



ADVANCED
BIOSIGNAL
ACQUISITION,
PROCESSING
AND ANALYSIS

PRODUCT
CATALOGUE

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The Annual BCI Research Award



“We have a vital interest in promoting excellence in the field of BCI. Achieving our goal to make BCIs more powerful, more intelligent and more applicable for patients’ and caregivers’ everyday life strongly relies on a creative research community worldwide.

The Annual BCI Research Award allows us to look back at highlights of BCI research in 20 years and to see how the field changed.”

Dr. Christoph Guger, CEO at g.tec



The prize, endowed with 3,000 USD for the winner, 2,000 USD for the 2nd place and 1,000 USD for the 3rd place and donated by g.tec, is an accolade to recognize outstanding and innovative research done in the field of Brain-Computer Interfaces. Each year, a renowned research laboratory is asked to judge the submitted projects and to award the prize. The jury consists of world-leading BCI experts recruited by the awarding laboratory.

BCI State-of-the-Art

The 10 nominated projects will be published in a book by Springer. The BCI Award is donated by g.tec medical engineering, a leading provider of brain-computer interface research systems and components located in Schiedlberg, Austria.

For more information see www.bci-award.com



g.tec has been awarded with the following prizes

Forward Award 2000 / GEWINN Award for Innovation 2001 / Austrian Prize of Innovation 2001
CinC challenge 2006 for the g.BSanalyze ECG toolbox / GEWINN-Jungunternehmerpreis 2006 / Personal prize of ÖGAHM 2007
European ICT Prize 2007 / Well-Tech Award 2007 / Fast Forward Award 2008 / Econovius 2008 / science2business Award 2010
Microsoft Innovation Award 2010 / Pegasus Award 2011 / Ernst & Young Entrepreneur Of The Year 2012
Fast Forward Award 2013 / KMU Nischenweltmeister 2013 / Nomination for the Austrian prize of innovation 2013

Master Student Awards

GIT-Prize 2008 / Innovation & Economy Division Health 2010 / Project Award 2009 / jugend innovativ 2009
Constantinus Award 2010 / Prix ARS Electronica 2010 acknowledgment / Innovation & Economy Division Health 2011
EUROINVENT Cyberlife Award 2014: Marian Poboroniuc, Danut Irimia, Florin Serea and Sergiu Hartopanu win the Cyberlife Award
“Future Medical Devices controlled by means of Brain-Computer Interface” of the EUROINVENT 2014

EUROINVENT Gold Medals 2014:

Marian Poboroniuc wins the Gold Medal for the project “ONZOFF control method to support Functional Electrical Stimulation-based standing in paraplegia”

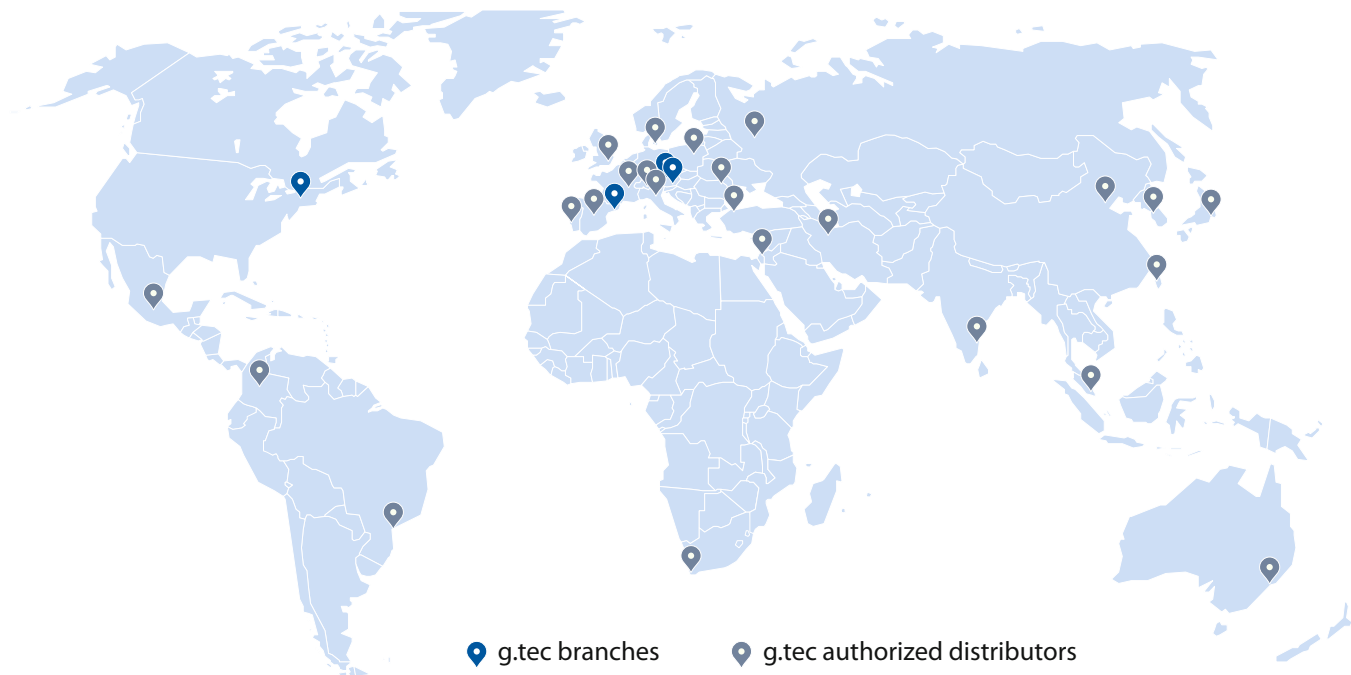
Danut Irimia and Marian Poboroniuc win the Gold Medal for the project “Facilitating cortical reorganization in stroke patients by means of a Brain-Computer Interface & FES hybrid system”



Florin Serea , Sergiu Hartopanu and Marian Poboroniuc win the Gold Medal for the project “New upper limb rehabilitation method in paralyzed people by means of FEs and exoskeletons”

Sergiu Hartopanu, Florin Serea and Marian Poboroniuc win the Gold Medal for the project “A new rehabilitation method based on a hybrid FES-mechatronic intelligent robotic glove”



Welcome



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g.tec is powered by

- ◆ SFG – Steirische Wirtschaftsförderung
- ◆ FFG – Forschungsförderungsfonds der gewerblichen Wirtschaft
- ◆ FET – Future and Emerging Technologies
- ◆ IST – Information Society Technologies
- ◆ ICT – Information and Communication Technologies
- ◆ Horizon 2020 – The EU Framework Programme for Research and Innovation

g.tec is actively involved in research and scientific publications
and is or was an active member, advisor or partner of the following research projects

 www.backhome-fp7.eu	 http://bnci-horizon-2020.eu	 http://cognovo.eu	 ComaWare	 www.ict-cream.eu	 www.neurographene.eu	 ComAlert
 RAPIDMAPS 2020	 http://graphene-flagship.eu	 recoveriX	 www.brainable.org	 www.eniac-csi.org/CSI	 Astonish	 www.decoder-project.eu
 http://future-bnci.org	 www.presencia.eu	 www.renachip.org	 www.iua.upf.edu/rgs	 http://specs.upf.edu/sf	 www.sm4all-project.eu	 www.tobi-project.org
 www.vereproject.eu	 DeNeCor	 www.highprofile-project.eu	 www.aal-alias.eu	 www.argealpinmed.at	 www.iai.csic.es/better	

Welcome to the biomedical engineering world of g.tec!

g.tec was founded in 1999 and consists now of four divisions:

- ◆ GUGER TECHNOLOGIES OG (development, research and production)
- ◆ g.tec medical engineering GmbH (sales, marketing/PR and research)
- ◆ g.tec medical engineering Spain LC (research and sales)
- ◆ g.tec neurotechnology USA, Inc. (research and sales)

g.tec is a growing enterprise with two branches in Austria (Graz and Schiedlberg), Spain (Barcelona) and USA (Albany) and distribution partners all over the world. All hardware and software development is done in-house by our team of researchers, engineers and developers. g.tec is also an active member in a number of national and international research projects and is active in scientific publishing.

g.tec developed the first commercially available BCI system in 1999 and now sells this system in more than 60 countries worldwide. Our products work with all major BCI approaches (motor imagery, P300, SSVEP and slow cortical potentials), so you can start BCI research within a few hours. The g.tec team tests different BCI technologies on more than 500 subjects internationally to guarantee a perfect working system.

Our team is prepared to find the best solution for your needs.

Take advantage of our experience!



Dr. Guenter Edlinger (CEO)



Dr. Christoph Guger (CEO)



Ing. Mag. Gunther Krausz (CBO)



Ing. BA MSc Armin Schnuerer
Head of Sales, Marketing



William Coon PhD
Office USA



Arnau Espinosa MSc
Office Spain



Hardware and Accessories

Groundbreaking technology for brain mapping



High demands lead to high level solutions and pathbreaking technology. g.Hlamp is a 256 channel biosignal amplifier for invasive and non-invasive measurements of brain functions that is CE approved and FDA listed. The amplifier has 256 ADC converters with 24 Bit inside for perfect signal resolution and has a wide input sensitivity to be able to measure EEG, ECoG, ECG, EMG, EOG without any saturation. Additionally external sensors can be connected. All channels are DC coupled. Internally signal processing is performed with the fastest floating point DSP and a sophisticated Linux Kernel. The amplifier performs a very high oversampling to reduce the noise as much as possible by averaging samples.

256 channels can be analyzed in real-time with the g.tec Highspeed Processing for SIMULINK toolbox. This leads to faster and more accurate control of brain-computer interface systems done with Common Spatial Patterns (CSP).

g.Hlamp is powered by a medical mains power supply or by a battery pack and the system is connected to the computer via USB. The system is equipped with 16 digital trigger channels and a HOLD input for artifact suppression (e.g. during electrical or magnetical stimulation).

g.Hlamp provides 80, 144 or 256 channels per unit. 80 and 144 channel systems can also be upgraded later on. Each block of 64 channels is connected via a multi-pole medical safety connector to the electrode interface box.

A big advantage is that g.Hlamp can be used with passive or active electrodes. The difference is just the electrode connector box (headbox). For ECoG grids and strips special interface connectors are available.

PRODUCT HIGHLIGHTS

- ◆ 256 channels perfectly synchronized with 24 Bit
- ◆ Supports active and passive EEG electrodes and ECoG grids
- ◆ g.Hlamp is a CE certified and FDA listed medical device
- ◆ Fully integrated into g.tec software for real-time analysis
- ◆ Integrated impedance measurement for active and passive electrodes



Dr. Aysegul Gunduz
University of Florida, US

“g.Hlomp allows us to perform robust intraoperative recordings to ensure cortical and subcortical electrodes are placed in correct functional regions for various clinical applications and research directions at the University of Florida Hospital.”



Nuri Firat Ince, PhD
University of Houston, US

“Fused with a variety of rapid prototyping and research software tools, g.Hlomp serves as a unique tool in our clinical research applications to record electrocorticogram and local field potentials. The oversampling process executed by the internal DSP provides exceptional SNR and enables capturing higher frequency brain rhythms with superior quality.”



Input channel properties

g.Hlomp uses wide-range DC-coupled amplifier technology in combination with 24-bit sampling. The result is an input voltage of ± 250 mV with a resolution of <60 nV! This means that every electrophysiological signal can be recorded directly without additional hardware. Neither high electrode offset voltage nor big artifacts resulting from electrical or magnetic stimulation will saturate the amplifier inputs. This feature is important for various artifact treatment and correction algorithms. The use of digital filters avoids hardware related variations between channels.



Accuracy and data quality

The amplifier is driving each ADC with 614.4 kHz which is much higher than the required sampling frequency. Then internally the floating point DSP performs the oversampling and averages samples to increase the signal-to-noise ratio. If the amplifier works e.g. with 256 Hz then 2400 samples are averaged and this suppresses the noise by a factor of 49. In addition the floating point DSP performs also the real-time bandpass filtering and NOTCH filtering of the data. Several hundred different bandpass filters are predefined. Also bipolar derivations can be calculated by the DSP to work with a very high CMRR. The amplifier uses 256 ADC for the 256 channels and therefore all signals are sampled exactly at the same time point to avoid any time delay between channels. This is especially important for brain mapping procedures.



Add more channels

g.Hlomp can be ordered with 64+16, 128+16 or 256 channels initially. The 64+16 channel version comes with one 64 and one 16 channel connector box. The 128+16 version comes with two 64 channel and one 16 channel connector box and the 256 channel version comes with four 64 channel boxes. Later on, if more channels are required, the amplifier can be upgraded by adding more amplifier channels. This makes it easy to start with an inexpensive system.



Skin-electrode impedance

g.Hlomp uses a new principle for impedance measurement that can determine the skin-electrode impedance for passive and also for active electrodes. It works also for gel or dry electrodes provided by g.tec, and even for ECoG grids. The impedance values are color coded, and all 256 channels are shown in one window, which is updated every few seconds! The impedance check can also beep if an electrode was successfully mounted. This allows very fast assembly of electrodes during real-time impedance control.



Software options

g.tec's philosophy is to provide a broad spectrum of software solutions for different groups of users (e.g. for engineers, researchers & scientists, physiologists, and medical staff, but also for software developers & programmers). From comfortable Windows-based recording software to MATLAB/Simulink based tools and device drivers and APIs you will find the appropriate tools for your application. Please see the list of related products/software below for more details. g.Hlomp is also supported and integrated into the main core of BCI2000.



Important information

We give a full 5-years warranty on g.Hlomp. g.Hlomp is a safe certified medical device for research in humans, even for invasive recordings such as electrocorticography (ECoG). It must not be used for patient monitoring or determination of brain death. Medical diagnosis and decisions about treatment of diseases must not be based (solely) on results obtained with this device.

TECHNICAL DETAILS AND SPECIFICATIONS

Sensitivity	<60 nV (LSB), ± 250 mV	Input impedance	>100 MOhm
Amplifier type	real DC coupled	Input connectors	standard safety connectors for passive electrodes, 2-pin connectors for active electrodes
256 \times ADC	24 Bit	Weight	1,875 g
Sampling rate	up to 38.4 kHz	Size	197 (L) \times 197 (W) \times 90 (H) mm
DAC	calibration signal		
Input channels	256 mono-polar / 128 bi-polar (per device, software selectable)		
CE certified medical device		Standards	EN60601-1, EN60601-1-2, EN60601-2-25, EN60601-2-26, EN60601-2-40, MDD 93/42/EEC, EN60601-1-4, EN ISO 14971, ANSI/AAMI SW68:2001
Applied part	CF		
Safety class	II		

CONNECT ACTIVE/PASSIVE ELECTRODES

A brilliant feature of the g.Hlamp is that the main amplifier unit can be used with different electrode connector boxes. Therefore the main amplifier unit is only purchased once and can be used for many different applications:

<p>g.HEADbox - passive 7006</p>  <p>passive electrode connector box - comes with 64 channels and is connected to one of the 4 groups of g.Hlamp. It can be used with standard 1.5 mm safety connectors which are standard for EEG and ECoG electrodes.</p>	<p>g.HEADbox - active 7005</p>  <p>active electrode connector box - comes with 64 channels and is connected to one of the 4 groups of g.Hlamp. It has 2-pin connectors to support all g.tec active electrodes such as g.LADYbird.</p>	<p>g.HEADbox16 - passive 7007</p>  <p>passive electrode connector box with 16 channels - comes with 16 channels and is connected to one of the 4 groups of g.Hlamp. This connector box is useful to have additional inputs for external sensors.</p>
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HARDWARE

Product no.	Product name	Description
7001	g.Hlamp 80, silvergrey, color code: A08	g.tec's multi-modal biosignal amplifier with USB interface; 64+16 channels; bi-, unipolar recordings; 16 digital trigger inputs to synchronize with external events; integrated electrode impedance check; CE-certified medical device EN 60601-1 (IEC 60601-1); device driver for OS Windows 32/64 bit; internal sampling frequency 38.4 kHz per channel; highest signal-to-noise ratio; multi-pole medical connectors, classification of device: safety class II, type of applied part CF, conformity class IIa; FDA listed; g.Hlamp water-proof heavy duty case; including g.Hlamp USB cable; (SN: HA-XXXX.XX.XX) standard color: silvergrey, different colors on request; choose your color of science for your personal g.Hlamp: saphirblack; calypsores; malachitgreen; mysticblue
7002	g.Hlamp 144, silvergrey, color code: A08	g.tec's multi-modal biosignal amplifier with USB interface; 128+16 channels; bi-, unipolar recordings; can be upgraded to 256 channel system; 16 digital trigger inputs to synchronize with external events; integrated electrode impedance check; CE-certified medical device EN 60601-1 (IEC 60601-1); device driver for OS Windows 32/64 bit; internal sampling frequency 38.4 kHz per channel; highest signal-to-noise ratio; multi-pole medical connectors, classification of device: safety class II, type of applied part CF, conformity class IIa; FDA listed; g.Hlamp water-proof heavy duty case; including g.Hlamp USB cable; (SN: HA-XXXX.XX.XX) standard color: silvergrey, different colors on request; choose your color of science for your personal g.Hlamp: saphirblack; calypsores; malachitgreen; mysticblue
7003	g.Hlamp 256, silvergrey, color code: A08	g.tec's multi-modal biosignal amplifier with USB interface; 256 channels; bi-, unipolar recordings; 16 digital trigger inputs to synchronize with external events; integrated electrode impedance check; CE-certified medical device EN 60601-1 (IEC 60601-1); device driver for OS Windows 32/64 bit; internal sampling frequency 38.4 kHz per channel; highest signal-to-noise ratio; multi-pole medical connectors, classification of device: safety class II, type of applied part CF, conformity class IIa; FDA listed; g.Hlamp water-proof heavy duty case; including g.Hlamp USB cable; (SN: HA-XXXX.XX.XX) standard color: silvergrey, different colors on request; choose your color of science for your personal g.Hlamp: saphirblack; calypsores; malachitgreen; mysticblue
7005	g.HEADbox - active	electrode interface box for 64 active channels, for usage with g.Hlamp; works with g.tec 2 pin safety connector active electrodes; g.INTERFACEHEADbox2Hlamp g.HEADboxPOWER
7006A	g.HEADbox - passive	electrode interface box for 64 passive channels, for usage with g.Hlamp; works with 1,5 mm medical safety connector passive electrodes; cable (g.INTERFACEHEADbox2Hlamp) included
7006B	g.HEADbox - passive	electrode interface box for 64 passive channels, for usage with g.Hlamp or g.USBamp for synchronized recordings of g.tec systems and clinical systems; works with 1,5 mm medical safety connector passive electrodes; 2 grounds (not internally connected); cable (g.INTERFACEHEADbox2Hlamp) included
7007	g.HEADbox16 - passive	electrode interface box for 16 passive channels, for usage with g.Hlamp; works with 1,5 mm medical safety connector electrodes; g.INTERFACEHEADbox2Hlamp
7008	g.INTERFACEHEADbox2Hlamp	interface cable g.HEADbox to g.Hlamp with mult pole connector, approx. 165 cm lead
7012	g.Hlamp 80 UPGRADE to 144	upgrade g.Hlamp from 80 to 144 channels; including medical device inspection
7014	g.Hlamp 144 UPGRADE to 256	upgrade g.Hlamp from 144 to 256 channels; including medical device inspection
7016	g.Hlamp 80 UPGRADE to 256	upgrade g.Hlamp from 80 to 256 channels; including medical device inspection
7282	g.Hlamp USB cable	connection of g.Hlamp to USB-port of PC/notebook
7277	adapter cable for trigger cable	DSUB25 female to 8xBNC (including 8xBNC to CINCH adapter)
7240	audio trigger cable for g.Hlamp	DIG IN 1 of g.Hlamp HA-xxxx.xx.xx to 2 pole 1/4" connector for AudioFire2 external sound card
7276A	trigger cable for g.Hlamp for DIG IN 1	trigger cable for g.Hlamp for DIG IN 1, 8 digital lines from DIG IN 1 g.Hlamp HA-xxxx.xx.xx to D_Sub 25 male (PC-parallel-port pinout), 3 m
7276B	trigger cable for g.Hlamp for DIG IN 2	trigger cable for g.Hlamp for DIG IN 2, 8 digital lines from DIG IN 1 g.Hlamp HA-xxxx.xx.xx to D_Sub 25 male (PC-parallel-port pinout), 3 m
0307C	external trigger button HA	external trigger button for g.Hlamp, connected to PIN 1 of DI 1; 2,5 m cable;
7051	g.Hlamp water-proof heavy duty case	water-proof heavy duty case for g.Hlamp equipment
3012	medical isolation transformer	600 VA, REO-MED, 6 outputs

SOFTWARE

Product no.	Product name	Description
0167D	g.Recorder for g.HIAMP	fully GUI-based (graphical user interface); comfortable biosignal visualization and storage; full control of the amplifier and header; real-time compressed spectral array; heart-rate, heart-rate variability; single place licence; prerequisite OS English Win 32/64
0260D	g.HIAMP SIMULINK HIGH-SPEED ONLINE Processing	SIMULINK driver and blockset modules; highly optimized hardware-interrupt controlled device driver; allowing data processing with the maximum system speed; supports real-time processing of the biosignal data; calibration block; impedance measurement block; signal analysis blocks; single place licence; prerequisite MATLAB for OS English Win 64, SIMULINK, Signal Processing Blockset and DSP System Toolbox
0291	g.EYEtracking Interface for SIMULINK	read eyetracking information into Simulink; single place licence; prerequisite MATLAB for OS English Win 64, SIMULINK Can be used with the following eyetracker models: Tobii X2 - 60
0144A	g.VIBROTACTILEp300 model for g.USBamp	2-, 3- and 8-channel vibrotactile P300 based BCI control; prerequisite: SIMULINK HIGH SPEED ONLINE Processing, g.STIMbox g.VIBROstim g.BSanalyze Base, EEG and Classify Toolbox
0146	hyperscanning BCI model	multi-user P300 and Motor Imagery based control; prerequisite SIMULINK HIGH-SPEED ONLINE Processing, g.RTanalyze, g.BSanalyze Base, EEG and Classify Toolbox
0147	hybrid BCI model	SSVEP and P300 hybrid based control; prerequisite SIMULINK HIGH-SPEED ONLINE Processing, g.RTanalyze, g.BSanalyze Base, EEG and Classify Toolbox
0148	ACTOR BCI - Application Control and Online Reconfiguration (ACTOR) protocol	Simulink model with matrix interface that can be remotely updated or configured with configuration files; sends commands to external devices; prerequisite SIMULINK HIGH-SPEED ONLINE Processing
0149	EMG/EOG/mouse control	Simulink model to control the matrix interface with EMG, EOG or mouse; prerequisite SIMULINK HIGH SPEED ONLINE processing
0139D	g.HIAMP P300 model	8-channel P300 based speller; prerequisite: SIMULINK HIGH-SPEED ONLINE Processing, g.BSanalyze Base, EEG and Classify Toolbox
0111	g.RTanalyze	real-time EEG, ECG, respiration, galvanic skin response and biosignal processing blockset under SIMULINK; real-time algorithms; single place licence; prerequisite MATLAB for OS English Win 32/64 or OS English Win 64, SIMULINK
0140D	g.HIAMP Ping Pong model	2 subject and 4-channel motor imagery based game; prerequisite: SIMULINK HIGH-SPEED ONLINE Processing, g.BSanalyze Base, EEG and Classify Toolbox
0141D	g.HIAMP SSVEP BCI model	8 channel SSVEP based control; prerequisite SIMULINK HIGH-SPEED ONLINE Processing for g.HIAMP, g.RTanalyze, g.BSanalyze Base, EEG and Classify Toolbox
1303D	SSVEP model and hardware for g.HIAMP	bundle for SSVEP based robot control; consists of g.HIAMP SSVEP BCI model, g.SSVEPbox for stimulation, g.STIMbox to run g.SSVEPbox and small robot with bluetooth interface (e-puck); prerequisite SIMULINK HIGH SPEED ONLINE processing for g.HIAMP, g.BSanalyze Base, EEG & Classify Toolboxes, g.RTanalyze
0136	g.BCI CVEP model	code-based BCI model; BCI systems can also use pseudo-random stimulation sequences on a screen (code-based BCI). Such a system can be used to control a robotic device. In this case, the BCI controls were overlaid on the video that showed a robot performing certain tasks; single place licence; prerequisite MATLAB for OS English Win 64, SIMULINK HIGH-SPEED ONLINE Processing, g.BSanalyze Base, EEG and Classify Toolbox
0137	g.BCI SOCI model	The SOCI system (Screen Overlay Control Interface module) can be used especially for virtual reality (VR) applications and remote control of devices to provide the standard user interface by directly embedding the BCI stimuli. The SOCI can be embedded in host applications to directly interact with BCI controls inside the displayed scene. It generates CVEP or SSVEP stimuli and supports single symbol and row column for P300 stimulation. single place licence; prerequisite MATLAB for OS English Win 64, SIMULINK, SIMULINK HIGH-SPEED ONLINE Processing, g.BSanalyze Base, EEG and Classify Toolbox
0264	g.UDPInterface	data exchange with network connection between Simulink/MATLAB on different PCs (eg. BCI, VR, XVR, ...); single place licence; prerequisite MATLAB for OS English Win 64, SIMULINK
0311	g.DISTRIBUTEDeeg	allows to record biosignal data from different distributed PCs in the network and transmit the recorded data to a central evaluation/data storage PC; data synchronisation using the OSC protocol for distributed systems and UDP network interface; synchronicity of +/- 2 samples at a sampling rate of 256 Hz; allows to record evoked potentials in a distributed system; prerequisite: MATLAB for OS English Win 64 ; SIMULINK; Signal Processing Blockset; DSP System Toolbox
0142B	g.HIAMP common spatial patterns	Simulink model to calculate CSPs for 2 / 3 classes, tutorial; prerequisite: SIMULINK HIGH-SPEED ONLINE Processing, g.RTanalyze, g.BSanalyze Base, EEG and Classify Toolbox
7263	g.HIAMP C API	application programming interface (API) for user specific application (eg. developed in C/C++); single place licence; prerequisite OS English Win 32/64
0133D	g.PHYSIOobserver for g.HIAMP	Simulink model for extraction and classification of physiological features with respect to arbitrary classes of user tasks and exercises, tutorial; prerequisite: SIMULINK HIGHSPEED ONLINE processing for g.HIAMP; g.RTanalyze; g.BSanalyze Base, Classify Toolbox; MATLAB for OS English Win 64 ; SIMULINK

G.HIAMP COMPLETE SOLUTIONS

Product no.	Product name	Description
8006	g.HIAMP package BCI	upgrade for BCI research consisting of: g.HIAMP SIMULINK HIGH-SPEED ONLINE Processing Software (drivers and blocksets for SIMULINK); g.HIAMP P300 model; g.HIAMP Ping Pong model; g.HIAMP SSVEP model; g.HIAMP common spatial patterns; g.RTanalyze (real-time software for biosignal parameter extraction); g.BSanalyze (Base version + EEG toolbox + Classify toolbox for offline data processing, analysis and classification); bundle offer (0260d, 0139d, 0140d, 0141d, 0142b, 0111, 0101, 0102, 0105)
8020	g.HIAMP AEP Setup	complete setup for auditory stimulation experiments with g.HIAMP; consisting of: ASSR, BAEP, AEP stimulation unit; audio trigger cable for g.HIAMP; Lecture 4: Evoked potentials; bundle offer (0150, 7240, 4053)
8030	RehaBCI for g.HIAMP	consisting of: g.HIAMP 80; g.SCARABEO 64 bundle; g.HEADbox - active; g.HIAMP SIMULINK HIGH-SPEED ONLINE Processing; g.RTanalyze; g.BSanalyze: Base Version, EEG-toolbox, Classify-toolbox; g.HIAMP common spatial patterns; g.VRsys; g.UDP interface; g.AVATAR; business PC; bundle offer (7001, 1098, 7005, 0260D, 0111, 0101, 0102, 0105, 0142b, 0299, 0264, 0380, 3001A)



A cost-effective solution for your research lab

High demands require high level solutions and groundbreaking technology. g.HIamp-RESEARCH is a 256 channel biosignal amplifier for non-invasive measurements of brain functions for research purpose only. The amplifier, which is colored in orange, has 256 ADC converters with 24 Bit inside for perfect signal resolution and has a wide input sensitivity to measure EEG, ECG, EMG, EOG without any saturation. External sensors can also be connected. All channels are DC coupled. Internally, signal processing is performed with the fastest floating point DSP and a sophisticated Linux Kernel. The amplifier relies on a very high oversampling to reduce the noise as much as possible by averaging samples.

256 channels can be analyzed in real-time with the g.tec Highspeed Processing for Simulink toolbox. This

leads to faster and more accurate control of brain-computer interface systems. The system is equipped with 16 digital trigger channels and a HOLD input for artifact suppression. 80 and 144 channel systems can also be upgraded later on. Each block of 64 channels is connected via a multi-pole safety connector to the electrode interface box. A big advantage is that g.HIamp-RESEARCH can be used with passive or active electrodes. The difference is just the electrode connector box (headbox).

g.HIamp-RESEARCH is intended to be used for research applications only. It is not intended to be used as a medical device nor for diagnosis, treatment of disease or other medical applications. The features of the device are freely accessible and configurable.

PRODUCT HIGHLIGHTS

- ◆ 256 channels perfectly synchronized with 24 Bit
- ◆ Supports active and passive EEG electrodes and ECoG grids
- ◆ Fully integrated into g.tec software for real-time analysis
- ◆ Integrated impedance measurement for active and passive electrodes

TECHNICAL DETAILS AND SPECIFICATIONS

Sensitivity	<60nV (LSB), +/-250mV	Input impedance	>100 MOhm
Amplifier type	real DC coupled	Input connectors	standard safety connectors for passive electrodes, 2-pin connectors for active electrodes
256 × ADC	24 Bit	Weight	1,875 g
Sampling rate	up to 38.4 kHz	Size	197 (L) × 197 (W) × 90 (H) mm
DAC	calibration signal		
Input channels	256 mono-polar / 128 bi-polar (per device, software selectable)		

G.HIAMP-RESEARCH COMPLETE SOLUTIONS

Product no.	Product name	Description
8018R	g.HIAMP-RESEARCH, 80ch bundle	bundle offer consisting of: g.HIAMP-RESEARCH, 80 channel (7001R), for research only: g.tec's multi-modal biosignal amplifier with USB interface; 64+16 channels; bi-, unipolar recordings; 16 digital trigger inputs to synchronize with external events; integrated electrode impedance check; device driver for OS Windows 32/64 bit; internal sampling frequency 38.4 kHz per channel; highest signal-to-noise ratio; multi-pole medical connectors; g.HIAMP water-proof heavy duty case (7051); including g.HIAMP USB cable (7282); (SN: HR-XXXX.XX.XX) furthermore including: g.HEADbox - active, g.HEADbox16 - passive, g.SCARABEO 64 bundle, g.Recorder for g.HIAMP, trigger cable for g.HIAMP DIG IN 1, (7005, 7007, 1098, 0167d, 7276a)
8017R	g.HIAMP-RESEARCH 144ch bundle	bundle offer consisting of: g.HIAMP-RESEARCH 144 channels (7002R), for research only: g.tec's multi-modal biosignal amplifier with USB interface; 128+16 channels; bi-, unipolar recordings; system; 16 digital trigger inputs to synchronize with external events; integrated electrode impedance check; device driver for OS Windows 32/64 bit; internal sampling frequency 38.4 kHz per channel; highest signal-to-noise ratio; multi-pole medical connectors; g.HIAMP water-proof heavy duty case (7051); including g.HIAMP USB cable (7282); (SN: HR-XXXX.XX.XX) furthermore including: 2x g.HEADbox - active, g.HEADbox16 - passive, g.Recorder for g.HIAMP, g.SCARABEO 128 bundle, trigger cable for g.HIAMP for DIG IN 1 (2x7005, 7007, 0167d, 1098, 7276a)
8016R	g.HIAMP-RESEARCH 256ch bundle	bundle offer consisting of: g.HIAMP-RESEARCH 256 channel (7003R), for research only: g.tec's multi-modal biosignal amplifier with USB interface; 256 channels, bi-, unipolar recordings; 16 digital trigger inputs to synchronize with external events; integrated electrode impedance check; device driver for OS 32/64 bit; internal sampling frequency 38.4 kHz per channel; highest signal-to-noise ratio; multi-pole medical connectors; g.HIAMP water-proof heavy duty case (7051); including g.HIAMP USB cable (7282); (SN: HR-XXXX.XX.XX) furthermore including: 4x g.HEADbox - active, g.HEADbox16 - passive, g.Recorder for g.HIAMP, trigger cable for g.HIAMP for DIG IN 1, g.SCARABEO 256 bundle (4x 7005, 7007, 0167d, 1100, 7276a)



g.HIAMP Plugin for DEWESoft X

This plugin allows you to acquire data with g.HIAMP inside the DEWESoft data acquisition system and store it together with all other signals acquired from additional devices in one DEWESoft data file.

Further the plugin allows to configure the g.HIAMP and to use its impedance measurement tool.

See also www.dewesoft.com



g.USBamp 3.0
USB BIOSIGNAL AMPLIFIER

g.tec's highest accuracy biosignal data acquisition and processing system

g.USBamp is a high-performance and high-accuracy biosignal amplifier and acquisition/processing system. It allows investigation of brain-, heart- and muscle-activity, eye movements, respiration, galvanic skin response and many other physiological and physical parameters. Due to its technical specifications and various software options, this instrument became a standard for many different fields of research, including neuropsychology, life science, medical research and biofeedback/neurofeedback/BCI research.

g.USBamp is USB enabled and comes with 16 simultaneously sampled biosignal channels with 24 bits. A total of 4 independent grounds guarantee no interference between the recorded signals.

Build a multi-channel system with more than 16 channels using multiple g.USBamp devices. A synchronization cable guarantees that all devices are sampling with exactly the same frequency.

The amplifier has an input range of ± 250 mV, which allows recording of DC signals without saturation.

Digital inputs and outputs allow the recording of trigger channels together with the biosignal channels to easily pass analysis results to the outside world.

A short-cut input allows connecting the amplifier inputs quickly to ground potential to protect the amplifier against overflows, which may occur in operating rooms with gamma knives or other environments.

PRODUCT HIGHLIGHTS

- ◆ 16 DC-coupled wide-range input channels per unit, 4 independent grounds, record any type of signal (EEG/ECOG/ECG/EMG/EOG/...), connect various sensors.
- ◆ 24-bit resolution with simultaneous sampling of all channels with up to 38.4 kHz, digital signal filtering and preprocessing, connect via USB 2.0.
- ◆ Works with passive and with active electrodes, 8 digital trigger inputs/unit, 4 digital outputs/unit, new simplified synchronization of units.
- ◆ Internal digital bandpass and notch filters, built-in calibration unit and impedance checking.
- ◆ Easy configuration and setup via the software, high-speed online data processing for SIMULINK and for LabVIEW available, recommended by BCI2000.
- ◆ Driver package/API available
- ◆ CE-certified and FDA cleared medical device, safety class: II, conformity class: IIa, type of applied part: CF.



Prof. Dr. Igor Farkaš
Comenius University, SK

“ We have been using g.USBamp intensively for several years, in collaboration with Slovak Academy of Sciences, for measuring EEG on paretic patients as well as healthy individuals, and we are happy with the product. We also appreciate very prompt and professional communication with the g.tec company. ”



Prof. Dr. Jens Rowold
Technische Universität
Dortmund, DE

“ The g.USBamp allows us to study effects of leadership interactions on both the leader's and the follower's brain and cognitive processes with great flexibility. ”



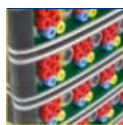
Input channel properties

g.USBamp uses wide-range DC-coupled amplifier technology in combination with 24-bit sampling. The result is an input voltage range of ± 250 mV with a resolution of < 30 nV! This means that any electrophysiological signal can be recorded directly without additional hardware. Neither high electrode offset voltage nor big artifacts resulting from electrical or magnetic stimulation will saturate the amplifier inputs. This feature is an important requisite for various artifact treatment and correction techniques. The use of digital filters avoids hardware-related variations between channels. g.tec's active electrode system can also be connected directly, as well as all of our sensors (e.g. GSR, skin temperature, blood pressure, oxygen saturation, respiration effort and airflow, pulse plethysmography, acceleration, limb movements, snoring sounds, and many more).



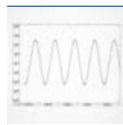
Accuracy and data quality

Each of the 16 analog to digital converters is operating at 2.4576 MHz. An oversampling of 64 times yields the internal sampling rate of 38.400 Hz (per channel and for all channels!). In addition, a powerful floating point Digital Signal Processor performs oversampling and real-time filtering of the biosignal data (between 0 Hz - 2.400 Hz). Therefore, a typical sampling frequency of 256 Hz yields an oversampling rate of 9.600. This results in a very high signal to noise ratio, which is especially critical when recording evoked potentials in the EEG or identifying small amplitude changes in high-resolution ECG recordings. You are measuring far below the noise-range of conventional amplifiers.



Add more channels or split systems

To set up a multi-channel system (32/48/64/... channels), g.USBamps can be stacked. Just add another 16 channels by connecting one more unit to the system. To assure 100% simultaneous sampling of all channels, a simple "SYNC cable" is used to interconnect the devices (via a plug in the rear side). Each input channel can be used for any type of signal (electrophysiological signals or external physiological or physical sensors). On the other hand, if you have a 64 channel system consisting of 4 amplifiers, you can split the system to have 4 units available.



Test signal generation and calibration

The amplifier can generate an internal sinusoidal-, rectangular-, sawtooth or white-noise test signal. The amplitude and frequency of the signal can be modified to test the recording and analysis chain. An internal calibration unit periodically detects offset and gain values for each channel and uses these values for automatic internal correction. This technique provides topmost accuracy - especially needed for high resolution EEG and source derivation/localization.



