 200 m lap indoors, ensures the most comparable results.

Setting up the course field

- You cannot enter the Cooper test as an exercise type in the software. The software automatically recognizes each run that lasts for at least 8 or 12 minutes as a Cooper test.
- If you are running on a SmarTracks location with integrated timing gates, you can start at any gate.
- If you are using Timing Gates Mobile, we recommend starting at the 100m finish line or any other fixed point on your track. From there, place the Timing Gates Mobile at stated intervals, e.g. every 100 m.

Performing the test

- The test starts from the start position, 1 m before a gate.
- Before and after each test there should be standing time of at least 1 second.

Test results

The test results are shown under the “Runs” tab.

8.3. Jumps

Explosively fast reactions and speed strength are among the most important physical requirements for athletes. An athlete’s jumping ability can tell us a lot about the speed strength of his leg muscles. Alongside other conditioning properties such as endurance and strength, speed strength is directly performance-related.

In the standard jump ability test, three different jumps – the Drop Jump (DJ), Countermovement Jump (CMJ) and Squat Jump (SJ) – are performed several times in succession. The general aim of all three jump types is to achieve the maximum jump height during a basic vertical jump.



Performing the test

- We recommend to execute the jump tests in the following order:
 1. Squat Jump (SJ)
 2. Drop Jump (DJ)
 3. Countermovement Jump (CMJ)

In this order the data of the jumps is more distinct and can be better evaluated afterwards.

- Before and after each test there should be standing time of at least 1 second.
- These tests are performed without timing gates.

8.3.1. Squat Jump (SJ)



The Squat Jump is a vertical jump used purely to test the concentric strength in muscles used for jumping. This jump is performed from the squat position without any countermovement. The upper body is bent slightly forward, with the knees bent to around 90°. The individual's hands are kept on their hips throughout the jump. This is to lessen the effect of the arms, which could be used to boost height while jumping.

The exercise consists of jumping up as high as possible from the rest position, without any countermovement when starting the jump. The jump height is normally lower than the jump height for the Countermovement Jump.

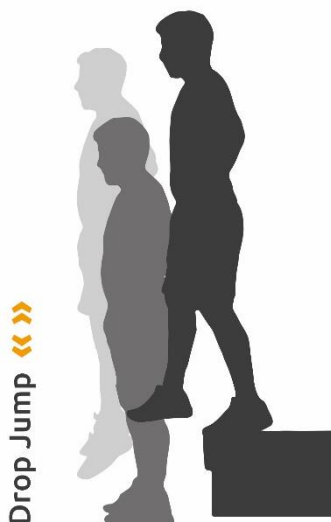
Measuring parameters:

- Jump height [cm]

Test results

The test results are shown under the "Jumps" tab.

8.3.2. Drop Jump (DJ)



The Drop Jump is a vertical jump for testing concentric strength in muscles used for jumping, including reactive strength.

This jump is performed from a defined fall height. The individual's hands are kept on their hips throughout the jump. This is to lessen the effect of the arms, which could be used to boost height while jumping.

When executing the Drop Jump the athlete steps down and falls from a box or platform. Upon landing, he immediately jumps up as high as possible, keeping the ground time and horizontal movement to a minimum.

Alongside the jump height, a brief contact time with the ground is also measured. A reactive strength index (jump height divided by contact time) can then be calculated. The impact velocity and energy input into the muscles used for jumping are altered by

varying the fall height. The output (jump height or the ratio of jump height and contact time on the ground) is maximized with optimal input (fall height).

The fall height is usually raised in 15 or 20 cm (6" or 8") steps and optimal height depends on the athlete's ability to absorb and transform the occurring forces. If the measured contact time exceeds 250 ms, the height should be decreased.

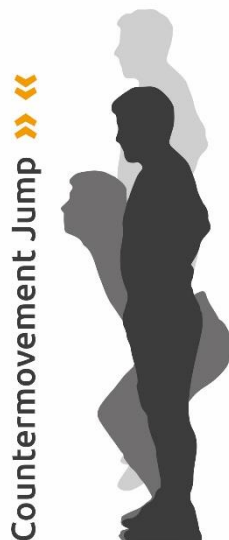
Measuring parameters:

- Jump height [cm]
- Ground contact time [ms]
- Reactive strength index (Jump height [cm]/ Ground contact time [s])

Test results

The test results are shown under the "Jumps" tab.

