h/p/cosmos®

gaitway® 3d

highly accurate 3 component force measurement Fz, Fy, Fx
force meets pressure and kinematics

powered by

Arsalis

ahead of time®

Highly accurate 3 component force measurement Fz, Fy, Fx

Gait analysis can provide important information about someone's kinematic and kinetic motion patterns, risk of falling and balance capabilities. Motion laboratories worldwide utilise tools such as 2D or 3D motion capturing systems, EMG, pressure distribution insoles or platforms and force plates to qualify and quantify the overall movement, especially in walking or running. The new h/p/cosmos gaitway® 3d is a powerful, innovative and accurate system in biomechanics not only for analysis but also offering on-line biofeedback for corrections in clinical gait rehabilitation and athletic running applications.

gaitway® 3d

gaitway® 3d is an instrumented treadmill designed jointly by h/p/cosmos and Arsalis. It measures the ground reaction forces in three directions and the position of the centre of pressure. The gaitway® 3d is available in three different different running deck sizes: 150/50, 170/65 or 190/65cm. Each size is optimized for a range of speeds.

The gaitway® 3d offers a rigid construction to record biomechnical signals with optimal quality. The functionalities include a patient weighing scale, a recording of the ground reaction forces at rates up to 10 kHz, left and right force measurement for the vertical force during walking and an extensive list of biomechanical parameters of normal and pathological gaits.

The system also offers biofeedback for gait rehabilitation and performance training. Digital start/stop input triggers, digital sync output and analog signal output allow the integration of the gaitway® 3d instrumented treadmill with e.g. EMG and motion analysis systems. The gaitway® 3d software is designed for Windows 7, 8 & 10. Automatic updates allow an easy expansion of the functionalities and customer support.

3 component force measurement, Fz, Fy, Fx during running (left) and walking (right) on the gaitway® 3d

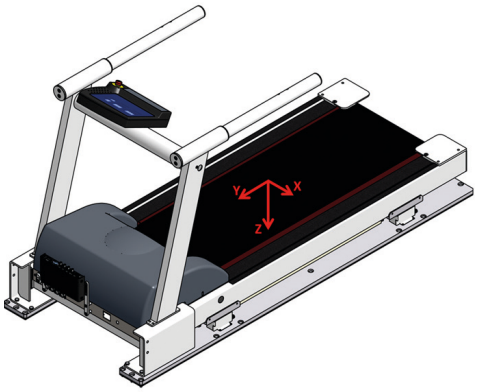
Force plates

The evaluation of the external forces acting upon each lower limb may be required, for example to estimate the joint forces and moments developed at the ankle, knee and hip by the inverse dynamic method. The most common ways to measure forces is to use force platforms or instrumented treadmills.

Force platforms can accurately measure the six forces and moment components, but while they offer a lower initial investment, they have some disadvantages. For accurate data collection, it is crucial for the subject to hit the platform, with only one foot. Results will be inaccurate if the subject missed the platform, placed only one part of the foot on it or touched the plate with both feet. This compels the subject to visually place the feet correctly on the force plates. As a result, kinematic and kinetic parameters and especially the variability of the step length will be affected (MEURISSE et al, 2016). OGGERO and colleagues (1998) reviewed their trials, and found that only 25% of their subjects would require three or less trials to obtain an accurate trial of one foot.

Getting sufficient data for both feet can be therefore very challenging, time consuming, fatiguing and frustrating for investigators and patients. It decreases the efficiency of a laboratory. Additionally, a setup using force plates requires more space in order to reach and keep a certain speed before hitting the plate. This not withstanding, force plates have to be mounted evenly into the floor, either in a pit our surrounded by a platform, which makes it very difficult to install retrospectively into an existing facility.

A fall prevention system for a number of patients while they are walking is another crucial demand. The safety arch with harness and chest belt can be installed on the gaitway treadmill series easily and provides the necessary safety and comfort for patients, therapists and scientists to walk as naturally as possible without the fear of falling.



gaitway® 3d with optional elevation

eight reinforced fixations during elevation mode for excellent force data quality

Instrumented treadmills

Nowadays there are different commercial instrumented treadmills available with different specifications. For example, pressure distribution platforms can be integrated underneath the belt of the treadmill. The pressure distribution, various gait and running parameters, COP, foot rotation, pronation, supination, gait symmetry as well as the vertical force can be calculated with the help of this technology (e.g. ZEBRIS).

Furthermore an optometric system like the Optogait (MICROGATE) can be embedded and measures timing and positioning parameters. Measuring forces with strain gauge or piezo-electric load cells, however, is considered to be state of the art and the gold standard in a biomechanical lab. Force measuring treadmills became increasingly common in bio-mechanical laboratories as an alternative to over ground gait analysis, because they allow for measurement of repetitive strides, require less laboratory space and facilitate the measurement of ground reaction forces through the embedded force plates (SLOOT et al., 2014).

The initial higher investment will be balanced by a quicker data acquisition and an improved efficiency of the laboratory. Also notable is the possibility to easily regulate the constant speed of the treadmill, ranging from the gait of an elderly individual to a sprinting healthy athlete.