Skin-electrode impedance

In order to obtain top-quality EEG recordings, the transition impedance between the skin and the electrode must be checked. The internal impedance testing unit measures the impedance for the individual electrodes and the results are displayed in the software. Bad electrodes can be identified easily and skin treatment and gel application can be performed during the impedance testing.



Software options

g.tec's philosophy is to provide a broad spectrum of software solutions for different groups of users (e.g. for engineers, researchers & scientists, physiologists, and medical staff, but also for software developers & programmers). From comfortable Windows-based recording software to MATLAB/SIMULINK and LabVIEW Highspeed Online-Processing environment and device drivers as well as APIs, you will find the appropriate tools for your application. Please see the list of related products/software below for more details. g.USBamp is also supported by some open source research communities such as OpenVibe and BCI2000.



Important information

We give a full 5-years warranty on g.USBamp. g.USBamp is a safe certified medical device (CE and FDA) for research in humans, even for invasive recordings such as electrocorticography (ECoG). It must not be used for patient monitoring or determination of brain death. Medical diagnoses and decisions about treatment of diseases must not be based (solely) on results obtained with this device.



For ECoG

Ad-Tech, PMT, Unique Medical and Cortec grid electrodes can be used for ECoG recordings.



Lukas Fiederer Dipl. Biol.
University Hospital of Freiburg, DE

“ The g.USBamp amplifiers make it possible for us to have a mobile and easy to use EEG setup. The suitcases are perfect for quick transportation and rapid setup of the system. ”



Dr. Natalie Mrachacz-Kersting
Aalborg University, DK

“ We have used the g.USBamps for approximately four years now and the quality of the signals surpasses our greatest expectations. Last year we also invested in the g.Nautilus system and have been able to move from the more stringent laboratory conditions to the real world settings where BCIs find their applications. ”



Dr. Ales Holobar
University of Maribor, SI

“ With g.USBamp you don't think about the amplifier anymore... You think about the EEG signals! ”

HARDWARE

Product no.	Product name	Description
0216	g.USBamp, color silver	multi-modal biosignal amplifier with USB interface; 16 channels; 4 separated grounds, which guarantee no interference between the signals; bi-, unipolar recordings; can be assembled to build multi-channel systems; integrated electrode impedance check; integrated calibration unit; CE-certified medical device EN 60601-1 (IEC 60601-1); device driver for OS Windows 32/64 bit; internal sampling frequency 38.4 kHz per channel; highest signal-to-noise ratio; standard 1.5 mm medical safety connectors; classification of device: safety class II, type of applied part CF, type of applied part BF if several amplifiers are connected, conformity class IIa; FDA listed; including: g.Power (power supply), g.USBamp water-proof heavy duty case, g.USBamp USB cable; version 3.0 (SN: UB-XXXX.XX.XX); standard color: silver, different colors on request, choose your color of science for your personal g.USBamp: O red (RAL3003) O red lilac (RAL4001) O gentian blue (RAL5010) O reseda green (RAL6011) O inky black (RAL9005)
0247	g.Power - g.USBamp	medical mains power supply for g.USBamp; 110/230 V; 50/60 Hz power line; single 5 V supply
0230	g.USBamp, 8 channels (U8)	g.USBamp with 8 unipolar EEG channels; multi pole input socket; 256Hz; no DIG I/O; CE certified; FDA listed; including g.Power (power supply)
0308	10 pin electrode connector box for U8 (g.USBamp 8ch)	connector box for g.USBamp 8 channel version; 1,5 mm touch-proof connectors; 8 unipolar channels + 1 ground and 1 reference
0281A	g.USBamp synch cable (dual) SET	synchronization set for 2 g.USBamps consisting of: g.USBamp synch cable (dual), shortcut jumper cable blue, shortcut jumper cable yellow
0225	g.USBamp cable for short-cut function (SC)	3 m cable with 3 pin screw terminal
0251A	g.ACCUpack for g.USBamp	rechargeable battery pack, 12V and 5V, 4.5 Ah, for g.USBamp + adapter cable
0252	charging device for g.ACCUpack	automatic charging device for battery pack g.ACCUpack, 110/230 V; 50/60 Hz power line, regional adapter for EU, USA, UK, CN/AUS
0253A	adapter cable g.ACCUpack/g.USBamp	adapter cable g.ACCUpack to g.USBamp, 2m
0282	g.USBamp USB cable	connection of g.USBamp to USB-port of PC/notebook
0284	USB 2.0 Hub	with 4 connectors; for 4 g.USBamps
0277	trigger cable for g.USBamp UB	DIO break-out cable to DSUB15-female; can be used e.g. for 4 trigger channels, from g.TRIGbox (D-sub 15), 3 m for g.USBamp 3.0 (UB-xxxx.xx.xx)
0240	audio trigger cable for g.USBamp UB	DIG I/O of g.USBamp UB-xxxx.xx.xx to 2 pole 1/4" connector for AudioFire2 external sound card
0278	adapter cable for trigger cable	DSUB15-male to 6x BNC-male adapter (including 6x BNC to CINCH adapter)
0275	trigger cable for g.USBamp UB	with open leads, for DIG I/O Trigger for UB-xxxx.xx.xx
0276A	trigger cable for g.USBamp UB	DIG I/O 1 and DIG I/O 2 of g.USBamp UB-xxxx.xx.xx to D Sub 25 male (parallel port), 3m
0307B	external trigger button UB	external trigger button for g.USBamp UB, connected to PIN 1 of DIO1/2; 2,5 m cable; 7 pin connector

SOFTWARE

Product no.	Product name	Description
0167A	g.Recorder for g.USBamp	fully GUI-based (graphical user interface); comfortable biosignal visualization and storage; full control of the amplifier and header; real-time compressed spectral array; heart-rate, heart-rate variability; single place licence; prerequisite OS English Win 32/64
0260A	g.USBamp SIMULINK HIGH-SPEED ONLINE Processing	SIMULINK driver and blockset modules; highly optimized hardware-interrupt controlled device driver; allowing data processing with the maximum system speed; supports real-time processing of the biosignal data; calibration block; impedance measurement block; signal analysis blocks; single place licence; prerequisite MATLAB for OS English Win 64, SIMULINK, Signal Processing Blockset and DSP System Toolbox
0168A	g.USBamp LabVIEW High-Speed Online Processing	LabVIEW drivers and virtual instrument modules; highly optimized hardware-interrupt controlled device driver; allows data processing with the maximum system speed; supports real-time processing of biosignal data, virtual instruments for calibration and impedance check; requires LabVIEW or higher; prerequisite OS English Win 32/64
0139A	g.USBamp P300 model	8-channel P300 based speller; prerequisite: SIMULINK HIGH-SPEED ONLINE Processing, g.BSanalyze Base, EEG and Classify Toolbox
0140A	g.USBamp Ping Pong model	2 subject and 4-channel motor imagery based game; prerequisite: SIMULINK HIGH-SPEED ONLINE Processing, g.BSanalyze Base, EEG and Classify Toolbox
0133A	g.PHYSIOobserver for g.USBamp	Simulink model for extraction and classification of physiological features with respect to arbitrary classes of user tasks and exercises, tutorial; prerequisite: SIMULINK HIGHSPEED ONLINE processing for g.USBamp; g.RTanalyze; g.BSanalyze Base, Classify Toolbox
0141A	g.USBamp SSVEP BCI model	8 channel SSVEP based control; prerequisite SIMULINK HIGH-SPEED ONLINE Processing for g.USBamp, g.RTanalyze, g.Bsanalyze Base, EEG and Classify Toolbox
0144A	g.VIBROTACTILEp300 model for g.USBamp	2-, 3- and 8-channel vibrotactile P300 based BCI control; prerequisite: SIMULINK HIGH SPEED ONLINE Processing, g.STIMbox, g.VIBROstim, g.Bsanalyze Base, EEG and Classify Toolbox
0146	hyperscanning BCI model	multi-user P300 and Motor Imagery based control; prerequisite SIMULINK HIGH-SPEED ONLINE Processing, g.RTanalyze, g.BSanalyze Base, EEG and Classify Toolbox
0147	hybrid BCI model	SSVEP and P300 hybrid based control; prerequisite SIMULINK HIGH-SPEED ONLINE Processing, g.RTanalyze, g.BSanalyze Base, EEG and Classify Toolbox
0148	ACTOR BCI - Application ConTrol and Online Reconfiguration (ACTOR) protocol	Simulink model with matrix interface that can be remotely updated or configured with configuration files; sends commands to external devices; prerequisite SIMULINK HIGH-SPEED ONLINE Processing
0149	EMG/EOG/mouse control	Simulink model to control the matrix interface with EMG, EOG or mouse; prerequisite SIMULINK HIGH SPEED ONLINE processing
1303A	SSVEP model and hardware for g.USBamp	bundle for SSVEP based robot control; consists of g.USBamp SSVEP BCI model, g.SSVEPbox for stimulation, g.STIMbox to run g.SSVEPbox and small robot with bluetooth interface (e-puck); prerequisite SIMULINK HIGH SPEED ONLINE processing for g.USBamp, g.BSanalyze Base, EEG & Classify Toolboxes, g.RTanalyze;
0142	g.USBamp common spatial patterns	Simulink model to calculate CSPs for 2 / 3 classes, tutorial; prerequisite: SIMULINK HIGH-SPEED ONLINE Processing, g.BSanalyze Base, EEG and Classify Toolbox
0111	g.RTanalyze	real-time EEG, ECG, respiration, galvanic skin response and biosignal processing blockset under SIMULINK; real-time algorithms; single place licence; prerequisite MATLAB for OS English Win 32/64 or OS English Win 64, SIMULINK
0261	g.USBamp API for MATLAB	MATLAB programming driver package for g.USBamp; single place licence; prerequisite MATLAB for OS English Win 32 , Data Acquisition Toolbox
0263	g.USBamp C API	application programming interface (API) for user specific application (eg. developed in C/C++); single place licence; prerequisite OS English Win 32/64
0169A	LINUX API for g.USBamp	driver software package for g.USBamp; full access to recording buffer; for user specific applications on the PC; single place licence; prerequisite Ubuntu Linux 32/64 bit
0263A	g.USBamp C API + BCI2000	application programming interface (API) for user specific application (eg. developed in C/C++); BCI2000 driver, BCI2000 software package; single place licence; prerequisite OS English Win 32/64
0136	g.BCI CVEP model	code-based BCI model; BCI systems can also use pseudo-random stimulation sequences on a screen (code-based BCI). Such a system can be used to control a robotic device. In this case, the BCI controls were overlaid on the video that showed a robot performing certain tasks; single place licence; prerequisite MATLAB for OS English Win 64, SIMULINK HIGH-SPEED ONLINE Processing, g.BSanalyze Base, EEG and Classify Toolbox
0137	g.BCI SOCI model	The SOCI system (Screen Overlay Control Interface module) can be used especially for virtual reality (VR) applications and remote control of devices to provide the standard user interface by directly embedding the BCI stimuli. The SOCI can be embedded in host applications to directly interact with BCI controls inside the displayed scene. It generates CVEP or SSVEP stimuli and supports single symbol and row column for P300 stimulation. single place licence; prerequisite MATLAB for OS English Win 64, SIMULINK, SIMULINK HIGH-SPEED ONLINE Processing, g.BSanalyze Base, EEG and Classify Toolbox
0264	g.UDPInterface	data exchange with network connection between Simulink/MATLAB on different PCs (eg. BCI, VR, XVR, ...); single place licence; prerequisite MATLAB for OS English Win 64, SIMULINK
0311	g.DISTRIBUTEDeeg	allows to record biosignal data from different distributed PCs in the network and transmit the recorded data to a central evaluation/data storage PC; data synchronisation using the OSC protocol for distributed systems and UDP network interface; synchronicity of +/- 2 samples at a sampling rate of 256 Hz; allows to record evoked potentials in a distributed system; prerequisite: MATLAB for OS English Win 64 ; SIMULINK; Signal Processing Blockset; DSP System Toolbox



COMPLETE SOLUTIONS

Product no.	Product name	Description
6023	g.BCIsys16USB: complete BCI-research system, PC included	16 channels; consisting of: g.USBamp (biosignal amplifier, CE-certified, FDA listed, with power supply); SIMULINK HIGH-SPEED ONLINE Processing software (drivers and blockset for SIMULINK); g.RTanalyze (real-time software for biosignal parameter extraction); g.BSanalyze (base version + EEG-toolbox + Classify-toolbox for offline data processing, analysis and classification); fully equipped business PC (with software ready-to-go installation); bundle offer (0216+0260+0111ae+0101ae+0102ae+0105ae+3001a+3060); prerequisite MATLAB for OS English Win 64, SIMULINK, Signal Processing Toolbox, Signal Processing Blockset and DSP System Toolbox
6029	g.BCIsys16USB, PC included ERD, SSVEP, P300	16 channels; consisting of: g.USBamp (biosignal amplifier, CE-certified, FDA listed, with power supply); SIMULINK HIGH-SPEED ONLINE Processing software (drivers and blockset for SIMULINK); g.RTanalyze (real-time software for biosignal parameter extraction); g.USBamp P300 model; g.USBamp Ping Pong model; g.USBamp SSVEP model and hardware; g.BSanalyze (base version + EEG-toolbox + Classify-toolbox for offline data processing, analysis and classification); fully equipped business PC (with software ready-to-go installation); bundle offer (6023+0139a+0140a+1303a); prerequisite MATLAB for OS English Win 64, SIMULINK, Signal Processing Toolbox, Signal Processing Blockset and DSP System Toolbox
6024	g.BCIsys32USB: complete BCI-research system, PC included	32 channels; consisting of: g.USBamp (biosignal amplifier, double unit, CE-certified, FDA listed, with power supply); SIMULINK HIGH-SPEED ONLINE Processing software (drivers and blockset for SIMULINK); g.RTanalyze (real-time software for biosignal parameter extraction); g.BSanalyze (base version + EEG-toolbox + Classify-toolbox for offline data processing, analysis and classification); fully equipped business PC (with software ready-to-go installation); synchronisation cable; USB 2.0 Hub; bundle offer (2x0216+0260A+0111+0101+0102+0105+3001A+0281A+0284+3060); prerequisite MATLAB for OS English Win 64, SIMULINK, Signal Processing Toolbox, Signal Processing Blockset and DSP System Toolbox
6031	g.BCIsys32USB ERD, SSVEP, P300, PC included	32 channels; consisting of: g.USBamp (biosignal amplifier, double unit, CE-certified, FDA listed, with power supply); SIMULINK HIGH-SPEED ONLINE Processing software (drivers and blockset for SIMULINK); g.USBamp P300 model; g.USBamp Ping Pong model; g.USBamp SSVEP model and hardware; g.USBamp common spatial patterns; g.RTanalyze (real-time software for biosignal parameter extraction); g.BSanalyze (base version + EEG-toolbox + Classify-toolbox for offline data processing, analysis and classification); fully equipped business PC (with software ready-to-go installation); synchronisation cable; USB 2.0 Hub; shortcut jumper cables; bundle offer (6024+0139a+0140a+0142+1303a); prerequisite MATLAB for OS English Win 64, SIMULINK, Signal Processing Toolbox, Signal Processing Blockset and DSP System Toolbox
6038	g.USBamp ECG bundle	complete setup for ECG research; consisting of: 1x g.USBamp, CE-certified and FDA listed biosignal amplifier; 1x g.Power - g.USBamp, medical mains power supply; 1x g.GAMMAbox; 1x g.USBmpGAMMAconnector; 16x g.GAMMAclip, active clip electrode; 2x g.GAMMAclipGND, active ground electrode; 2x g.GAMMAclipREF, active reference electrode; 2x disposable Ag/AgCl electrodes; 1x g.USBamp Simulink High Speed Online Processing, single place license; g.BSanalyze Base, ECG Toolbox; Lecture ECG, for ECG teaching (1x0216+1x016A+1x019A+16x1024+2x1025+2x1047+2x1032+1x0260A+1x0101+1x0104A+1x4052+1x3060)
6039	g.USBamp EMG bundle	complete setup for EMG research; consisting of: 1x g.USBamp, CE-certified and FDA listed biosignal amplifier; 1x g.Power - g.USBamp, medical mains power supply; 1x g.GAMMAbox; 1x g.USBmpGAMMAconnector; 16x g.GAMMAclip, active clip electrode; 2x g.GAMMAclipGND, active ground electrode; 2x g.GAMMAclipREF, active reference electrode; 2x disposable Ag/AgCl electrodes; 1x g.USBamp Simulink High Speed Online Processing, single place license; g.BSanalyze Base, EEG and Classify Toolbox (1x0216+1x016A+1x019A+16x1024+2x1025+2x1047+1x1032+1x0260A+1x0153+1x3060)
6021	g.BCIsys64USB: complete BCI-research system, PC included	64 channels; consisting of: g.USBamp (biosignal amplifier, quadruple unit, CE-certified, FDA listed, with power supply); SIMULINK HIGH-SPEED ONLINE Processing software (drivers and blockset for SIMULINK); g.RTanalyze (real-time software for biosignal parameter extraction); g.BSanalyze (base version + EEG-toolbox + Classify-toolbox for offline data processing, analysis and classification); fully equipped business PC (with software ready-to-go installation); synchronisation cable; USB 2.0 Hub; shortcut jumper cables; bundle offer (4x0216+0260A+0111+0101+0102+0105+3001a+0283A+0284+3060); prerequisite MATLAB for OS English Win 64, SIMULINK, Signal Processing Toolbox, Signal Processing Blockset and DSP System Toolbox
6070	g.EEG16sys, complete portable EEG recording/analysis system, NB included	consisting of: g.USBamp (16 channel biosignal amplifier, CE-certified, FDA listed, with power supply); g.Recorder; g.BSanalyze (base version) for offline data visualization/processing and EEG-Toolbox for advanced EEG analysis; fully equipped business notebook (with software ready-to-go installation); bundle offer (0216+0167a+0101+0102+3003+3060); prerequisite MATLAB for OS English Win 32/64, Signal Processing Toolbox
6080	g.EEG32sys, complete EEG recording/analysis system, PC included	consisting of: g.USBamp (32 channel biosignal amplifier, CE-certified, FDA listed, with power supply); g.Recorder; g.BSanalyze (base version) for offline data visualization/processing and EEG-Toolbox for advanced EEG analysis; fully equipped business PC (with software ready-to-go installation); synchronisation cable; USB 2.0 Hub; shortcut jumper cables; bundle offer (2x0216+0167a+0101+0102+3001a+0281A+0284+3060); prerequisite MATLAB for OS English Win 32/64, Signal Processing Toolbox
6090	g.EEG64sys, complete EEG recording/analysis system, PC included	consisting of: g.USBamp (64 channel biosignal amplifier, CE-certified, FDA listed, with power supply); g.Recorder; g.BSanalyze (base version) for offline data visualization/processing and EEG-Toolbox for advanced EEG analysis; fully equipped business PC (with software ready-to-go installation); synchronisation cable; USB 2.0 Hub; shortcut jumper cables; bundle offer (4x0216+0167a+0101+0102+3001a+0283A+0284+3060); prerequisite MATLAB for OS English Win 32/64, Signal Processing Toolbox
6095	g.USBamp AEP Setup	complete setup for auditory stimulation experiments with g.USBamp; consisting of: ASSR, BAEP, AEP stimulation unit; audio trigger cable for g.USBamp UB; Lecture 4: Evoked potentials; bundle offer (0150, 0240, 4053)
6028	g.tec BCI2000 bundle offer with g.USBamp, NB included	consisting of: g.USBamp (16 channel biosignal amplifier, CE-certified, FDA listed, with power supply); water-proof heavy duty case; USB cable; fully equipped business notebook; C API and BCI2000 driver package; bundle offer (0216+3003+0263a)
6032	RehaBCI, PC included	32 channels; consisting of: g.BCIsys32USB; g.VRsys; g.GAMMAbundle for g.USBamp CSP; g.UDPinterface for communication between the PCs; g.USBamp common spatial patterns model; 3D human avatar; bundle offer; (6024+0299+1111b+0264+0380)

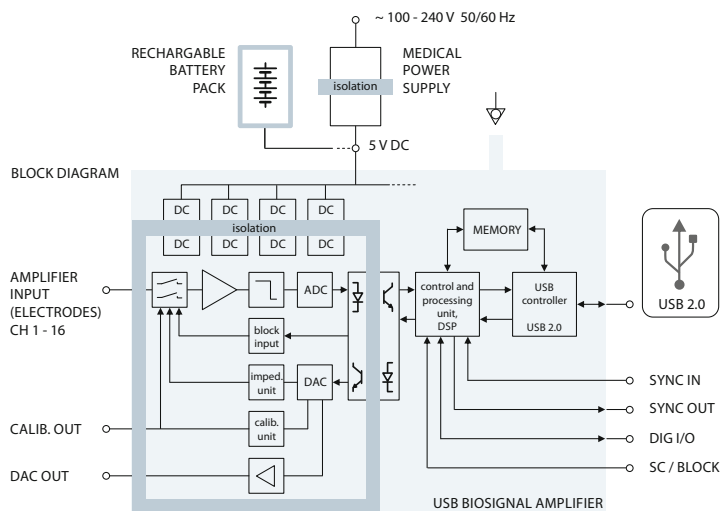


Ing. Salvatore Tramonte
University of Palermo, IT

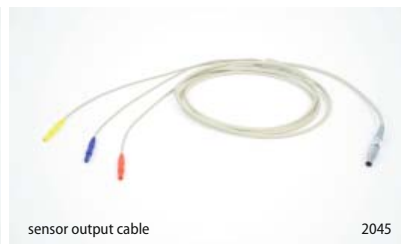
“The g.USBamp really improved the usability of the BCI, enabling interconnection with an external robotic agent to develop assistive technology for locked-in people, enabling them to put their thought in actions.”



SPECS



- Sensitivity: < 30 nV (LSB) - ± 250 mV
- Amplifier type: real DC coupled
- 16 x ADC: 24 bit (38.4 kHz internal sampling per channel)
- 2 x DAC: 12 bit
- Input channels: 16 mono- / 8 bi-polar (per device, software-selectable)
- Noise level: < 0.4 μ V RMS (0.1 - 10 Hz)
- Input impedance: > 100 MOhm
- Input connectors: standard safety connectors and system connectors
- Weight: 1000 g
- Size: 197 x 155 x 40 mm
- Applied part: type CF
- Safety class: II
- Directive of medical products: 93/42/EWG
- Standards: EN60601-1 (+A1 +A2 +A12 +A13)
EN60601-2-26
EN60601-1-2
EN60601-2-25 +A1
EN60601-2-40





g.Nautilus 64-channel version with g.SCARABEO electrode technology.

g.Nautilus is g.tec's new wireless biosignal acquisition system. Its design is completely different from all other devices and it sets a new standard of usability. The tiny and lightweight device is attached to the EEG cap to avoid cable movements and to allow completely free movements. In combination with g.tec's active electrode technology, you will get top-quality EEG recordings from 64/32/16/8 channels within a few minutes. Just put on the cap, add a bit of gel in each electrode, and start your recording. A dry electrode version based on the worldwide proven g.SAHARA electrodes is also available. g.Nautilus has a built-in lithium ion battery, which allows for continuous recordings of up to 8 hours. The battery is recharged via a contactless charging pad within 2–3 hours. The device is completely waterproof, which allows easy cleaning of the electrodes together with the cap, with no need to disconnect or disassemble anything! g.Nautilus transmits data via the 2.4 GHz band with an indoor operating

g.Nautilus
WIRELESS BIOSIGNAL ACQUISITION SYSTEM

g.tec's wireless EEG system with active electrodes



Ernst & Young
Entrepreneur Of The Year®
Award



range of about 10 m. The input sensitivity of all channels is adjustable and the sampling rate can be set up to 500 Hz (250 Hz with the 64 channel version). An electrode impedance check can be performed automatically via software, and a 3-axis acceleration sensor provides online head movement information along with the biosignals. The base station for g.Nautilus is just a small receiver box connected to the PC via USB. 8 digital trigger lines can be connected to the base station to record event timing information. g.Nautilus comes with a 64-channel EEG setup (10/20 system), but subsets with different electrode arrangements are available on request.



The g.Nautilus headset placed on the Qi contactless charging pad

HARDWARE

Product no.	Product name	Description
5130	g.Nautilus 64	64 active channels with electrodes prefixed on a medium cap; 24 bit resolution; 250 Hz sample rate; built in 3-axis acceleration sensor; Lithium ION batteries in Compliance with Section II of P1967, easy wireless charging, Qi compatible; wireless data transmission; watertight housing for easy cleaning; internal impedance check; for research only; flexible electrode positioning

HARDWARE

Product no.	Product name	Description
5100	g.Nautilus 32, g.LADYbird	32 prefixed channels with active electrode system on a medium cap; 24 bit resolution; 250 or 500 Hz sample rate; built in 3-axis acceleration sensor; Lithium ION batteries in Compliance with Section II of PI967, easy wireless charging, Qi compatible; wireless data transmission; watertight housing for easy cleaning; internal impedance check with active electrodes; for research only!
5100PRO	g.Nautilus-PRO 32, g.LADYbird	32 prefixed channels with active electrode system on a medium cap; 24 bit resolution; 250 or 500 Hz sample rate; built in 3-axis acceleration sensor; Lithium ION batteries in Compliance with Section II of PI967, easy wireless charging, Qi compatible; wireless data transmission; watertight housing for easy cleaning; internal impedance check with active electrodes; certified medical device
5110	g.Nautilus 16, g.LADYbird	16 prefixed channels with active electrode system on a medium cap; 24 bit resolution; 250 or 500 Hz sample rate; built in 3-axis acceleration sensor; Lithium ION batteries in Compliance with Section II of PI967, easy wireless charging, Qi compatible; wireless data transmission; watertight housing for easy cleaning; internal impedance check with active electrodes; for research only!
5110PRO	g.Nautilus-PRO 16, g.LADYbird	16 prefixed channels with active electrode system on a medium cap; 24 bit resolution; 250 or 500 Hz sample rate; built in 3-axis acceleration sensor; Lithium ION batteries in Compliance with Section II of PI967, easy wireless charging, Qi compatible; wireless data transmission; watertight housing for easy cleaning; internal impedance check with active electrodes; certified medical device
5120	g.Nautilus 8, g.LADYbird	8 prefixed channels with active electrode system on a medium cap; 24 bit resolution; 250 or 500 Hz sample rate; built in 3-axis acceleration sensor; Lithium ION batteries in Compliance with Section II of PI967, easy wireless charging, Qi compatible; wireless data transmission; watertight housing for easy cleaning; internal impedance check with active electrodes; for research only!
5120PRO	g.Nautilus-PRO 8, g.LADYbird	8 prefixed channels with active electrode system on a medium cap; 24 bit resolution; 250 or 500 Hz sample rate; built in 3-axis acceleration sensor; Lithium ION batteries in Compliance with Section II of PI967, easy wireless charging, Qi compatible; wireless data transmission; watertight housing for easy cleaning; internal impedance check with active electrodes; certified medical device
5300S_3	g.GAMMAcap3 for g.Nautilus, Size S, 5mm	electrode cap with 74 position, for g.Nautilus with g.LADYbird, extended 10/20 system and 86 intermediate positions; size: S (50-54 cm); chin strap and occipital velcro pad
5300M_3	g.GAMMAcap3 for g.Nautilus, Size M, 5mm	electrode cap with 74 position, for g.Nautilus with g.LADYbird, extended 10/20 system and 86 intermediate positions; size: M (54-58 cm); chin strap and occipital velcro pad
5300L_3	g.GAMMAcap3 for g.Nautilus, Size L, 5mm	electrode cap with 74 position, for g.Nautilus with g.LADYbird, extended 10/20 system and 86 intermediate positions; size: L (58-62 cm); chin strap and occipital velcro pad

PRODUCT HIGHLIGHTS

- ◆ 64/32/16/8 channel wireless EEG/ExG with 3-axis accelerometer
- ◆ 24 bit accuracy up to 500 Hz sampling rate
- ◆ a new benchmark in usability
- ◆ the only wireless system with active electrode technology
- ◆ g.tec's internal impedance check with active electrodes
- ◆ waterproof device with contactless charging
- ◆ 8 hours continuous recording and 2-3 hours charging
- ◆ 2.4 GHz digital transmission, range: 10 meters indoor
- ◆ full integration into g.tec's software environment
- ◆ also available as a CE certified medical device (g.Nautilus PRO)



The g.Nautilus base station connects to the PC/notebook via USB and has 8 digital trigger inputs

g.Nautilus 32-channel version with g.LADYbird electrode technology.



HARDWARE

Product no.	Product name	Description
5200	g.Nautilus 32, g.SAHARA	32 prefixed channels with dry active electrode system on a medium cap; 24 bit resolution; 250 or 500 Hz sample rate; built in 3-axis acceleration sensor; Lithium ION batteries in Compliance with Section II of PI967, easy wireless charging, Qi compatible; wireless data transmission; watertight housing for easy cleaning; internal impedance check with active electrodes; for research only! g.SAHARA 7mm electrodes "short-pin" included (16mm "long-pin" electrodes must be ordered seperately)
5200PRO	g.Nautilus-PRO 32, g.SAHARA	32 prefixed channels with dry active electrode system on a medium cap; 24 bit resolution; 250 or 500 Hz sample rate; built in 3-axis acceleration sensor; Lithium ION batteries in Compliance with Section II of PI967, easy wireless charging, Qi compatible; wireless data transmission; watertight housing for easy cleaning; internal impedance check with active electrodes; g.SAHARA 7mm electrodes "short-pin" included (16mm "long-pin" electrodes must be ordered seperately); certified medical device
5210	g.Nautilus 16, g.SAHARA	16 prefixed channels with dry active electrode system on a medium cap; 24 bit resolution; 250 or 500 Hz sample rate; built in 3-axis acceleration sensor; Lithium ION batteries in Compliance with Section II of PI967, easy wireless charging, Qi compatible; wireless data transmission; watertight housing for easy cleaning; internal impedance check with active electrodes; for different hair conditions short and long pin g.SAHARA Electrodes included; for research only! g.SAHARA 7mm electrodes "short-pin" included (16mm "long-pin" electrodes must be ordered seperately)
5210PRO	g.Nautilus-PRO 16, g.SAHARA	16 prefixed channels with dry active electrode system on a medium cap; 24 bit resolution; 250 or 500 Hz sample rate; built in 3-axis acceleration sensor; Lithium ION batteries in Compliance with Section II of PI967, easy wireless charging, Qi compatible; wireless data transmission; watertight housing for easy cleaning; internal impedance check with active electrodes; for different hair conditions short and long pin g.SAHARA Electrodes included; g.SAHARA 7mm electrodes "short-pin" included (16mm "long-pin" electrodes must be ordered seperately); certified medical device
5220	g.Nautilus 8, g.SAHARA	8 prefixed channels with dry active electrode system on a medium cap; 24 bit resolution; 250 or 500 Hz sample rate; built in 3-axis acceleration sensor; Lithium ION batteries in Compliance with Section II of PI967, easy wireless charging, Qi compatible; wireless data transmission; watertight housing for easy cleaning; internal impedance check with active electrodes; for research only! g.SAHARA 7mm electrodes "short-pin" included (16mm "long-pin" electrodes must be ordered seperately)
5220PRO	g.Nautilus-PRO 8, g.SAHARA	8 prefixed channels with dry active electrode system on a medium cap; 24 bit resolution; 250 or 500 Hz sample rate; built in 3-axis acceleration sensor; Lithium ION batteries in Compliance with Section II of PI967, easy wireless charging, Qi compatible; wireless data transmission; watertight housing for easy cleaning; internal impedance check with active electrodes; g.SAHARA 7mm electrodes "short-pin" included (16mm "long-pin" electrodes must be ordered seperately); certified medical device
5300S_2	g.GAMMAcap2 for g.Nautilus, Size S, 2mm	electrode cap with 74 position, for g.Nautilus with g.SAHARA, extended 10/20 system and 86 intermediate positions; size: S (50-54 cm); chin strap and occipital velcro pad
5300M_2	g.GAMMAcap2 for g.Nautilus, Size M, 2mm	electrode cap with 74 position, for g.Nautilus with g.SAHARA, extended 10/20 system and 86 intermediate positions; size: M (54-58 cm); chin strap and occipital velcro pad
5300L_2	g.GAMMAcap2 for g.Nautilus, Size L, 2mm	electrode cap with 74 position, for g.Nautilus with g.SAHARA, extended 10/20 system and 86 intermediate positions; size: L (58-62 cm); chin strap and occipital velcro pad



g.Nautilus 32-channel version with g.SAHARA dry electrode technology.

HARDWARE

Product no.	Product name	Description
5321	Trigger cable for g.Nautilus (Parallel Port)	Trigger cable to connect the 8 trigger inputs of the g.Nautilus base station to the parallel port (25-pin, sub-D). Can be used with E-prime or Presentation stimulation system. Length: 3m
5322	Trigger cable for g.Nautilus (g.STIMbox)	Trigger cable to connect the 8 trigger inputs of the g.Nautilus base station to the digital output connector of g.STIMbox (26-pin, sub-D). Length: 3m
5323	Trigger cable for g.Nautilus (g.TRIGbox)	Trigger cable to connect 4 trigger inputs of the g.Nautilus base station to the output connector of g.TRIGbox (15-pin, sub-D). Length: 3m

SOFTWARE

Product no.	Product name	Description
6305	g.NEEDaccess API	g.tec general device data access interface; application programming interface
6310	g.NEEDaccess bundle	complete g.NEEDaccess API bundle, including mini-pc to run the device server
0260E	g.Nautilus SIMULINK HIGH-SPEED ONLINE Processing	SIMULINK driver and blockset modules; highly optimized hardware-interrupt controlled device driver; allowing data processing with the maximum system speed; supports real-time processing of the biosignal data; g.Nautilus configuration block, single place license; prerequisite MATLAB for OS English Win 64, SIMULINK, Signal Processing Blockset and DSP System Toolbox
0291	g.EYetracking Interface for SIMULINK	read eyetracking information into Simulink; single place licence; prerequisite MATLAB for OS English Win 64, SIMULINK Can be used with the following eyetracker models: Tobii X2 - 60
0139E	g.Nautilus P300 BCI model	8-channel P300 based speller; prerequisite: SIMULINK HIGH-SPEED ONLINE Processing, g.BSanalyze Base, EEG and Classify Toolbox
0140A	g.USBamp Ping Pong model	2 subject and 4-channel motor imagery based game; prerequisite: SIMULINK HIGH-SPEED ONLINE Processing, g.BSanalyze Base, EEG and Classify Toolbox
0141E	g.Nautilus SSVEP BCI model	8 channel SSVEP based control; prerequisite SIMULINK HIGH-SPEED ONLINE Processing for g.Nautilus, g.RTanalyze, g.BSanalyze Base, EEG and Classify Toolbox
0144E	g.VIBROTACTIONP300 BCI model for g.Nautilus	2-, 3- and 8-channel vibrotactile P300 based BCI control; prerequisite: SIMULINK HIGH SPEED ONLINE Processing, g.STIMbox, g.VIBROstim, g.BSanalyze Base, EEG and Classify Toolbox
0147	hybrid BCI model	SSVEP and P300 hybrid based control; prerequisite SIMULINK HIGH-SPEED ONLINE Processing, g.RTanalyze, g.BSanalyze Base, EEG and Classify Toolbox
0148	ACTOR BCI - Application ConTrol and Online Reconfiguration (ACTOR) protocol	Simulink model with matrix interface that can be remotely updated or configured with configuration files; sends commands to external devices; prerequisite SIMULINK HIGH-SPEED ONLINE Processing
1303E	SSVEP model and hardware for g.Nautilus	bundle for SSVEP based robot control; consists of g.Nautilus SSVEP BCI model, g.SSVEPbox for stimulation, g.STIMbox to run g.SSVEPbox and small robot with bluetooth interface (e-puck); prerequisite SIMULINK HIGH SPEED ONLINE processing for g.Nautilus, g.BSanalyze Base, EEG & Classify Toolboxes, g.RTanalyze
0142E	g.Nautilus common spatial patterns BCI model	Simulink model to calculate CSPs for 2 / 3 classes, tutorial; prerequisite: SIMULINK HIGH-SPEED ONLINE Processing, g.BSanalyze Base, EEG and Classify Toolbox; special g.Nautilus electrode montage necessary!
0111	g.RTanalyze	real-time EEG, ECG, respiration, galvanic skin response and biosignal processing blockset under SIMULINK; real-time algorithms; single place license; prerequisite MATLAB for OS English Win 32/64, SIMULINK
0136	g.BCI CVEP model	code-based BCI model; BCI systems can also use pseudo-random stimulation sequences on a screen (code-based BCI). Such a system can be used to control a robotic device. In this case, the BCI controls were overlaid on the video that showed a robot performing certain tasks; single place licence; prerequisite MATLAB for OS English Win 64, SIMULINK HIGH-SPEED ONLINE Processing, g.BSanalyze Base, EEG and Classify Toolbox
0137	g.BCI SOCI model	The SOCI system (Screen Overlay Control Interface module) can be used especially for virtual reality (VR) applications and remote control of devices to provide the standard user interface by directly embedding the BCI stimuli. The SOCI can be embedded in host applications to directly interact with BCI controls inside the displayed scene. It generates CVEP or SSVEP stimuli and supports single symbol and row column for P300 stimulation. single place licence; prerequisite MATLAB for OS English Win 64, SIMULINK, SIMULINK HIGH-SPEED ONLINE Processing, g.BSanalyze Base, EEG and Classify Toolbox



Dr. Aysegul Gunduz
University of Florida, US

“g.Nautilus wireless EEG amplifiers allow us to investigate freezing of gait in Parkinson’s disease, a dangerous symptom for the aging population, as it can lead to falls. We can synchronize the EEG signals with VICON motion capture data seamlessly, without adding extra burdens to our patients such as backpacks or wired-in hardware following them.”



Dr. Robert Leeb, CH

“The g.Nautilus allows my participants to interact more freely in our experimental environment, since they finally are untied from the amplifier.”