8.3.3. Countermovement Jump (CMJ)



The Countermovement Jump is a vertical jump for testing concentric strength in muscles used for jumping. This jump is performed from a standing position with a downward countermovement. The countermovement is a rapid downward movement to the start position of the Squat Jump. The individual's hands are kept on their hips throughout the jump. This is to lessen the effect of the arms, which could be used to boost height while jumping.

The exercise consists of jumping up as high as possible from an upright position, after making a countermovement when starting the jump. The jump height is normally greater than the jump height of the Squat Jump.

Measuring parameters:

- Jump height [cm]

Test results

The test results are shown under the "Jumps" tab.

8.4. Tappings

The tappings test is a test to determine cyclical speed. It is especially suitable for spotting “speed talent”. Tapping performance depends on the ability to coordinate, as well as the individual’s level of strength. SmarTracks records the tapping frequency, i.e. the number of contacts with the ground per second, measured in Hertz. The number of ground contacts is determined over 6 or 15 seconds.

Performing the test

- This test is performed without Timing Gates.
- Before and after each test the athlete should stand still for at least 1 second.
- The athlete starts in a standing, athletic position. Knees are slightly bent and the torso is slightly leaned forward.
- Feet have to leave the ground on every sequence.
- The athlete should not move in the horizontal plane during the duration of the test.
- The athlete should move with maximum intent and speed for at least 6 seconds.

Test results

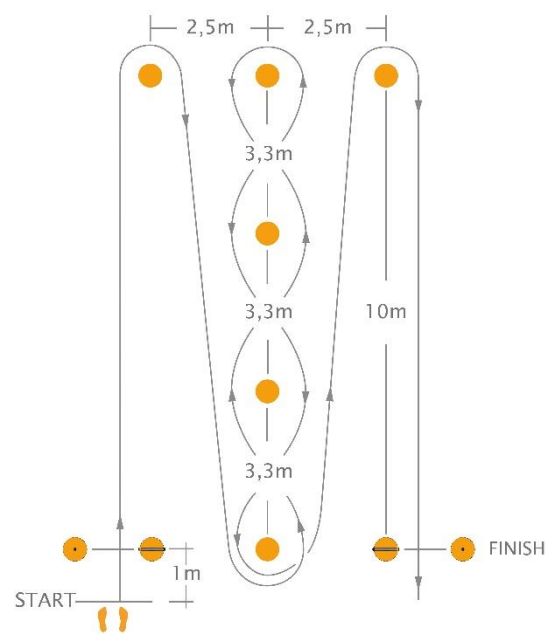
The test results are shown under the “Tappings” tab.

We recommend to use the test results of maximal frequency or 6 sec tap count for comparison of groups or individual athletes. Both test results are independent from the duration of the test and therefore results are not influenced by it.

8.5.1. Illinois Agility Test (IAT)

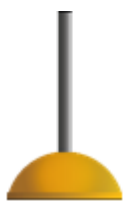
Setting up the course field

- 6 cones and 2 Timing Gates are to be set up according to the figures below.
- Place one Timing Gate at the start, and one Timing Gate at the finish.
- For better measurement results, we advise that the two magnetic elements on the inside position be angled. For the use of angled mounts, see 4.2.1. Timing Gates Mobile.

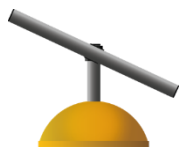


Course field for Illinois Agility Test starting from the **left**.

Position and set-up of angled Timing Gates for the Illinois Agility Test



Timing Gate on the left



Timing Gate on the right



Performing the test

- The athlete starts from the start position, 1 m before a timing gate.
- Before and after each test there should be standing time of at least 1 second.