Especially when it comes to pathological gait and clinical applications such as locomotion therapy, a treadmill is an indispensable tool. Unlike force plates, an instrumented treadmill can record an unlimited number of steps in a safe environment (harness for fall prevention and/or unweighting for partial body weight) on a treadmill. Combined with biofeedback and additional gait support via the robowalk® expander system, a modern instrumented treadmill is by far superior to conventional force plates in almost all gait applications.

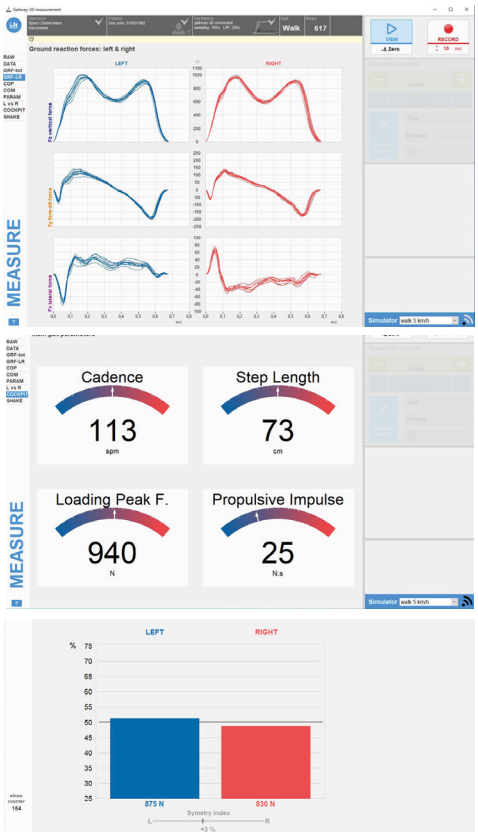
Split-belt and fore-aft arranged treadmills

Because of the occurrence of the double contact phase in human walking, some manufacturers of force measuring treadmills followed the idea of measuring separately the forces under the left and the right foot. Some feature a side-by-side and some a fore-aft arrangement of two independent belts with force plates. In both cases, the belt of the treadmill is split, which requires a specific position for the subject on the treadmill, in order to measure the forces distinctly.

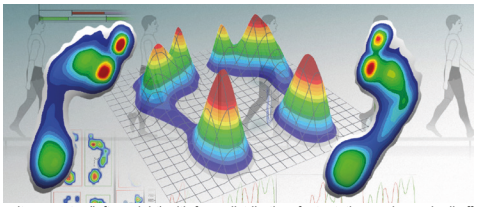
This forced position inhibits free and natural movement on a treadmill. For instance, ALTMAN and coworkers (2012) found that the gait width was widened by 3.7 cm, on a side-by-side split-belt treadmill. Moreover, a correlation between this alteration and a reduction in peak knee and hip adduction angle was found.

This may have resulted from the more constrained foot placement required as subjects attempted to keep one foot on each belt. They also noted that the 4 mm gap between the belts on the treadmill used in their study is quite narrow compared to the 1-2 cm gaps of most other split-belt treadmills.

With gaps 3 to 4 times as wide, the effect on base of gait is likely to be even greater, which will have a more significant effect on kinematics at a possibly medically important level. In addition, ZENI and HIGGINSON (2010) concluded in their research, that step width might be the largest concern when using a split-belt treadmill. Furthermore, initial anxiety when walking on a split-belt treadmill, can cause an unnatural gait pattern.



gait symmetry with bio-feedback left vs. right and on-line active gait correction with robowalk



gait symmetry (left vs. right) with force distribution, foot rotation angles and roll off characteristics measured with ZEBRIS pressure distribution option

Single belt treadmill

The gaitway® 3d is different and consists of one large single platform that does not have a split belt. It is available in different running deck sizes like 150/50, 170/65 and 190/65 cm. As running consist of single contact phases (one single foot on the floor at any time) the treadmill is perfect to measure forces also at higher speeds. The ample running surface encourages a natural running position. Moving slightly forward or sideward does not affect the measurement accuracy.

Also when walking on the treadmill, the subjects do not need to worry about the position. They are not required to place the heel on the front belt, nor are they forced to hit the right belt with the right foot and vice versa. When walking on a single platform, the load cells will measure a sum of left and right limb forces, but only in the double stance phase. A dedicated algorithm can decompose this sum. The procedure was published some years ago and improved in subsequent years (DAVIS & CAVANAGH, 1993; DIERICK et al, 2004; RAISON et al, 2005, MEURISSE et al, 2016, BASTIEN et al, 2019). This algorithm is validated now for both healthy and clinical gait and published in highly rated journals. Someone might say, an algorithm is a mathematical model and all models have their weaknesses. It is true, but the relative error is almost negligible, compared to those resulting from unnatural walking pattern on a split belt treadmill or on regular force plates. For example, MEURISSE et al (2016) validated this algorithm at 374 steps of healthy and 437 steps of clinical gait. Their median of the relative error was 1.8% for the healthy and 2.5% for the clinical gait between the reconstructed and real measured forces.

Special feature biofeedback and self-paced mode

Beside being an accurate measurement system, the gaitway® 3d is also an advanced system in gait therapy. Due to a live biofeedback tool, therapists and patients as well as athletes can see their walking and running symmetry for all gait parameters. E.g. a stroke survivor will see the symmetry of the left and right step lengths or loading forces.