Omar Mendoza Montoya
Freie Universität Berlin, DE

“With the g.Nautilus system, our research group has managed to combine BCI technology with other intelligent systems without expending time on replicating laboratory conditions everywhere to obtain good quality signals. Now we believe it’s possible to have computers, robots and smart devices interacting with a BCI in places where just a few years ago it was technically unfeasible.”





GEWINN
AWARD FOR
INNOVATION

Wireless biosignal acquisition system in your pocket

g.MOBilab+ is the perfect tool for recording multi-modal biosignal data on a standard PC or notebook. This allows investigation of brain-, heart-, and muscle- activity, eye movement, respiration, galvanic skin response, pulse and other body signals. g.MOBilab+ is available in two versions: the 8 channel EEG and the multi-purpose version. A switch can be connected for external triggering of the data. g.MOBilab+ is equipped with low-noise biosignal

amplifiers and a 16-bit A/D converter (256 Hz) which guarantees excellent data quality and a high signal-to-noise ratio. For sophisticated data analyses, g.MOBilab-data can be imported directly into g.BSanalyze, the toolbox for advanced biosignal processing and analyses. Data can also be converted into ASCII-format for other programs like MS-Excel or foreign toolboxes.

PRODUCT HIGHLIGHTS

- ◆ Acquire EEG, ECG, EOG, EMG and other signals even outside your lab
- ◆ On-line visualization and storage of up to 16 channels on a PC or a notebook
- ◆ Various software solutions available (driver/API, recording software, MATLAB/SIMULINK/LabVIEW, ...)
- ◆ Transmit online biosignal data wirelessly via bluetooth 2.0 to a PC or notebook
- ◆ Log data directly on an internal flash card memory (Mini-SD card)
- ◆ Integrate the device into your real-time system under SIMULINK (BCI, neuro-, biofeedback)



Sandro Hardy, MSc
Technical University
of Darmstadt, DE

“ Thanks to the g.MOBilab+ in combination with active electrodes, we are able to capture biosignals such as EMG and EEG with high quality, even while users are moving. ”



TECHNICAL DETAILS AND SPECIFICATIONS

g.MOBilab+ (8-channel EEG version)	EEG Channels: 8, Filters: 0.5 - 100 Hz, Sensitivity: 500 μ V (monopolar), no additional analog inputs		
g.MOBilab+ (multi-purpose version)	EEG Channels: 2 Filters: 0.5 - 100 Hz Sensitivity: 500 μ V (bipolar)	EEG/EOG Channels: 2 Filters: 0.01 - 100 Hz Sensitivity: 2 mV (bipolar)	ECG/EMG Channels: 2 Filters: 0.5 - 100 Hz Sensitivity: 5mV (bipolar)
Analog inputs (multi-purpose)	Channels: 2, Filters: DC-100 Hz, Sensitivity: +/- 250 mV (monopolar)		
Additional inputs/outputs	4 digital inputs/outputs, 4 digital inputs (TTL), +5V		
Power supply	4 standard AA batteries or accumulators (25 - 100 hours operation time, depending on mode)		
Data acquisition	ADC with 16 Bit and 256 Hz/channel, serial interface (RS232), Bluetooth 2.0 / class I (+)		
Standard	Manufactured according to IEC 60601-1, for research application, no medical device		
Internal storage card	Micro-SD flash memory card (up to 2 GB), accessible via the battery compartment		
Weight	360 gram (including batteries)		
Dimension	155 mm x 100 mm x 40 mm		

HARDWARE

Product no.	Product name	Description
5033	g.MOBilab+ multi-purpose version	2 EEG; 2 EEG/EOG; 2 ECG/EMG bipolar channels; 2 analog inputs; 4 x digital I/O + 4 x digital IN; battery supplied with 4 AA type batteries; wireless signal transmission; streaming onto removable storage card; removable storage card; electronic handbook; Bluetooth dongle
5603	g.MOBilab+ 8 channel EEG version	8 unipolar EEG channels; 4 x digital I/O + 4 x digital IN; battery supplied with 4 AA type batteries; wireless signal transmission; streaming onto removable storage card; removable storage card; electronic handbook; Bluetooth dongle
5002	5-lead ECG/EMG patient cable for g.MOBilab+ multi-purpose version	for 2 ECG/EMG bipolar channels for g.MOBilab+, for use with disposable electrodes; with clip leads
5003	9-pin EEG/EOG connector box for g.MOBilab+ multi-purpose version	for 2 EEG and 2 EEG/EOG bipolar channels, for g.MOBilab+; 1.5 mm touch-proof connectors
5003C	6-pin ECG/EMG connector box for g.MOBilab+ multi-purpose version	for ECG/EMG recordings for g.MOBilab+; 1.5 mm touch-proof connectors; 2 bipolar channels + 2 grounds
5052	6-pin analog input connector box for g.MOBilab+ multi-purpose version	for analog signal recordings, for g.MOBilab+; 1.5 mm touch-proof connectors; 2 unipolar channels + 2 grounds
5601	10-pin connector cable to DSUB25 male for g.MOBilab+ EEG version	for EEG recordings with ribbon cable electrode caps, specify channel pinout at order!
5602	10-pin EEG electrode connector box for g.MOBilab+ EEG version	for EEG recordings, for g.MOBilab+; 1.5 mm touch-proof connectors; 8 unipolar channels + 1 ground + 1 reference
0241	g.Zcheck	electrode impedance measurement system; 10 Hz, portable; built-in 5 kOhm test impedance; 9V battery supplied
0242	g.SiGgen	sine-wave generator; uV-mV; 10 Hz; portable; 9V battery supplied
3017	PC RS232 data cable set	g.MOBilab+ to PC serial cable incl. adapter for USB port
5001A	external trigger button	for g.MOBilab+; 4 pin connector
5004	4 pin connector (TRIG)	with 3 m cable; with open leads
5005	10 pin connector (AIN/DIGITAL I/O)	with 3 m cable; with open leads
5006	8 pin connector (ECG/EMG)	with 3 m cable; with open leads
5007	10 pin connector (EEG)	with 3 m cable; with open leads
5050	g.MOBilab+ water-proof heavy duty case	water-proof heavy duty case for the g.MOBilab+ equipment
5070	serial to USB converter	

COMPLETE SOLUTIONS

Product no.	Product name	Description
6006	g.BCIsys8MOBilab+: BCI research system, 8 EEG, NB included	consisting of: g.MOBilab+ 8 channel EEG version; 10-pin connector box; g.MOBilab Simulink High-Speed Online Processing software; g.RTanalyze (software for online biosignal parameter extraction); g.BSanalyze (Base version + EEG toolbox + Classify toolbox for offline data processing, analysis and classification); Bluetooth dongle; fully equipped business notebook (with software ready-to-go installation); cables; bundle offer (5603+5602+5012a+0111+0101+0102+0105+3060+3003+3017); prerequisite MATLAB for OS English Win 64, SIMULINK, Signal Processing Toolbox, Signal Processing Blockset and DSP System Toolbox
6014	g.BCIsys8MOBilab+ SSVEP, P300, NB included	consisting of: g.MOBilab+ 8 channel EEG version + removable storage card; 10-pin connector box; g.MOBilab Simulink High-Speed Online Processing software; g.MOBilab+ P300 model; g.MOBilab+ SSVEP model and hardware; g.RTanalyze (software for online biosignal parameter extraction); g.BSanalyze (Base version + EEG toolbox + Classify toolbox for offline data processing, analysis and classification); Bluetooth dongle; fully equipped business notebook (with software ready-to-go installation); cables; bundle offer (6006+0139b+1303b); prerequisite MATLAB for OS English Win 64, SIMULINK, Signal Processing Toolbox, Signal Processing Blockset and DSP System Toolbox
6007	g.BCIsysMOBilab+: BCI research system, multi-purpose, NB included	consisting of: g.MOBilab+ multi-purpose version (4 EEG/EOG, 2 ECG/EMG, 2 analog inputs, digital I/Os); 9-pin connector box; g.MOBilab Simulink High-Speed Online Processing software; g.RTanalyze (software for online biosignal parameter extraction); g.BSanalyze (Base version + EEG toolbox + Classify toolbox for offline data processing, analysis and classification); Bluetooth dongle; fully equipped business notebook (with software ready-to-go installation); cables; bundle offer (5033+5003+5012a+0111+0101+0102+0105+3016+3003); prerequisite MATLAB for OS English Win 64, SIMULINK, Signal Processing Toolbox, Signal Processing Blockset and DSP System Toolbox
6008	g.EEGsys g.MOBilab+ multi-purpose version, NB included	consisting of: g.MOBilab+ (4 EEG/EOG, 2 ECG/EMG, 2 analog inputs, digital I/Os); 9-pin connector box; g.Recorder; g.BSanalyze (Base version + EEG toolbox for offline data processing); 5 lead ECG/EMG patient cable; Bluetooth dongle; fully equipped business notebook (with software ready-to-go installation); cables; bundle offer (5033+5003+0167b+0101+0102+5002+3016+3003); prerequisite MATLAB for OS English Win 32/64, Signal Processing Toolbox
6009	g.EEGsys g.MOBilab+ 8 channel EEG version, NB included	consisting of: g.MOBilab+ 8 channel EEG version; 10-pin connector box; g.Recorder; g.BSanalyze (Base version + EEG toolbox for offline data processing); Bluetooth dongle; fully equipped business notebook (with software ready-to-go installation); cables; bundle offer; prerequisite MATLAB for OS English Win 32/64, Signal Processing Toolbox
6011	g.BCIsys8MOBilab+: P300, 8 EEG, NB included	consisting of: g.MOBilab+ 8 channel EEG version; 10-pin connector box; g.MOBilab Simulink High-Speed Online Processing software; g.BSanalyze (Base version + EEG toolbox + Classify toolbox for offline data processing, analysis and classification); Bluetooth dongle; fully equipped business notebook (with software ready-to-go installation); cables; bundle offer for P300 experiments (5603+5602+5012a+0101+0102+0105+3003+3060); prerequisite MATLAB for OS English Win 64, SIMULINK, Signal Processing Toolbox, Signal Processing Blockset and DSP System Toolbox
6012	g.tec BCI2000 bundle offer with g.MOBilab+, NB included	consisting of: g.MOBilab+ EEG version + Mini SD card 1 GB; 10-pin connector; g.MOBilab+ C API + BCI2000 driver, BCI2000 software package; fully equipped business notebook (with ready to go installation); bundle offer (5603+5602+5011A+3003)

SOFTWARE

Product no.	Product name	Description
0167B	g.Recorder for g.MOBilab+	fully GUI-based (graphical user interface); comfortable biosignal visualization and storage; full control of the amplifier and header; real-time compressed spectral array; heart-rate, heart-rate variability; single place licence; prerequisite OS English Win 32/64
5012A	g.MOBilab+ SIMULINK HIGH-SPEED ONLINE Processing	SIMULINK driver and blockset modules; highly optimized hardware-interrupt controlled device driver; allowing data processing with the maximum system speed; supports real-time processing of the biosignal data; signal analysis blocks; single place licence; prerequisite MATLAB for OS English Win 64, SIMULINK, Signal Processing Blockset and DSP System Toolbox
0168B	g.MOBilab+ LabVIEW High-Speed Online Processing	LabVIEW drivers and virtual instrument modules; highly optimized hardware-interrupt controlled device driver; allows data processing with the maximum system speed; supports real-time processing of biosignal data, requires LabVIEW or higher; prerequisite OS English Win 32/64
0291	g.EYEtracking Interface for SIMULINK	read eyetracking information into Simulink; single place licence; prerequisite MATLAB for OS English Win 64, SIMULINK Can be used with the following eyetracker models: Tobii X2 - 60
5011	g.MOBilab+ C API	driver software package for g.MOBilab+; full access to recording buffer; for user specific applications on the PC; single place licence; prerequisite OS English Win 32/64
5011A	g.MOBilab+ C API + BC12000	driver software package for g.MOBilab+; full access to recording buffer; for user specific applications on the PC; BC12000 driver, BC12000 software package; single place licence; prerequisite OS English Win 32/64 (or later)
5016	g.MOBilab+ API for MATLAB	MATLAB driver software package for g.MOBilab+; full access to the amplifier from MATLAB command window; for user specific applications under MATLAB; single place licence; prerequisite MATLAB for OS English Win 32 , Data Acquisition Toolbox
0169B	LINUX API for g.MOBilab+	driver software package for g.MOBilab+; full access to recording buffer; for user specific applications on the PC; single place licence; prerequisite Ubuntu Linux 32/64 bit
0111	g.RTanalyze	real-time EEG, ECG, respiration, galvanic skin response and biosignal processing blockset under SIMULINK; real-time algorithms; single place licence; prerequisite MATLAB for OS English Win 32/64 or OS English Win 64, SIMULINK
0144B	g.VIBROTACTILEp300 model for g.MOBilab+	2-, 3- and 8-channel vibrotactile P300 based BCI control; prerequisite: SIMULINK HIGH SPEED ONLINE Processing, g.STIMbox, g.VIBROstim, g.BSanalyze Base, EEG and Classify Toolbox
0136	g.BCI CVEP model	code-based BCI model; BCI systems can also use pseudo-random stimulation sequences on a screen (code-based BCI). Such a system can be used to control a robotic device. In this case, the BCI controls were overlaid on the video that showed a robot performing certain tasks; single place licence; prerequisite MATLAB for OS English Win 64, SIMULINK HIGH-SPEED ONLINE Processing, g.BSanalyze Base, EEG and Classify Toolbox
0137	g.BCI SOCI model	The SOCI system (Screen Overlay Control Interface module) can be used especially for virtual reality (VR) applications and remote control of devices to provide the standard user interface by directly embedding the BCI stimuli. The SOCI can be embedded in host applications to directly interact with BCI controls inside the displayed scene. It generates CVEP or SSVEP stimuli and supports single symbol and row column for P300 stimulation. single place licence; prerequisite MATLAB for OS English Win 64, SIMULINK, SIMULINK HIGH-SPEED ONLINE Processing, g.BSanalyze Base, EEG and Classify Toolbox
0264	g.UDPinterface	data exchange with network connection between Simulink/MATLAB on different PCs (eg. BCI, VR, XVR, ...); single place licence; prerequisite MATLAB for OS English Win 64, SIMULINK
0311	g.DISTRIBUTEDeeg	allows to record biosignal data from different distributed PCs in the network and transmit the recorded data to a central evaluation/data storage PC; data synchronisation using the OSC protocol for distributed systems and UDP network interface; synchronicity of +/- 2 samples at a sampling rate of 256 Hz; allows to record evoked potentials in a distributed system; prerequisite: MATLAB for OS English Win 64 ; SIMULINK; Signal Processing Blockset; DSP System Toolbox
0139B	g.MOBilab+ P300 model	8-channel P300 based speller; prerequisite: SIMULINK HIGH-SPEED ONLINE Processing for g.MOBilab+, g.BSanalyze Base, EEG and Classify Toolbox
0141B	g.MOBilab+ SSVEP BCI model	8 channel SSVEP based control; prerequisite SIMULINK HIGH-SPEED ONLINE Processing for g.MOBilab+, g.BSanalyze Base, EEG and Classify Toolbox
1303B	SSVEP model and hardware for g.MOBilab+	bundle for SSVEP based robot control; consists of g.MOBilab+ SSVEP BCI model, g.SSVEPbox for stimulation, g.STIMbox to run g.SSVEPbox and small robot with bluetooth interface (e-puck); prerequisite SIMULINK HIGH SPEED ONLINE Processing for g.MOBilab+ , g.BSanalyze Base, EEG & Classify Toolboxes, g.RTanalyze
0133B	g.PHYSIOobserver for g.MOBilab	Simulink model for extraction and classification of physiological features with respect to arbitrary classes of user tasks and exercises, tutorial; prerequisite: SIMULINK HIGHSPEED ONLINE processing for g.MOBilab; g.RTanalyze; g.BSanalyze Base, Classify Toolbox



Fast Forward Award

g.BSamp
BIOSIGNAL AMPLIFIER

Stand-alone analog biosignal amplifier

The g.tec biosignal amplifier is a basic signal-conditioning tool to establish biosignal data acquisition and real-time analysis from MATLAB and SIMULINK. Its user-selectable multi-channel modules allow the simultaneous recording of EEG, EMG, EOG and ECG. The stand-alone amplifier system can be equipped with 8 or 16 channels, or it can be stacked to have a 32-, 48-, or 64- channel system. The modules are designed with bipolar inputs in order to perform not only referenced recordings, but also true bipolar recordings and analyses. Filter, sensitivity and notch settings are user selectable. You can combine the g.BSamp with the g.EEGcap and the g.GAMMAcap, and choose from a huge range of possible electrodes. g.BSamp represents the optimal equipment for research in the field: from cars to aeroplanes and/or in vivo training procedures as well as from research to rehabilitation. It has an operation time of 8–10 hours with the battery supplied so that even time consum-

ing trainings or long field investigations are warranted. For use in the lab a medical mains receiver is available.

Standard settings: LP: 100 Hz/1kHz; HP: 0.5/2 Hz;
Sensitivity: +/- 500 μ V/5mV; 50(60) Hz notch on/off

PRODUCT HIGHLIGHTS

- ◆ Multi-modal amplifier system (EEG, EMG, EOG & ECG)
- ◆ +/- 5V analog output signal range
- ◆ 8 or 16 bipolar/real differential input channels
- ◆ User selectable filter and sensitivity settings via robust DIP switches
- ◆ Portable due to available battery supply
- ◆ Compatible with many other user-specific systems
- ◆ Designed for EEG, EMG, EOG and ECG data acquisition

HARDWARE

Product no.	Product name	Description
0201A	g.BSamp, 16 channels	biosignal amplifier for EEG, ECG, EMG, EOG or custom signals; 16 channels uni-/bipolar; analog output; electronic handbook; 2 independent grounds; LP: 100 Hz/1kHz, HP: 0,5/2 Hz; Sensitivity: 500 μ V/5 mV, 50 Hz Notch, incl. jumper cable, AVAILABILITY ON REQUEST
0201B	g.BSamp, 16 channels	biosignal amplifier for EEG, ECG, EMG, EOG or custom signals; 16 channels uni-/bipolar; analog output; electronic handbook; 2 independent grounds; LP: 100 Hz/1kHz, HP: 0,5/2 Hz; Sensitivity: 500 μ V/5 mV, 60 Hz Notch, incl. jumper cable, AVAILABILITY ON REQUEST
0244	g.Power - g.BSamp	medical mains power supply for g.BSamp, 110/230 V, 50/60 Hz power line, single 12 V supply
0214	BNC adapter 8 channels	adapter SUB-D to BNC connector; 8 channels; for g.BSamp
0217	BNC adapter 16 channels	adapter SUB-D to BNC connector, 16 channels; for g.BSamp
0241	g.Zcheck	electrode impedance measurement system; 10 Hz, portable; built-in 5 kOhm test impedance; 9 V battery supplied
0242	g.SIGgen	sine-wave generator; μ V-mV; 10 Hz; portable; 9 V battery supplied
0251C	g.ACCUpack for g.BSamp	rechargeable battery pack, 12 V and 5 V, 4.5 Ah, for one g.BSamp; adapter cable
0252	charging device for g.ACCUpack	automatic charging device for battery pack g.ACCUpack, 110/230 V; 50/60 Hz power line, regional adapter for EU, USA, UK, CN/AUS
0253C	adapter cable g.ACCUpack/g.BSamp	adapter cable g.ACCUpack to g.BSamp

g.tec's programmable electrical current stimulator



g.Estim is a constant current, mono/biphasic stimulator intended for electrical stimulation of neural tissue. g.Estim has an applied part of type BF with connectors for bipolar stimulation electrodes (anode and cathode). Additionally the device has digital outputs and digital inputs for synchronization with other devices and a USB interface to control the device from a computer. A hand or foot switch allows to perform the stimulation manually. The device can also be triggered in real-time from a computer system and measures the actual stimulation current.



rear side



foot switch



hand switch

PRODUCT HIGHLIGHTS

- ◆ Delivers bi-phasic or mono-phasic, constant current pulses
- ◆ Stand-alone device that can be controlled in real-time from a computer system
- ◆ Fully configurable from a computer system
- ◆ Can send/receive triggers to/from other devices for synchronization
- ◆ Includes stimulation current control

HARDWARE

Product no.	Product name	Description
1150	g.Estim PRO	intracranial electrical stimulator; DC stimulation, single & repetitive pulses; programmable, trigger able

Deep Brain Stimulation (DBS)

Treatment for patients suffering Essential Tremor or Parkinson's Disease can include the use of a Deep-Brain Stimulation (DBS) device. Such a device emits short electrical pulses for directly stimulating the brain neural tissue. For this approach, depth electrodes are implanted into the brain using a neuronavigation system. The coordinates are extracted based on each patient's anatomy. The exact positioning of the stimulation electrodes is essential for being able to help the

patient effectively. The DBS device is usually implanted in the chest of the patient, and is connected to the stimulation electrode. The effects of Essential Tremor or Parkinson's Disease can then be attenuated by the systematic stimulation of the relevant brain area. This can dramatically improve patients' quality of life, since they are able to move more freely through their daily activities. Every year, hundreds of thousands of surgeries like this are performed worldwide.



The approach also bears some disadvantages

- ◆ The electrodes are inserted into the brain until a certain position is reached, and the effects of the disease attenuate. However, this procedure occurs without consideration of other brain processes, and therefore is rather approximate
- ◆ Stimulation is performed steadily, so the brain is influenced permanently
- ◆ The stimulator has to be exchanged when its battery is empty

g.tec developed a research system that has the following benefits

- ◆ the stimulation electrode can be positioned based on precise knowledge of other brain processes
- ◆ Optimization of electrical stimulation, towards more flexible stimulation on demand
- ◆ Optimization of stimulation parameters and times for preserving battery power, which enables longer overall usage
- ◆ This procedure also paves the way for scientific studies for the optimization of DBS

New features

- ◆ The system can be used for setting up closed-loop systems to optimize DBS
- ◆ The system can be used for real-time analysis of biosignal data (local field potentials and/or multi-/single- unit activity) acquired from a variety of brain regions, and these analysis results can control the stimulation
- ◆ Analysis of brain activity in real-time
- ◆ Stimulation of different electrode positions for performance optimization

Advantages

- ◆ Better positioning and control of DBS electrodes and brain areas
- ◆ Reduced tremor and better control of Parkinson's Disease
- ◆ Reduced battery power consumption by using event-related stimulation
- ◆ Rapid prototyping system for scientific research in DBS



g. TRIGbox
MULTIMODE TRIGGER BOX

g.tec's multimodal trigger system

The g.TRIGbox is a device to generate trigger pulses from various sensors or input signals. Input and output lines are isolated from each other. The trigger outputs can be connected to digital or analog inputs of a data acquisition system (such as g.USBamp, g.HIamp, g.Nautilus or g.MOBILab+).

Thus, g.TRIGbox provides exact detection and recording of almost any type of stimulation in your experimental paradigms. Its wide range of possible input

signals and sensors allows the use of various trigger sources such as sound card outputs, microphones, piezoelectric or inductive sensors, response buttons, various logic signals (TTL, C-MOS, ...) provided by external stimulators, visual markers from the computer monitor, LED indicators, flash lamps or slide projectors. The threshold levels are adjustable separately for each channel. 4 LEDs indicate the proper detection for each channel.

TECHNICAL DETAILS AND SPECIFICATIONS

Trigger output voltage	TTL +5 V , BSL 200 mV	Supply	9V battery or power supply
Input voltage (low level)	± 0.5 mV to ± 200 mV (4 inputs)	Current consumption	~ 40 mA
Input voltage (high level)	± 100 mV to ± 5 V (4 inputs)	Low battery indicator	~ 7 V
Trigger output duration	min. 20 ms	Isolation voltage	4 kV (input/output)

PRODUCT HIGHLIGHTS

- ◆ Simply use PowerPoint for stimulus/paradigm setup and presentation
- ◆ > 1.5 kV isolation between trigger inputs and outputs
- ◆ Use various trigger sources from visual, auditory, electrical or tactile stimulators
- ◆ Connect to a data acquisition system, g.MOBILab+, g.HIamp, g.Nautilus or g.USBamp
- ◆ Compatible with many other user-specific systems
- ◆ Use one encoded trigger channel for up to 16 different experimental conditions

HARDWARE

Product no.	Product name	Description
0274d	g.TRIGbox (HA)	multimode trigger-conditioner-box, battery supplied; 3 x 4 trigger inputs for analog, optical and digital trigger signals; adjustable thresholds; LED indicators; 1 x analog encoded output; cable for 4 x trigger output included; for g.HIamp HA-xxxx.xx.xx
0274ub	g.TRIGbox (UB)	multimode trigger-conditioner-box, battery supplied; 3 x 4 trigger inputs for analog, optical and digital trigger signals; adjustable thresholds; LED indicators; 4 x TTL-outputs; cable for 4 x trigger output for DIO 1 or DIO 2 included; output: 5V, for g.USBamp UB-xxxx.xx.xx
0268a	g.Power for g.TRIGbox	medical mains power supply for g.TRIGbox; 110/230 V; 50/60 Hz power line; single 9 V supply
0269	g.TRIGbox, push-button	bounce-free, to record subject responses, 1.8 m cable
0270	g.TRIGbox, optical trigger sensor	for screen marker or strobe lamp detection, 1.8 m cable
0271	g.TRIGbox, microphone	to trigger on acoustic events, 1.8 m cable



Receive digital trigger input information and send stimulation patterns to external stimulators

The g.STIMbox is used to generate and record trigger signals. Arbitrary paradigms can be programmed easily using the 16 digital outputs and are executed with high temporal precision. At the same time, trigger signals from external devices can be recorded using the 14 digital inputs of the device.

Therefore the g.STIMbox is an ideal extension for electrophysiological research systems which require additional digital input and output possibilities. The device provides versatile cinch connectors for 8 of the 16 outputs which can be used very conveniently, e.g. with LEDs for visual stimulation, to connect electrical stimulators or other devices triggered by 5V pulses. Compact devices like the g.SSVEPbox, which require several output/input channels, are connected using the SUB-D ports of the device. The 14 digital inputs can be used to record signals from external devices.

Here, again, 8 of the 14 digital inputs are implemented as cinch connectors. The g.STIMbox is connected to the recording computer via USB, offers synchronous and asynchronous operation modes, and comes with a C-application programming interface (API), a MATLAB-API and a SIMULINK-block.

Highly accurate stimulation frequencies can be defined and are calculated on the g.STIMbox (e.g. 10 Hz for SSVEP stimulation). Therefore a highly precise SSVEP stimulation as used for BCI experiments can be realized.

Vibro-tactile Stimulator



PRODUCT HIGHLIGHTS

- ◆ μ C controlled inputs and outputs for accurate timing
- ◆ Digital outputs can produce precisely-timed paradigms
- ◆ Digital inputs can be acquired and used within the recording system
- ◆ Direct control of inputs/outputs from a computer via USB
- ◆ 14 digital inputs (TTL) and 16 digital outputs (TTL)
- ◆ Digital outputs usable for tactile or visual stimulation
- ◆ C API, MATLAB API and Simulink drivers

HARDWARE

Product no.	Product name	Description
1302	g.STIMbox	stimulation box to record and generate trigger signals, 16 digital outputs and 14 digital inputs; C API, MATLAB API and Simulink driver; including external power supply unit and USB cable; prerequisite: MATLAB for OS English Win 32/64, SIMULINK
1300	g.SSVEPbox	SSVEP stimulation box with 4 stimulation- and 4 training-LEDs, adjustable intensity; including connection cable to g.STIMbox; prerequisite g.STIMbox
1305	g.VIBROstim	stimulator for vibro-tactile evoked potential experiments; prerequisite g.STIMbox
1307	push button, for g.STIMbox	bounce free, to record subject response, 1,8m cable; prerequisite g.STIMbox
1309	single flashing LED, for g.STIMbox	single flashing LED for SSVEP experiments; prerequisite g.STIMbox

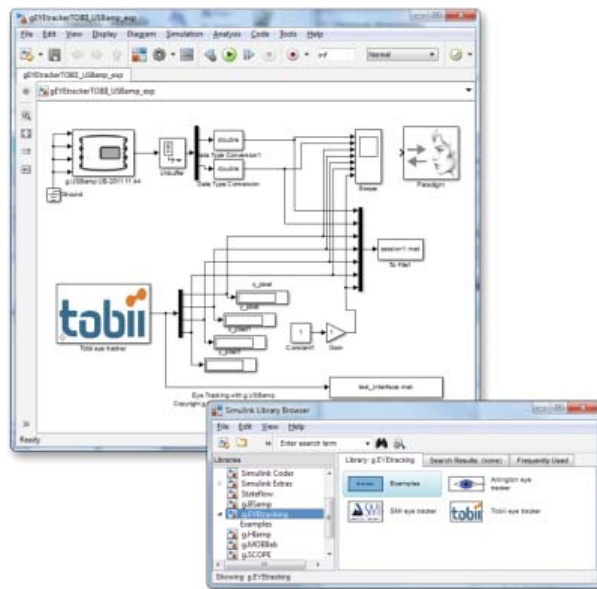
Real-time eye movement data under SIMULINK high-speed online processing

The g.EYetracking Interface for SIMULINK allows you to acquire eye gaze and x-, y-coordinates of the eye together with biosignal data. The signals can be visualized, stored and analyzed in real-time in SIMULINK and off-line in MATLAB.

g.tec offers interfaces to different eye-trackers that are either worn or fixed on the monitor.

Functional principle: The infrared light source of the tracker illuminates the eye and also provides a specular reflection from the surface of the eye (from the smooth cornea) that is captured with a camera. Then,

the computer system uses image segmentation algorithms to locate the areas of the pupil and the bright corneal reflection (glint). Additional image processing algorithms locate these areas and calculate a difference vector between the center locations. A mapping function transforms the eye position signals into coordinates. Additionally, the program can determine whether the gaze point is inside of any region of interest (ROI) that was previously defined by the user.



A scene camera captures the environment and allows you to project the eye movement on the real situations.

A prerequisite is a calibration system that presents calibration stimuli to the user to measure the eye position signals for each stimulus point. These data are used to compute an optimal mapping function.

SOFTWARE

Product no.	Product name	Description
0291	g.EYetracking Interface for SIMULINK	read eyetracking information into Simulink; single place licence; prerequisite MATLAB for OS English Win32/64, SIMULINK

g.tec's miniaturized pre-amplifier



The g.tec 16-channel head-stages allow the recording of action potentials/spikes with g.Hlamp or g.USBamp. The boards are extremely small and lightweight and are connected via a very flexible cable to the amplifier. This allows the animal to move with almost no restrictions. The electronic system has an extremely low noise level and very high input impedance for high quality recordings. The channels have very similar gain, and therefore a very high Common Mode Rejection Ratio is obtained. The head-stages can also be used for biosignal recordings like EEG or ECG in animals. The head-stages are connected to the g.SPIKEsens power supply and filtering box that is connected to the amplifier. One g.SPIKEsens box supports up to 16 channels. Several head-stages can be used simultaneously. The g.SPIKEsens box filters the signal between 0.5 Hz and 6000 Hz. Voltage Noise Density at 1 kHz is only 10 nV/SQRT(Hz). Aggregation

boards can be used to interface the head-stages with different electrodes like twisted wires, silicon electrodes and/or multi-electrode arrays. Micro-wires and micro-electrode arrays (MEAs) have high impedances and must be very stable on the animal's heads. Therefore, the electrodes are connected with a very flexible cable to the input of the head-stage amplifier that has very high input impedance. It is important that this input impedance is magnitudes higher than the electrode impedance to pick up the neural activity correctly. Then, operational amplifiers with precise gain are used to amplify the spikes and to drive the cable that connects the animal to the main recording system. The precise gain is especially important for a high common-mode rejection ratio (CMRR, 100 dB). The pre-amplifiers avoid also distortions in the signal such as power line interference, electromagnetic interference, and cable artifacts.

PRODUCT HIGHLIGHTS

- ◆ Extremely small board (16 channels: 23 mm × 23 mm)
- ◆ Low weight (<3 g)
- ◆ Aggregation boards help interface different electrodes types
- ◆ High quality neuronal activity recordings
- ◆ LED slot to support easier video tracking
- ◆ Very high signal-to-noise ratio

HARDWARE

Product no.	Product name	Description
1206g	g.HEADstage (16 channels)	tiny amplifier for recording of action potentials; reduces cable artefacts; including 3 m low-noise cable to g.SPIKEsens Driver Box; with golden pin connector; 16 channels, not approved for use in humans
1206m	g.HEADstage (16 channels)	tiny amplifier for recording of action potentials; reduces cable artefacts; including 3 m low-noise cable to g.SPIKEsens Driver Box; with multi pin connector; 16 channels, not approved for use in humans
1230	Headstage Electrode Connector with open leads	Samtec connector to open leads
1203	g.SPIKEsens Driver Box	driver box for g.HEADstage; connection cable to g.USBamp
1220	g.SPIKEsensHEADstageconnector	connector cable between the g.USBamp (system connector) and the g.SPIKEsens Driver Box; 40 cm lead



Complete virtual reality setup for research – flexible, cost-efficient and powerful



g.VRsys is a complete Virtual Reality (VR) research system that consists of a VR PC running XVR for 3D simulations, a projection wall with a 3D projector, an optional tracker and 3D shutter glasses with infrared emitter. g.VRsys can also be combined with a physiological analysis system. The VR scenarios can be programmed easily with XVR and are shown with a standard Internet Explorer. Physiological signals can be logged simultaneously in MATLAB and can be analyzed in real-time to influence the VR.

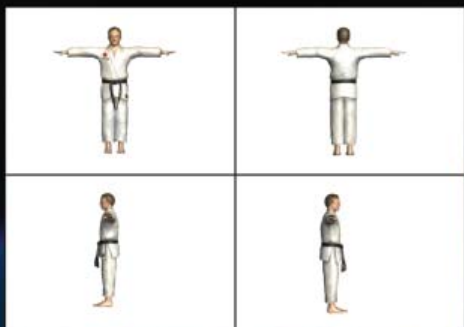
The development of a complete Virtual Reality application is a complex activity that requires good knowledge of several time-critical tasks. Computer graphics, real-time physics and network programming are examples of fundamental building blocks that need to coexist in many modern Virtual Reality

systems. Each of these building blocks constitutes a research field on its own, and a vast literature exists on techniques and algorithms to address specific problems. Still, from a more high level perspective, a complex framework can only achieve optimal performance through tight integration and balanced design. The development of a Virtual Reality application can turn out to be a very lengthy and difficult process, where fundamental design choices and their implications should be carefully considered. The choice of the right tools is also very important, as common everyday practice shows how difficult is still to put together a successful and robust system.

g.tec hence designed together with VRMedia, a complete VR package that allows you easily run VR applications in your lab.

PRODUCT HIGHLIGHTS

- ◆ Cost efficient VR system with 3D projections on a PowerWall
- ◆ Programming environment for VR based on XVR
- ◆ Connection to g.tec's amplifiers possible: acquisition and analysis of biosignals such as EEG, ECG, EMG, EOG, GSR and respiration, simultaneous with VR simulation
- ◆ Example code available for high-resolution 3D
- ◆ Control VR scenarios with the BCI system
- ◆ Use VR to give highly immersive feedback e.g. for stroke BCI rehabilitation



g.VRsys allows you to project human avatars and create a real-time visualization and animation of a humanoid virtual character in Virtual Reality. The avatar system uses the HALCA (Hardware Accelerated Library for Character Animation) library for loading, visualising and animating the virtual characters in XVR. The virtual character provided to g.tec is shown from different views in the figure below.

Currently, the animations can open and close the avatar's left or right hand, and walk forwards or backwards, but animations can be added on request. The virtual character is usually visualized from a first person perspective, but can also be shown from a third person perspective. A possible application using the

g.tec Brain Computer Interface would be open or close the avatar's hand by asking the user to imagine performing the same task.



XVR is a new technology to develop advanced multimedia content. It is focused mainly on 3D graphics and sound, but many forms of media are supported. XVR is a tiny ActiveX component developed by VRMedia. All you need to integrate an XVR content in a web page is a computer with a decent video card installed and Internet Explorer.

The first time you access a web page that uses XVR, you will be asked to install it, like any other ActiveX plug-in (Adobe Flash, for example). A simple mouse-click and it's done. It's that simple. The XVR ActiveX control weights only 535 KB and is been developed from the ground up with three goals in mind: efficiency, flexibility, and scalability.