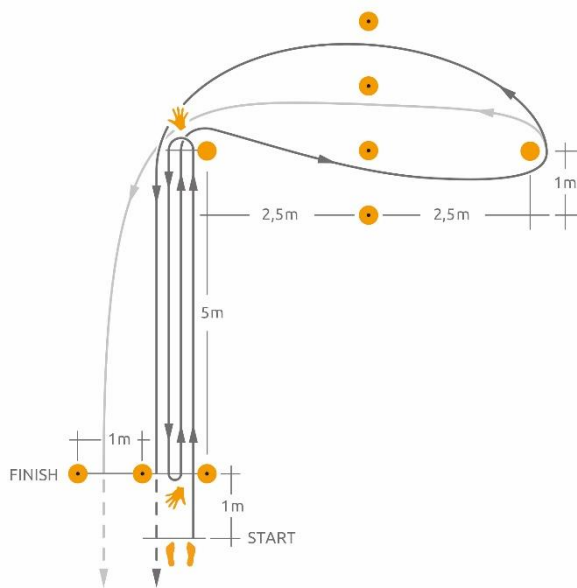
Test results

The test results are shown under the “Runs” tab.

8.5.2. Three Cone Drill (3CD)

The Three Cone Drill (3CD) is one of the most common tests of agility (COD) in American football. It is used as part of athlete assessment in the NFL combine. Nevertheless, the 3CD is a suitable test for all sports with high demands in Change of Direction, relatively short action periods and the necessity to maneuver in crowded spaces.

Setting up the course field



Three magnetic elements are set up at the start, each 1.2m apart. One cone is placed 5m from the starting line. Another cone is placed 5m from cone A at a 90 degree angle. In between both cones four magnetic elements are placed, each 1.2m apart.

Performing the test

The athlete starts in a three-point position or upright with his hand and/or feet behind or on the starting line. To ensure comparability, we recommend to define and use a standard position of your choice and make use of the "comment" field in the results if you differ from your standard.

The athlete can then either start on a given command or on his own accord (after at least 1 second of calm state).

The athlete runs to the first cone, bends down and touches the ground with the **right** hand and turns over his **left shoulder**. Then he turns and runs back to the starting line, bends down and touches that line with his **right** hand and again turns over his **left shoulder**. Then he runs back to the first cone and runs around the outside of it (right shoulder inside), weaves inside the other cone and then around it (left shoulder inside). He runs back and around the first cone (left shoulder inside) before finishing by maximally accelerating and running through the gate past the starting line.

- The athlete starts from the start position, 1 m before the timing gate.
- Before and after each test there should be standing time of at least 1 second.

Test results

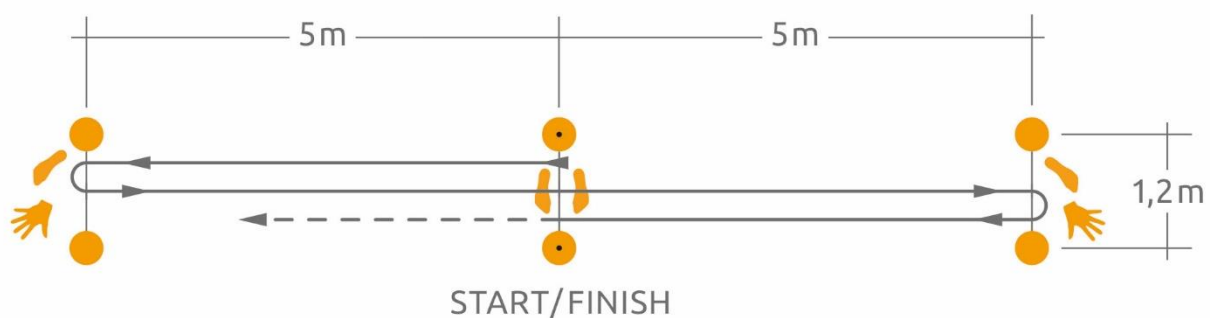
The test results are shown under the "Runs" tab.

8.5.3. 5-10-5 Shuttle (Pro Agility Test)

The 5-10-5 Shuttle, or Pro Agility Test consists of rapid directional changes in a linear plane. It is commonly used as an assessment in American football, basketball, soccer, and most other field and court sports. It is used as part of athlete assessment in the NFL combine.