Moreover, some assessments and therapy programs require the patient to walk a self-selected speed (e.g. 6 min walking test). The gaitway® 3d offers a selfpaced mode were the treadmill automatically increased or decreased the speed, depending of the subject´s gait pattern.

Observations that can be seen by an experienced analyst can be detected by technology. With the external intervention of therapists, orthopedic devices, unweighting systems (h/p/cosmos airwalk® ap) or active gait correction systems like the h/p/cosmos robowalk® expander, someone´s gait or running characteristics can be easily live qualified and step by step normalized.

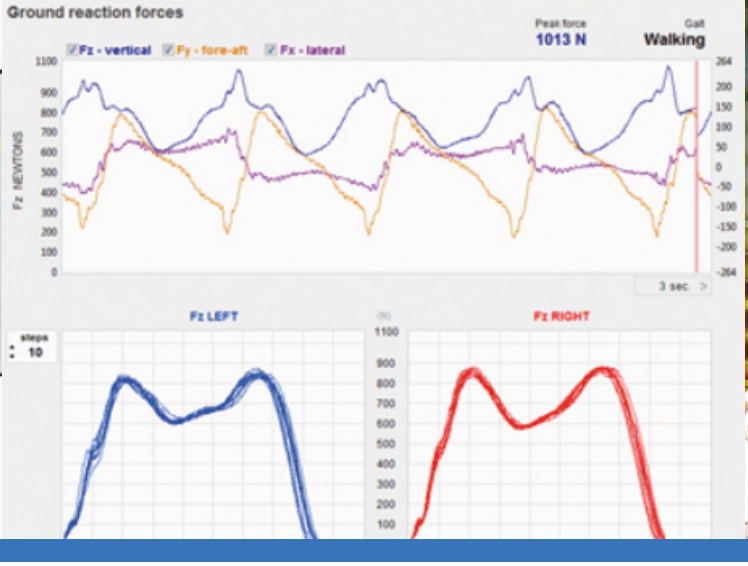
Optional pressure distribution measurement

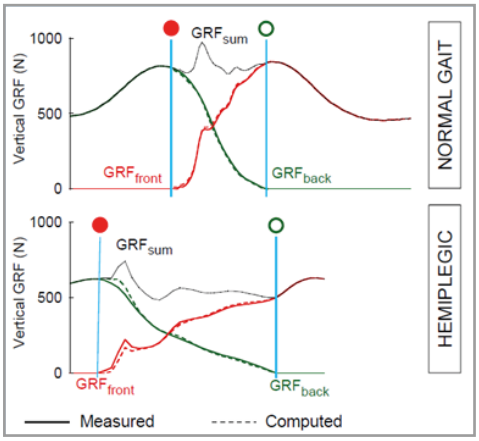
Additional value to the gaitway® 3d single belt treadmill developed by h/p/cosmos in co-operation with ARSALIS, can be added by incorporating a pressure distribution platform made by ZEBRIS into the running deck. The pressure distribution assessment adds valuable information such as the COP under each foot during the single and double contact phase, the foot rotation angles and roll off characteristics.

This additional technology in the gaitway® 3d force measuring treadmill is an available option. 3D force measurement plus pressure distribution combined in one system will represent the most advanced treadmill for biomechanics in the world.

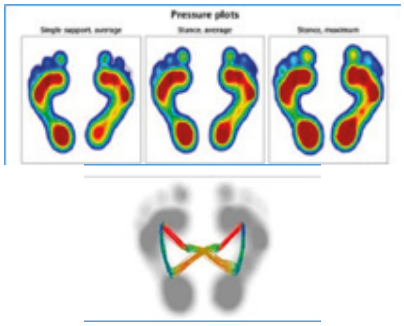
Perfect data from analysis ... and then!?

Nowadays sophisticated analysis tools are available delivering tons of data, graphs, tables and charts indicating asymmetries, imbalances and various problems.
The great challenge that comes after that is, to perform gait correction. For active gait correction h/p/cosmos developed the visual on-line biofeedback and the robowalk expander system, which help patients and therapists to transform the knowledge from the analysis data to a better gait of patients and higher performance of athletes.





Real (continuous) and reconstructed (dashed) vertical GRFs during double contact. Note that the dashed lines are partially hidden by the continuous lines. The thin continuous line represents the sum of Ffront and Fback (Fsum). The double contact phase is delimited between the front foot contact (plain red circle) and the back foot lift-off (empty green circle).