COMPLETE SOLUTIONS

Product no.	Product name	Description
0298	g.VRsys (small screen), PC included	consisting of 3D stereo compatible projector (100 Hz); rear projection wall – size in cm (viewable area in cm): 240x180 (220x160); 3D shutter glasses with infrared emitter; PC with high performance 3D stereo compatible graphic card with an interface for the infrared emitter; XVR – 3D programming language (XVR needs Microsoft Windows and Internet Explorer); professional XVR development environment; connection (to g.tec amplifiers) through UDP with g.UDPInterface (0264) - not included; prerequisite OS English Win 32/64
0299	g.VRsys (medium screen), PC included	consisting of 3D stereo compatible projector (100 Hz); rear projection wall – size in cm (viewable area in cm): 320x245 (300x225); 3D shutter glasses with infrared emitter; PC with high performance 3D stereo compatible graphic card with an interface for the infrared emitter; XVR – 3D programming language (XVR needs Microsoft Windows and Internet Explorer); professional XVR development environment; connection (to g.tec amplifiers) through UDP with g.UDPInterface (0264) - not included; prerequisite OS English Win 32/64
0300	g.VRsys (large screen), PC included	consisting of 3D stereo compatible projector (100 Hz); rear projection wall – size in cm (viewable area in cm): 450x335 (430x315); 3D shutter glasses with infrared emitter; PC with high performance 3D stereo compatible graphic card with an interface for the infrared emitter; XVR – 3D programming language (XVR needs Microsoft Windows and Internet Explorer); professional XVR development environment; connection (to g.tec amplifiers) through UDP with g.UDPInterface (0264) - not included; prerequisite OS English Win 32/64
0380	g.AVATAR	3D human avatar for rehabilitation applications

Accessories

IMPEDANCE MEASUREMENT SYSTEM AND TEST SIGNAL GENERATOR



Product no.	Product name	Description
0241	g.Zcheck	electrode impedance measurement system; 10 Hz; portable; built-in 5 kOhm test impedance; 9V battery supplied
0242	g.SIGgen	sine-wave generator; uV-mV; 10 Hz; portable; 9V battery supplied

SHORTCUT / JUMPER CABLES



Product no.	Product name	Description
0223	shortcut jumper cable for 2 channels	shortcut cable for 2 channels medical safety connector; can be daisy chained
0224b	shortcut cables for 4 channels	for 3 medical safety sockets of 1.5 mm + 1 jumper connector; highly flexible cables; color: blue
0224y	shortcut cables for 4 channels	for 3 medical safety sockets of 1.5 mm + 1 jumper connector; highly flexible cables; color: yellow
8040	cortiQ jumper cable	shortcut cable for 2 channels; side A stackable touch proof connector, side B single slim touch proof connector; length: approx. 500 mm; color grey
0218	shortcut cables for 16 channels	for 15 medical safety sockets of 1.5 mm + 1 jumper connector; highly flexible cables
0226b	shortcut jumper cable for 2 channels, extra long	shortcut cable for 2 channels; medical safety connector; length 500 mm; can be daisy chained; color: blue
0226r	shortcut jumper cable for 2 channels, extra long	shortcut cable for 2 channels; medical safety connector; length 500 mm; can be daisy chained; color: red
0226y	shortcut jumper cable for 2 channels, extra long	shortcut cable for 2 channels; medical safety connector; length 500 mm; can be daisy chained; color: yellow

MOBILE TROLLEY

Product no.	Product name
7020	g.LABboy, AVAILABILITY ON REQUEST
Description	
mobile trolley for biosignal recording and data processing devices; with one rack and one drawer; integrated power line with triple socket and power switch; 55x60x115 cm; grey-blue	





Software



Software overview

g.tec's philosophy is to support all kinds of users with the appropriate software solutions for their projects:

For developers and programmers, there are APIs for Windows/Linux based programming languages as well as for MATLAB. Powerful online/real-time signal acquisition and processing is provided by our High-Speed Online Processing environment for SIMULINK and LabVIEW. Comfortable hardware configuration, signal visualization and storage is possible with g.Recorder, our recording software under Windows. Special plugins for

g.Recorder allow online parameter extraction and visualization for clinical research. Offline biosignal analysis with specialized toolboxes for EEG, ECG, classification, high resolution mapping and CFM analysis is provided with g.BSanalyze (available for MATLAB or stand-alone). For BCI-research systems, we offer ready-to-go examples for various approaches. intendiX is the world's first BCI system (P300-speller) developed for patients at home.

g.HIamp



available software ▾

g.USBamp



available software ▾

g.MOBilab+



available software ▾

g.Nautilus



available software ▾

g.Recorder

New independent recording software. Visualization and storage of biosignal data in the open hdf5-format. Full access to header information, amplifier setup / configuration and device functionality, full video-EEG. Online visualization, storage and print-out of biosignal parameters HR, HRV and CSA.

g.HIsys – High-speed online processing for SIMULINK

Online biosignal processing and recording with maximum system speed. Easy setup and rapid prototyping for biofeedback/neurofeedback and Brain-Computer Interface applications. Full SIMULINK functionality, easy setup of user-specific applications.

- Optional:**
- ◆ **g.RTanalyze for SIMULINK** Specialized SIMULINK blockset for real-time/high-speed biosignal analysis and feature extraction (bandpower, Hjorth, Barlow, AAR, filters, heart-rate, heart-rate variability, respiration deepness, spasticity control, ...).
 - ◆ **BCI applications** P300 spelling, motor imagery, Common Spatial Patterns, SSVEP control, Ping Pong game, vibro-tactile BCI, ACTOR BCI, hyperscanning BCI, hybrid BCI, EMG/EOG/mouse control, CVEP BCI control
 - ◆ **g.EYEtracking Interface** Acquire eye movements together with biosignals
 - ◆ **g.UDPInterface** Send data from Simulink to other computers or receive data
 - ◆ **g.RehaBCI** Complete BCI research bundle for rehabilitation
 - ◆ **Noldus Observer Interface** Synchronize data with the Noldus Observer
 - ◆ **g.PHYSIOobserver** Physiological state classification

not available for g.HIamp

g.HIsys – High-speed online processing for LabVIEW

Online biosignal processing and recording with maximum system speed. Easy setup and rapid prototyping for biofeedback/neurofeedback and Brain-Computer Interface applications. Full LabVIEW functionality, easy setup of user-specific applications.

not available for g.Nautilus

Device drivers for MATLAB (API)

Full access to the recording buffer and the DAQ device functionality. The Data Acquisition Toolbox enables a quick and easy implementation of data visualization, processing and storage applications under MATLAB. All devices can also be integrated into existing user-specific applications.

g.NEEDaccess

API / device driver package API for user specific applications based on almost any programming language under Windows or LINUX.

g.NEEDaccess

API / device driver package API for user specific applications based on almost any programming language under Windows or LINUX.

API / device driver package

API for user specific applications based on almost any programming language under Windows or LINUX.

g.NEEDaccess

API / device driver package API for user specific applications based on almost any programming language under Windows or LINUX.

not available for g.HIamp

intendiX

Patient-ready P300 spelling system under Windows, easy operation, for communication and control. World's first personal BCI speller.

Optional: extendiX, extendiX Painting To control external devices, this special extension tool serves as an interface. extendiX runs on a separate computer that controls other devices/applications such as TV, music, assistive robots, games and so on. extendiX just receives commands from intendiX* via UDP and starts/executes the corresponding application or batch. extendiX Painting integrates a landmark painting application into the intendiX personal Brain-Computer Interface. It allows users to paint by thoughts!

not available for g.Nautilus

g.BSanalyze: Offline biosignal processing and analysis

Fully GUI-based software package with specialized toolboxes for EEG analysis, ECG analysis, high resolution EEG, cerebral function, spikes and biosignal data classification. The software supports batch processing and the integration of user-specific MATLAB routines. Powerful result presentation. Stand-alone version available (no MATLAB required).



Comfortable amplifier configuration, data visualization, storage and review

g.Recorder supports all g.tec biosignal-acquisition devices and provides comfortable configuration and setup of the system. Signals and parameters can be checked in the display mode, stored to disk, and later reviewed in the offline/replay mode.

Video data can be stored simultaneously with the biosignals, and the following parameters can be computed online with g.Recorder:

CSA: Compressed Spectral Array (explorative analysis of signal properties and data quality for long-term recordings), **HR:** Heart Rate (based on automatic R-peak detection from the ECG raw signal), **HRV:** Heart Rate Variability (HR and HRV parameters reflect the

state of the autonomous nervous system), **EP:** Online EP calculation with statistical analysis

In the extended version g.Recorder also allows monitoring Cerebral Function/aEEG (amplitude integrated EEG) with automatic pattern classification. This is used to monitor the ongoing brain function of premature infants in the neonatal intensive care unit. This additional plug-in to g.Recorder is called g.FEATUREmonitor. In addition to the online classification, there is also an offline CFM-toolbox available, as a part of g.BSanalyze (g.tec's biosignal analysis software package).

The generated data format supports analysis with EMSE® and BESA® Software.

PRODUCT HIGHLIGHTS

- ◆ Support for various g.tec biosignal amplifiers
- ◆ Multimodal biosignal visualization and recording
- ◆ Synchronized storage of biosignal data, triggers and video
- ◆ Configuration and setup of hardware parameters
- ◆ Storage of header information and subject/patient data
- ◆ User/Admin mode for save operation
- ◆ Intelligent file management and search functions
- ◆ Stand-alone program
- ◆ Data format supported by EMSE and BESA
- ◆ Real-time EP calculation with statistical analysis
- ◆ Online filters for visualization
- ◆ Load topographic information for result presentation

SOFTWARE

Product no.	Product name	Description
0167	g.Recorder	fully GUI-based (graphical user interface); comfortable biosignal visualization and storage; full control of the amplifier and header;
0167EXT	g.Recorder Extension Pack	additional features for g.Recorder: real-time EP (evoked potential) visualization, video recording, data review mode, feature analysis: HR, HRV, CSA, CFM



g.Hsys
LABVIEW HIGH-SPEED
ONLINE PROCESSING

High-speed/real-time data acquisition, processing and analysis under LabVIEW

The High-Speed Online Processing under LabVIEW allows acquiring biosignals like EEG, EMG, EOG, and ECG with LabVIEW.

Therefore the High-Speed Online Processing under LabVIEW block is copied into a LabVIEW project and can be connected to any other available LabVIEW block for further signal processing. The amplifier device driver guarantees that the LabVIEW is updated in real-time.

This Rapid Prototyping environment speeds up the development cycle dramatically, and within a few hours, the first real-time experiments can already be conducted. The High-Speed Online Processing under LabVIEW allows using all LabVIEW standards and writing your own LabVIEW based programs.

The High-Speed Online Processing under LabVIEW gives access to specific hardware settings like analog channel selection, digital I/O lines, and SD card streaming. Just put the High-Speed Online Processing under LabVIEW in your LabVIEW program and start the biosignal acquisition and analysis.

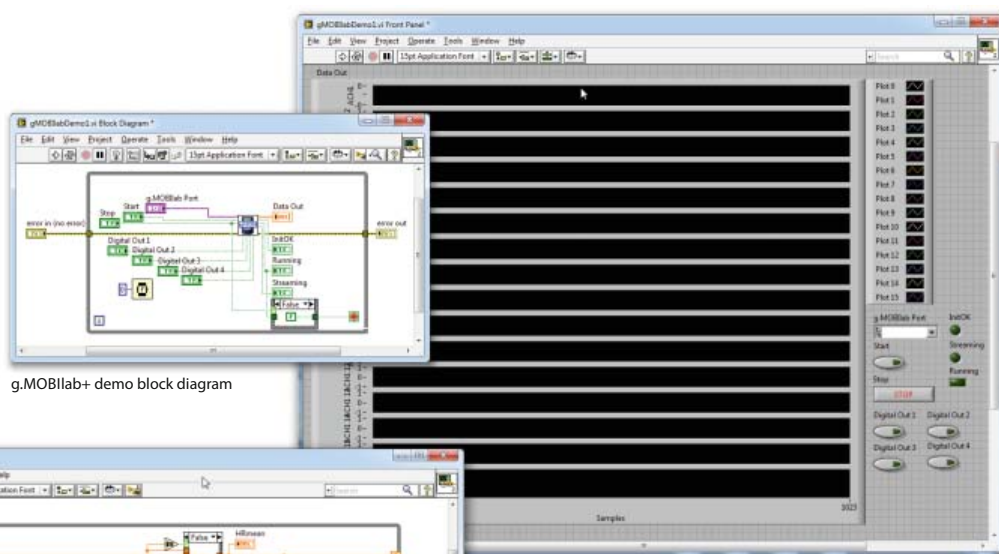
Biosignal data can be visualized and stored directly to the harddisk in LabVIEW data format.

PRODUCT HIGHLIGHTS

- ◆ Acquire EEG, ECG, EMG, EOG data directly within LabVIEW
- ◆ Wireless biosignal data acquisition with g.MOBILab+ or over USB with g.USBamp
- ◆ Add graphically your own sophisticated data processing algorithms
- ◆ Use standards of LabVIEW for online analysis
- ◆ No compilation of the LabVIEW is necessary for real-time analysis
- ◆ Benefit from the Rapid Prototyping environment for developing, testing and releasing your biosignal applications
- ◆ Store data to a LabVIEW file

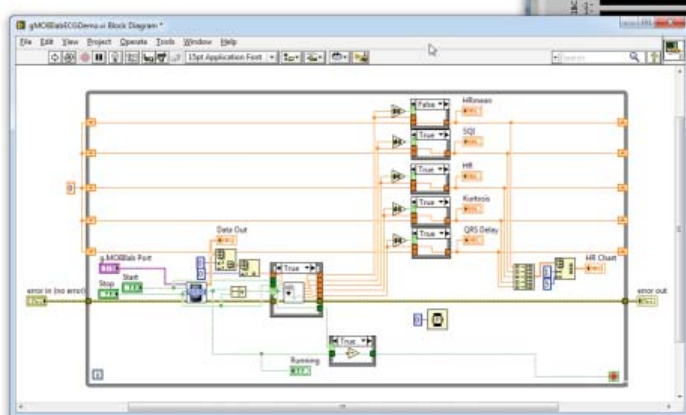


EXAMPLES OF LABVIEW VIRTUAL INSTRUMENTS

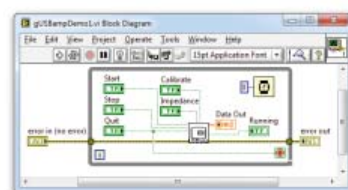


g.MOBilab+ demo block diagram

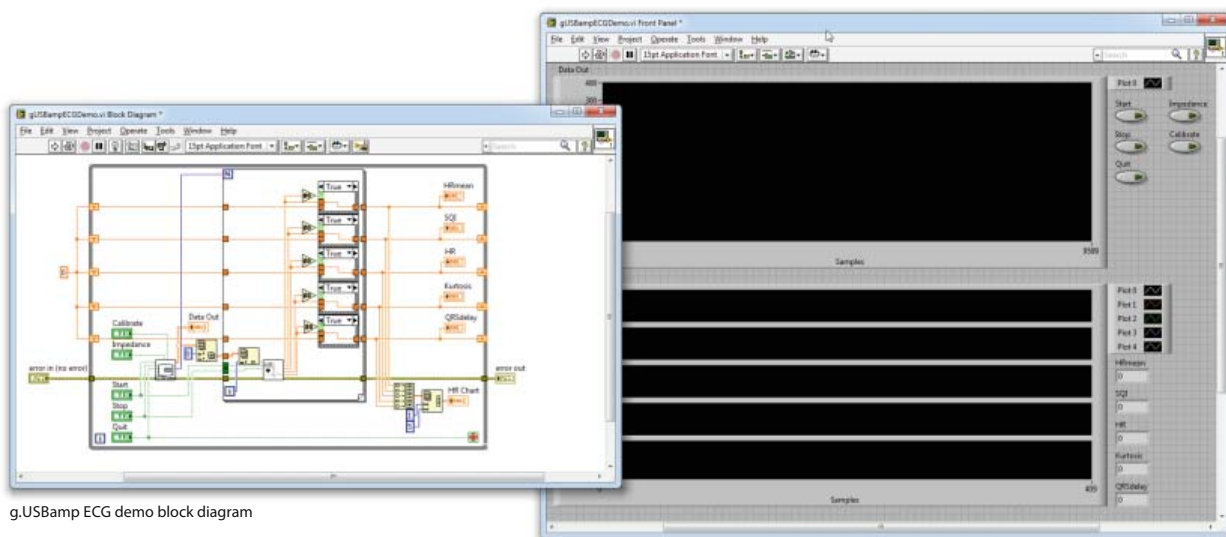
g.MOBilab+ front panel



g.MOBilab+ ECG demo

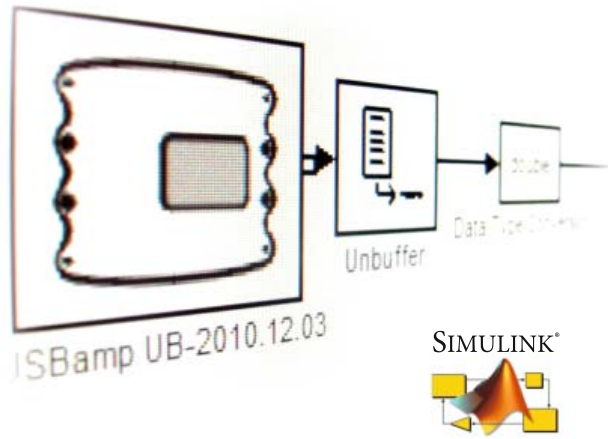


g.USBamp demo



g.USBamp ECG demo block diagram

g.USBamp ECG demo front panel



High-speed/real-time data acquisition, processing and analysis under SIMULINK

The Highspeed Online Processing blockset is available for g.MOBllab+, g.Hlamp, g.USBamp and g.Nautilus. The blockset lets you collect biosignal data like EEG, ECoG, EMG, EOG and ECG within a Simulink model for further real-time processing. Therefore, the device driver blocks, g.MOBllab+, g.Hlamp, g.USBamp or g.Nautilus, are copied into the Simulink model and are connected to other blocks that do the signal analysis. Then, the model is started, and the device driver guarantees real-time processing.

This Rapid Prototyping environment speeds up the development cycle dramatically, and your first real-time experiments are possible within a few hours. The Highspeed Online Processing blockset allows you to use all standard Simulink blocks in your model and to write your own blocks in MATLAB code or C code.

The device driver block gives you access to all amplifier specific settings like sampling frequency, digital I/O lines, bandpass and notch filtering. Just double-click the g.MOBllab+, g.Hlamp, g.USBamp or g.Nautilus block to perform the settings. Then, click on Play in the Simulink model to start the biosignal acquisition. Additionally g.Hlsys comes with many useful blocks for pre-processing, transformation, analysis and storage.

Data can be visualized with Scope blocks and stored on the hard disk in MATLAB format. The model works with double precision accuracy. g.MOBllab+ can store the data during acquisition on an SD card inside the unit. The g.tec blockset g.RTanalyze supports the Rapid Prototyping of biosignal applications by ready-to-use algorithms. Tutorials are provided for brain-computer interface experiments, evoked potentials, ECG analysis and respiration analysis. The Simulink models contained in the Highspeed Online Processing blockset can be used as templates for your own applications.

With the Highspeed Online Processing blockset, we offer the g.EYEtrackingInterface and g.UDPInterface. The packages provide Simulink blocks that can be easily copied into every model to capture the eye-movements of the subject or to send/receive data to/from other systems.

A plugin of g.Hlsys is a data import for EEGLAB, which allows directly access recorded data from g.tec devices.

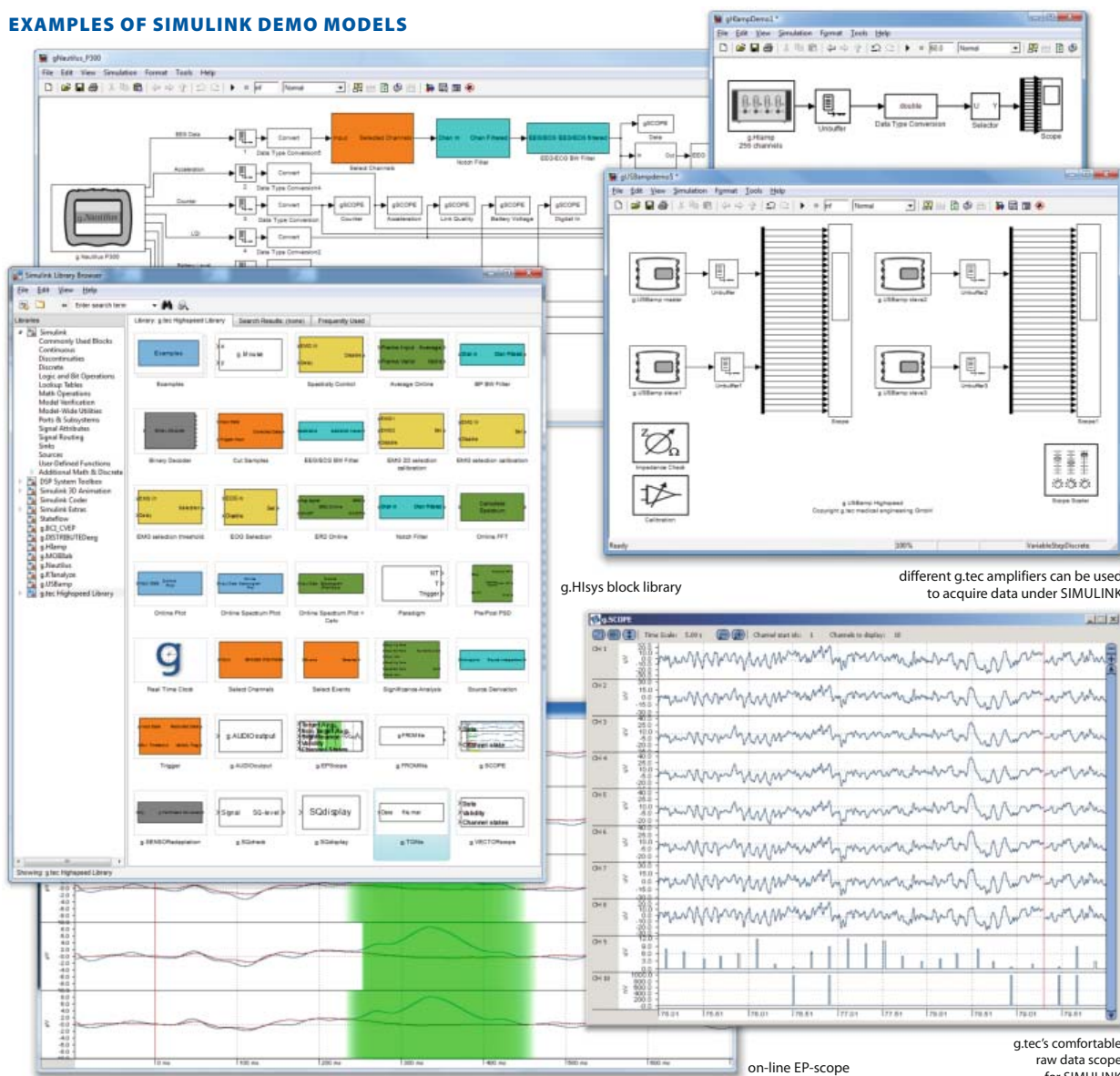
NEW! g.DISTRIBUTEDeeg allows you to record biosignal data using the g.tec amplifier g.USBamp from different distributed PCs in the network!

PRODUCT HIGHLIGHTS

- ◆ Acquire and process EEG, ECoG, ECG, EMG, EOG and spike data directly within Simulink
- ◆ Wireless biosignal data acquisition with g.MOBllab+ and g.Nautilus
- ◆ Add your own sophisticated data processing algorithms graphically
- ◆ Benefit from the Rapid Prototyping environment for developing, testing and releasing your biosignal applications
- ◆ No compilation of the Simulink model is necessary for real-time analysis
- ◆ Use standard Simulink blocks for online analysis
- ◆ Add your own algorithms, such as MATLAB S-Functions or C S-Functions
- ◆ Store data to the MATLAB workspace or to a MATLAB file
- ◆ Display Evoked Potentials in real-time
- ◆ Acquire eye-movement data together with biosignals

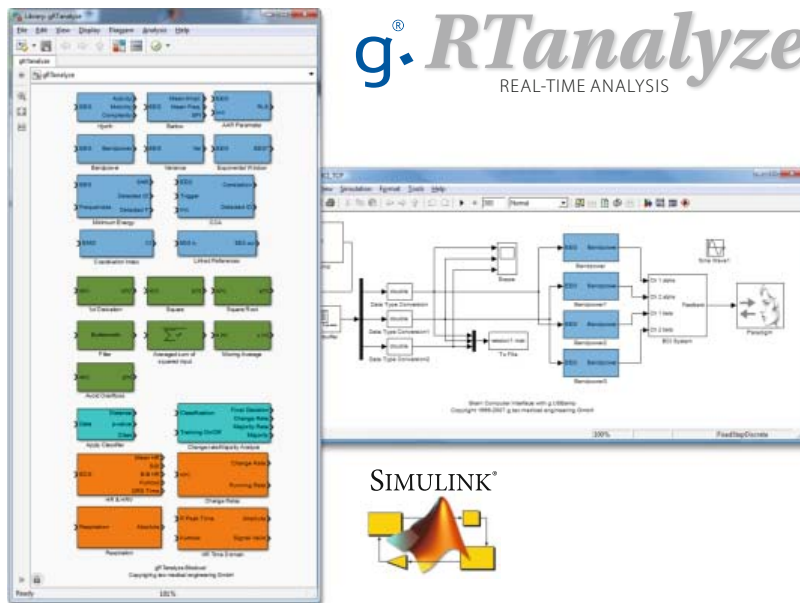


EXAMPLES OF SIMULINK DEMO MODELS



SOFTWARE

Product no.	Product name	Description
0260D	g.Hlsys SIMULINK HIGH-SPEED ONLINE Processing	SIMULINK driver and blockset modules; highly optimized hardware-interrupt controlled device driver; allowing data processing with the maximum system speed; supports real-time processing of the biosignal data; calibration block; impedance measurement block; signal analysis blocks; single place licence; prerequisite MATLAB for OS English Win 64, SIMULINK, Signal Processing Blockset and DSP System Toolbox
0260A	g.USBamp SIMULINK HIGH-SPEED ONLINE Processing	SIMULINK driver and blockset modules; highly optimized hardware-interrupt controlled device driver; allowing data processing with the maximum system speed; supports real-time processing of the biosignal data; calibration block; impedance measurement block; signal analysis blocks; single place licence; prerequisite MATLAB for OS English Win 64, SIMULINK, Signal Processing Blockset and DSP System Toolbox
0260E	g.Nautilus SIMULINK HIGH-SPEED ONLINE Processing	SIMULINK driver and blockset modules; highly optimized hardware-interrupt controlled device driver; allowing data processing with the maximum system speed; supports real-time processing of the biosignal data; g.Nautilus configuration block, single place licence; prerequisite MATLAB for OS English Windows 64, SIMULINK, Signal Processing Blockset and DSP System Toolbox
5012A	g.MOBilab+ SIMULINK HIGH-SPEED ONLINE Processing	SIMULINK driver and blockset modules; highly optimized hardware-interrupt controlled device driver; allowing data processing with the maximum system speed; supports real-time processing of the biosignal data; signal analysis blocks; single place licence; prerequisite MATLAB for OS English Win 64, SIMULINK, Signal Processing Blockset and DSP System Toolbox
0311	g.DISTRIBUTEDeeg	allows to record biosignal data from different distributed PCs in the network and transmit the recorded data to a central evaluation/data storage PC; data synchronisation using the OSC protocol for distributed systems and UDP network interface; synchronicity of +/- 2 samples at a sampling rate of 256 Hz; allows to record evoked potentials in a distributed system; prerequisite: MATLAB for OS English Win 64; SIMULINK; Signal Processing Blockset; DSP System Toolbox
0111	g.RTanalyze	real-time EEG, ECG, respiration, galvanic skin response and biosignal processing blockset under SIMULINK; real-time algorithms; single place licence; prerequisite MATLAB for OS English Windows 32/64, SIMULINK
0264	g.UDPInterface	data exchange with network connection between Simulink/MATLAB on different PCs (eg. BCI, VR, XVR, ...); single place licence; prerequisite MATLAB for OS English Windows 64, SIMULINK



Online and real-time biosignal processing library for use with SIMULINK

g.RTanalyze is a biosignal processing blockset for use with Simulink (MathWorks Inc., Natick, USA). The g.RTanalyze blocks can be used for on-line simulations under Simulink and for real-time applications with Highspeed Online Processing for Simulink.

Drag and drop the pre-processing, parameter estimation and classification algorithms into your SIMULINK real-time application to accelerate your research, encourage creativity and reduce project costs. The blockset enables you to quickly compare multiple algorithms. Use the blocks as templates and make your own modifications. The blockset is divided into general purpose blocks and biosignal processing blocks. General purpose blocks are derivations, filters and different algebraic blocks. Biosignal processing blocks are used for pre-processing, parameter estimation and classification of off-line or real-time EEG, ECG, EMG, respiration or galvanic skin response data.

Included parameter estimation blocks are: Hjorth parameters, Barlow parameters, Bandpower, Variance

and Adaptive Autoregressive Models with RLS, Kalman and LMS algorithms, minimum energy, EMG coactivation index and EMG spasticity. All important methods for BCIs based on P300, motor imagery, SSVEP/SSSEP and slow cortical potentials are included. The ECG block allows you to calculate heart-rate and heart-rate variability parameters. Furthermore, respiration rate/deepness and the change rate of galvanic skin response can be calculated. The blockset contains also blocks to control a system with EOG and EMG activity for human computer interaction.

The apply classifier block allows you to use linear and non-linear classifiers for the on-line classification of parameters. Examples are linear discriminant analysis or support vector machine based classifiers calculated in g.BSanalyze. The classifier block also performs a statistical analysis to realize a zero class for BCI control. This means that the BCI system will not make a decision if the subject is not paying attention. Furthermore, blocks for majority voting and change rate calculation are included.

PRODUCT HIGHLIGHTS

- ◆ Optimized pre-processing, signal processing, feature extraction and classification blocks
- ◆ Helps to design your real-time application rapidly
- ◆ Code can be used for off-line and on-line biosignal analysis
- ◆ Algorithms for fast, accurate, flexible simulations and estimations
- ◆ Blocks for EEG, ECG, respiration and GSR analysis
- ◆ On-line classification with LDA, SVM,... included
- ◆ Zero class detection integrated

SOFTWARE

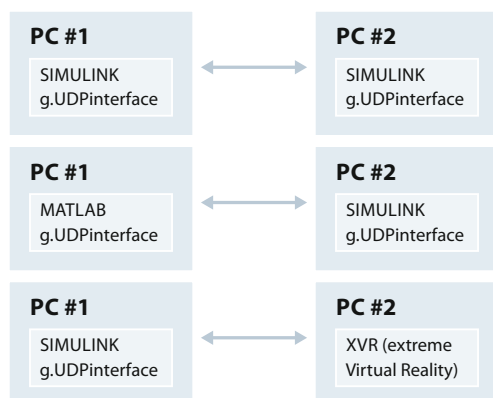
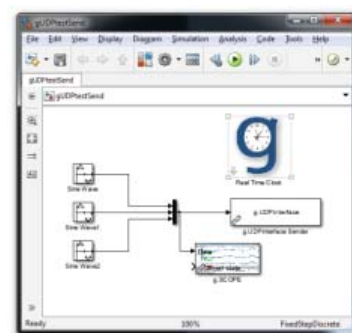
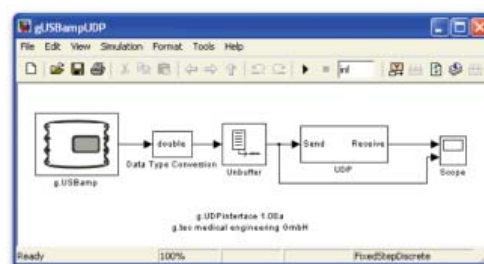
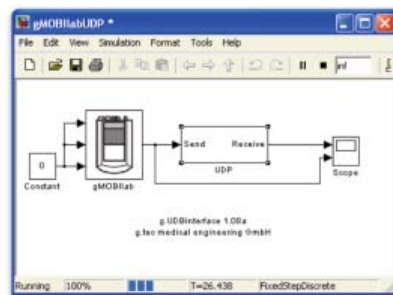
Product no.	Product name	Description
0111	g.RTanalyze	real-time EEG, ECG, respiration, galvanic skin response and biosignal processing blockset under SIMULINK; real-time algorithms; single place license; prerequisite MATLAB for OS English Win 32/64 or OS English Win 64, SIMULINK

Exchange data over networks between computers under MATLAB/SIMULINK

The exchange of data between different computer systems is important for many applications.

The g.UDPinterface for MATLAB/SIMULINK provides ready-to-use Simulink blocks and MATLAB functions to transmit data from a biosignal recording device to other applications like a Virtual Reality system or another MATLAB instance on another PC.

The g.UDPinterface can be used to exchange data between 2 Simulink applications running on two different PCs or notebooks.



PRODUCT HIGHLIGHTS

- ◆ Exchange data between MATLAB/Simulink on two PCs over a standard network connection
- ◆ PCs are just connected with a normal network cable for data exchange
- ◆ The Simulink blocks can be used per drag-and-drop
- ◆ Fast data exchange with response time < 1ms
- ◆ Allows you to interface MATLAB with other software packages

SOFTWARE

Product no.	Product name	Description
0264	g.UDPinterface	data exchange with network connection between Simulink/MATLAB on different PCs (eg. BCI, VR, XVR, ...); single place licence; prerequisite MATLAB for OS English Win 32/64, SIMULINK

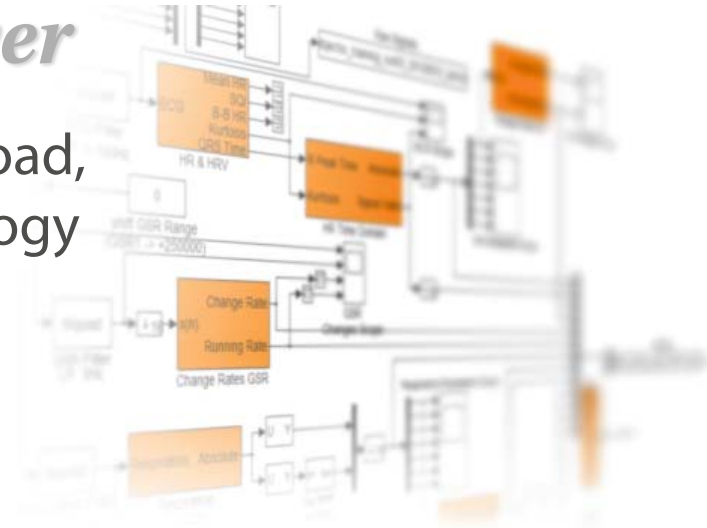


Analyze emotions, workload, activity based on physiology

The g.PHYSIOobserver is a complete system to classify different states of a subject based on physiological parameters. The system contains all necessary components to quantify emotions, workload, physical tasks and many other things. The g.PHYSIOobserver works with many different sensors and electrodes to measure physiological and physical parameters of a subject and can calculate many different parameters from these signals.

A key feature of the system is that it allows you to run experimental paradigms that are synchronized with physiological signals. The paradigms allow you to bring the subject into specific states of emotions, workload, memory tasks, etc., while all parameters are captured. These states can be chosen by the experimenter. Then, a classification algorithm is trained on these parameters during the different states and tries to discriminate them. Finally, the accuracy is calculated and gives an objective measure of the quality of the classification.

The g.PHYSIOobserver works also in real-time and can therefore track the current state of a subject on-line. This information can be transmitted to other applications or devices, including real-time feedback systems.



The g.PHYSIOobserver is able to measure ECG, EEG, EMG, GSR, respiration, temperature, acceleration and oxygen saturation with g.HIamp, g.USBamp or g.MOBilab+. This biosignal data is transmitted via USB or wireless to the recording computer that is storing and visualizing the data for inspection.

The recording computer also controls the experimental paradigm that instructs the subject about different tasks (e.g. calculating). The real-time processing system extracts parameters from the biosignal data such as heart rate, heart rate variability, respiration rate, inhalation time, change rate of GSR, etc. and classifies the data. Finally, the classification result predicts the subject's current state. This result is updated in real-time, and can also be transmitted to other applications or the experimenter.

PRODUCT HIGHLIGHTS

- ◆ Train the g.PHYSIOobserver with different tasks
- ◆ Classifies physiological parameters in real-time to determine the state of the subject
- ◆ Gives accuracy as an objective measure
- ◆ Select from a large variety of different parameters
- ◆ Send the classification result to other applications to execute closed-loop experiments

SOFTWARE

Product no.	Product name	Description
0133A	g.PHYSIOobserver for g.USBamp	Simulink model for extraction and classification of physiological features with respect to arbitrary classes of user tasks and exercises, tutorial; prerequisite: SIMULINK HIGHSPEED ONLINE processing for g.USBamp; g.RTanalyze; g.BSanalyze Base, Classify Toolbox; MATLAB for OS English Win 64; SIMULINK
0133B	g.PHYSIOobserver for g.MOBilab	Simulink model for extraction and classification of physiological features with respect to arbitrary classes of user tasks and exercises, tutorial; prerequisite: SIMULINK HIGHSPEED ONLINE processing for g.MOBilab; g.RTanalyze; g.BSanalyze Base, Classify Toolbox; MATLAB for OS English Win 64; SIMULINK
0133D	g.PHYSIOobserver for g.HIamp	Simulink model for extraction and classification of physiological features with respect to arbitrary classes of user tasks and exercises, tutorial; prerequisite: SIMULINK HIGHSPEED ONLINE processing for g.HIamp; g.RTanalyze; g.BSanalyze Base, Classify Toolbox; MATLAB for OS English Win 64; SIMULINK

Offline biosignal analysis with powerful toolboxes



g.BSanalyze is an interactive environment for multimodal biosignal data processing and analysis in the fields of clinical research and life sciences. g.BSanalyze has been on the market for more than ten years, and is used in more than 70 countries. It is the most comprehensive package to analyze non-invasive and invasive brain-, heart- and muscle-functions and dysfunctions. The package won several international Awards. The new version includes many new functions such as topographic plots, CCA, new filters, an importer for cortiQ files, updates for Result2D, and more!

g.BSanalyze consists of a base version for data import, visualization, transformation and pre-processing and has several dedicated toolboxes:

- ◆ EEG toolbox: specialized functions for pre-processing, analysis and parameter extraction for EEG data
- ◆ ECG toolbox: find QRS complexes and calculate heart rate variability parameters
- ◆ Classify toolbox: classify parameters with linear and non-linear methods including statistical analysis for zero class detection
- ◆ High-resolution EEG: map EEG activity on realistic head models
- ◆ CFM toolbox: calculate amplitude integrated EEG
- ◆ SPIKE toolbox: analyze spikes, multi-unit activity and positions to map physiological parameters

The package comes with many sample biosignal data-sets, including P300, SSVEP, motor imagery, CSP BCIs, Tilt-Table, EPs, multi-unit activity, CFM, and ERD/ERS.

g.BSanalyze's graphical user interface includes more than 100 state-of-the art functions for defining electrode montages, spatial or temporal filter designs, artifact treatment, quality control, spectral analysis, coherence, correlation, bandpower analysis, ERD/ERS analyses, EP analyses, visualization, data set classification, and other goals. It is the only package that supports all BCI principles: P300, SSVEP/SSSEP, motor imagery and slow cortical potentials. You can load and save your preferred processing steps within a script program and automatically process your data in g.BSanalyze batch mode.

g.BSanalyze's processing capabilities allow you to extract relevant features from your multimodal data and define useful parameters for postprocessing. Use these parameters directly with g.BSanalyze's classification tools to assign distinct classes to your data with linear and non-linear classifiers.