Setting up the course field

One magnetic gate consisting of two magnetic elements is set up at the starting line. The magnetic elements are 1.2m apart. Two cones are placed 5m on each side from the starting line to mark the turn-round-lines.



Performing the test

The athlete positions himself in a 3-point position on the starting line with feet shoulder width apart and placed equally either side of the starting line.

The hand in contact with the floor during the 3-point position determines which direction the athlete should travel. For example, if the athlete is going right, then he must start with his right hand on the starting line, and vice versa. We recommend to standardize the starting direction to ensure comparability.

The test can also be conducted from an upright starting position. To ensure comparability, we recommend to define and use a standard position of your choice and make use of the "comment" field in the results if you differ from your standard.

Example when starting with the **right** hand on the starting line:

The athlete starts the drill by accelerating maximally to the turn-around-line to his **right**. At the turn-around-line the athlete touches it with his **right foot and hand** and then turns over his **left shoulder**. Then he accelerates towards the opposite turn-around-line this time touching it with the **left foot and hand** and turning over his **right shoulder**. The athlete then accelerates towards the starting line to finish the test. On all turns the inside hand must never touch the ground.

- Before and after each test there should be standing time of at least 1 second.

Test results

The test results are shown under the "Runs" tab.

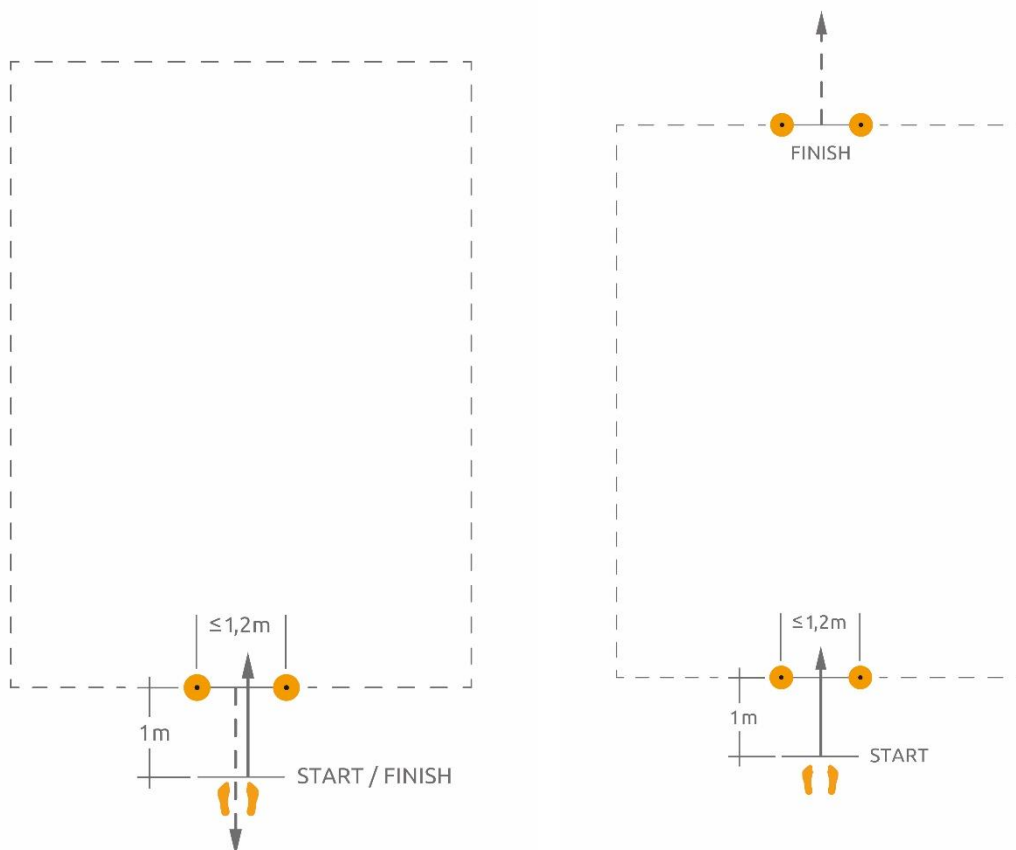
8.5.4. Custom Agility Test

The Custom Agility Test allows trainers and athletes to create their own tests. Either to make them as specific as possible to their sport, or to make standard tests that are not embedded in SmarTracks Diagnostics (e.g. 505 Test). The only general requirement is a start point and a finish point. There is no pre-specified distance or running course.