COP center of pressure, roll-off analysis

Applications

- Biomechanics
- Industrial material testing (e.g. shoes, prosthesis, insole)
- Sports science and research
- Medical & rehabilitation on request
- Exercise training in rehabilitation or sports

Functionalities

- Biofeedback to subject
- Data recording & analysis
- Patient evaluation (e.g. for clinical facilities)
- Pertubation module (sudden speed changes)
- Active gait correction on-line with biofeedback and robowalk®

Measured and computed signals

- Forces in 3 planes / directions (F_z, F_y, F_x)
- Center of pressure (Op_x, Op_y)
- Frictional torque (T_z)
- Belt speed, heart rate

Strengths

- Rigid treadmill construction
- State-of-the-Art sensors
- Customized configuration
- Single belt treadmill
- L/R force decomposition algorithm

Opportunities

- Reduction of lab space
- Fast and valid data acquisition
- Increasing technology in health science
- Worldwide distribution network

Biomechanical parameters

- Step length, width, frequency
- Swing / stance durations
- Contact / aerial durations
- Stride asymmetry
- Force peaks (push-off, landing)
- Force vector orientation
- Loading and unloading rate
- Left / right vertical force decomposition

System performance features

- Extremely wide measuring range from children to obese
- Excellent measuring accuracy
- Built-in amplifier with acquisition system
- LAN connection
- Control & acquisition Software included
- Start and stop trigger inputs and digital sync output for integration with e.g. EMG and motion analysis systems
- Raw data accessible via interface
- Cost-effective

gaitway® 3d Software allows

- Management of subject database
- Control of the treadmill speed and incline (if applicable)
- Monitoring of exercise time, distance and heart rate
- Recording of 3D ground reaction force & treadmill speed
- L/R online decomposition of vertical and horizontal force
- Automatic updates
- User biofeedback on biomechanical parameters
- Automatic speed control (self-paced mode)
- Pertubation mode (optional) for sudden speed changes

Options

- additional pressure distribution Zebris FDM-T
- Incline -20...+20% (reverse) incl. fixation
- reverse belt rotation for downhill
- safety arch with harness or ceilling mounted version
- special voltage
- unweighting system airwalk lt
- portability wheels to move the gaitway within the lab space
- perturbation module „shake“
- digital interfaces / plug-ins for Qualisys / Vicon (further interfaces on request)
- medical certification on request

Installation

The base frame will be bolted on the floor. Vibrations of the floor shall be avoided by preferring a location at ground floor without basement and in distance to roads with heavy traffic or railway tracks. Vibrations of handrails and safety arch are reduced by isolating these components from the main treadmill frame and mount them on a seperate frame.
Installation, commissioning, instruction, maintenance and repair work only to be conducted by h/p/cosmos trained and authorized personnel.

publications about the gaitway® 3d (short list)

Bastien, G. J., Gosseye, T. P., & Penta, M. (2019). A robust machine learning enabled decomposition of shear ground reaction forces during the double contact phase of walking. Gait & posture, 73, 221-227.

Detrembleur, C., & Leemrijse, T. (2009). The effects of total ankle replacement on gait disability: analysis of energetic and mechanical variables. Gait & posture, 29(2), 270-274.

Dierick, F., Penta, M., Renaut, D., & Detrembleur, C. (2004). A force measuring treadmill in clinical gait analysis. Gait & posture, 20(3), 299-303.

Mahaudens, P., Detrembleur, C., Mousny, M., & Banse, X. (2009). Gait in adolescent idiopathic scoliosis: energy cost analysis. European Spine Journal,18(8), 1160-1168.

Meurisse, Dierick, Schepens & Bastien (2016). Determination of the vertical ground reaction forces acting upon individual limbs during healthy and clinical gait. Gait & posture, 43, 245-250.

Pavei, G., Seminati, E., Storniolo, J. L., & Peyré-Tartaruga, L. A. (2016). Estimates of Running Ground Reaction Force Parameters from Motion Analysis. Journal of Applied Biomechanics, 1-21.

Additional References

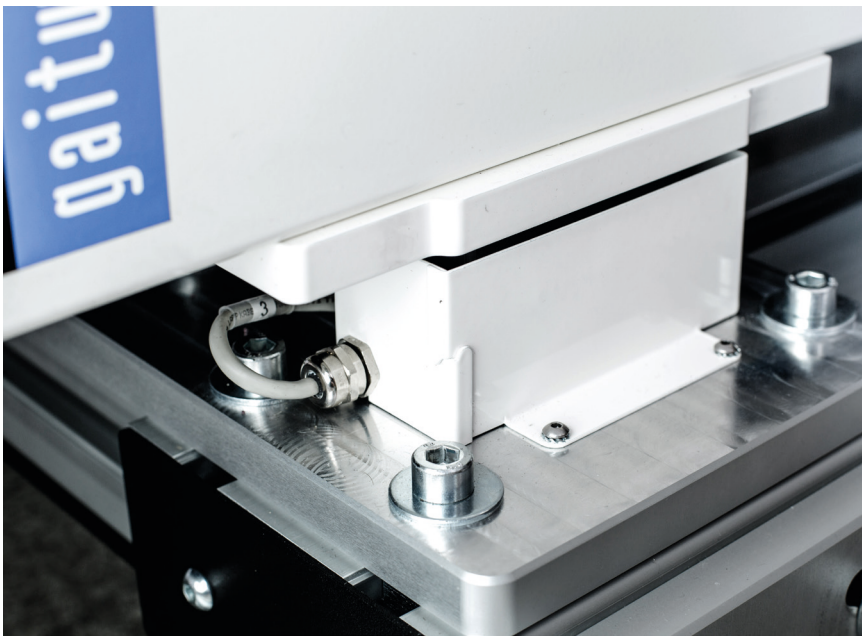
Altman, Reisman, Higginson & Davis, I. S. (2012). Kinematic comparison of split-belt and single-belt treadmill walking and the effects of accommodation. Gait & posture, 35(2), 287-291.