The combination of the graphical user interface and the programming environment makes g.BSanalyze a truly unique package for biosignal analyses.

The stand-alone version of g.BSanalyze can run without a Matlab installation, but batch processing in the Matlab command window is not possible.

PRODUCT HIGHLIGHTS

- ◆ Interactive and intuitive graphical user interface for EEG, ECoG, EOG, EMG, ECG, spikes, and physical data analyses and documentation under MATLAB as well as a stand-alone version
- ◆ Extensive tools for data processing in time, space, and frequency domains
- ◆ Powerful 2-D and 3-D visualization tools to rapidly generate publication ready figures
- ◆ Enhancement of power with g.tec's specialized EEG, aEEG, ECG, SPIKE, CLASSIFY and High-Resolution EEG toolboxes
- ◆ Flexibility to integrate other MATLAB toolboxes, as well as customers' specific algorithms
- ◆ Analyze data from: g.Recorder, Highspeed On-line Processing for Simulink, MATLAB and C API and many other 3rd-party recording devices
- ◆ More than 100 state-of-the-art functions for analyzing biosignal data
- ◆ More than 15 years of development and used in over 70 countries worldwide
- ◆ The only package that supports all BCI principles: P300, motor imagery, SSVEP/SSSEP, slow cortical potentials
- ◆ Optimized for high-gamma activity analysis



Analyze functions

Data quality (histogram, distribution and statistic measures), Average across trials (EP analysis, baseline correction, SNR, graph comparison, ...), Power spectrum analysis and significance test of differences, Wavelet analysis

Parameter extraction

Adaptive autoregressive (AAR) parameters Signal variance, Bandpower, Exponential window, Cross correlation and CC-based template matching, Minimum energy

Result visualization

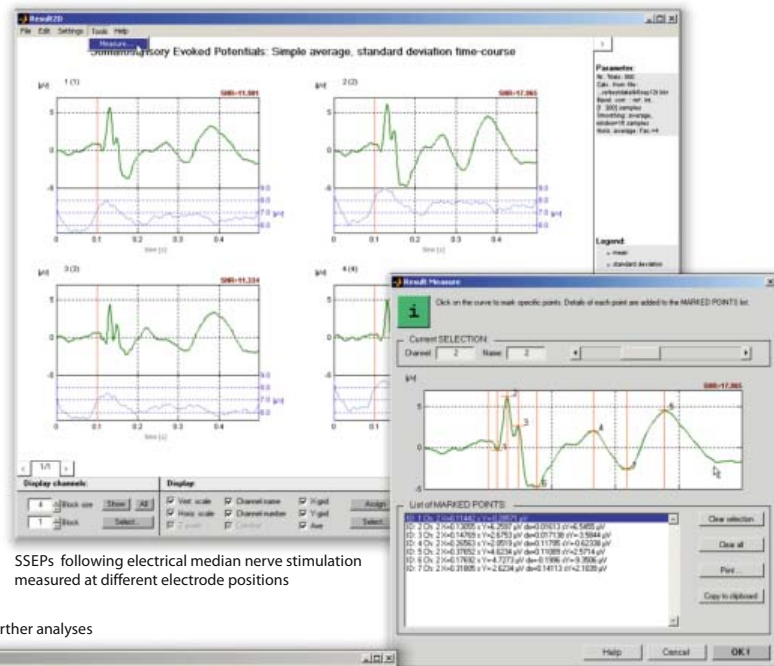
2D plots of analysis results, Layout editor, Copy and measure, Background image, ASCII export, Clone plots, Topography, Header editor

Pre-processing

Source derivation

Montage creator

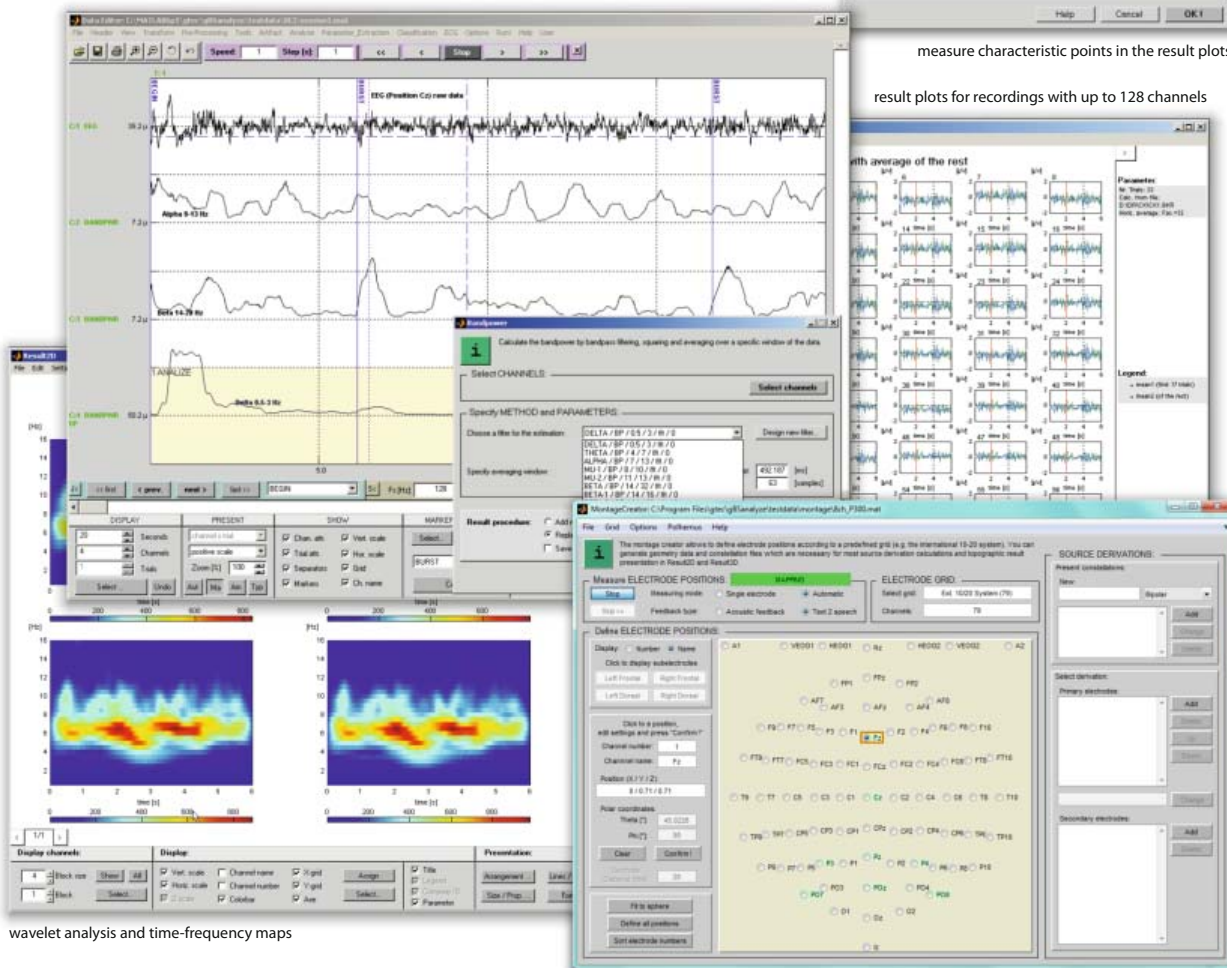
Edit topography/electrode positions according to the international 10-20 system or free electrode system, Specify source derivations (BIP/CAR/LAR/LAP,...), Edit geometry data



extract different parameters from biosignal raw data for further analyses

measure characteristic points in the result plots

result plots for recordings with up to 128 channels



define electrode positions and configurations for source derivations, locate electrode positions with Polhemus Patriot Digitizer or NDI Polaris Krios scanner and import 3D coordinates



ECG TOOLBOX: SPECIALIZED ANALYSES FOR THE ELECTROCARDIOGRAM

ECG specific analyze functions

Coherence, Event-related coherence,
Event-related ECG changes

QRS/R-peak detector

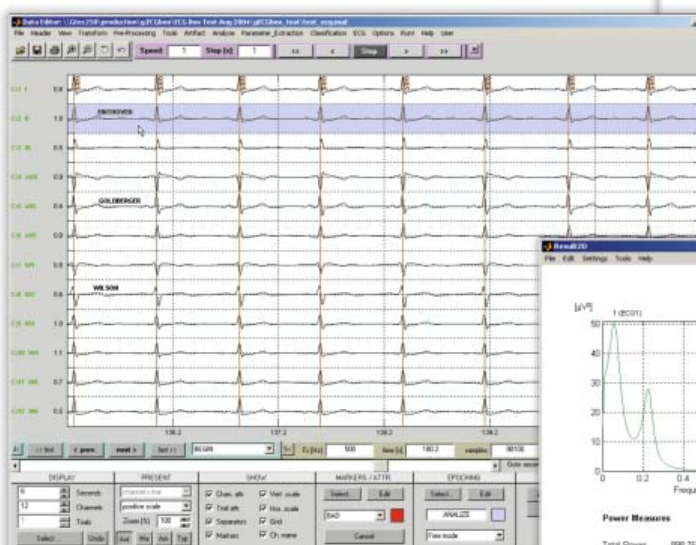
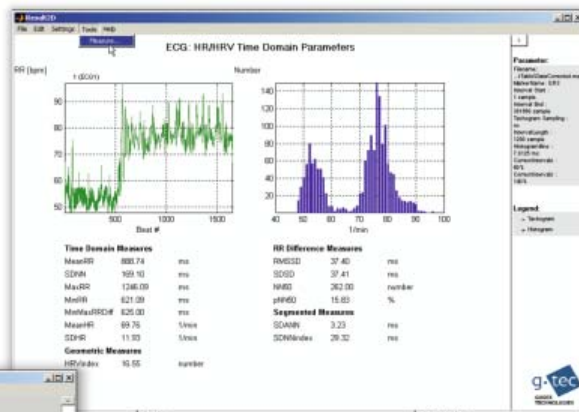
Automatic R-peak detection and
marker assignment

Parameter extraction

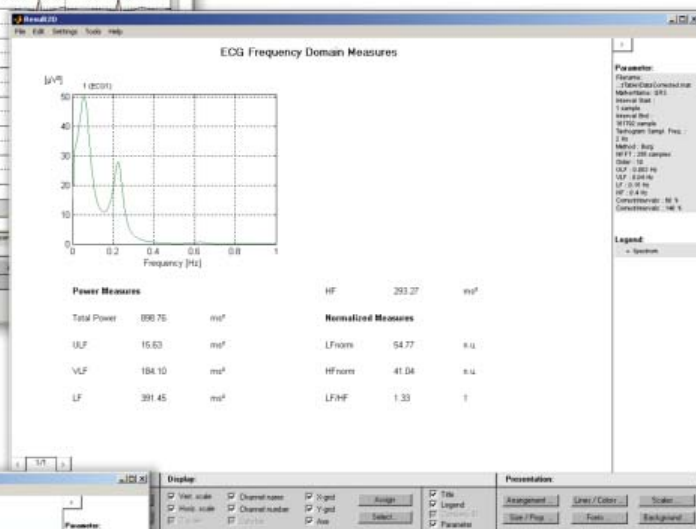
Tachogram

HR/HRV (heart rate/heart rate variability)

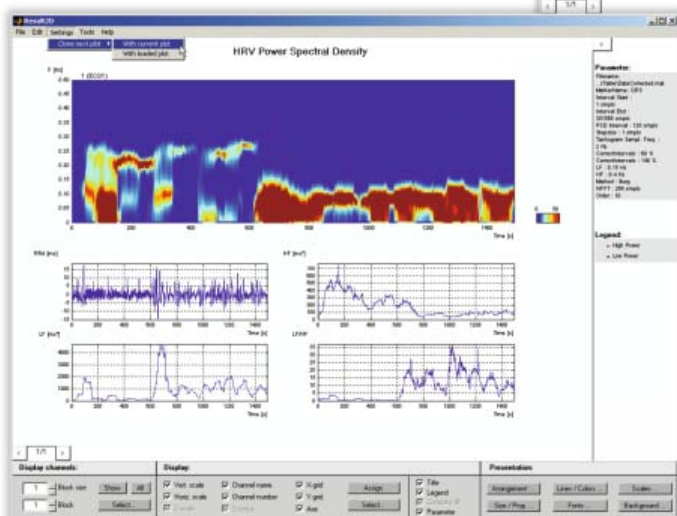
HR/HRV time domain parameters,
Geometric measures, RR difference
measures, Segmented measures, Poincaré
plots, HR/HRV frequency domain
parameters, Power measures, Normalized
measures, HRV time-frequency maps



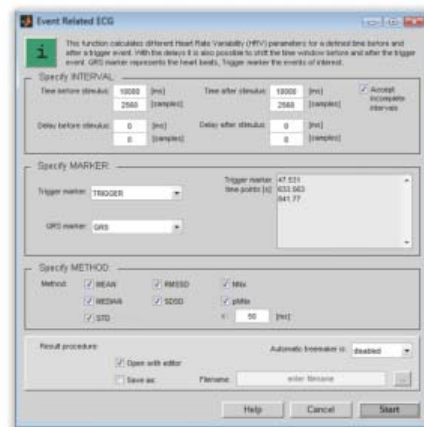
multi-lead ECG analysis



ECG frequency domain measures



HRV: time-frequency maps



event related ECG



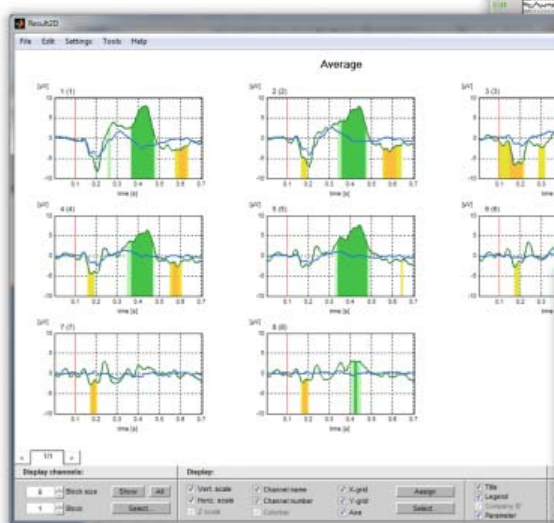
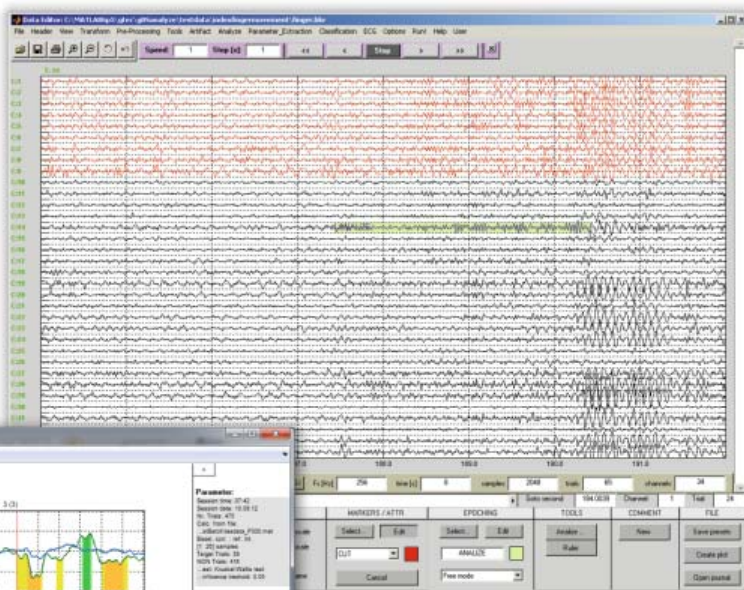
EEG specific analyze functions

Coherence, Event-related coherence, ERD/ERS analysis with significance test, ERD/ERS time-frequency maps with bootstrap test for significance, ERD/ERS time-frequency maps with complex demodulation, ERD/ERS time-frequency maps with wavelets, ERD/ERS time-frequency maps with Hilbert transformation, Common spatial patterns (CSP), Mean frequency, Phaselocking value, Averaging function with statistical comparison of different classes, EP calculation (ASSR, MNN, BAEP, P300, N400, ...)

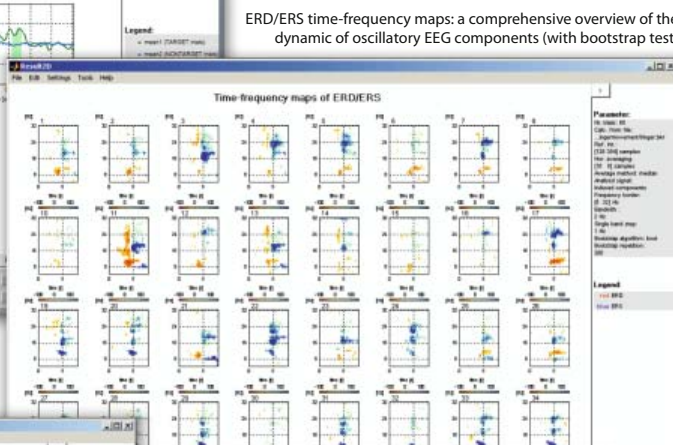
Parameter extraction

Hjorth parameters, Barlow parameters, Running fractal dimension, Temporal and spatial complexity, Minimum energy for SSVEP- and SSSEP-based BCI, P300-BCI accuracy

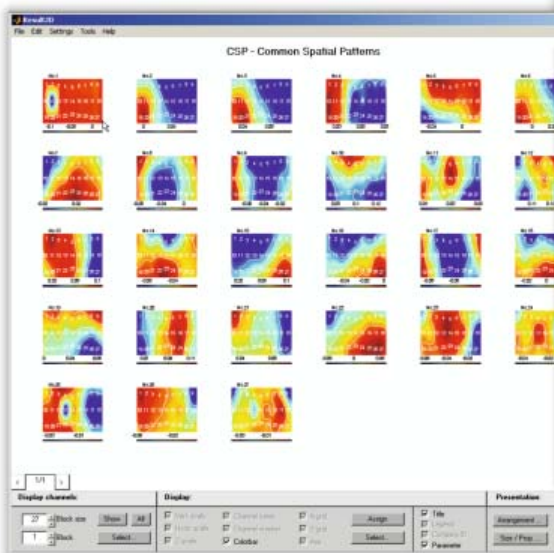
easy handling, viewing, scoring, transformation and processing of multi-channel EEG recordings



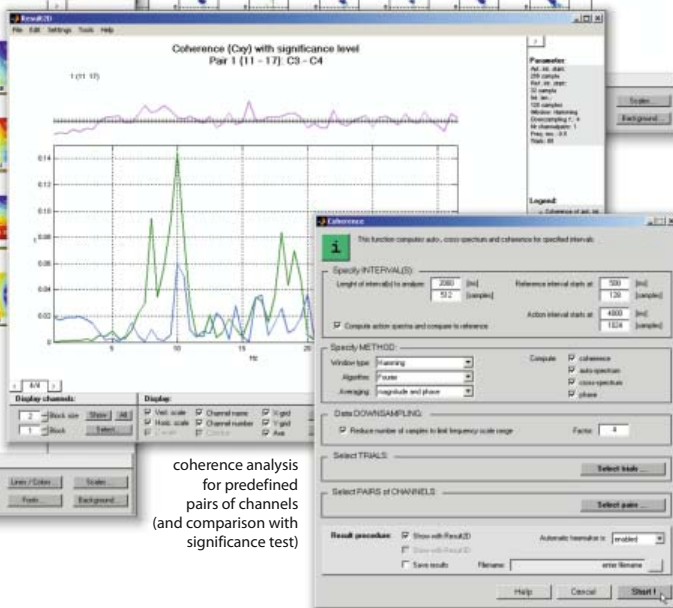
averaging function with statistical comparison of different classes



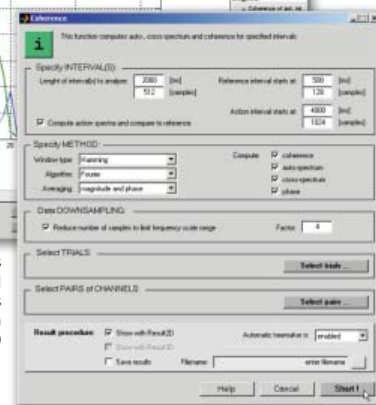
ERD/ERS time-frequency maps: a comprehensive overview of the dynamic of oscillatory EEG components (with bootstrap test)



common spatial patterns allow generating new time series for optimal distinction between classes (maps display CSPs with topographic information arranged according from the most distinctive to the least one)



coherence analysis for predefined pairs of channels (and comparison with significance test)





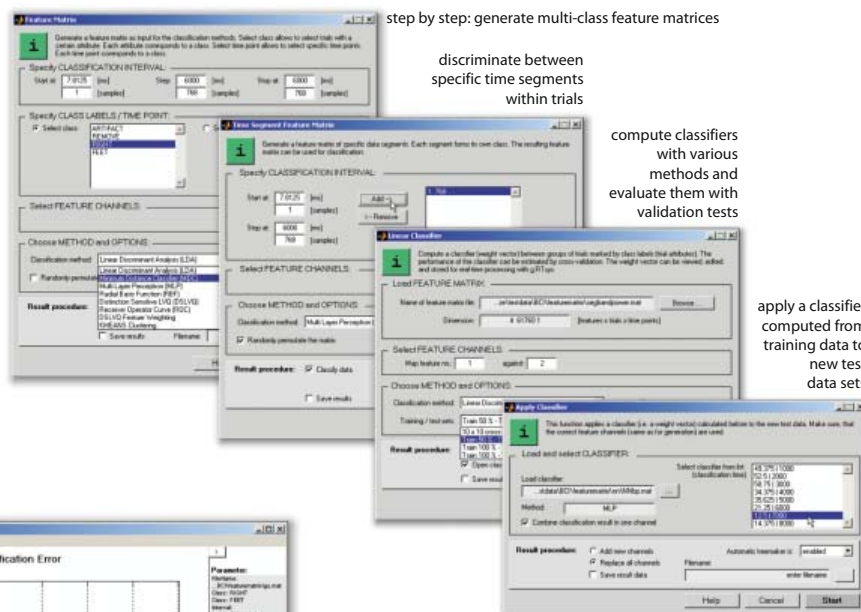
CLASSIFY TOOLBOX: BIOSIGNAL CLASSIFICATION METHODS

Tools

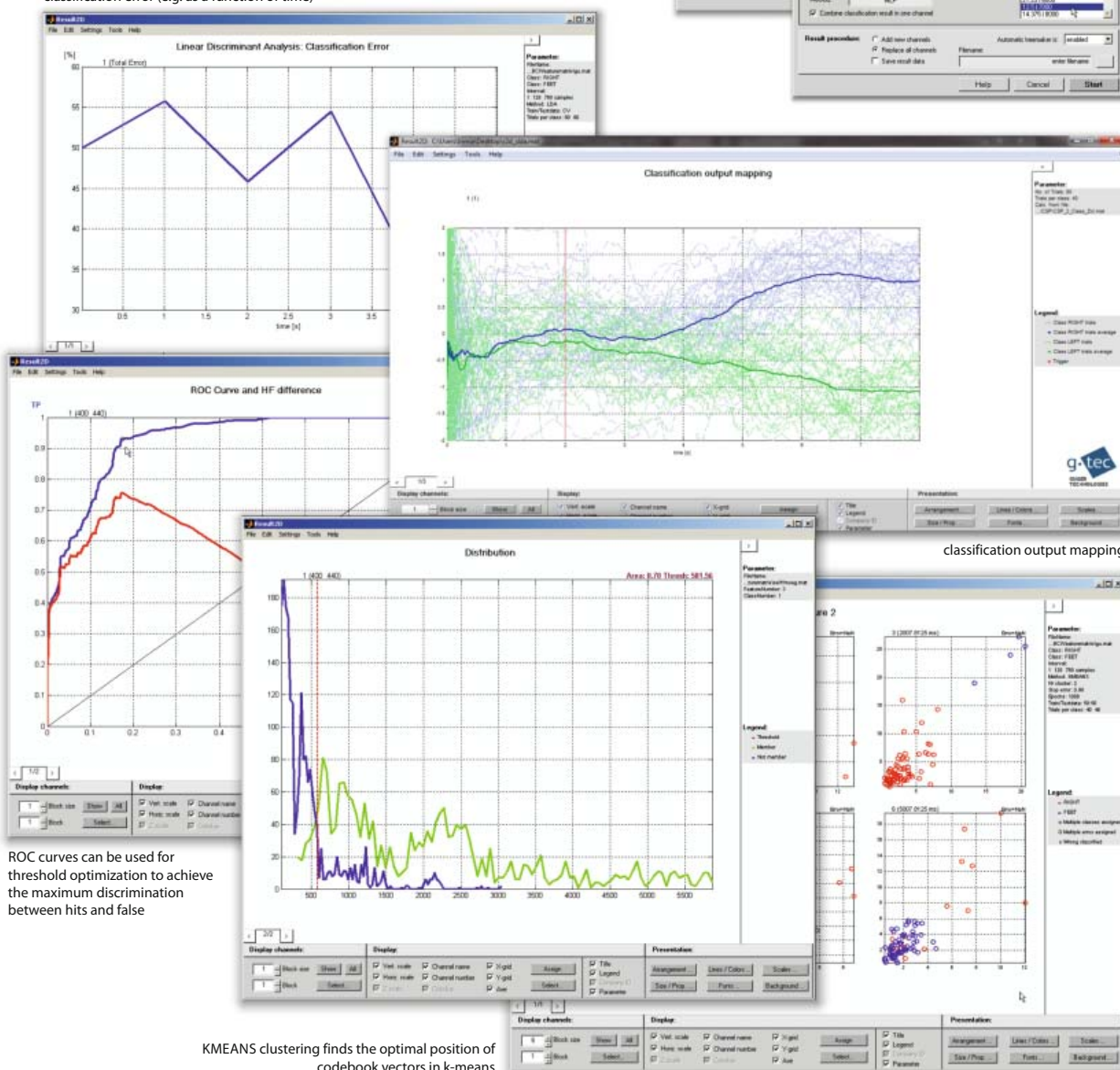
Generate feature matrix, Generate time segment feature matrix, Test classifier, Apply classifier, Store classifiers for online application (biofeedback, BCI, ...)

Methods

Multi-class linear discriminant analysis, Minimum distance classifier, Backpropagation neural network, Receiver operator curves, Radial basis function, Distinction sensitive learning vector quantization (DSLVO), DSLVO for feature weighting, K-means clustering, Support vector machine, Change rate/majority voting, Zero-class, P300-accuracy, Plot classification result



the validation of a classifier leads to a classification error (e.g. as a function of time)



ROC curves can be used for threshold optimization to achieve the maximum discrimination between hits and false

KMEANS clustering finds the optimal position of codebook vectors in k-means

Offline analysis of neonate EEG

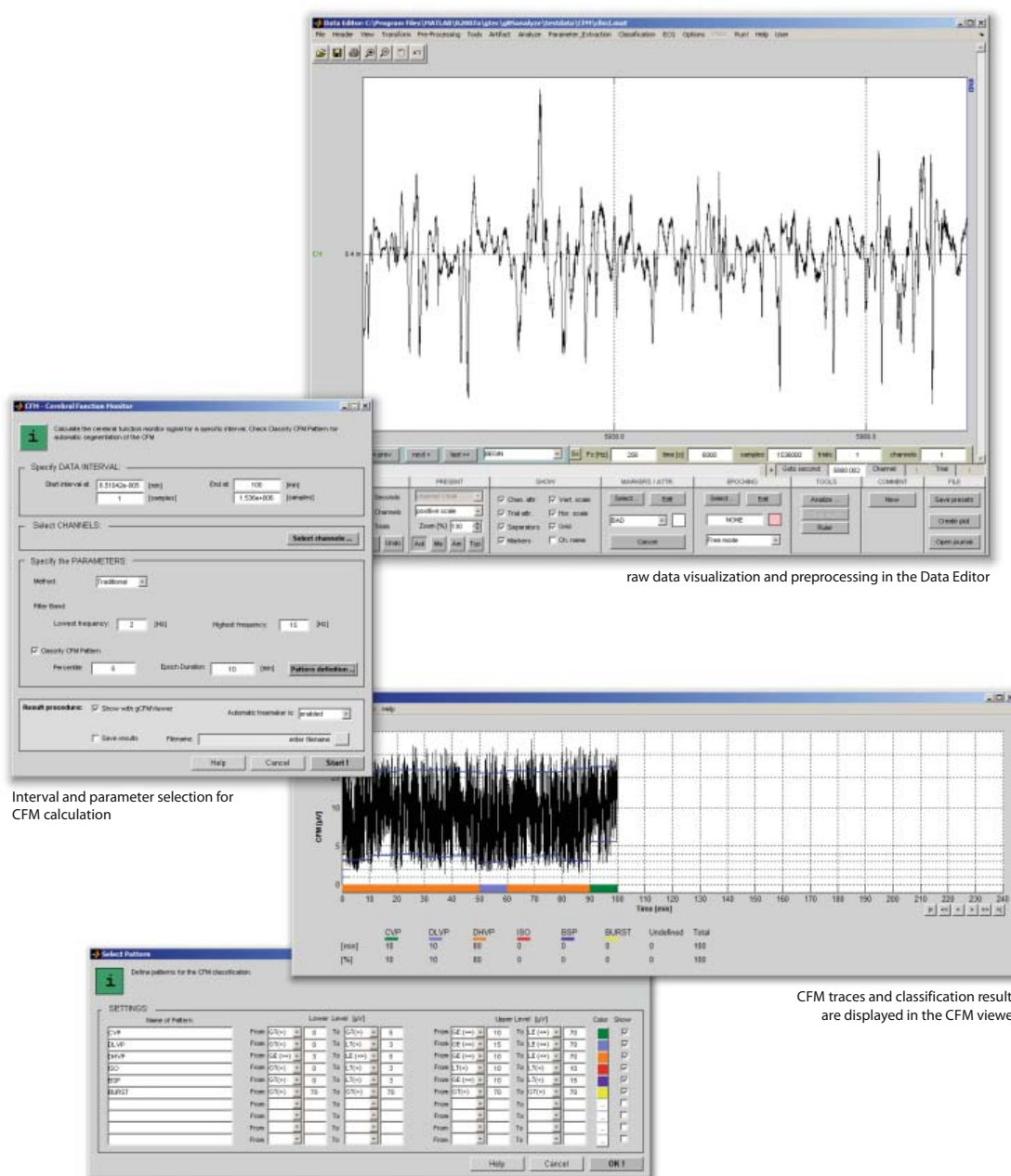
The CFM (aEEG) signal can be computed from selected data segments. The CFM traces are displayed in a viewer window for visual inspection.

Automatic CFM segmentation

CFM traces can be classified automatically. The following classes are assigned to data segments of a predefined length (e.g. 10 min):

CVP ... continuous voltage pattern
DLVP ... discontin. low voltage pattern
DHVP ... discontin. high voltage pattern
ISO ... isoelectric pattern
BSP ... burst suppression mode
BURST ... bursts

Criteria for automatic segmentation can be adjusted/optimized for special applications or derivation techniques.



Interval and parameter selection for CFM calculation

raw data visualization and preprocessing in the Data Editor

CFM traces and classification results are displayed in the CFM viewer

setup for automatic CFM segmentation: criteria for each class can be modified separately



HIGH RESOLUTION EEG TOOLBOX: REALISTIC ANATOMICAL MULTI-LAYER MODELS AND RESULT MAPPING

Pre-processing

High resolution spline Laplacian derivations for ERD/ERS, ERP, ...

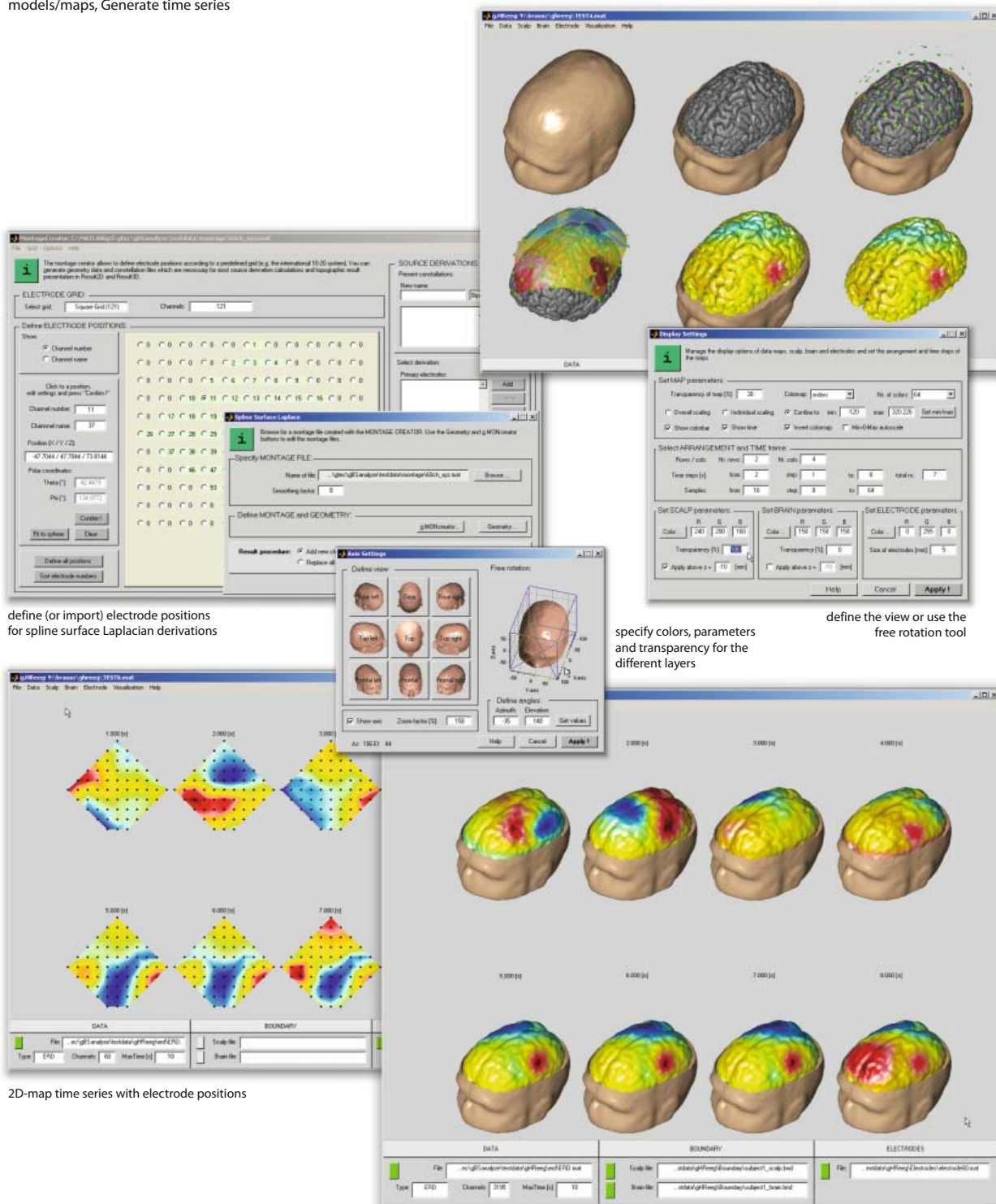
Anatomical modeling

Generation of realistic anatomical multi-layer models from segmented CT/MRI data, Fit electrode positions to models, Edit geometry data

Result mapping

2D and 3D mapping of results for different model layers, Edit transparency and colors, Free rotation of models/maps, Generate time series

different model layers and combinations:
scalp, brain, electrodes, data on scalp, interpolation of data on brain surface



Neuronal activity processing

PSTH – Peristimulus Time Histogram

Analyze position data

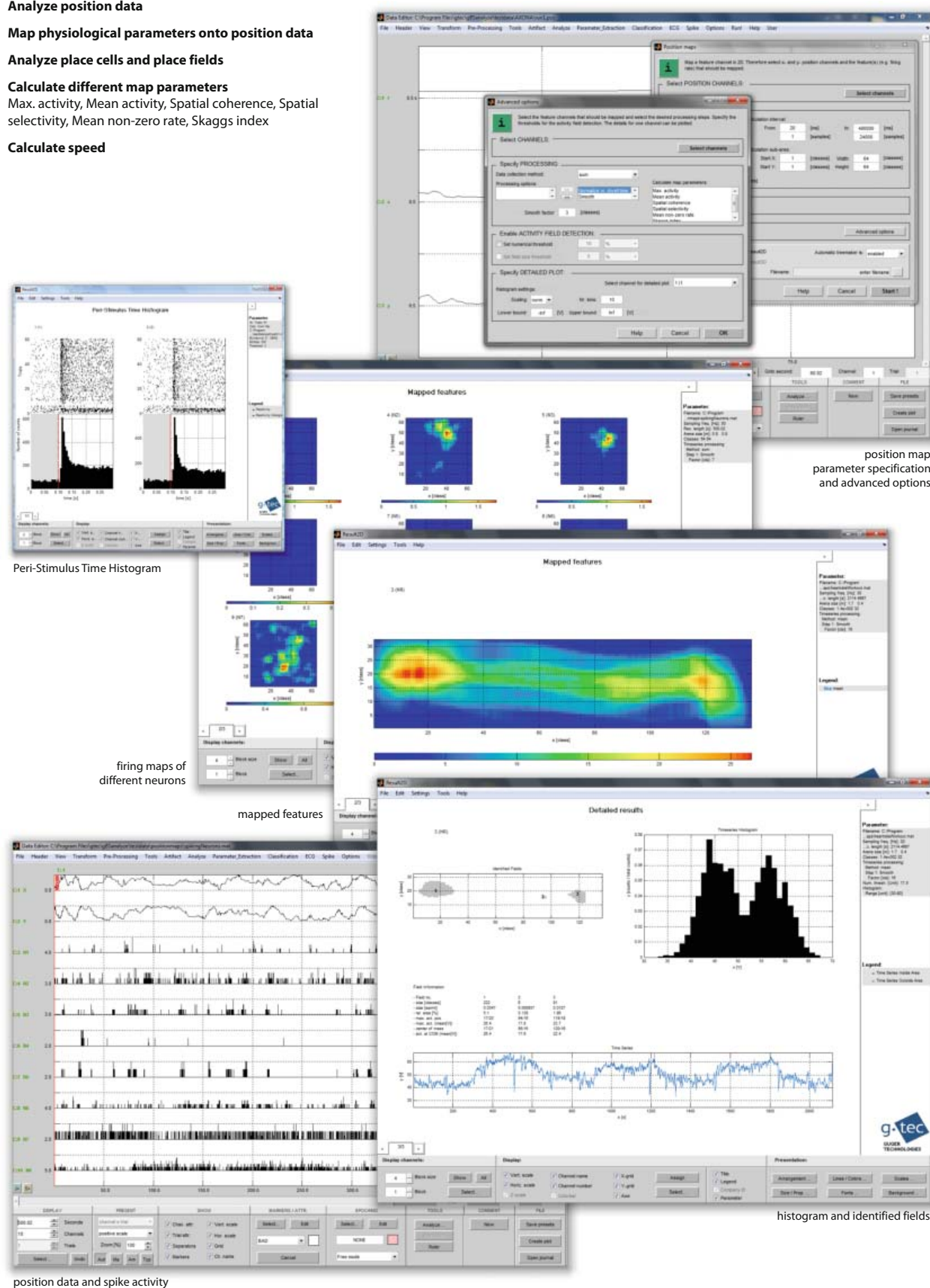
Map physiological parameters onto position data

Analyze place cells and place fields

Calculate different map parameters

Max. activity, Mean activity, Spatial coherence, Spatial selectivity, Mean non-zero rate, Skaggs index

Calculate speed





BSANALYZE TOOLBOXES

Product no.	Product name	Description
0101	g.BSanalyze: Base Version	advanced biosignal data processing toolbox, basic version, needed for using further g.BSanalyze toolboxes; prerequisite MATLAB for OS English Win 32/64, Signal Processing Toolbox; plus stand-alone version without MATLAB
0102	g.BSanalyze: EEG-toolbox	specialised EEG processing toolbox: includes specialised functions for EEG data analysis, parameter extraction, result presentation according to an editable electrode arrangement, source derivation calculation and various methods for spectral analysis and comparison; prerequisite MATLAB for OS English Win 32/64, Signal Processing Toolbox; plus stand-alone version without MATLAB
0104A	g.BSanalyze: ECG-toolbox part I	specialised ECG processing toolbox (according to the US/European task force) for HR (heart rate) and HRV (heart rate variability) analysis in time and frequency domain; prerequisite MATLAB for OS English Win 32/64, Signal Processing Toolbox; plus stand-alone version without MATLAB
0105	g.BSanalyze: Classify toolbox	specialised data classification toolbox, which enables to categorize patterns and signal features of biosignals into different classes; prerequisite MATLAB for OS English Win 32/64, Signal Processing Toolbox; plus stand-alone version without MATLAB
0110	g.BSanalyze: High-Resolution Toolbox	high resolution 3D-spline Laplacian and mapping software; allows to combine EEG analysis with the anatomy of the brain (MRI/fMRI/CT data). It includes head model generation from MR/CT segmented volumes; prerequisite MATLAB for OS English Win 32/64, Signal Processing Toolbox and Image Processing Toolbox; plus stand-alone version without MATLAB
0115	g.BSanalyze: CFM toolbox	amplitude integrated EEG calculation with automatic segmentation; prerequisite MATLAB for OS English Win 32/64, Signal Processing Toolbox; plus stand-alone version without MATLAB
0116	g.BSanalyze: SPIKE toolbox	specialised spike processing toolbox: includes specialised functions for spike and position data analysis, spike rate, firing field, dwell time, statistical parameters; prerequisite MATLAB for OS English Win 32/64, Signal Processing Toolbox
0112	g.MONcreator standalone	stand-alone version of g.tec's montage creator

BSANALYZE BUNDLE OFFERS

Product no.	Product name	Description
0152	bundle price (g.BSanalyze: EEG+ECG I)	g.BSanalyze Base Version + g.BSanalyze EEG-toolbox + g.BSanalyze ECG-toolbox part I; bundle offer (0101+0102+0104A)
0153	bundle price (g.BSanalyze: EEG+Classify)	brain computer interface analysis – g.BSanalyze Base Version + g.BSanalyze EEG-toolbox + g.BSanalyze Classify toolbox; bundle offer (0101+0102+0105)

SUBSCRIPTION AND SUPPORT

Subscription

g.BSanalyze comes with a hardlock for an unlimited single-place license or classroom license (network dongle). The software includes a 1-year subscription with free updates. The subscription can be renewed after 1 year.