Setting up the course field

This test will not be recognized automatically by the software. It has to be either chosen from the drop-down menu “Exercise type” before the measurement is started or changed under “Exercise” after the data was analyzed (Custom Agility Test).

- **A maximum of 2 gates** can be set up for the Custom Agility Test: either a gate for the start line and a gate for the finish line, or a single gate, which serves as the start and finish line.
- The starting gate and the finish gate should be at a minimum distance of 5 meters from each other.
- A turn cannot take place within a range of 5 meters from a gate.
- It is recommended to set up cones at points where the athlete should turn/change direction.



Performing the test

- The athlete starts the Custom Agility Test 1m before the starting gate, and finishes the test by running through the finish gate.
- The athlete needs to run forwards (not backwards or sideways).
- The athlete cannot use any objects (e.g. a ball).
- Before and after each test there should be standing time of at least 1 second.

We cannot guarantee correct data analysis if tests do not adhere to the above-mentioned guidelines.

Test results

The test results are shown under the “Runs” tab.

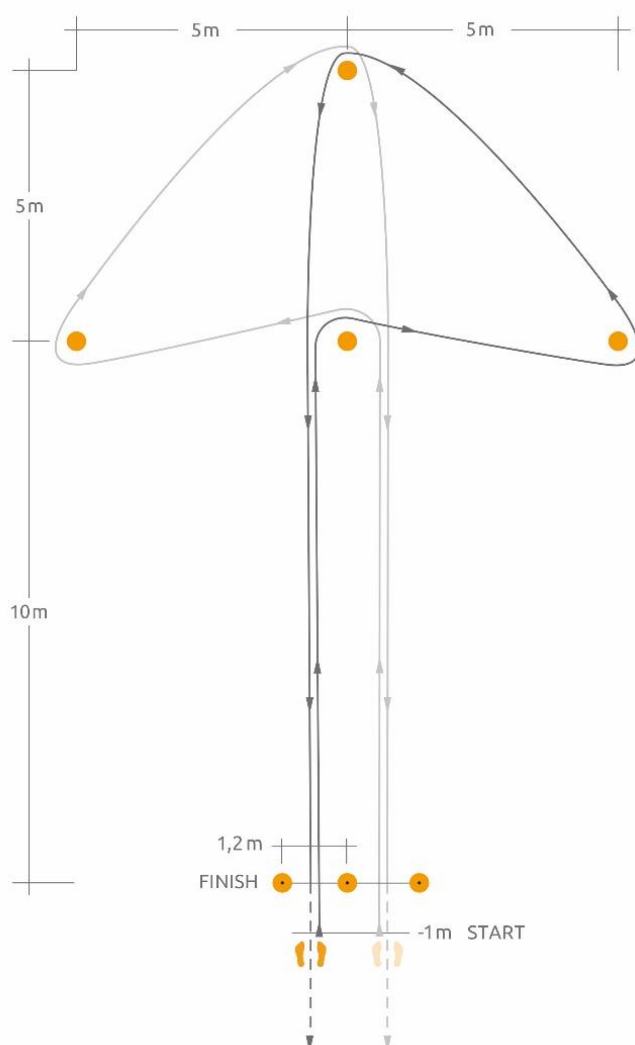
8.5.5. Arrowhead Agility Test (AAT)

The Arrowhead Agility Test (AAT) is a simple but effective tool to assess an athlete's change of direction speed. Although appropriate for all team sports, it is typically used in soccer.

Setting up the course field

One magnetic gate consisting of two magnetic elements is set up at the starting line. The magnetic elements are 1.2m apart. One cone (A) is placed 10m after the starting line, another one (C) 15m after the starting line. Two cones (B and D) are placed 5m on each side from the 10m cone (A), resulting in an arrow-shaped set up.