Oggero, Pagnacco, Morr, Simon & Berme (1998). Probability of valid gait data acquisition using currently available force plates. Biomedical sciences instrumentation, 34, 392-397.

Raison, Detrembleur, Fisette, Penta, Samin & Willems (2005). Determination of ground reaction forces and centres of pressure of both feet during normal walking on a single platform. Computer Methods in Biomechanics and Biomedical Engineering, 8(S1), 227-228.

Sloot, Van der Krogt & Harlaar (2014). Self-paced versus fixed speed treadmill walking. Gait & posture, 39(1), 478-484.

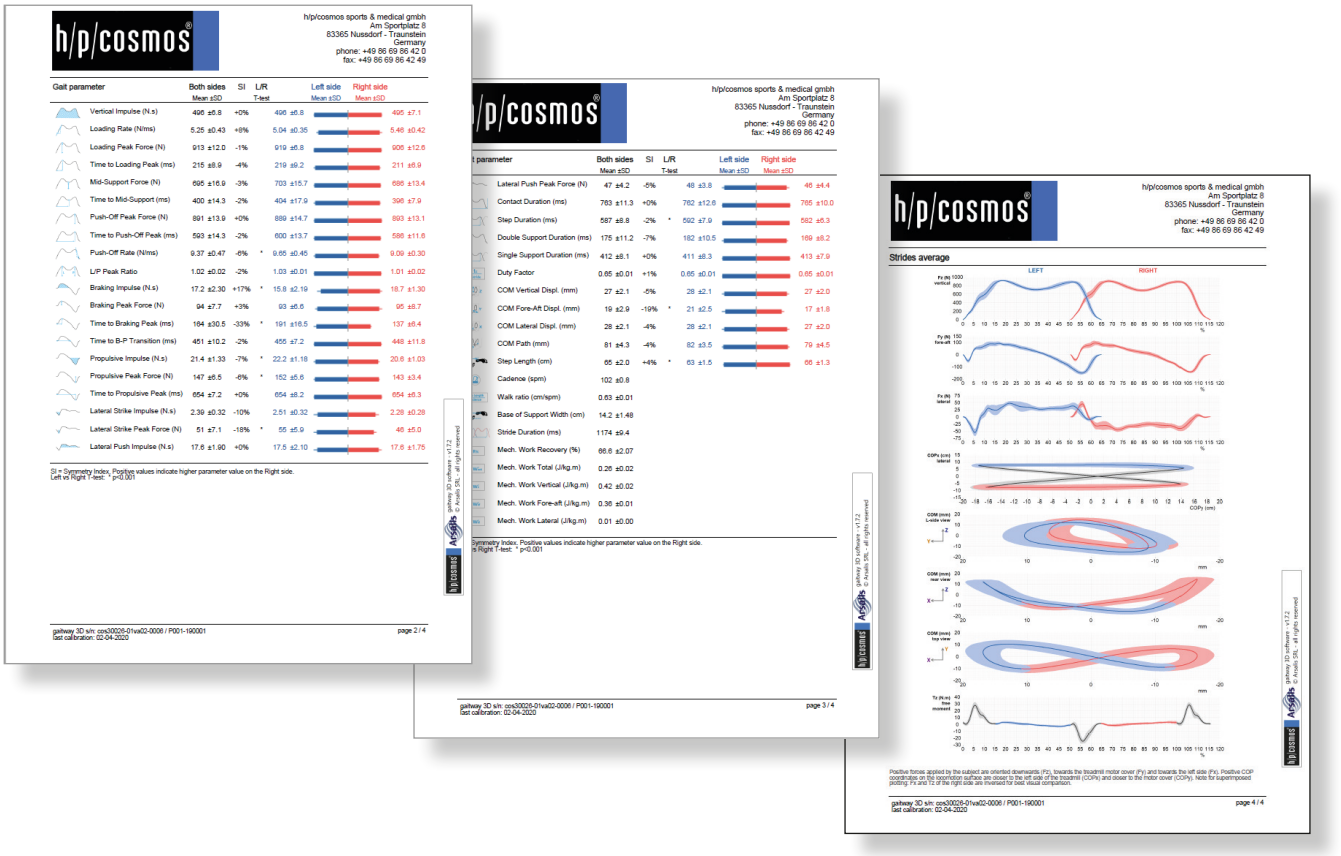
Zeni & Higginson (2010). Gait parameters and stride-to-stride variability during familiarization to walking on a split-belt treadmill. Clinical Biomechanics, 25(4), 383-386.



raw data from the h/p/cosmos gaitway® 3d

All data recorded with the gaitway® 3d is also available in raw format and can be imported by various other software and analysis systems. Raw data is collected sample-by-sample at a maximum rate of 10.000 Hz. For maximum compatibility with external platforms such as motion capturing software or EMG, the gaitway® 3d is equipped with analog or digital interfaces and sync capabilities.

example report h/p/cosmos gaitway software

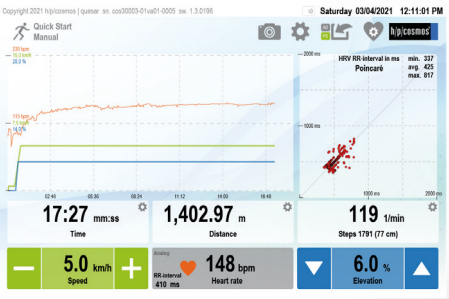


example report noraxon mr3 software „force meets pressure"