Support

On-demand implementation of user specific methods/algorithms. Full e-mail/phone support with minimum delay. Full support for 3rd party data formats.



C API – g.tec's Application Programming Interface for Windows and Linux

The Application Programming Interface (API) allows you to access the amplifier from many programming environments. The API has functions to fully control the amplifier from C, C++, Visual Basic, LabWindows and many more programming languages. The API is available for Windows and Linux operating systems. It enables you to program your own sophisticated biosignal acquisition and data processing applications. Sample programs and the well documented source code in the electronic manual serve as a template for your programs. The device driver package contains demo programs that show you the usage of all functions and help to get started with the API.

The device driver for g.USBamp and g.Hlamp gives access to the data which is sent over USB to the computer. Bandpass and Notch filter settings can be performed, the sampling frequency can be selected, a test signal can be applied and the amplifier can be calibrated by your own program. Bipolar derivations can be calculated between two electrodes.

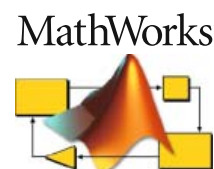
The g.MOBilab+ API allows you to set up the communication with the g.MOBilab+ amplifier, to initialize the amplifier, to start and stop the data acquisition, to set and reset digital I/O lines and to store data on the device.

PRODUCT HIGHLIGHTS

- ◆ Acquire EEG, ECoG, ECG, EMG, EOG data in your own programs
- ◆ Available for Windows and Linux
- ◆ Include your own sophisticated data processing algorithms
- ◆ Develop stand-alone programs for biosignal analysis

SOFTWARE OPTIONS

Product no.	Product name	Description
7263	g.Hlamp C API	application programming interface (API) for user specific application (eg. developed in C/C++); single place licence; prerequisite OS English Win 32/64
0263	g.USBamp C API	application programming interface (API) for user specific application (eg. developed in C/C++); single place licence; prerequisite OS English Win 32/64
0169A	Linux API for g.USBamp	driver software package for g.USBamp; full access to recording buffer; for user specific applications on the PC; single place licence; prerequisite Ubuntu Linux 32/64 bit
5011	g.MOBilab+ C API	driver software package for g.MOBilab+; full access to recording buffer; for user specific applications on the PC; single place licence; prerequisite OS English Win 32/64
0169B	LINUX API for g.MOBilab+	driver software package for g.MOBilab+; full access to recording buffer; for user specific applications on the PC; single place licence; prerequisite Ubuntu Linux 32/64 bit



API for MATLAB – g.tec's device driver for MATLAB

The API for MATLAB is available for g.Hlamp, g.USBamp, g.Nautilus and g.MOBilab+. The toolbox is a device driver that lets users read biosignal data like EEG, ECoG, EMG, EOG and ECG within the MATLAB environment. MATLAB is a very flexible development environment which allows you to easily set up your own signal acquisition and analysis by utilizing all available toolboxes from MATLAB (like Statistics, Neural Networks, and Signal Processing).

The API for MATLAB contains commands which give full access to the amplifiers. There are commands for reading the data, setting the bandpass and Notch filters, changing the sampling frequency of the amplifiers, defining bipolar derivations and calibrating the system.

One of the key advantages of API for MATLAB is that it is fully integrated into MATLAB. Therefore, you can start data acquisition within minutes, and build your application easily and quickly on top of it.



PRODUCT HIGHLIGHTS

- ◆ Acquire EEG, ECoG, ECG, EMG, EOG data directly within MATLAB
- ◆ Control g.Hlamp, g.USBamp, g.Nautilus and g.MOBilab+ from the MATLAB command line
- ◆ Write your own MATLAB programs for on-line visualization and signal analysis
- ◆ Easily use the MATLAB API to handle g.tec amplifiers
- ◆ Data can be read directly into MATLAB for further off-line processing
- ◆ Speed up your development time from months to hours

SOFTWARE

Product no.	Product name	Description
0261	g.USBamp API for MATLAB	MATLAB programming driver package for g.USBamp; single place licence; prerequisite MATLAB for OS English Win 32, Data Acquisition Toolbox
0261D	g.Hlamp API for MATLAB	MATLAB programming driver package for g.Hlamp; single place licence; prerequisite MATLAB for OS English Win 32/64
0261E	g.Nautilus API for MATLAB	MATLAB programming driver package for g.Nautilus; single place licence; prerequisite MATLAB for OS English Win 32/64
5016	g.MOBilab+ API for MATLAB	MATLAB driver software package for g.MOBilab+; full access to the amplifier from MATLAB command window; for user specific applications under MATLAB; single place licence; prerequisite MATLAB for OS English Win 32, Data Acquisition Toolbox



Complete Systems

Complete research systems

g.tec provides complete research systems including all components required for the intended field of application. Smaller systems can be upgraded at any time. Demos and example applications allow an immediate start of work.



Development and research system for data acquisition, analysis, classification and neurofeedback

g.tec provides complete MATLAB-based research and development systems, including all hard- and software components needed for data acquisition, real-time and off-line data analysis, data classification and providing neurofeedback.

A BCI system can be built with g.MOBilab+, g.USBamp, g.HIamp or g.Nautilus. g.MOBilab+ is available with up to 8 EEG channels with wireless signal transmission and is portable. g.USBamp is available with 16–64 EEG channels and transmits the data over USB to the PC or notebook. g.HIamp acquires 80–256 channels over USB. g.Nautilus wireless EEG is available with 8–64 channels.

With the software package High-Speed Online Processing under SIMULINK, you can read the biosignal

data directly into SIMULINK. SIMULINK blocks are used to visualize and store the data. The parameter extraction and classification can be performed with standard SIMULINK blocks, the g.RTanalyze library or self-written S-functions.

After the EEG data acquisition, the data can be analyzed with g.BSanalyze, the EEG and classification toolbox.

With ready-to-use BCI sample applications, you can develop state-of-the-art BCI experiments within a few hours. g.tec started to develop BCI systems more than 15 years ago. Therefore, all important BCI functions are included in the package and can easily be used and modified.

PRODUCT HIGHLIGHTS

- ◆ Complete BCI research system for EEG and ECoG
- ◆ Ready to go paradigms for spelling, robot and cursor control
- ◆ Seamless integration of real-time experiments and off-line analysis
- ◆ Runs with g.MOBilab+, g.USBamp, g.HIamp or g.Nautilus technology
- ◆ Open source paradigms let you make adaptations and develop applications easily
- ◆ MATLAB/Simulink Rapid Prototyping environment speeds up development times from months to days
- ◆ BCI technology proven by hundreds of subjects and labs
- ◆ Zero class enabled for SSVEP, P300 and motor imagery
- ◆ The only environment that supports all BCI approaches (P300, SSVEP/SSSEP, Motor Imagery, slow waves)
- ◆ Recommended setup plan for a fully equipped BCI lab available

Brain-Computer Interface

A Brain-Computer Interface (BCI) provides a new communication channel between the human brain and a computer. Mental activity involves electrical activity, and these electrophysiological signals can be detected with techniques like the Electroencephalogram (EEG) or Electrocorticogram (ECoG). The BCI system detects such changes and transforms them into control signals, which can be used for moving objects, writing letters, opening doors, changing TV channels and other everyday household activities. This technology helps people with limited mobility increase their independence. One of the main goals is to enable completely paralyzed patients (locked-in syndrome) to communicate with their environment.

A new field of BCI research approaches applications for consciousness assessment in patients with disorders of consciousness and motor rehabilitation for stroke patients (see mindBEAGLE and recoveriX).

THE MAJOR TYPES OF BRAIN-COMPUTER INTERFACES

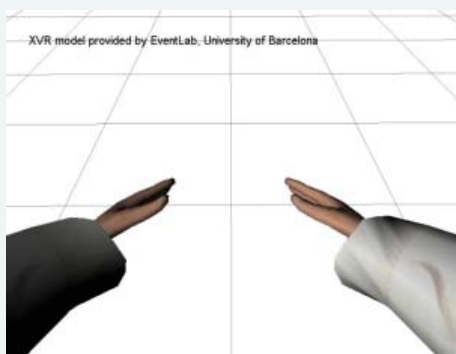
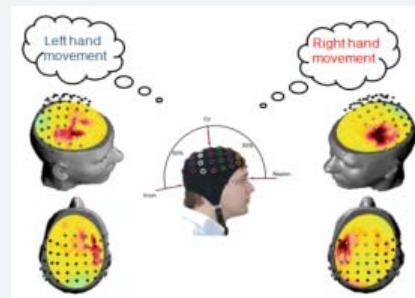
Motor Imagery

The subject imagines performing an action, like squeezing a ball. The EEG data are classified online, and the result is graphically presented to the subject as a horizontal bar on the screen that moves right if right hand motor imagery is detected or moves left if left hand motor imagery is detected. The continuous feedback helps the subject learn to produce motor imagery activity that leads to correct classification. To improve performance, the classifier should be updated after some successful sessions. Offline analysis of the recorded data supports feature optimization.

Motor Rehabilitation System

One of the most common types of Brain-Computer Interface (BCI) systems relies on motor imagery (MI). The user is asked to imagine moving either the right or left hand. This produces specific patterns of brain activity in the EEG signal, which an artificial classifier can interpret to detect which hand the user imagined moving. This approach has been used for a wide variety of communication and control purposes, such as spelling, navigation through a virtual environment, or controlling a cursor, wheelchair, orthosis, or prosthesis.

In the last few years, however, a totally novel and promising application for MI-based BCIs has gained great attention. Several recent articles have shown that MI-based BCIs can induce neural plasticity and thus serve as an important tool to enhance motor rehabilitation for stroke patients. In other words, the overall goal of the BCI system is not communication, but improved stroke recovery. Furthermore, other work has shown that this rehabilitation can be even more effective when combined with immersive graphical environments that can help users interact effectively and naturally with the BCI system. Immersive BCI stroke rehabilitation is an ongoing research effort in numerous American and European research projects, many of which involve g.tec.



g.REHAbci – Motor Rehabilitation with Virtual Limbs

Neurofeedback is critical in a MI-based BCI. Rehabilitation is most effective when users get immersive feedback that relates to the activities they imagine or perform. For example, if people imagine grasping an object with their left hand, then an image of a grasping hand can help users visualize this activity. If a stroke patient keeps trying to imagine or perform the same movement, while receiving feedback that helps to guide this movement, then users might regain the ability to grasp, or at least recover partial grasp function.

Recently, g.tec developed a full research package for stroke rehabilitation. The system consists of a 64 channel cap with active EEG electrodes that are connected to biosignal amplifier g.Hlamp. To train the BCI system, the user imagines left and right hand movements. Common Spatial Patterns (CSPs) are then calculated from the 64 channels that weight each electrode according to its importance.

This electrode selection is done fully automatically and includes algorithms to improve the signal-to-noise ratio. Furthermore, a linear discriminant analysis is trained to distinguish left vs. right hand movements. When this training is finished, which typically takes less than an hour, the patient can control virtual hands that are projected in a highly immersive 3D environment using g.VRsys. Smaller setups can be realized with computer screens or headmounted devices.

As with all g.tec BCI systems, the BCI stroke rehabilitation system relies on well-known software platforms such as Matlab Simulink, which can easily be interfaced with other components from other sources. For more information, including a list of references or technical details, please contact g.tec.

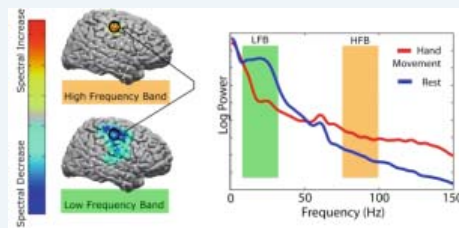


Motor Rehabilitation with Robotic Devices

Exercising motor imagery (MI) is known to be an effective therapy in stroke rehabilitation, even if no feedback about the performance is given to the user. Providing additional real-time feedback can elicit Hebbian plasticity, which increases cortical plasticity, and could improve functional recovery. The MI based Brain-Computer Interface (BCI) is linked to a rehabilitation robot (Amadeo, tyromotion GmbH, Austria), giving motoric and haptic feedback to the user. If a correct pattern of right-hand MI was detected, the robot performed a complete movement (flexion and extension) of the hand, thus giving online feedback.

Ping-Pong game

Everybody knows the famous Ping-Pong game that was played in the seventies on TV sets. In this example, two persons are connected to the BCI system and can control the paddle with motor imagery. The paddle moves upwards via left hand movement imagination and downwards via right hand movement imagination. The algorithm extracts EEG bandpower features in the alpha and beta ranges of two EEG channels per person. Therefore, in total, 4 EEG channels are analyzed and classified.



High Gamma Activity

This picture (courtesy of Dr. Kai Miller) shows high frequency band activity recorded by ECoG, which cannot be detected with EEG.

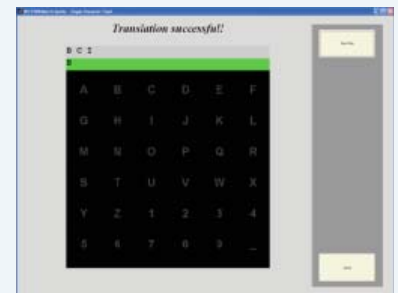
While most BCIs rely on the EEG, some newer work has drawn attention to BCIs based on ECoG. ECoG based systems have numerous advantages over EEG systems, including (i) higher spatial resolution, (ii) higher frequency range, (iii) fewer artifacts, and (iv) no need to prepare users for each session of BCI use, which usually requires scraping the skin and applying electrode gel. Recent research has demonstrated, over and over, that ECoG can outperform comparable EEG methods because of these advantages. Scientific work showed that ECoG methods can not only improve BCIs but also help us address fundamental questions in neuroscience. A few efforts have sought to map "eloquent cortex" with ECoG. That is, scientists have studied language areas of the brain while people say different words or phonemes. Results revealed far more information than EEG based methods, and have inspired new ECoG BCIs that are impossible with EEG BCIs. Other work explored the brain activity associated with movement. This has been very well studied with the EEG, leading to the well-known dominant paradigm that real and imagined movement affects activity in the 8-12 Hz range. ECoG research showed that this is only part of the picture. Movement also affects a higher frequency band, around 70-200 Hz, which cannot be detected with scalp EEG. This higher frequency band is more focal and could lead to more precise and accurate BCIs than EEG methods could ever deliver.

P300

The P300 is another type of brain activity that can be detected with the EEG. The P300 is a brainwave component that occurs after a stimulus that is both important and relatively rare. In the EEG signal, the P300 appears as a positive wave 300 ms after stimulus onset. The electrodes are placed over the posterior scalp.

P300 Spelling

The P300 paradigm presents e.g. 36 letters in a 6 x 6 matrix on the computer monitor. Each letter (or row or column of letters) flashes in a random order, and the subject has to silently count each flash that includes the letter that he or she wants to communicate. As soon as the corresponding letter flashes, a P300 component is produced inside the brain. The algorithms analyze the EEG data and select the letter with the highest P300 component. Then, this letter is written onto the screen. Normally, between 2-15 flashes per letter are required for high accuracy. The number depends on many factors, including the electrodes and their scalp positions, the data processing parameters, and the individual height of the subject's P300 brainwave.

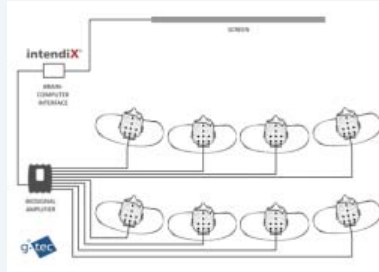


P300 Smart Home Control

The BCI was connected to a Virtual Reality (VR) system. The virtual 3D representation of the smart home had different control elements (TV, music, windows, heating system, phone), and allowed the subjects to move through the apartment. Users could perform tasks like playing music, watching TV, open doors, or moving around. Therefore, seven control masks were created: a light mask, a music mask, a phone mask, a temperature mask, a TV mask, a move mask and a "go to" mask. The controlling mask for the TV is shown.

P300 Second Life Control

g.tec implemented a BCI system based on the P300 brainwave. Different symbols are arranged on a computer screen and are highlighted in a random order. If the subject silently counts one specific symbol that is flashing, the P300 should be elicited, and the BCI system can recognize this P300 and therefore the symbol. To control Second-Life, different masks (GUI with icons) were created for moving around, chatting, or other tasks specialized to each user's wishes.



Hyperscanning - Connecting Minds

Many futurists believe that people in the distant future will use advanced technology to work together more directly, something like a "hive mind". People could use technology to help them not just work together but also think together, accomplishing goals more quickly and effectively. That future may not be so distant. Recently, the P300 speller was used for a demonstration called "Hyperscanning" that represents an important step toward direct cooperation through thought alone. Today, several different groups have EEG-based P300 spellers that can identify targets reliably with about 3 flashes per letter. But, despite very extensive effort from groups around the world, faster communication has not been possible without neurosurgery, since brainwave activity from

one flash is usually too noisy for accurate classification. Recently, eight people worked together to spell "Merry Christmas" through the P300 speller with only one flash per letter. They spelled all 14 characters without a single mistake. Hence, by combining the brainwave signals across eight people, the system managed to substantially improve communication speed and accuracy. This approach could be used for cooperative control for many different applications. People might work together to play games or draw paintings, or could work together for other tasks like making music, voting or otherwise making decisions, or solving problems. Someday, users might put their heads together for the most direct "meeting of the minds" ever.

Vibro-tactile stimulation

However, P300 BCIs based on visual stimuli do not work with patients who lost their vision. Auditory paradigms can also be implemented using a frequent stimulus with a certain frequency and an infrequent stimulus with another frequency. The user is asked to count how many times the infrequent stimulus occurs. Like with the visual P300 speller, the infrequent stimuli also produce a P300 response in the EEG. The same principle can be used for vibro-tactile stimulation if e.g. the right hand is frequently stimulated and the left hand is infrequently stimulated. The EEG will also exhibit a P300 if the user is paying attention to the infrequent stimuli. This auditory and vibro-tactile setup can assess whether the patient is able to follow instructions and experimental procedures. To answer yes and no questions, it is necessary to extend the vibro-tactile setup to 3 stimulators. One of the stimulators applies the frequent stimuli, and 2 stimulators apply the infrequent stimuli. The user can concentrate on one of the infrequent stimulators to say (in this case) yes or no. Typically, an evoked potential is calculated by averaging the frequent and infrequent stimuli. A statistical analysis helps to visualize statistically significant differences, which is especially important for patient data collected in field settings, which is frequently noisy.



Avatar control

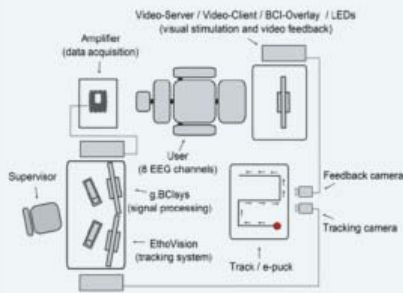
Avatar control has been developed through the research project VERE (Virtual Embodiment and Robotic Re-Embodiment). The VERE project is concerned with embodiment of people in surrogate bodies so that they have the illusion that the surrogate body is their own body – and that they can move and control it as if it were their own. There are two types of embodiment: (i) robotic embodiment and (ii) virtual embodiment. In the first type, the person is embodied in a remote physical robotic device, which they control through a BCI. For example, a patient confined to a wheelchair or bed, who is unable to physically move, may nevertheless re-enter the world actively and physically through such remote embodiment. In the second type, the VERE project uses the IntendiX ACTOR protocol to access the BCI output from within the eXtreme Virtual Reality (XVR) environment (VRMedia S.r.l., Pisa, Italy) to control both the virtual and robotic avatars. The BCI is part of the intention recognition and inference component of the embodiment station.

The intention recognition and inference unit takes inputs from fMRI, EEG and other physiological sensors to create a control signal together with access to a knowledge base, taking into account body movements and facial movements. This output is used to control the virtual representation of the avatar in XVR and to control the robotic avatar. The user gets feedback showing the scene and the BCI control via the HMD or a display. The BCI overlay, for example, allows users to embed the BCI stimuli and feedback within video streams recorded by the robot and the virtual environment of the user's avatar. The user is situated inside the embodiment station, which also provides different stimuli such as visual, auditory and tactile. The setup can also be used for invasive recordings with the electrocorticogram (ECoG). The avatar control is promising from a market perspective because it could be used in rehabilitation systems, such as for motor imagery with stroke patients.

Steady State Visual Evoked Potential (SSVEP)

Steady state visual evoked potentials based BCIs use several stationary oscillating light sources (e.g. flickering LEDs, or phase-reversing checkerboards), each of which oscillates at unique frequency. When a person gazes at one of these lights, or even focuses attention on it, then the EEG activity over the occipital lobe will show an increase in power at the corresponding frequency.

With four choices, anyone could easily move a robot forwards, backwards, to the left and to the right. Hence, in our SSVEP BCI, we have four lights. (Of course, SSVEP BCIs have been developed with more or less than four lights, depending mainly on how many commands are required.) All the user has to do now is to look at one specific flickering light (for example, the light that is assigned to the “move forward” command). Our algorithms determine which EEG frequency component(s) are higher than normal, which reveals which light the user was observing and thus which movement command the user wanted to send. This system also uses a “no-control” state. When the user does not look at any oscillating light, the robot doesn’t move.



Code-based BCI

BCI systems can also use pseudo-random stimulation sequences on a screen (code-based BCI). Such a system can be to control a robotic device. In this case, the BCI controls were overlaid on the video that showed a robot performing certain tasks.

The user was seated in front of a computer monitor and was connected with active EEG electrodes to a biosignal amplifier. The amplifier sent the EEG data to the BCI system that allowed the subject to control a robotic device (e-puck) in real-time. The robotic device was located beside the subject on the floor and the movement was observed with a tracking camera that recorded x- and y-positions on the tracking system computer (EthoVision, Noldus, The Netherlands). Additionally the robotic movements were also captured with a feedback camera that passed the video image to the computer monitor in front of the subject (Technical University of Munich, Germany) and showed the experimental paradigm together with the BCI controls that the subject used to control the robotic device. The code-based BCI system reached a very high on-line accuracy, which is very promising for real-time control applications where a continuous control signal is needed.

SOCI System

The intendiX SOCI system (Screen Overlay Control Interface module) can be used especially for virtual reality (VR) applications and similar applications where merging BCI controls with the applications native interface is essential for an improved and optimal user experience. Using SOCI the intendiX platform can be configured to remotely display its stimuli and feedback on various different devices and systems. The intendiX SOCI can be embedded in host applications to directly interact with BCI controls inside the displayed scene. It generates CVEP, SSVEP stimuli and supports single symbol, row column and random patterns for P300 stimulation.

Through dedicated interfaces it is possible to define and replay custom patterns such as scanning cursors as used by the g.EOGEMGcontrol application. Besides the basic highlighting and colour inversion stimulus types the SOCI system to use a predefined set of colour images, for example images of famous faces, as stimuli, which is for example used by intendiX and g.BCI_SOCI to implement the face speller.



Actor Protocol

The ACTOR protocol allows users to interface external applications easily with a BCI system. If the applications understands the protocol, it can just be plugged to the BCI system. The protocol allows users to implement smart home control, spelling, painting, exoskeleton control, VR control, robotic control, game control, and new applications in development.

For complex control tasks, the BCI Application ConTrol and Online Reconfiguration (ACTOR) Protocol is provided. The ACTOR protocol uses eXtensible Markup Language (XML) formatted message strings to exchange information between the BCI and the attached system. Whenever the BCI system is started, it broadcasts a dedicated hello message to identify the available and active applications. As soon as the BCI has detected external applications, it will request from the application the list of applications and services available from this client. The BCI will acknowledge the received list of commands, services and actions and report whether it was able to process them successfully.

This allows you to easily configure your BCI system according to your applications via UDP or from definition files, either at start-up or during operation, which makes the system very flexible. The BCI system also sends standard XML commands to the external applications for e.g. switching on the light in a smart home environment. If external applications are able to understand the ACTOR protocol, it can just be plugged into the BCI system. The ACTOR protocol is already used in many EC research projects, including such as Brainable, Backhome, Vere, and ALIAS.

By combining the ACTOR protocol with the SOCI system, the BCI can be fully embedded within and controlled by a large variety of user applications, and configured, dynamically by each of them. The ACTOR protocol is designed to empower users to communicate and interact with their environment and control various applications, services and devices therein using one single BCI device.



Hybrid BCIs

Hybrid BCIs combine different input signals to provide more flexible and effective control. g.Hlsys supports (i) mouse control, (ii) EMG 1D and 2D control, (iii) EOG 1D control and (iv) eye-tracker control, as well as the standard BCI signals. EMG and EOG are recorded via the biosignal amplifier and are analyzed with g.RTanalyze to generate the control signals, while the mouse and the eye-tracker use external devices that are interfaced with g.Hlsys. The combination of these input signals makes it possible to use a BCI system for a larger patient group and to make the system faster and more reliable.



g.EOGEMGcontrol

The g.EOGEMGcontrol provides a set of BCI type models that uses eye motion (EOG) signals or muscular contraction (EMG) signals to select individual symbols initiate commands and control external devices.

COMPLETE SOLUTIONS

Product no.	Product name	Description
6006	g.BCIsys8MOBilab+: BCI research system, 8 EEG, NB included	consisting of: g.MOBilab+ 8 channel EEG version; 10-pin connector box; g.MOBilab Simulink High-Speed Online Processing software; g.RTanalyze (software for online biosignal parameter extraction); g.BSanalyze (Base version + EEG toolbox + Classify toolbox for offline data processing, analysis and classification); Bluetooth dongle; fully equipped business notebook (with software ready-to-go installation); cables; bundle offer (5603+5602+5012a+0111+0101+0102+0105+3060+3003+3017); prerequisite MATLAB for OS English Win 64, SIMULINK, Signal Processing Toolbox, Signal Processing Blockset and DSP System Toolbox
6014	g.BCIsys8MOBilab+ SSVEP, P300, NB included	consisting of: g.MOBilab+ 8 channel EEG version + removable storage card; 10-pin connector box; g.MOBilab Simulink High-Speed Online Processing software; g.MOBilab+ P300 model; g.MOBilab+ SSVEP model and hardware; g.RTanalyze (software for online biosignal parameter extraction); g.BSanalyze (Base version + EEG toolbox + Classify toolbox for offline data processing, analysis and classification); Bluetooth dongle; fully equipped business notebook (with software ready-to-go installation); cables; bundle offer (6006+0139b+1303b); prerequisite MATLAB for OS English Win 64, SIMULINK, Signal Processing Toolbox, Signal Processing Blockset and DSP System Toolbox
8030	RehaBCI for g.Hlamp	consisting of: g.Hlamp 80; g.SCARABEO 64 bundle; g.HEADbox - active; g.Hlamp SIMULINK HIGH-SPEED ONLINE Processing; g.RTanalyze; g.BSanalyze: Base Version, EEG-toolbox, Classify-toolbox; g.Hlamp common spatial patterns; g.VRsys; g.UDP interface; g.AVATAR; business PC; bundle offer (7001, 1098, 7005, 0260D, 0111, 0101, 0102, 0105, 0142b, 0299, 0264, 0380, 3001A)
6011	g.BCIsys8MOBilab+: P300, 8 EEG, NB included	consisting of: g.MOBilab+ 8 channel EEG version; 10-pin connector box; g.MOBilab Simulink High-Speed Online Processing software; g.BSanalyze (Base version + EEG toolbox + Classify toolbox for offline data processing, analysis and classification); Bluetooth dongle; fully equipped business notebook (with software ready-to-go installation); cables; bundle offer for P300 experiments (5603+5602+5012a+0101+0102+0105+3003+3060); prerequisite MATLAB for OS English Win 64, SIMULINK, Signal Processing Toolbox, Signal Processing Blockset and DSP System Toolbox
6023	g.BCIsys16USB: complete BCI-research system, PC included	16 channels; consisting of: g.USBamp (biosignal amplifier, CE-certified, FDA listed, with power supply); SIMULINK HIGH-SPEED ONLINE Processing software (drivers and blockset for SIMULINK); g.RTanalyze (real-time software for biosignal parameter extraction); g.BSanalyze (base version + EEG-toolbox + Classify-toolbox for offline data processing, analysis and classification); fully equipped business PC (with software ready-to-go installation); bundle offer (0216+0260+0111ae+0101ae+0102ae+0105ae+3001a+3060); prerequisite MATLAB for OS English Win 64, SIMULINK, Signal Processing Toolbox, Signal Processing Blockset and DSP System Toolbox
6029	g.BCIsys16USB, PC included ERD, SSVEP, P300	16 channels; consisting of: g.USBamp (biosignal amplifier, CE-certified, FDA listed, with power supply); SIMULINK HIGH-SPEED ONLINE Processing software (drivers and blockset for SIMULINK); g.RTanalyze (real-time software for biosignal parameter extraction); g.BSanalyze (base version + EEG-toolbox + Classify-toolbox for offline data processing, analysis and classification); fully equipped business PC (with software ready-to-go installation); bundle offer (6023+0139a+0140a+1303a); prerequisite MATLAB for OS English Win 64, SIMULINK, Signal Processing Toolbox, Signal Processing Blockset and DSP System Toolbox
6024	g.BCIsys32USB: complete BCI-research system, PC included	32 channels; consisting of: g.USBamp (biosignal amplifier, double unit, CE-certified, FDA listed, with power supply); SIMULINK HIGH-SPEED ONLINE Processing software (drivers and blockset for SIMULINK); g.RTanalyze (real-time software for biosignal parameter extraction); g.BSanalyze (base version + EEG-toolbox + Classify-toolbox for offline data processing, analysis and classification); fully equipped business PC (with software ready-to-go installation); synchronisation cable; USB 2.0 Hub; bundle offer (2x0216+0260A+0111+0101+0102+0105+ 3001A+0281A+0284+3060); prerequisite MATLAB for OS English Win 64, SIMULINK, Signal Processing Toolbox, Signal Processing Blockset and DSP System Toolbox
6031	g.BCIsys32USB ERD, SSVEP, P300, PC included	32 channels; consisting of: g.USBamp (biosignal amplifier, double unit, CE-certified, FDA listed, with power supply); SIMULINK HIGH-SPEED ONLINE Processing software (drivers and blockset for SIMULINK); g.USBamp P300 model; g.USBamp Ping Pong model; g.USBamp SSVEP model and hardware; g.USBamp common spatial patterns; g.RTanalyze (real-time software for biosignal parameter extraction); g.BSanalyze (base version + EEG-toolbox + Classify-toolbox for offline data processing, analysis and classification); fully equipped business PC (with software ready-to-go installation); synchronisation cable; USB 2.0 Hub; shortcut jumper cables; bundle offer (6024+0139a+0140a+0142+1303a); prerequisite MATLAB for OS English Win 64, SIMULINK, Signal Processing Toolbox, Signal Processing Blockset and DSP System Toolbox
6021	g.BCIsys64USB: complete BCI-research system, PC included	64 channels; consisting of: g.USBamp (biosignal amplifier, quadruple unit, CE-certified, FDA listed, with power supply); SIMULINK HIGH-SPEED ONLINE Processing software (drivers and blockset for SIMULINK); g.RTanalyze (real-time software for biosignal parameter extraction); g.BSanalyze (base version + EEG-toolbox + Classify-toolbox for offline data processing, analysis and classification); fully equipped business PC (with software ready-to-go installation); synchronisation cable; USB 2.0 Hub; shortcut jumper cables; bundle offer (4x0216+0260A+0111+0101+0102+0105+3001a+0283A+0284+3060); prerequisite MATLAB for OS English Win 64, SIMULINK, Signal Processing Toolbox, Signal Processing Blockset and DSP System Toolbox
6032	RehaBCI, PC included	32 channels; consisting of: g.BCIsys32USB; g.VRsys; g.GAMMAbundle for g.USBamp CSP; g.UDPinterface for communication between the PCs; g.USBamp common spatial patterns model; 3D human avatar; bundle offer; (6024+0299+1111b+0264+0380)
8006	g.Hlamp package BCI	upgrade for BCI research consisting of: g.Hlamp SIMULINK HIGH-SPEED ONLINE Processing Software (drivers and blocksets for SIMULINK); g.Hlamp P300 model; g.Hlamp Ping Pong model; g.Hlamp SSVEP model; g.Hlamp common spatial patterns; g.RTanalyze (real-time software for biosignal parameter extraction); g.BSanalyze (Base version + EEG toolbox + Classify toolbox for offline data processing, analysis and classification); bundle offer (0260d, 0139d, 0140d, 0141d, 0142b, 0111, 0101, 0102, 0105)



Prof. Nima Mesgarani
Columbia University,
New York City, NY/ US

“ The g.tec brain-computer interface environment allows my lab to rapidly realize new applications. ”



Dr. N. Firat Özkan
Eskisehir Osmangazi
University, TR

“ g.BCIsys is an inspiring tool for researchers who want to go several steps further in BCI studies. ”



Augusto Garcia MSc
Technical University Darmstadt, DE

“ Thanks to the easy integration of g.tec amplifiers into Simulink, we are able to analyze users' physiological signals without additional implementation efforts. ”