Performing the test – example direction left (orange line)



The athlete starts in an upright starting position, 1m in front of the starting line.

The athlete then maximally accelerates to cone A. He runs around the cone, turning to the left and accelerates to cone B, this turning to the right and starts accelerating to cone C. Another right turn and the athlete can accelerate back to the finish line.

Since the test can and should be conducted in two directions, it should be decided beforehand which direction the athlete should turn first at cone A. Consequently, this needs to stay constant for all athletes to ensure comparability.

Test results

The test results are shown under the “Runs” tab.

BASIC INSTRUCTIONS

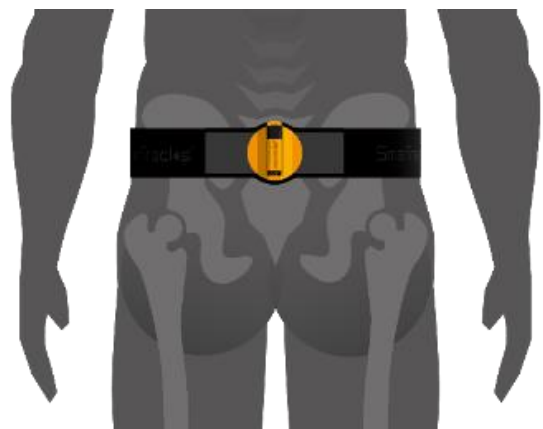
STEPS FOR PERFORMING A MEASUREMENT

1. Start SmarTracks Diagnostics software
2. Connect sensor to PC
3. Select "New measurement", insert team name, athlete name, location
4. Click "Next" and wait until measurement has started
5. Disconnect sensor from PC and attach sensor to belt
6. Put on sensor-belt
7. Perform assessment(s)
8. Reconnect sensor to PC
9. Data is uploaded and analyzed automatically by software

CHECKLIST TO ENSURE CORRECT MEASUREMENTS

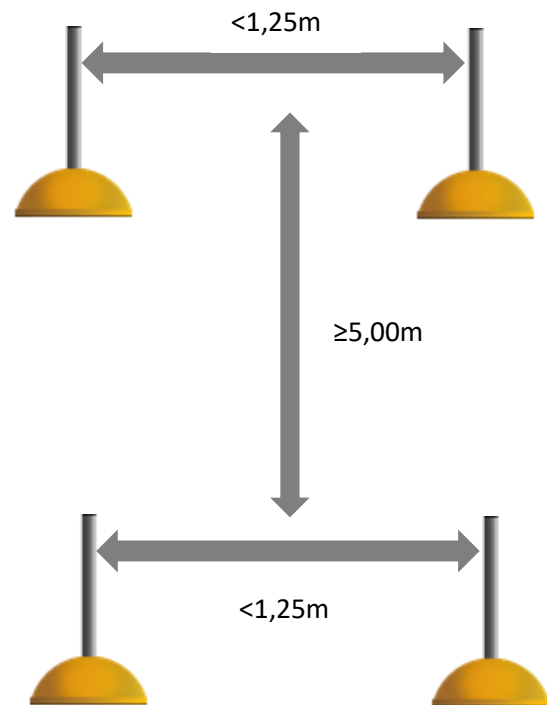
Sensor

- Is the sensor inserted correctly into the holder? Did it "click"?
- Does the sensor record? Does the red light blink?
- Is the sensor placed correctly on the body, with the black cap pointing upwards?



Timing Gates Mobile

- Are the Timing Gates placed correctly? (see manual for assessment ground plans)
- Is there a maximum of 1,25m distance between the individual elements of a timing gate?
- Is there a minimum distance of 5m between each individual timing gate?
- In the individual elements of the Timing Gates, does the yellow-colored side point upwards?
- Did you use the angled mounts when advised in the manual? (e.g. Illinois Agility Test)



Runs & Tests

- Does the athlete start with a distance of at least 1m in front of the first timing gate?
- Does the athlete stay in a calm state for at least 1 second before and after each test?
- For jump tests: does the athlete show minimal knee bend on landings?
- For agility tests: When changing direction, does the athlete turn in the right direction? (see manual for instructions)



Contact Info

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