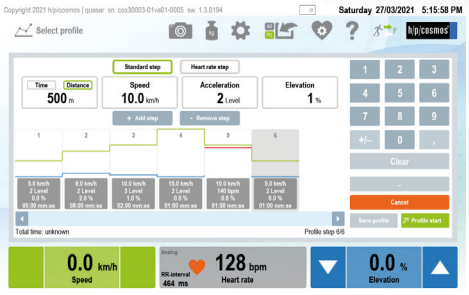
system solutions biomechanics gaitway 3d „force meets pressure advanced"

recommended configuration
biomechanics for scientific and industrial research
gaitway® 3d 170/65

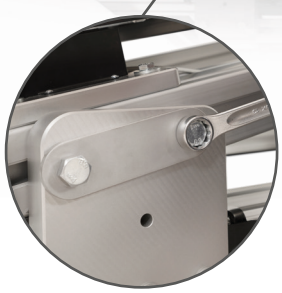
Fully removable handrails and terminal allow maximum visibilty for motion capturing or video analysis.
For any application without handrails, a fall prevention system is mandatory.



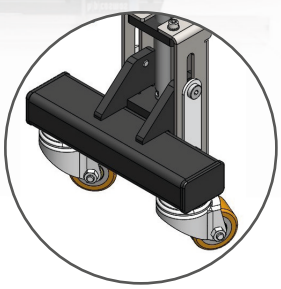
MCU6 Screenshot with parameters also including HRV (heart rate variability) in chatter diagram and optional step count, step length and step frequency.



Free definiable programs including acceleration and deceleration levels for each individual program step.



eight reinforced fixations during elevation mode enable utmost stability and excellent force data quality



retractable transportation wheels allows flexible relocation of the gaitway® 3d if neccessary

system solutions biomechanics gaitway 3d „force meets pressure advanced"

recommended configuration **biomechanics for scientific and industrial research** gaitway® 3d 170/65

pos.	qty.	order number	product description		
1.	1	cos30003-01va05	**h/p/cosmos treadmill ergometer stellar® MCU6** running surface 170 x 65 cm, speed range 0 ... 25 km/h, elevation 0 % (optional 28%), 10.1" TouchScreen with Windows 10, RS232 com1 interface, USB, LAN, para control® software		
2.	1	cos102999_ 170-65_MCU6	gaitway® 3d biomechanics upgrade 3 component (Fx, Fy, Fz) force measurement		
3.	1	cos102999_XXX- 65elevva02	Elevation 0% to +20% for gaitway® 3d 170/65 0...20.0 % (0...11.3°) motorized adjustment (-20 %...+20 % when using optional reverse belt rotation) for treadmill 170/65		
4.	1	cos103971	retractable transportation wheels (4x) for gaitway® 3d 170/65		
5.	1	cos103975	special speed 0 ... 30 km/h, 0 ... 8.33 m/sec (0 ... 18.64 mph)		
6.	1	cos103815	Reverse belt rotation (downhill) 170/65 with MCU 6 TouchScreen for models with running surface 170/65 cm, incl. belt centering rolls, max. reverse speed: 5 km/h, with safety arch: 25 km/h		
7.	1	cos103019	Special matt design for motion analysis frame colour RAL 9005 deep black (powder coated, non-shiny) to reduce reflections on the treadmill frame		
8.	1	cos10079-01va02	Safety arch 65 with harness & chest belt / stop function fall protection for all applications (mandatory for high risk applications); running surface 65 cm wide. Including chest belt size M		
9.	1	cos14903-04-S	chest belt for safety arch, size S (chest measurement: 65-95 cm), colour code red		
10	1	cos14903-04-L	chest belt for safety arch, size L (chest measurement: 105-135 cm), colour code yellow		
11.	1	cos14903-04-XL	chest belt for safety arch, size XL (chest measurement: 125-155 cm), colour code greenx		
12.	1	cos102293va02	zebris® FDM pressure measuring platform 3i, upgrade for running deck 170/65, without treadmill option pressure distribution platform 135.5 x 54.1 cm, 10.240 sensors, 120 Hz, price only valid for initial fitting-out, incl. software zebris FDM for gait analysis		
13.	1	cos101734	zebris® modular extension with 180 Hz for running deck 170/65 extension (must be ordered with the treadmill!) from standard 120 Hz by further 180 Hz to 300 Hz sampling rate in total		
14.	1	cos102999ip_set	Soft-& hardware set „ Noraxon Package 3D Force und Pressure Treadmill". Integration package for h/p/cosmos gaitway® 3d: Treadmill and Zebris pressure distribution measuring plate have to be ordered separately at extra cost. The software combines several sensors and provides a visual representation of the force superposition. incl. 2x High-speed color video cameras and 1x MYO synchronisation module, 1x Zebris-Noraxon sync cabel, 1x BNC-3.5mm audio adapter		
15.	1	cos102999ds	Digital data streaming interface module, Interface module for digital data streaming, control from a third-party application with data streaming option. Seamless integration with other biomechanical measuring systems, such as motion analysis system, motion sensors, EMG, pressure distribution sensors, video software, etc.		
16.	1	cos14970-03	h/p/cosmos satellite PC med DELL PC, 2x 24" LCD Monitor, COL Laser printer, potential isolation transformer, h/p/cosmos PC-rack with 4 casters		
17.	1	cos12769-01	USB to RS232 converter, converter from USB to serial port RS232 (Sub-D 9-pin male)		
18.	1	cos102999pert_MCU6	Perturbation option „Shake" for gaitway® 3d		
19.	1	cos10177	Packing treadmill 170&190/65 (SA), part assembled, packed part assembled on pallet with cardboard hood, incl. safety arch		
20.	1	cos16631	transport treadmill 170&190/65 (within Germany, Export on request)		
21.	1	cos102999inst-eu	Installation gaitway® 3d EU within EU, Installation onsite at customer´s facility, gaitway® 3D will be bolted to the floor. Incl. traveling, hotel, labour costs and 4 hours training		
22.	1	cos101094	1 day workshop (in Export: virtual/remote training)		
			total price net, excluding VAT, excluding shipping, EXW., excluding custom duties		
			VAT (19 % in Germany, other VAT and/or custom duties may apply in other countries)		
			system price h/p/cosmos solution for gait rehabilitation: please ask your dealer for a quotation		