OPTIONAL MODULES

Product no.	Product name	Description
1303	SSVEP model and hardware	bundle for SSVEP based robot control; consists of SSVEP BCI model, g.SSVEPbox for stimulation, g.STIMbox to run g.SSVEPbox and small robot with bluetooth interface (e-puck); prerequisite: SIMULINK HIGH-SPEED ONLINE Processing, g.BSanalyze Base, EEG & Classify Toolboxes, g.RTanalyze
0137	g.BCI SOCI model	The SOCI system (Screen Overlay Control Interface module) can be used especially for virtual reality (VR) applications and remote control of devices to provide the standard user interface by directly embedding the BCI stimuli. The SOCI can be embedded in host applications to directly interact with BCI controls inside the displayed scene. It generates CUEP or SSVEP stimuli and supports single symbol and row column for P300 stimulation. single place licence; prerequisite: MATLAB for OS English Win 64, SIMULINK, SIMULINK HIGH-SPEED ONLINE Processing, g.BSanalyze Base, EEG and Classify Toolbox
0136	g.BCI CUEP model	code-based BCI model; BCI systems can also use pseudo-random stimulation sequences on a screen (code-based BCI). Such a system can be used to control a robotic device. In this case, the BCI controls were overlaid on the video that showed a robot performing certain tasks; single place licence; prerequisite: MATLAB for OS English Win 64, SIMULINK HIGH-SPEED ONLINE Processing, g.BSanalyze Base, EEG and Classify Toolbox
0139	P300 model	8-channel P300 based speller; prerequisite: SIMULINK HIGH-SPEED ONLINE Processing (0260E), g.BSanalyze Base, EEG and Classify Toolbox
0140	Ping Pong model	2 subject and 4-channel motor imagery based game; prerequisite: SIMULINK HIGH-SPEED ONLINE Processing, g.BSanalyze Base, EEG and Classify Toolbox
0141	SSVEP BCI model	8 channel SSVEP based control; prerequisite: SIMULINK HIGH-SPEED ONLINE Processing, g.RTanalyze, g.BSanalyze Base, EEG and Classify Toolbox
0142	Common spatial patterns	Simulink model to calculate CSPs for 2/3 classes, tutorial; prerequisite: SIMULINK HIGH-SPEED ONLINE Processing, g.RTanalyze, g.BSanalyze Base, EEG and Classify Toolbox
0144	g.VIBROTACTILEp300 model	2-, 3- and 8-channel vibrotactile P300 based BCI control; prerequisite: SIMULINK HIGH-SPEED ONLINE Processing
0146	hyperscanning BCI model	multi-user P300 and Motor Imagery based control; prerequisite: SIMULINK HIGH-SPEED ONLINE Processing, g.RTanalyze, g.BSanalyze Base, EEG and Classify Toolbox
0147	hybrid BCI model	SSVEP and P300 hybrid based control; prerequisite: SIMULINK HIGH-SPEED ONLINE Processing, g.RTanalyze, g.BSanalyze Base, EEG and Classify Toolbox
0148	ACTOR BCI-Application Control and Online Reconfiguration (ACTOR) protocol	Simulink model with matrix interface that can be remotely updated or configured with configuration files; sends commands to external devices; prerequisite: SIMULINK HIGH-SPEED ONLINE Processing
0149	EMG/EOG/mouse control	Simulink model to control the matrix interface with EMG, EOG or mouse; prerequisite: SIMULINK HIGH-SPEED ONLINE processing
0111	g.RTanalyze	real-time EEG, ECG, respiration, galvanic skin response and biosignal processing blockset under SIMULINK; real-time algorithms; single place licence; prerequisite: MATLAB for OS English Windows 32/64, SIMULINK
0264	g.UDPinterface	data exchange with network connection between Simulink/MATLAB on different PCs (eg. BCI, VR, XVR, ...); single place licence; prerequisite: MATLAB for OS English Windows 64, SIMULINK

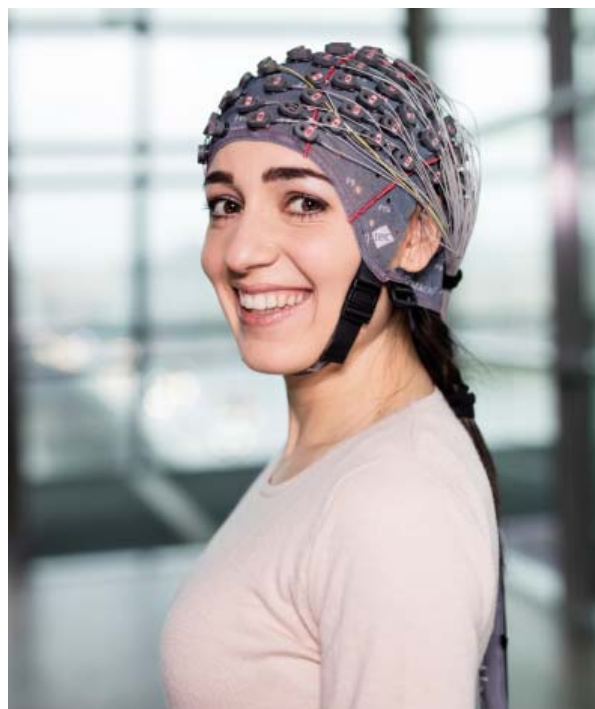
A complete EEG research system, ready-to-go installation for cognitive neuroscience

Start your EEG research immediately! We provide various complete EEG-research packages with 8 to 256 channels to meet your research needs. The systems include amplifier(s), acquisition software, analysis software and a high-end business PC or notebook with all the software installed and ready to go. Just add your desired sensors, caps, electrodes, consumables and stimulation setup for doing ERPs and your lab is ready to go!

g.Recorder enables easy amplifier configuration, data visualization and storage. You can assign and record triggers and markers, review data, and perform other tasks. For data analysis, g.EEGsys packages include g.BSanalyze (base version plus EEG toolbox).

g.EEGsys can be set up with g.MOBilab+, g.USBamp, g.Hlamp and g.Nautilus. Systems based on g.USBamp can be upgraded for more channels at any time. All g.tec systems can be used with active or passive electrodes using gel, and also work with dry electrodes. Upgrading the system for real-time processing, including BCI research, is also no problem at all. Please see the software options.

For ERP research, g.tec offers various stimulation devices: (I) electrical stimulators, (II) vibro-tactile



stimulators, (III) auditory stimulation for doing BAEPs, MMN, P300, N400, ASSR, SEP..., and (IV) visual stimulation for VEPs and SSVEPs. Additionally, external stimulators such as heat can send trigger signals to the g.tec system. Visual stimulation can be done with head-mounted displays, computer monitors, VR systems or LEDs.

Auditory stimulation is done via in-ear phones on the left and right ear. For ERP analysis, the correct time resolution of the trigger event is very important. Therefore, g.tec sends hardware trigger signals from the stimulator to the digital inputs of the amplifiers, which provides perfect time resolution because the triggers are sampled with the analog channels. Such triggers come from the auditory stimulation system, the electrical stimulator, the tactile stimulator or the g.TRIGbox that detects visual, auditory events or button presses.

PRODUCT HIGHLIGHTS

- ◆ The complete solution for your lab
- ◆ All software already installed and tested on a high end business PC/notebook
- ◆ Based on g.MOBilab+ (8 channels), g.USBamp (16–64 channels), g.Hlamp (80–256 channels) or g.Nautilus(8–64 channels)
- ◆ Includes data acquisition software
- ◆ Includes g.BSanalyze offline analysis software (base version + EEG toolbox)
- ◆ Can be upgraded to a real-time/BCI system at any time
- ◆ High resolution ERP acquisition and analysis including statistical analysis
- ◆ Records short, middle and late latency ERPs
- ◆ Presentation or e-prime can be used as stimulation systems
- ◆ Recommended setup for a fully equipped EP lab plan available

COMPLETE SOLUTIONS

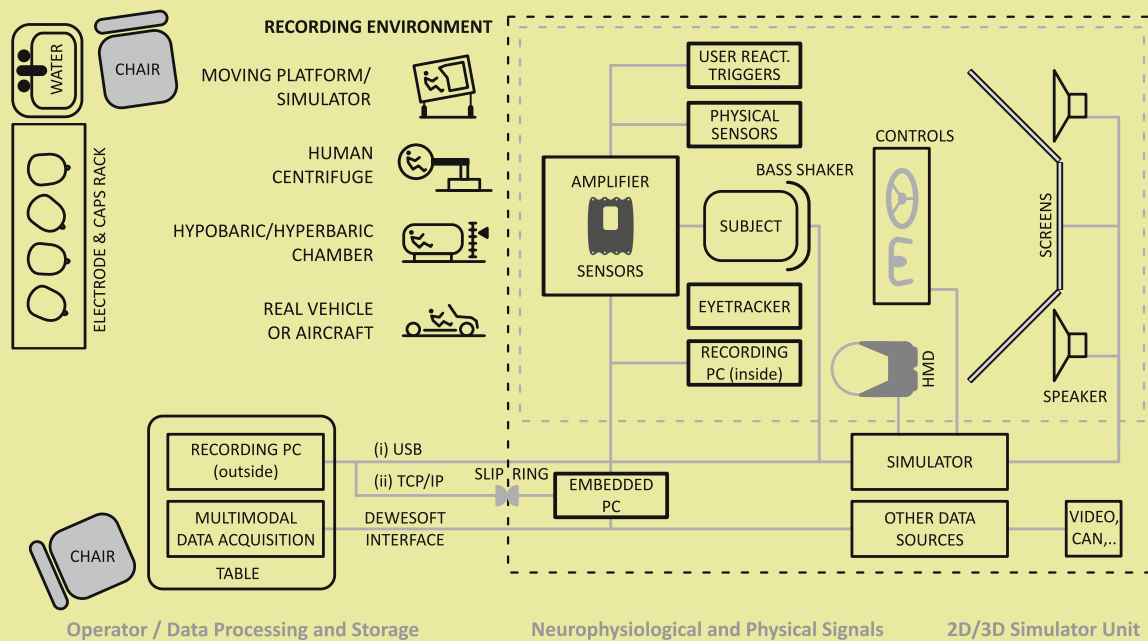
Product no.	Product name	Description
6070	g.EEG16sys, complete portable EEG recording/analysis system, NB included	consisting of: g.USBamp (16 channel biosignal amplifier, CE-certified, FDA listed, with power supply); g.Recorder; g.BSAnalyze (base version) for offline data visualization/processing and EEG-Toolbox for advanced EEG analysis; fully equipped business notebook (with software ready-to-go installation); bundle offer (0216+0167a+0101+0102+3003+3060); prerequisite MATLAB for OS English Win 32/64, Signal Processing Toolbox
6080	g.EEG32sys, complete EEG recording/analysis system, PC included	consisting of: g.USBamp (32 channel biosignal amplifier, CE-certified, FDA listed, with power supply); g.Recorder; g.BSAnalyze (base version) for offline data visualization/processing and EEG-Toolbox for advanced EEG analysis; fully equipped business PC (with software ready-to-go installation); synchronisation cable; USB 2.0 Hub; shortcut jumper cables; bundle offer (2x0216+0167a+0101+0102+3001a+0281A+0284+3060); prerequisite MATLAB for OS English Win 32/64, Signal Processing Toolbox
6090	g.EEG64sys, complete EEG recording/analysis system, PC included	consisting of: g.USBamp (64 channel biosignal amplifier, CE-certified, FDA listed, with power supply); g.Recorder; g.BSAnalyze (base version) for offline data visualization/processing and EEG-Toolbox for advanced EEG analysis; fully equipped business PC (with software ready-to-go installation); synchronisation cable; USB 2.0 Hub; shortcut jumper cables; bundle offer (4x0216+0167a+0101+0102+3001a+0283A+0284+3060); prerequisite MATLAB for OS English Win 32/64, Signal Processing Toolbox
6008	g.EEGsys g.MOBilab+ multi-purpose version, NB included	consisting of: g.MOBilab+ (4 EEG/EOG, 2 ECG/EMG, 2 analog inputs, digital I/Os); 9-pin connector box; g.Recorder; g.BSAnalyze (Base version + EEG toolbox for offline data processing); 5 lead ECG/EMG patient cable; Bluetooth dongle; fully equipped business notebook (with software ready-to-go installation); cables; bundle offer (5033+5003+0167b+0101+0102+5002+3016+3003); prerequisite MATLAB for OS English Win 32/64, Signal Processing Toolbox
6009	g.EEGsys g.MOBilab+ 8 channel EEG version, NB included	consisting of: g.MOBilab+ 8 channel EEG version; 10-pin connector box; g.Recorder; g.BSAnalyze (Base version + EEG toolbox for offline data processing); Bluetooth dongle; fully equipped business notebook (with software ready-to-go installation); cables; bundle offer; prerequisite MATLAB for OS English Win 32/64, Signal Processing Toolbox
6095	g.USBamp AEP Setup	complete setup for auditory stimulation experiments with g.USBamp; consisting of: ASSR, BAEP, AEP stimulation unit; audio trigger cable for g.USBamp UB; Lecture 4: Evoked potentials; bundle offer (0150, 0240, 4053)
8016	g.Hlamp 256 bundle	bundle offer consisting of: g.Hlamp 256 (7003DEV): g.tec's multi-modal biosignal amplifier with USB interface; 256 channels, bi-, unipolar recordings; 16 digital trigger inputs to synchronize with external events; integrated electrode impedance check; CE-certified medical device EN 60601-1 (IEC 60601-1); device driver for Microsoft Windows 32/64 bit; internal sampling frequency 38.4 kHz per channel; highest signal-to-noise ratio; multi-pole medical connectors, classification of device: safety class II, type of applied part CF, conformity class IIa; FDA listed; g.Hlamp water-proof heavy duty case (7051); including g.Hlamp USB cable (7282); (SN: HA-XXXX.XX.XX) standard color: silvergrey, different colors on request; choose your color of science for your personal g.Hlamp: O saphirblack (475) O calypsored (252) O malachitgreen (205) O mysticblue (A07) furthermore including: g.Power - g.Hlamp, 4x g.HEADbox - active, g.HEADbox16 - passive, g.Recorder for g.Hlamp, trigger cable for g.Hlamp for DIG IN 1, g.SCARABEO 256 bundle, 2xg.GAMMAgelSET, g.BSAnalyze: Base version, g.BSAnalyze: EEG-toolbox; (7004, 4x 7005, 7007, 0167d, 1100, 7276a, 0101ae, 0102ae, 2x1060)
8017	g.Hlamp 144 bundle	bundle offer consisting of: g.Hlamp 144 (7002DEV): g.tec's multi-modal biosignal amplifier with USB interface; 128+16 channels; bi-, unipolar recordings; can be upgraded to 256 channel system; 16 digital trigger inputs to synchronize with external events; integrated electrode impedance check; CE-certified medical device EN 60601-1 (IEC 60601-1); device driver for Microsoft Windows 32/64 bit; internal sampling frequency 38.4 kHz per channel; highest signal-to-noise ratio; multi-pole medical connectors, classification of device: safety class II, type of applied part CF, conformity class IIa; FDA listed; g.Hlamp water-proof heavy duty case (7051); including g.Hlamp USB cable (7282); (SN: HA-XXXX.XX.XX) standard color: silvergrey, different colors on request; choose your color of science for your personal g.Hlamp: O saphirblack (475) O calypsored (252) O malachitgreen (205) O mysticblue (A07) furthermore including: g.Power - g.Hlamp, 2x g.HEADbox - active, g.HEADbox16 - passive, g.Recorder for g.Hlamp, g.SCARABEO 128 bundle, g.GAMMAgelSET, trigger cable for g.Hlamp for DIG IN 1, g.BSAnalyze: Base version, g.BSAnalyze: EEG-toolbox, (7004, 2x7005, 7007, 0167d, 1098, 7276a, 0101ae, 0102ae, 1060)
8018	g.Hlamp 80 bundle	bundle offer consisting of: g.Hlamp 80 (7001): g.tec's multi-modal biosignal amplifier with USB interface; 64+16 channels; bi-, unipolar recordings; can be upgraded to a 144 or 256 channel system; 16 digital trigger inputs to synchronize with external events; integrated electrode impedance check; CE-certified medical device EN 60601-1 (IEC 60601-1); device driver for Microsoft Windows 32/64 bit; internal sampling frequency 38.4 kHz per channel; highest signal-to-noise ratio; multi-pole medical connectors, classification of device: safety class II, type of applied part CF, conformity class IIa; FDA listed; g.Hlamp water-proof heavy duty case (7051); including g.Hlamp USB cable (7282); (SN: HA-XXXX.XX.XX) standard color: silvergrey, different colors on request; choose your color of science for your personal g.Hlamp: O saphirblack (475) O calypsored (252) O malachitgreen (205) O mysticblue (A07) furthermore including: g.Power - g.Hlamp, 2x g.HEADbox - active, g.HEADbox16 - passive, g.SCARABEO 64 bundle, g.Recorder for g.Hlamp, trigger cable for g.Hlamp DIG IN 1, g.BSAnalyze: Base version, g.BSAnalyze: EEG-toolbox, g.GAMMAgelSET; (7004, 7005, 7007, 1098, 0167d, 7276a, 0101ae, 0102ae, 1060)
8020	g.Hlamp AEP Setup	complete setup for auditory stimulation experiments with g.Hlamp; consisting of: ASSR, BAEP, AEP stimulation unit; audio trigger cable for g.Hlamp; Lecture 4: Evoked potentials; bundle offer (0150, 7240, 4053)

Plan your lab

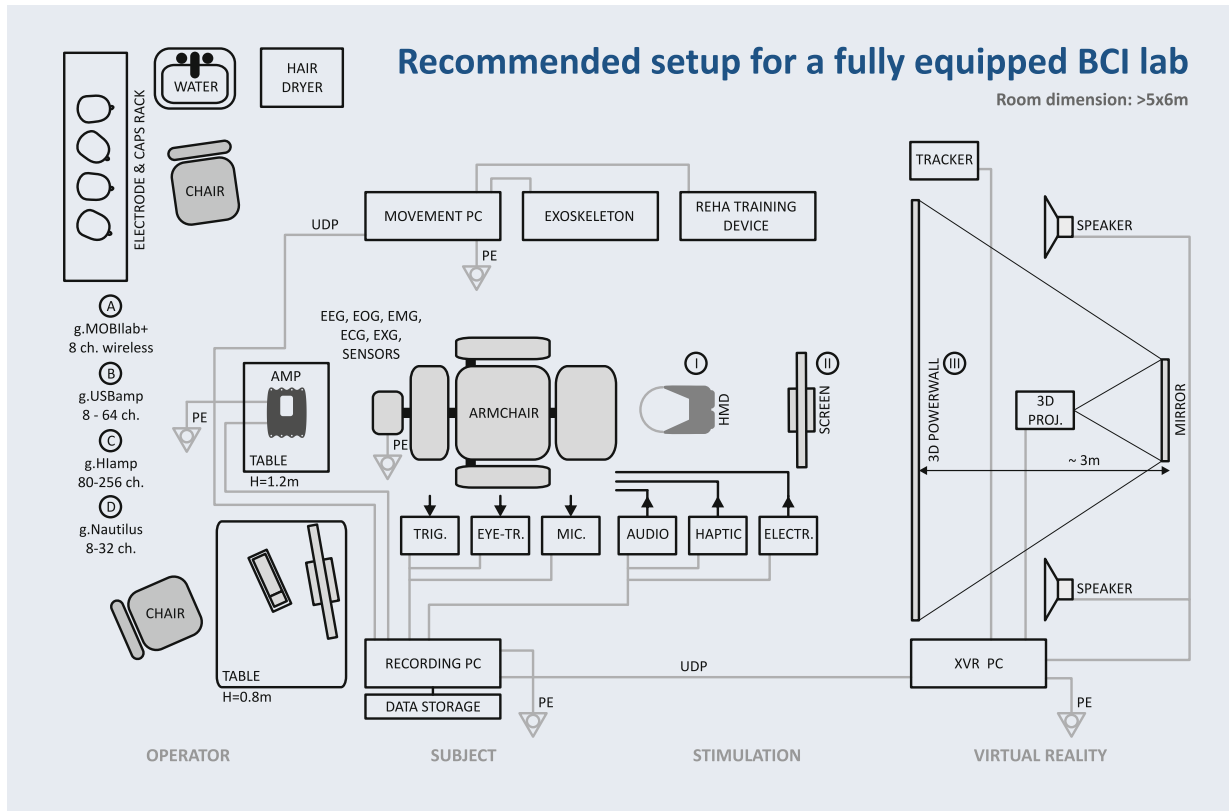
Do you need help for planning your research lab? g.tec offers so-called lab plans, which give an overview about the recommended setup for equipping a complete research lab.



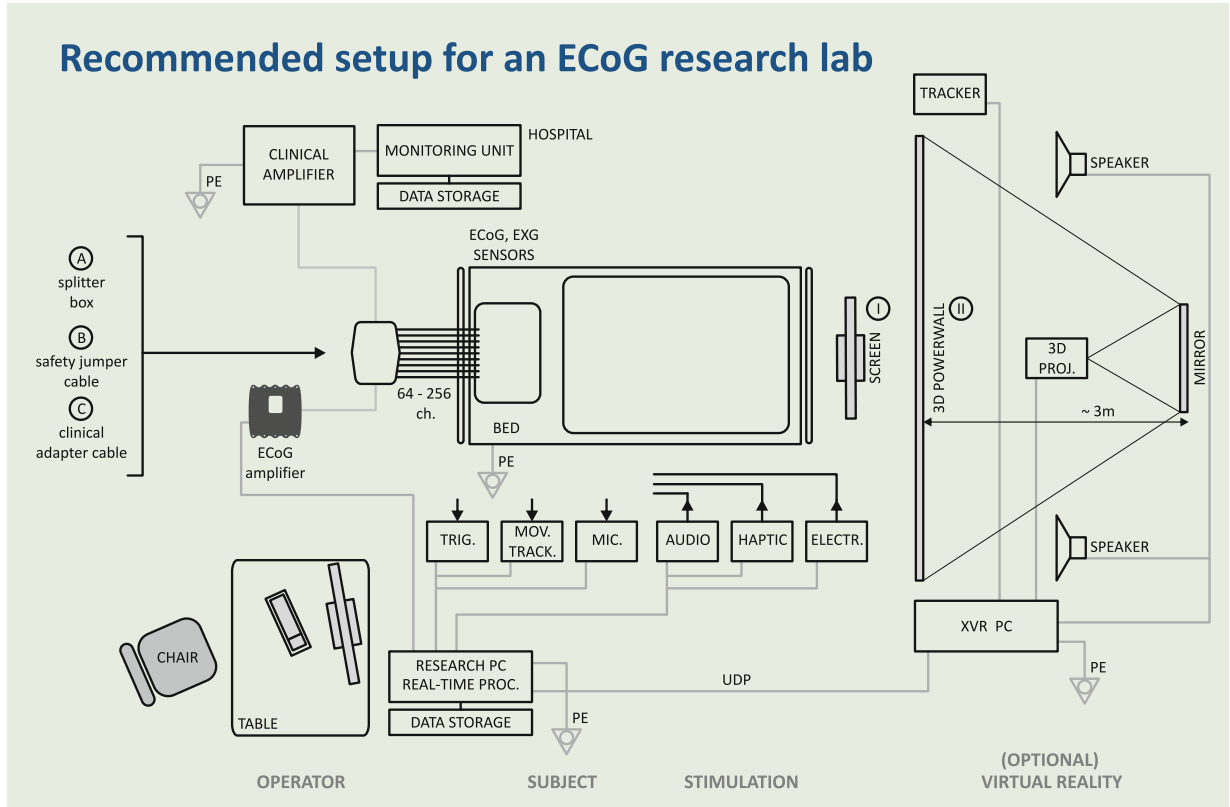
Automotive/Aerospace Neurophysiology Lab



Study psychological and physiological reactions of car drivers, pilots or other subjects under extreme conditions

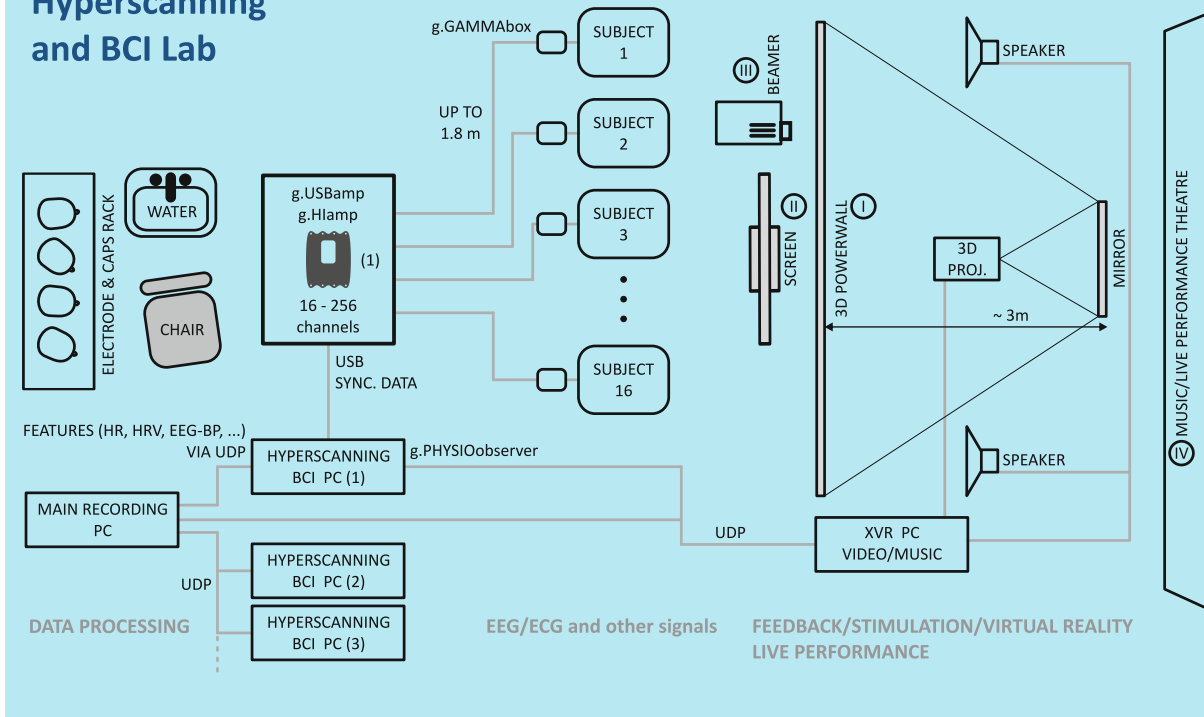


Develop new applications with the full range of available state-of-the-art BCI technology



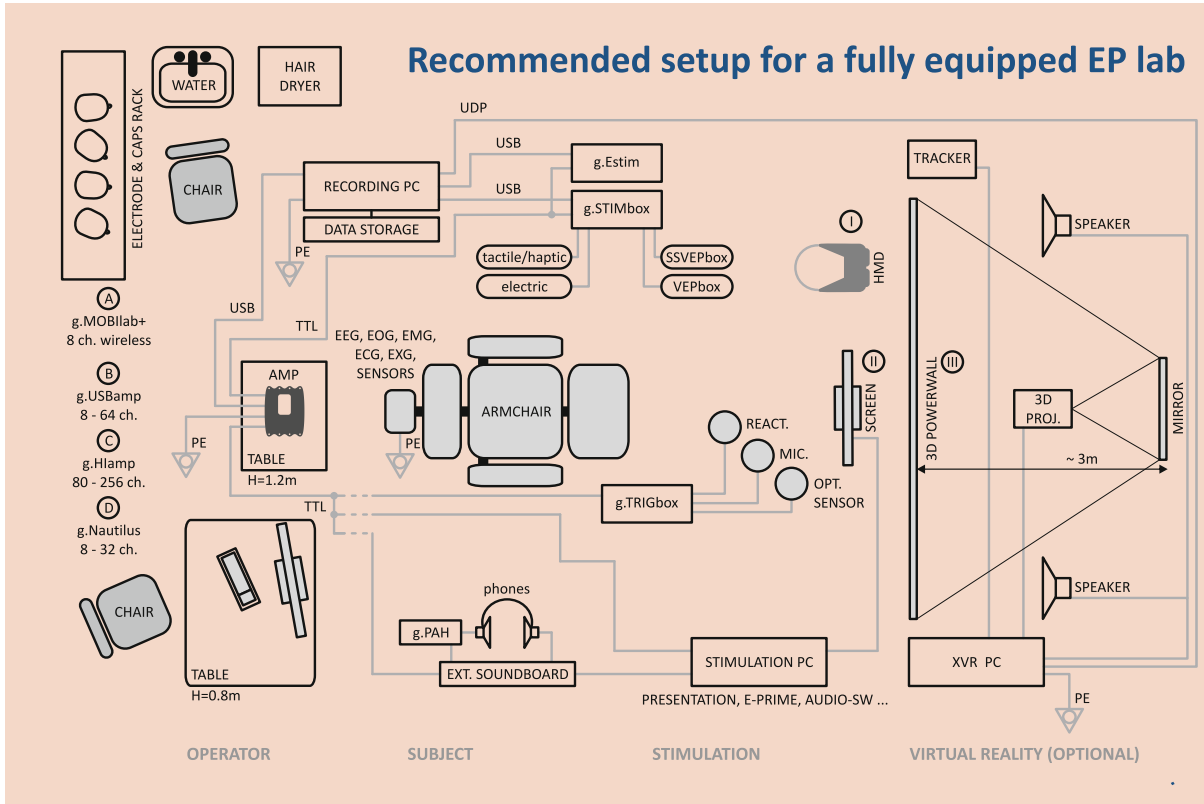
Get deeply into ECoG research without disconnecting the patient from the clinical monitoring system

Multi-User Hyperscanning and BCI Lab



Investigate responses of multiple subjects by synchronous recording of brain and peripheral parameters

Recommended setup for a fully equipped EP lab



Do sophisticated EP studies with any kind of stimulation

g.tec's solution for your teaching and research environment

g.tec offers complete solutions for your professional academic teaching- and research-lab! The BCI teaching lab is designed for Universities to run biomedical engineering, computer science, signal processing or brain-computer interface lectures, across 1 or 2 terms. Students can quickly get started running ready-to-go experiments with P300, SSVEP or motor imagery to learn all necessary tasks. Students will also be assigned problem-solving challenges during the teaching lectures. The BCI Teaching Lab features videos, expert talks, and hands-on experience that provide important methods to inspire users and develop innovative solutions. After successful completion of the first term, students develop their own BCI solution and interface the system with Facebook, a robotic device, or another systems to complete the second term at the University. After these two steps, students are fit for doing a master thesis in the area of BCIs, working on EEG acquisition, paradigm design, signal processing, application development or validating the effectiveness of their new solutions.

The BCI Teaching Lab creates an interdisciplinary environment where students with different backgrounds (electrical or biomedical engineering, mechanical engineering, computer science, neuroscience, psychology, biology, journalism, etc...) get a chance to interact and work as a team. This interdisciplinary approach allows more students to learn about BCI technology, providing a new and immersive teaching opportunity with a great value for Universities.

Technical Features

The system is MATLAB-based and includes all hardware and software components needed for data acquisition, real-time and off-line data analysis, data classification and provides neurofeedback.

The teaching lab BCI system comes with a g.USBamp with 16 channels. The amplifier transmits the data over USB to the computer. With the software package High-Speed Online Processing under SIMULINK, you can read the biosignal data directly into SIMULINK. SIMULINK blocks are used to visualize and store the data. The parameter extraction and classification can be performed with standard SIMULINK blocks, the g.RTanalyze library or self-written S-functions.

After the EEG data acquisition, the data can be analyzed with g.BSanalyze, the EEG and classification toolbox.

With ready-to-use BCI sample applications, you can develop state-of-the-art BCI experiments within a few hours. g.tec started to develop BCI systems more than 15 years ago. Therefore, all important BCI functions are included in the package and can easily be used and modified.

PRODUCT HIGHLIGHTS

- ◆ Complete BCI solutions for teaching and research with EEG and ECoG
- ◆ Ready to go paradigms for spelling, robot and cursor control
- ◆ Make your students and lab members ready for neuroengineering
- ◆ Unique interdisciplinary teaching approach that brings students from different backgrounds together
- ◆ Expert talks at your site to inspire students
- ◆ Seamless integration of real-time experiments and off-line analysis
- ◆ Out of the box solution to run experiments quickly
- ◆ Installation and training
- ◆ The only environment that supports all BCI approaches (P300, SSVEP, motor imagery, slow waves)
- ◆ MATLAB/Simulink Rapid Prototyping environment speeds up the development time

TL 16 systems	TL 8 systems	TL 4 systems	BCI Teaching Lab Version		
16	8	4	Complete 16-ch g.USBamp systems	Hardware	
16	8	4	Caps with active electrode systems, gel, consumables		
16	8	4	Sensors for respiration air flow and GSR		
16	8	4	Hardware sets required for BCI examples, stimulators, I/O		
16	8	4	Complete PC sets with pre-installed software		
12	6	3	Sync cables to use multiple amplifiers together		
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Eye-tracker systems		
16	8	4	g.Hlsys, High-Speed Online Processing for SIMULINK	Software	
16	8	4	g.RTanalyze, real-time processing/analysis/classification blocksets		
16	8	4	g.BSanalyze, offline processing, analysis and classification		
16	8	4	SIMULINK models for BCI (P300, SSVEP, motor imagery, CSP, hybrid BCI, ping-pong game, EMG/EOG control, Reha-BCI, hyperscanning, g.PHYSIOobserver, vibro-tactile BCI, ACTOR protocol, ...)		
16	8	4	g.UDPinterface for network data exchange between systems		
5	3	1	Full subscription with software updates (years)		
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	g.EYEtracker interface for SIMULINK		
18	9	6	BCI webinars	Teaching	
6	3	2	BCI expert talks at your institution		
✓	✓	✓	Lecture materials with solutions (EEG, BCI, EP, PHYSIOobserver)		
✓	✓	✓	Video collection of 10 BCI application examples		
✓	✓	✓	BCI PowerPoint slides for teaching		
✓	✓	✓	Lab plans		
✓	✓	✓	BCI-Award book		
✓	<input type="checkbox"/>	<input type="checkbox"/>	BCI Wolpaw book		
✓	✓	✓	On-site installation & training	Service & Support	
3	2	1	Supported master theses at g.tec		
2	1	<input type="checkbox"/>	Student internship at g.tec		
✓	✓	✓	Listing as certified teaching partner (website, press release)		
✓	✓	✓	Teaching lab certificate		
✓	✓	✓	Student certificates for examinations		
✓	✓	✓	Preferred member for free conference batches		
✓	✓	✓	Briefing for BCI-Award submission		
✓	✓	✓	BCI lab user-story published in newsletter		
get the special discount!	get the special discount!	get the special discount!	BCI Teaching Lab Package Prices		
			✓ ... included		
			<input type="checkbox"/> ... optional		



COMPLETE SOLUTIONS

Product no.	Product name	Description
6500	BCI teaching lab 4 systems	Delivery time on request
6501	BCI teaching lab 8 systems	Delivery time on request
6502	BCI teaching lab 16 systems	Delivery time on request



Prof. Nima Mesgarani,
Columbia University,
New York City, NY/ US

“

The BCI teaching lab gives my students the unique opportunity to learn data acquisition, signal processing and experimental design within one class. The g.tec brain-computer interface environment helped us develop a unique BCI teaching lab in the Electrical Engineering Department at Columbia University.

”



Dr. Brendan Allison,
g.tec Guger Technologies, AT

“

The BCI teaching labs are a great way to learn the different skills needed for real-time BCIs and other biomedical signal processing applications.

”



Electrodes and Electrode Systems

g. GAMMAcap
ACTIVE/PASSIVE/DRY EEG ELECTRODE CAP

Quick, comfortable,
active/passive/dry



The second generation of g.GAMMAcap: new optimized cut for perfect fit, new highly flexible super-narrow seams for high-density electrode placement, 74 labeled standard positions (10-10/extended 10-20 system) plus 86 additional intermediate positions, can now be used either with a chest belt set or with a chin strap that comes with each cap. Size M fits most adult subjects, but a cap set includes sizes S, M and L.

The g.GAMMAcap can be configured with active electrodes for a certain experiment (such as the P300 speller), and the electrodes remain inside the cap even during cleaning. This allows a very fast preparation and cleaning procedure, which speeds up experiments considerably. A typical setup time for a P300 speller experiment (10 electrodes) is about 2 minutes

- just put on the cap and inject the gel. After the cap is removed, the gel almost disappears after drying.

g.GAMMAsys was designed to increase the speed of EEG/ECG/EMG/EOG experimental setups, while still using a comfortable cap and a very high signal quality.

g.GAMMAsys includes different types of active and passive electrodes that can be mounted with the g.GAMMAcap onto the head for EEG recordings or can be mounted on the body for ECG/EMG/EOG recordings.