The perturbation mode called „shake" will allow sudden speed changes to simulate slips and trips on the gaitway 3d.

specifications h/p/cosmos gaitway® 3d

running machine:	h/p/cosmos stratos® (other models on request)
manufacturer:	h/p/cosmos sports & medical gmbh / Germany
order number:	cos30000-02va09 (treadmill stratos® sport) cos102999_150-50_G6 cos30003-01va05 (treadmill stellar® sport) cos102999_170-65_MCU6 cos30004va04 (treadmill stellar® sport 190/65) cos102999_190-65 Medical versions on request. For medical versions please allow longer delivery times.
running surface:	L: 150 cm W: 50 cm L: 170 cm W: 65 cm L: 190 cm W: 65 cm
speed range:	0 ... 22.0 km/h (optional up to 45.0 km/h for 190/65-3p)
elevation:	optional electr. adjustable and fixed at up to 20%
classification:	scientific instrument device; for medical and therapeutic applications allow longer delivery time
load range on sensors Fx, Fy, Fz:	10 kN
overload (sensors):	24 kN
linearity Fx, Fy: Fz:	 <0.8 % <0.2 %
hysteresis Fx, Fy: Fz:	 <0.8 % <0.2 %
cross-talk Fz → Fx, Fy:	 <2.0 %
drift Fx, Fy, Fz:	 <0.05 N/min
natural frequency Fx: Fy, Fz:	 55 Hz 65 Hz
interfaces:	built-in amplifier ethernet interface analog / digital interface start & stop digital input triggers and digital sync output serial port RS232 for treadmill control via coscom v3 interface
accessories (extra charge):	safety arch fall stop [cos10079-01] for 150/50] safety arch fall stop [cos10170-01] for 170&190/65] science port for raw speed data [cos101277] special speed 0 - 10 km/h 150/50 [cos10000] special speed 0 - 25 km/h 190/65-3p [cos12995p3p] special speed 0 - 40 km/h 170/65 [cos10158] special speed 0 - 45 km/h 190/65-3p [cos10159va06] non-reflecting powder coating [cos102465ralxxxx] NORAXON EMG software & video cameras IMUs Zebris FDM upgrade 3d motion capture systems
temperature operation temperature storage:	10 ... 40 °C -25 ... 40 °C
operating humidity storage humidity:	30 ... 70 % (non condensing) / 0 ... 95 % (non condensing)
air pressure:	700...1,060 hPa (max 3000m altitude)
audible noise:	noise emission LpA < 70 dB(A) (63dB) acc. EN957-6
resolution:	adjustable (12-375 mN/bit)
measurement range:	adjustable (375-12,000 N)
sampling rate:	adjustable (100-10,000 Hz)

example specifications stellar® sport (MCU6) [basic treadmill model befor gaitway® 3d modification]

treadmill ergometer	**stellar® sport**
manufacturer:	h/p/cosmos sports & medical gmbh / Germany
order number:	cos30003-01va05
applications:	endurance training walking and running, stress device for performance testing, gait analysis and gait training
control:	via UserTerminal MCU6 with keyboard, touch display and Windows® 10 operating system, integrated interface coscom v4
keyboard:	9 keys for manual control, easily controllable with medical gloves and under sweaty conditions
running surface:	L: 170 cm (5ft 6.9“) B: 65 cm (2ft 1.6“) access height: 23 cm (9.06“). For gaitway height depends on installation. - shock load reduction for the joints - running belt with slip resistant surface - reinforced running belt with profiled surface, 5 mm thick - max. permissible load: 300 kg (660 lbs)
speed range:	0...25.0 km/h (0...6.9 m/s) (0...15.5 mph) special speed available at extra charge: 0...10 km/h (0...6.2 mph) 0...30 km/h (0...18.6 mph) 0...40 km/h (0...24.8 mph)
acceleration:	7 acceleration / deceleration levels between 131 s and 3 s from 0 to max. or from max. to 0; equals 0.053 ... 2.315 m/s² programmable via para control® PC software
elevation:	0 %.(optional on request)
running direction:	switch for reversing running belt direction at extra charge, max. permissible reverse speed 5 km/h (3.1 mph) if no safety-harness with fall-stop prevention system is used.
motor systems:	3.3 kW (4.5 HP) 3-phase AC motor, maintenance free and brushless; 20 years warranty on main drive motor. For high-performance applications, we recommend models with a 3-phase 3x400 volt power supply and a running surface min. 190/65cm.
power transmission:	frequency inverter, poly-V-belt, very quiet operation
safety systems:	CE; machinery directive 2006/42/EC; ISO 20957-1; EN 957-6; EN 60335-1; EN 60601-1-2 (EMC tested); emergency-stop switch (mushroom push button for drive systems power-off); emergency stop switch (safety lanyard with actuator, pull cord and clip);
degree of protection:	appliance class I ⏚ / IP 20
classification:	sports and fitness device; not for medical, not for therapeutic applications medical versions on request
usage class:	S, I according to ISO 20957-1
accuracy class:	A (high accuracy) according to EN 957-6
earth leakage current:	≤ 0.2 mA
ambient condition:	temperature: +10...+40 °C (-30...+50 °C on request) humidity: 30...70 % (up to 100 % on request) air pressure: 700...1060 hPa; 3,000 m (~10,000 ft) max.altitude without pressurization
display (resolutions) paramter:	25.9 cm/10.1“ (1280x800), color touch display parameter: speed, time, elevation, distance, METS, energy consumption, altitude, power, pace, heart rate, heart rate variability (digital and scatter diagram), diagram view of heart rate and load parameter parameter export to .pdf and .csv tables to USB
resolution:	1 decimal place
units:	metric / imperial
heart rate monitoring:	pulse receiver incorporated (analogue 5kHz + digital Bluetooth®), incl. chest belt POLAR H10, automatic control of speed and elevation according to programmed target heart rate („cardio mode“)
digital interface:	RFID / NFC® Reader (optional at extra charge) 4x USB 2.0 (1x USB 3.0 internal) Bluetooth®, WiFi / WLAN (optional at extra charge) 1x LAN / RJ45, 1x HDMI connection 1x RS232, 1x connection for safety arch fall stop

programs:	18 programs / profiles (predefined) - 8 exercise profiles (scalable) - 10 test profiles (UKK 2 km Walktest, Conconi, Graded test, Naughton, Ellestad, Cooper, Balke, etc.) - min. 100 free definable programs import / export of profiles from / to USB stick also for further processing
PC software (incl.):	h/p/cosmos para control® for display & remote control
accessory (incl.):	instruction for use on USB stick, drinking bottle holder, service box, special oil, PE potential equalization cable POLAR® H10 heart rate chest belt (Bluetooth® + 5 kHz)
colour of frame:	pure white RAL 9010 (powder coated)
handrails:	steel tube handrails Ø 60 mm on both sides, over min. 1/3 of treadmill length with front-handrail crossbar other handrail designs at extra charge
voltage supply:	230 Volt AC 1~/N/PE 50/60 Hz 15...16A fuse; dedicated circuit, line and protection;
size of frame:	L: 230 (+/-1) cm (7ft 6.6“ +/- ½“) W: 105 cm (+/- 1) (3ft 5.3“+/- ½“) H: 149 cm (+/- 1) (4ft 10.7“ +/- ½“)
net. weight:	device approx. 282 kg (621 lbs)
gross weight:	device approx. 500...550 kg (1102...1212 lbs)

Optionally available at extra charge are special frame colours, other handrail designs, special voltage supply and other options and accessories. Weight and package specifications can deviate according to options, accessories packing and way of transport. E&OE. Subject to alterations without prior notice. Please consider the natural and physical performance limitations of the single phase 230 volt power supply. The single phase 230 volt power supply is sufficient up to normal fitness or therapy applications. For all special high performance applications (speed running, controlled jump-ons, sidesteps, heavy subjects at higher speed, extreme elevations, etc.), we recommended models with a 3-phase, 3x400 volt power supply (for example model h/p/cosmos quasar med 3p, pulsar 3p, venus or saturn).

Warning! Installation, commissioning, instruction, maintenance and repair work only to be conducted by h/p/cosmos trained and authorized personnel. For treadmills with oversized deck (width >65cm), for children, special applications, without sufficient safety space behind the treadmill, for subjects and / or patients with health or other limitations (e.g. visual impairment, etc.), for running at high speed and / or for all individuals, where a fall triggers a dangerous risk of injury or death (e.g. newly operated hip patients, invasive probes, etc.), a fall prevention system is obligatory (e.g. safety arch with chest belt and harness or a weight support system). For more information see the instructions for use. Safety space behind the treadmill: min. L: 2 m (6ft 6.74“) x treadmill width. Children are only allowed to be on the treadmill, if under permanent supervision and secured by a fall prevention system.

sports / athletics

sports
quasar®

cycling & athletics
saturn® med 300/100r

performance diagnostics
pulsar® med 3p

h/p/cosmos®

German Engineering since 1988

inline skating
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mercury® med / arm support / airwalk® ap

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