PRODUCT HIGHLIGHTS

- ◆ Avoid or reduce artifacts from movements and electromagnetic interference
- ◆ Fastest electrode montage for multi-channel recordings
- ◆ System can be used with passive, active or dry electrodes
- ◆ Single electrodes can be replaced easily
- ◆ Electrodes remain in the cap for cleaning, which allows fast montage and cleaning
- ◆ 74 standard + 86 intermediate positions; user can add positions freely
- ◆ Kids' sizes (mini/midi/maxi) available

Product no.	Product name	Description
1023S_2	g.GAMMAcap2, size S, 2mm	electrode cap with 2mm hole diameter for use with g.SCARABEO and g.SAHARA, extended 10/20 system and 86 intermediate positions; size: S (50-54 cm), additional positions can be added freely by the user; chin strap
1023M_2	g.GAMMAcap2, size M, 2mm	electrode cap with 2mm hole diameter for use with g.SCARABEO and g.SAHARA, extended 10/20 system and 86 intermediate positions; size: M (54-58 cm), additional positions can be added freely by the user; chin strap
1023L_2	g.GAMMAcap2, size L, 2mm	electrode cap with 2mm hole diameter for use with g.SCARABEO and g.SAHARA, extended 10/20 system and 86 intermediate positions; size: L (58-62 cm), additional positions can be added freely by the user; chin strap
1023S_3	g.GAMMAcap3, size S, 5mm	electrode cap with 5mm hole diameter for use with g.LADYbird and g.SAHARA, extended 10/20 system and 86 intermediate positions; size: S (50-54 cm), additional positions can be added freely by the user; chin strap
1023M_3	g.GAMMAcap3, size M, 5mm	electrode cap with 5mm hole diameter for use with g.LADYbird and g.SAHARA, extended 10/20 system and 86 intermediate positions; size: M (54-58 cm), additional positions can be added freely by the user; chin strap
1023L_3	g.GAMMAcap3, size L, 5mm	electrode cap with 5mm hole diameter for use with g.LADYbird and g.SAHARA, extended 10/20 system and 86 intermediate positions; size: L (58-62 cm), additional positions can be added freely by the user; chin strap
1023MINI	g.GAMMAcap2KIDS, 74 position, mini	electrode cap with 74 position for kids; extended 10/20 system; size: mini (32 - 36 cm); additional positions can be added freely by the user; chin strap
1023MIDI	g.GAMMAcap2KIDS, 74 position, midi	electrode cap with 74 position for kids; extended 10/20 system; size: midi (37 - 43 cm); additional positions can be added freely by the user; chin strap
1023MAXI	g.GAMMAcap2KIDS, 74 position, maxi	electrode cap with 74 position for kids; extended 10/20 system; size: maxi (44 - 48 cm); additional positions can be added freely by the user; chin strap
1027_2	g.GAMMAcap2SET, 2mm	set of 3 caps (size S, M, L) with 2mm hole diameter for use with g.SCARABEO and g.SAHARA, 74 standard and 86 intermediate positions according to the international 10-10/extended 10-20 system, additional positions can be added freely by the user, one chest belt set
1027_3	g.GAMMAcap3SET, 5mm	set of 3 caps (size S, M, L) with 5mm hole diameter for use with g.LADYbird and g.SAHARA, 74 standard and 86 intermediate positions according to the international 10-10/extended 10-20 system, additional positions can be added freely by the user, one chest belt set
1027B	g.GAMMAcap2SETKIDS	set of 3 kids caps (size mini, midi, maxi), 74 standard positions according to the international 10-10/extended 10-20 system, additional positions can be added freely by the user, one chest belt set
1028	g.GAMMAcapBELT	chest belt set, flexible velcro chest belt (90 - 150 cm), 2 adjustable strips for g.GAMMAcap, measuring tape, syringe
1090	electrode cable sleeve for g.GAMMAcap	special zip tube for covering cables
1095	Velcro strap	Velcro strap for binding cables; 10 pcs/pkg

g.GAMMAcapKIDS

g.GAMMAcapKIDS is available
in head circumference sizes
mini: 32–36 cm
midi: 37–43 cm
maxi: 44–48 cm



Active electrode system for high-density EEG/ExG



PRODUCT HIGHLIGHTS

- ◆ Compact active electrode for high-density EEG and multi-purpose application
- ◆ Fully compatible with g.GAMMAsys and g.Hlomp's active headbox
- ◆ Touchproof sintered Ag/AgCl-ring electrode in a durable molded housing
- ◆ Super-fast and reliable setup: fill-and-ready
- ◆ Usable with g.GAMMAcap or with adhesive washers
- ◆ Simultaneous impedance check of all channels with g.Hlomp

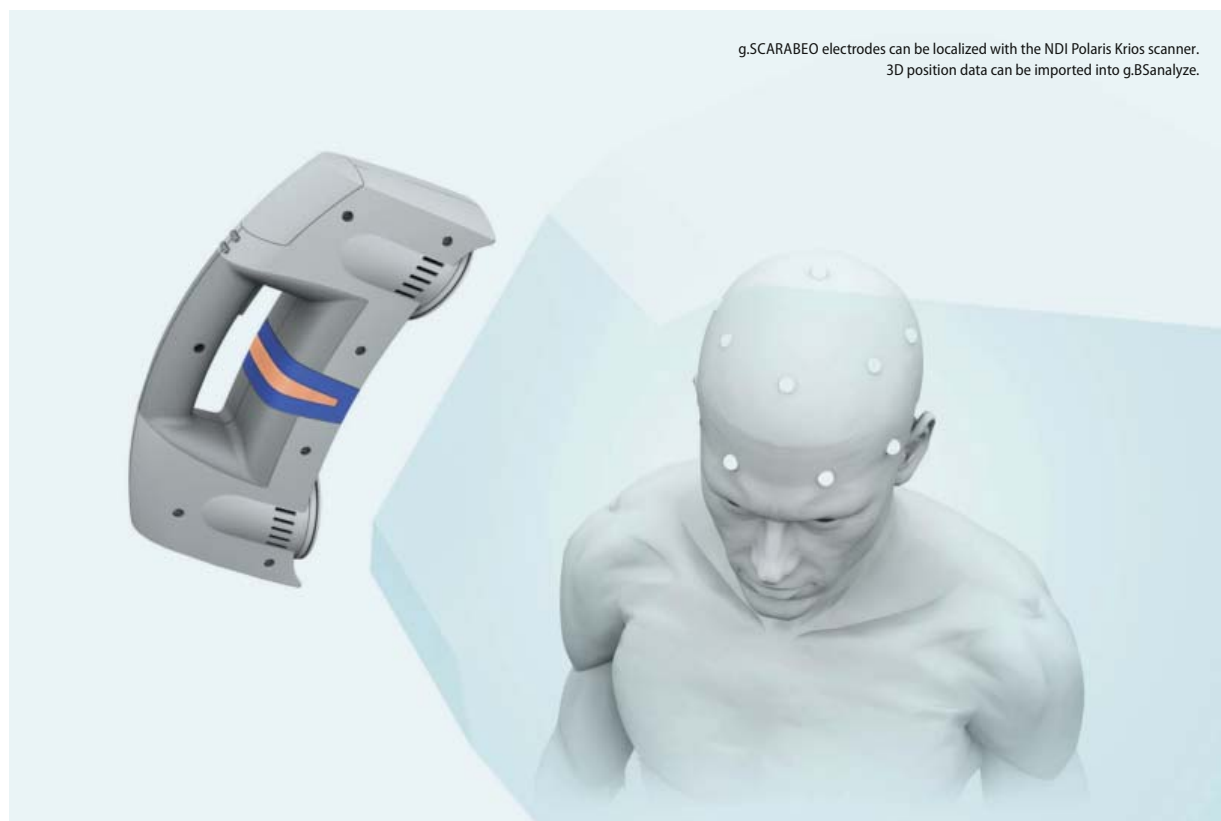
SCARABEO ELECTRODES AND BUNDLES

Product no.	Product name	Description
1085	g.SCARABEO	active ring electrode, can be used with electrode holder ring and g.GAMMAcap2 (EEG) or with adhesive washer (ECG, EMG, EOG); g.SCARABEO electrode holder ring (1087) included; sintered Ag/AgCl ring (for DC recordings), size: 16 x 10 x 5 mm, 125 cm lead, 2-pin safety connector, remains in the cap for cleaning, connector color: grey
1085Z	g.SCARABEO 'Z'	active ring electrode to be used for channel 1 with g.Hlomp to enable impedance measurement, can be used with electrode holder ring and g.GAMMAcap2 (EEG) or with adhesive washer (ECG, EMG, EOG), sintered Ag/AgCl ring (suitable for DC recording), g.SCARABEO electrode holder ring (1087) included; remains in the cap for cleaning, size: 16 x 10 x 5 mm, 125 cm lead, connector color: black
1086	g.SCARABEOgnd	passive ground ring electrode, can be used with electrode holder ring and g.GAMMAcap2 (EEG) or with adhesive washer (ECG, EMG, EOG), sintered Ag/AgCl ring (for DC recordings), g.SCARABEO electrode holder ring (1087) included; size: 16 x 10 x 5 mm, 125 cm lead, 2-pin safety connector, remains in the cap for cleaning, connector color: yellow
1120	g.SCARABEO 16 bundle	bundle consisting of 1x g.GAMMAcap2SET, 17x g.SCARABEO, 2x g.SCARABEO 'Z', 2x g.SCARABEOgnd, 2x g.GAMMAearclip, 1x g.SCARABEO label set, 3x g.SCARABEO syringe, 1x g.SCARABEO cleaning brush set, 1x electrode cable sleeve for g.GAMMAcap2, 1x g.SCARABEO electrode holder rings, 1x Velcro straps (1x 1027_2, 17x 1085, 2x 1085'Z', 2x 1086, 2x 1039, 1x 1091A, 3x 1088, 1x 1089, 1x 1090, 1x 1087_2, 1x 1095)
1098	g.SCARABEO 64 bundle	bundle consisting of 1x g.GAMMAcap2SET, 70x g.SCARABEO, 2x g.SCARABEO 'Z', 2x g.SCARABEOgnd, 2x g.GAMMAearclip, 1x g.SCARABEO label set, 3x g.SCARABEO syringe, 1x g.SCARABEO cleaning brush set, 1x electrode cable sleeve for g.GAMMAcap2, 1x g.SCARABEO electrode holder rings, 1x Velcro straps (1x 1027_2, 70x 1085, 2x 1085'Z', 2x 1086, 2x 1039, 1x 1091B, 3x 1088, 1x 1089, 1x 1090, 1x 1087_2, 1x 1095)
1099	g.SCARABEO 128 bundle	bundle consisting of 1x g.GAMMAcap2SET, 135x g.SCARABEO, 2x g.SCARABEO 'Z', 2x g.SCARABEOgnd, 2x g.GAMMAearclip, 1x g.SCARABEO label set, 3x g.SCARABEO syringe, 1x g.SCARABEO cleaning brush set, 1x electrode cable sleeve for g.GAMMAcap2, 1x g.SCARABEO electrode holder rings, 1x Velcro straps (1x 1027_2, 135x 1085, 2x 1085'Z', 2x 1086, 2x 1039, 1x 1091C, 3x 1088, 1x 1089, 1x 1090, 1x 1087_2, 1x 1095)
1100	g.SCARABEO 256 bundle	bundle consisting of 1x g.GAMMAcap2SET, 270x g.SCARABEO, 2x g.SCARABEO 'Z', 2x g.SCARABEOgnd, 2x g.GAMMAearclip, 1x g.SCARABEO label set, 3x g.SCARABEO syringe, 1x g.SCARABEO cleaning brush set, 1x electrode cable sleeve for g.GAMMAcap2, 1x g.SCARABEO electrode holder rings, 1x Velcro straps, standard montage with g.GAMMAcap: max. 160 electrodes (1x 1027_2, 270x 1085, 2x 1085'Z', 2x 1086, 2x 1039, 1x 1091E, 3x 1088, 1x 1089, 1x 1090, 1x 1087_2, 1x 1095)



Product no.	Product name	Description
1087_2	g.SCARABEO electrode holder ring	holder ring with cone for the g.SCARABEO, fits for g.GAMMAcap2; 10 pcs/pkg
1088	g.SCARABEO syringe	syringe with blunt cannula for placing g.GAMMAgel in g.SCARABEO; 3 blunt cannulas inclusive
1089	g.SCARABEO cleaning brush set	set consisting of 1x brush holder, 12 spare brushes and 12 brush sticks
1091A	g.SCARABEO label set 16	extra set of labels for g.SCARABEO 16 bundle; consisting of 24 holder ring labels, 3 x 16 label tags and 1 set (10 pcs) of velcro straps
1091B	g.SCARABEO label set 64	extra set of labels for g.SCARABEO 64 bundle; consisting of 72 holder ring labels, 3 x 64 label tags and 1 set (10 pcs) of velcro straps
1091C	g.SCARABEO label set 128	extra set of labels for g.SCARABEO 128 bundle; consisting of 144 holder ring labels, 3 x 128 label tags and 1 set (10 pcs) of velcro straps
1091D	g.SCARABEO label set 160	extra set of labels for g.SCARABEO 160 channel cap montage; consisting of 168 holder ring labels, 3 x 160 label tags and 1 set (10 pcs) of velcro straps
1091E	g.SCARABEO label set 256	extra set of labels for g.SCARABEO 256 bundle; consisting of 264 holder ring labels, 3 x 256 label tags and 2 sets (20 pcs) of velcro straps

g.SCARABEO electrodes can be localized with the NDI Polaris Krios scanner.
3D position data can be imported into g.BSanalyze.



GAMMABOX, CABLES AND CLIPS



Product no.	Product name	Description
1016A	g.GAMMAbox for 16 channels, DC	power supply & driver/interface box for 16 active electrodes, DC coupled for usage with g.USBamp, works with g.tec 2-pin safety connector electrodes
1016C	g.GAMMAbox for 16 channels, AC	power supply & driver/interface box for 16 active electrodes, AC coupled for usage with g.USBamp, g.BSamp and g.MOBilab; works with g.tec 2-pin safety connector electrodes
1019A	Active Electrode Driver Box Connector for g.USBamp	connector cable between the g.USBamp (system connector) and the g.GAMMAbox/g.SAHARAbbox; 25 cm lead
1019B	Active Electrode Driver Box Connector for g.MOBilab+ EEG	connector cable between the g.MOBilab+ 8 channel EEG version (system connector to 8 EEG channels) and the g.GAMMAbox/g.SAHARAbbox; 40 cm lead
1019C	Active Electrode Driver Box Connector for touch-proof medical connectors	connector cable between 1.5 mm touch proof medical connectors (monopolar) and the g.GAMMAbox/g.SAHARAbbox; 40 cm lead
1019E	Active Electrode Driver Box Connector for g.MOBilab+ MP EEG/EOG	connector cable between the g.MOBilab+ multi-purpose version (system connector to 4 EEG/EOG channels) and the g.GAMMAbox/g.SAHARAbbox for bipolar recordings; 84 cm lead
1019G	Active Electrode Driver Box Connector for g.MOBilab+ MP EEG/EOG and ECG/EMG	connector cable between g.MOBilab+ multi-purpose version (system connector to 4 EEG/EOG channels and 2 ECG/EMG channels) and the g.GAMMAbox/g.SAHARAbbox for bipolar recordings; 84 cm lead
1019H	Active Electrode Driver Box Connector for g.USBamp8	connector cable between the g.USBamp-8 and the g.GAMMAbox/g.SAHARAbbox; 40 cm lead
1019I	Extension cable for Active Electrode Driver Box Connector for g.USBamp (LEMO)	1,5 m extension cable between g.GAMMAbox/g.SAHARAbbox and g.USBamp; for LEMO connector type (LEMO28male_to_LEMO28female)
1019J	Extension cable for Active Electrode Driver Box Connector for g.USBamp (DSUB)	1,5 m extension cable for g.GAMMAbox/g.SAHARAbbox Output; for DSUB connector type (DSUB26male_to_DSUB26female)
1022	g.EXTENSIONbox for g.GAMMAbox	for additional 16 active electrodes; without ground and reference; DC coupled
1024	g.GAMMAclip	active clip connector for use with disposable pre-gelled adhesive electrodes for ECG/EMG/EGG/..., 125 cm lead, 2-pin safety connector, color: red
1072	g.ACTIVEclipREF	active clip connector (reference) for use with disposable electrodes, for g.SAHARA or ECG/EMG/EGG, 125 cm lead, 2 pin safety connector, color: blue
1073	g.ACTIVEclipGND	passive ground clip connector for use with disposable electrodes, for g.SAHARA or ECG/EMG/EGG, 125 cm lead, 2 pin safety connector, color: yellow



Product no.	Product name	Description
1033	g.LADYbird	active ring electrode, can be used with g.GAMMAcap2 (EEG) or with adhesive washer (ECG, EMG, EOG), sintered Ag/AgCl crown (for DC recordings), 125 cm lead, 2-pin safety connector, remains in the cap for cleaning, color: red
1033Z	g.LADYbird 'Z'	active ring electrode to be used for channel 1 with g.Hlamp to enable impedance measurement, can be used with g.GAMMAcap ² (EEG) or with adhesive washer (ECG, EMG, EOG), sintered Ag/AgCl crown (suitable for DC recording), 125cm lead, remains in the cap for cleaning, color: black
1034	g.LADYbirdGND	passive ground ring electrode, can be used with g.GAMMAcap2 (EEG) or with adhesive washer (ECG, EMG, EOG), sintered Ag/AgCl crown (for DC recordings), 125 cm lead, 2-pin safety connector, remains in the cap for cleaning, color: yellow
1039	g.GAMMAearclip Ag/AgCl	active earclip Ag/AgCl electrode (reference), sintered Ag/AgCl disk, 125 cm lead, 2-pin safety connector, color: blue
1035	g.LADYbirdPASSIVE	passive ring electrode, can be used with g.GAMMAcap (EEG) or with adhesive washer (ECG, EMG, EOG), sintered Ag/AgCl ring (for DC recordings), 120 cm lead, 1.5 mm safety connector, remains in the cap for skin preparation and cleaning
1051	Ag/AgCl passive earclip	passive earclip electrode (reference), 2 sintered Ag/AgCl disks, 125 cm lead wire; 1.5mm safety connector, color: blue
1043	double-sided adhesive washers	500 pieces; 20 mm outer diameter, 8 mm inner diameter for g.LADYbird or g.SCARABEO electrodes
1111	g.GAMMAbundle for g.USBamp	consisting of g.GAMMAcap3SET; 17x g.LADYbird; 2x g.LADYbirdGND; 2x g.GAMMAearclip Ag/AgCl; 5x g.GAMMAgel; 1x g.GAMMAbox for 16 channels; 1x Active Electrode Driver Box Connector for g.USBamp; 3x g.GAMMASyringe (1027_3+17x1033+2x1034+2x1039+5x1021+ 1016a+1019a+3x1067)
1116	g.GAMMAbundle for g.BSamp	consisting of g.GAMMAcap3SET; 17x g.LADYbird; 2x g.LADYbirdGND; 2x g.GAMMAearclip Ag/AgCl; 5x g.GAMMAgel; 1x g.GAMMAbox for 16 channels; 1x Active Electrode Driver Box Connector for touch-proof medical connectors; 3x g.GAMMASyringe (1027_3+17x1033+2x1034+2x1039+5x1021+1016A+1019C+3x1067)
1111B	g.GAMMAbundle for g.USBamp CSP	consisting of g.GAMMAcap3SET; 33x g.LADYbird; 2x g.LADYbirdGND; 2x g.GAMMAearclip Ag/AgCl; 5x g.GAMMAgel; 1x g.GAMMAbox for 16 channels; 1x g.EXTENSIONbox for g.GAMMAbox for additional 16 channels; 2x Active Electrode Driver Box Connector for g.USBamp; 3x g.GAMMASyringe (1027_3+33x1033+2x1034+2x1039+5x1021+1016a+1022+2x1019a+3x1067)
1114	g.GAMMAbundle for g.MOBilab+ 8 channel EEG version	consisting of g.GAMMAcap3SET; 9x g.LADYbird; 2x g.LADYbirdGND; 2x g.GAMMAearclip Ag/AgCl; 5x g.GAMMAgel; 1x g.GAMMAbox for 16 channels; 1x Active Electrode Driver Box Connector for g.MOBilab+ EEG; 3x g.GAMMASyringe (1027_3+9x1033+2x1034+2x1039+5x1021+1016a+1019b+3x1067)



g.SAHARAsys
ACTIVE DRY ELECTRODE SYSTEM

Dry like the desert



Normally, the electroencephalogram (EEG) is recorded from the surface of the head with gel based electrodes to get a low electrode-skin impedance. If passive electrodes are used, the skin must be abraded beforehand to reduce the impedance. With active electrodes, which contain an amplifier inside, the electrode gel is injected between the electrode material and the skin. This allows a faster montage of the electrode system.

One of the main advantages of gel based active electrodes is their robust behavior, but the main disadvantages are the long montage time and the need to wash the user's hair after the recording. g.tec thus developed a dry electrode system which does not require electrode gel. The g.SAHARA electrode system (patent pending) consists of an 8 pin electrode made of a special gold alloy. The pins have sufficient length to reach through the hair to the skin. The material and the 8 pins reduce the electrode-skin

impedance. The electrode itself can be connected with a clip to the active electrode system on top of it.

EEG recordings are performed at frontal, central, parietal and occipital regions of the head, and therefore a mechanical system is required that holds the electrode to the skin with a constant pressure at every possible recording location. EEG electrodes are typically positioned according to the international 10/20 system. g.tec hence developed the 2nd generation of the g.GAMMAcap, with a total of 160 positions according to an extended 10/20 system, to allow a very flexible electrode montage

PRODUCT HIGHLIGHTS

- ◆ The first and only dry electrode system that works for all frontal, central, occipital and parietal sites
- ◆ The first dry active electrode already available on the market
- ◆ The first and only dry system tested with all major BCI concepts in group studies with success
- ◆ Cost range of an active EEG electrode
- ◆ Captures the whole EEG frequency spectrum from 0.1-40 Hz
- ◆ Perform EEG recordings without gel
- ◆ Mount the cap in under one minute!
- ◆ Washing hair is no longer required!
- ◆ Able to pick up frequency spectra for P300, motor imagery and SSVEP based BCIs



Lukas Fiederer Dipl. Biol.
Univesity Hospital
of Freiburg, DE

“ The g.SAHARA dry EEG electrodes are extremely useful for rapid prototyping and testing of ideas before large scale experiments. The quality of the signal is sufficient for preliminary analysis up to the beta frequency range, as well as for educational purposes. ”



SAHARASYS ELECTRODES, CLIPS AND BUNDLES

Product no.	Product name	Description
1070A	g.SAHARAElectrode, 7 mm	dry electrode, 8 gold-alloy coated pins with 7 mm length, 19 mm diameter, clip connector on top to connect to g.SAHARAClip, color: orange
1070B	g.SAHARAElectrode, 16 mm	dry electrode, 8 gold-alloy coated pins with 16 mm length, 19 mm diameter, clip connector on top to connect to g.SAHARAClip, color: orange
1071	g.SAHARAClip	active clip connector for use with g.SAHARAElectrode, 125 cm lead, 2 pin safety connector, color: orange
1072	g.ACTIVEclipREF	active clip connector (reference) for use with disposable electrodes, for g.SAHARA or ECG/EMG/EGG, 125 cm lead, 2 pin safety connector, color: blue
1073	g.ACTIVEclipGND	passive ground clip connector for use with disposable electrodes, for g.SAHARA or ECG/EMG/EGG, 125 cm lead, 2 pin safety connector, color: yellow
1075	Adhesive mastoid electrodes	disposable adhesive mastoid electrodes, diameter 24 mm, 50 pcs, for use with g.SAHARAClipREF and with g.SAHARAClipGND, no gel remains on the skin after use
1082	Anti static wrist band and power socket connector	Anti static wrist band and power socket connector for electro-static artefact reduction; consists of 1 x power socket connector, 2 x spiral cable and 2 wrist bands
1074	g.SAHARAbbox	power supply & driver/interface box for 16 g.SAHARAElectrodes, for usage with all g.tec amplifiers, frequency range 0.1 Hz - 40 Hz
1078	g.SAHARAsset 8, for g.USBamp	consisting of g.GAMMAcap2SET; 8x g.SAHARAElectrode, 7mm; 8x g.SAHARAElectrode, 16mm; 8x g.SAHARAClip; 2x g.SAHARAClipREF; 2x g.SAHARAClipGND; 1x g.SAHARAbbox; 1x Active Electrode Driver Box Connector for g.USBamp; 2x adhesive mastoid electrodes (100 pcs); 1x anti static wristband & power connector; (1027_2 + 8x1070a + 8x1070b + 8x1071 + 2x1072 + 2x1073 + 1x1074 + 2x1075 + 1x1019A + 1x1082)
1079	g.SAHARAsset 8, for g.BSamp	consisting of g.GAMMAcap2SET; 8x g.SAHARAElectrode, 7mm; 8x g.SAHARAElectrode, 16mm; 8x g.SAHARAClip; 2x g.SAHARAClipREF; 2x g.SAHARAClipGND; 1x g.SAHARAbbox; 1x Active Electrode Driver Box Connector for touch-proof medical connectors; 2x adhesive mastoid electrodes (100 pcs); 1x anti static wristband & power connector; (1027_2 + 8x1070a + 8x1070b + 8x1071 + 2x1072 + 2x1073 + 1x1074 + 2x1075 + 1x1019C + 1x1082)
1080	g.SAHARAsset 8, for g.MOBilab+	consisting of g.GAMMAcap2SET; 8x g.SAHARAElectrode, 7mm; 8x g.SAHARAElectrode, 16mm; 8x g.SAHARAClip; 2x g.SAHARAClipREF; 2x g.SAHARAClipGND; 1x g.SAHARAbbox; 1x Active Electrode Driver Box Connector for g.MOBilab+ EEG; 2x adhesive mastoid electrodes (100 pcs); 1x anti static wristband and power connector; (1027_2 + 8x1070a + 8x1070b + 8x1071 + 2x1072 + 2x1073 + 1x1074 + 2x1075 + 1x1019B + 1x1082)
1081A	g.SAHARAsset 16, for g.USBamp, 7mm	consisting of g.GAMMAcap2SET; 16x g.SAHARAElectrode, 7mm; 16x g.SAHARAClip; 2x g.SAHARAClipREF; 2x g.SAHARAClipGND; 1x g.SAHARAbbox; 1x Active Electrode Driver Box Connector for g.USBamp; 2x adhesive mastoid electrodes (100 pcs); 1x anti static wristband & power connector; (1027_2 + 16x1070a + 16x1071 + 2x1072 + 2x1073 + 1x1074 + 2x1075 + 1x1019A + 1x1082)
1083A	g.SAHARAsset 16, for g.BSamp, 7mm	consisting of g.GAMMAcap2SET; 16x g.SAHARAElectrode, 7mm; 16x g.SAHARAClip; 2x g.SAHARAClipREF; 2x g.SAHARAClipGND; 1x g.SAHARAbbox; 1x Active Electrode Driver Box Connector for touch-proof medical connectors; 2x adhesive mastoid electrodes (100 pcs); 1x anti static wristband & power connector; (1027_2 + 16x1070a + 16x1071 + 2x1072 + 2x1073 + 1x1074 + 1x1019C + 2x1075 + 1x1082)
1081B	g.SAHARAsset 16, for g.USBamp, 16mm	consisting of g.GAMMAcap2SET; 16x g.SAHARAElectrode, 16mm; 16x g.SAHARAClip; 2x g.SAHARAClipREF; 2x g.SAHARAClipGND; 1x g.SAHARAbbox; 1x Active Electrode Driver Box Connector for g.USBamp; 2x adhesive mastoid electrodes (100 pcs); 1x anti static wristband & power connector; (1027_2 + 16x1070b + 16x1071 + 2x1072 + 2x1073 + 1x1074 + 2x1075 + 1x1019A + 1x1082)
1083B	g.SAHARAsset 16, for g.BSamp, 16mm	consisting of g.GAMMAcap2SET; 16x g.SAHARAElectrode, 16mm; 16x g.SAHARAClip; 2x g.SAHARAClipREF; 2x g.SAHARAClipGND; 1x g.SAHARAbbox; 1x Active Electrode Driver Box Connector for touch-proof medical connectors; 2x adhesive mastoid electrodes (100 pcs); 1x anti static wristband & power connector; (1027_2 + 16x1070b + 16x1071 + 2x1072 + 2x1073 + 1x1074 + 1x1019C + 2x1075 + 1x1082)



MISC CABLES AND ELECTRODES



Product no.	Product name	Description
1002	EEGelectrodes, gold	10 pieces; disk electrodes; electrode length 150 cm; 10 mm diameter
1044	EOG sintered electrode, 14 mm	sintered Ag/AgCl electrode; diameter 14 mm; cable length: 150 cm, safety connector
1009	ECG electrode cable with clip lead	3 leads/piece; 150 cm length; for disposable electrodes



Product no.	Product name	Description
1101	Ear-clip electrode Au	gold; to apply at the earlobes; 2 pieces
1039	g.GAMMAearclip Ag/AgCl	active earclip Ag/AgCl electrode (reference), sintered Ag/AgCl disk, 125 cm lead, 2-pin safety connector, color: blue

CONSUMABLES



Product no.	Product name	Description
1021	g.GAMMAgel	special highly conductive high-viscosity electrode gel for g.GAMMAsys active electrodes, water-soluble, non-abrasive, non-greasy, non-irritant, non-corrosive, CE class 1 product, in doser can, 200g, easy insertion through electrode holes; no syringe included
1060	g.GAMMAgelSET	10 x g.GAMMAgel (1021)
1050	g.GAMMAcream	special highly conductive high-viscosity electrode cream for long-term recording with g.GAMMAsys active electrodes, water-soluble, non-abrasive, non-greasy, non-irritant, non-corrosive, CE class 1 product, in doser can, 200g, easy insertion through electrode holes; incl. syringe
1030	Elefix	electrode gel for optimal low impedances; 400 g
1031	abrasive gel	to prepare the skin before EEG measurements; 500 g
1075	Adhesive mastoid electrodes	disposable adhesive mastoid electrodes, diameter 24 mm, 50 pcs, for use with g.SAHARAclipREF and with g.SAHARAclipGND, no gel remains on the skin after use
1032	disposable Ag/AgCl electrodes	for EMG, ECG; 50 pieces; pre-gelled
1043	double-sided adhesive washers	500 pieces; 20 mm outer diameter, 8 mm inner diameter for g.LADYbird or g.SCARABEO electrodes
1042	double-sided adhesive washers	500 pieces; outer diameter 20 mm, inner diameter 5 mm for reusable EOG Ag/AgCl electrodes
1067	g.GAMMAsyringe	syringe to fill up g.LADYBIRD and g.BUTTERFLY electrodes with g.GAMMAgel
1065	g.GAMMAgel BIGbag	5 liter bag with g.GAMMAgel. Is equal to volume of 22x g.GAMMAgel (1021) special highly conductive high-viscosity electrode gel for g.GAMMAsys active electrodes, water-soluble, non-abrasive, non-greasy, non-irritant, non-corrosive, CE class 1 product, easy insertion through electrode holes;



Sensors



CONTINUOUS NON-INVASIVE BLOOD PRESSURE MONITORING

g.CNAP is a world-leading system for non-invasive blood pressure recording and can be used as a stand-alone system as well. The analog output signal (continuous BP in mmHg) can be recorded together with other parameters and biosignals with g.tec systems.

Product no.	Product name
2044a	g.CNAPsensor
Description	
continuous non-invasive arterial pressure monitor, with finger cuffs and upper arm cuff for calibration, graphic and numeric display; mains (110 – 230 V, 50/60 Hz) and battery powered, analog interface box (1x9V battery supplied), 1 mV=1 mmHg, output cable with touchproof connectors (2045) included	



SNORING SENSOR

Piezo-electric snoring sensor for sleep research. Picks up tracheal sounds. To be placed on the neck of the patient.



Product no.	Product name	Description
2001	g.SNORINGsensor	piezo sensor; is intended to detect tracheal sounds; output of 1 to 5 mV; no power supply needed; 5 - 70 Hz, incl. jumper cable, output: 1.5 mm touch proof connectors

TEMPERATURE SENSOR

20° C - 45° C, for skin temperature, accuracy: 0.2° C
The sensor is already calibrated and provides an output voltage of 0 ... 200 mV



Product no.	Product name	Description
2037	g.TEMPsensor	sensor for changes in skin temperature (20 – 45 °C, accuracy 0.2 °C), 9V battery supplied, output 0 - 200 mV; DC - 1 Hz, output cable with touchproof connectors included

RESPIRATION AIRFLOW SENSOR

This thermistor sensor is placed in front of the nose and mouth and measures temperature changes in inhaled and exhaled air. The resulting respiration signal is very robust against movement artifacts.

Product no.	Product name
2043	g.FLOWsensor
Description	
thermistor flow sensor (nose and mouth), battery life time min. 1 year, output: 1.5 mm touch proof connectors ± 1 mV: DC - 20 Hz, incl. jumper cable	



RESPIRATION EFFORT SENSOR

Piezo-electric crystal sensor in a robust belt system. Can be used to record chest and abdominal respiration waveforms independently. Our respiration sensors connect directly to amplifier inputs.

Product no.	Product name	Description
2002	g.RESPsensor	piezoelectric respiration sensor; measures respiration efforts; output of ± 1 mV; no power supply needed; 0.01 - 60 Hz, incl. jumper cable, output: 1.5 mm touch proof connectors

OXYGEN SATURATION

Two light sources with different wavelengths are used to measure the saturation of oxygen in the blood (SpO_2). The sensor can be placed on the index finger. A calibrated output signal is provided.



Product no.	Product name	Description
2041	g.SpO2sensor	oxygen saturation, finger sensor; output ± 250 mV; DC - 1 Hz, 2xAA battery supplied, output cable with touchproof connectors included

**PULSE**

Compact and lightweight plethysmographic pulse sensor. Earlobe or finger transducers available. Provides a clear analog pulse wave signal (e.g. to be recorded together with ECG).



Product no.	Product name	Description
2005	g.PULSEsensor	photoelectric pulse sensor for pulsatile blood flow recording, peripheral circulation studies; monitors changes in reflected light from fingers; output: 1.5 mm touch proof connectors, +/- 1 mV; 0.01 - 60Hz; with velcro strap

GALVANIC SKIN RESPONSE

Also called EDA (electro-dermal activity) or skin conductance. Two small electrodes are used, preferably on the fingers without any gel. The isolated circuit guarantees no interference with other electrodes on the body. 1 μ S (micro MHO) calibration button.



Product no.	Product name	Description
2035_2	g.GSRsensor	galvanic skin response sensor with finger electrodes; 9V battery supplied; only connect to medical safe data acquisition system with ± 250 mV; 0(DC) - 20 Hz, output cable with touchproof connectors included

ACCELERATION

3-axes, +/- 3 g acceleration sensor. Can be applied on the subject's body or directly in a simulator, vehicle or airplane to monitor g-forces, acceleration and vibration.



Product no.	Product name	Description
2039	g.Gsensor	range: ± 3 g ; 3-axis-acceleration/vibration-sensor; with ± 250 mV output, 9V battery supplied, output: 1.5 mm touch proof connectors

LIMB MOVEMENTS

This piezo-electric sensor is placed on the ankle to detect movements of the feet during sleep. For investigation of restless leg syndrome (RLS) and periodic limb movements (PLM).



Product no.	Product name	Description
2040	g.LIMBSensor	piezo limb movement sensor, detects sudden movements during sleep, output max. ± 50 mV, no power supply needed, incl. jumper cable, output: 1.5 mm touch proof connectors



Patient-Ready Systems





mindBEAGLE®
CONSCIOUSNESS ASSESSMENT & COMMUNICATION



Fast Forward Award

Opening doors for patients with disorders of consciousness

See also www.mindBEAGLE.com

Over 40% of patients diagnosed as vegetative are reclassified as (at least) minimally conscious when assessed by expert teams. g.tec now introduces a new tool called mindBEAGLE® that uses BCI (Brain-Computer Interface) technology for quick and easy assessment of DOC patients and even provides basic communication with some of them. A BCI detects changes in brain activity induced by the user's mental activity. The EEG (Electroencephalogram) is used to measure brain signals, which are automatically ana-

lysed and classified on a standard laptop. Brain's electrical activity may provide the only direct path to a patient's mental state assessment. The mindBEAGLE® system consists of a portable medical grade biosignal amplifier, an EEG cap with active electrodes, a standard laptop computer with the mindBEAGLE® software, in-ear phones for auditory stimulation and vibro-tactile stimulators to be attached to the patient's body.

PRODUCT HIGHLIGHTS

- ◆ May provide the only direct path to a patient's mental state assessment
- ◆ Easy to use
- ◆ Complete solution comes with all required hardware and software components
- ◆ Provides different stimulation types (auditory, vibro-tactile, movement imagination)
- ◆ Supports a longitudinal screening to investigate stability and improvement of responses
- ◆ mindBEAGLE can also be used as a communication tool



Dr. Steven Laureys,
FNRS Research Director,
Coma Science Group,
GIGA-Ulg and CHU Liège, BE

“mindBEAGLE combines important electro-physiological tests that allow us to search for signs of consciousness after coma. The big advantage of mB is that it is integrated. You can take it to any patients and plug them in and get the results directly. It is still a challenge and it doesn't work with all the patients. mindBEAGLE is a big help for us to use the paradigms as they are implemented in mB for very challenging patients.”

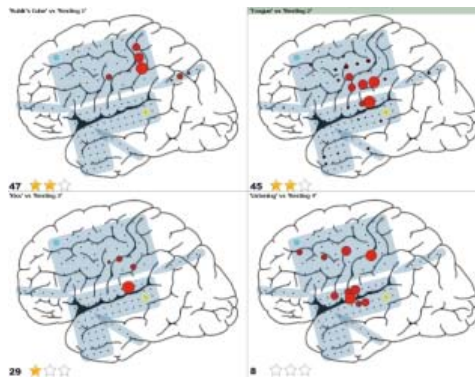


Dr. Melanie Fried Oken
Oregon Health & Science
University, USA

“mindBEAGLE helps us to work with individuals in their home environments to determine if they have measureable evoked potentials.”



Co-funded by the Horizon 2020 programme
of the European Union



Rapid functional mapping of the cortex using the electrocorticogram

See also www.cortiQ.at

cortiQ allows rapid functional mapping of the cortex using the electrocorticogram (ECoG). It provides physicians with real-time results during pre-surgical evaluation for epilepsy or other conditions.

cortiQ allows users to position the used electrode grids (selected from the cortiQ grid library) over a schematic brain map. For different tasks performed by the patient (e.g. using the Ritaccio or Kamada paradigm), high gamma activity is indicated in form of red circles for all electrodes. A big red circle shows that the corresponding electrode is placed over a brain area which is highly active in the performed task.

cortiQ is delivered as complete system, which includes:

- Biosignal amplifier–high quality biosignal amplifier with 24 Bit and 256 channels (CE approved and FDA listed)
- Real-time processing system–high performance real-time control unit to manage all devices in real-time, to analyze the signals and to visualize and store data
- Mapping system–high performance source localization and mapping system to identify brain regions

PRODUCT HIGHLIGHTS

- ◆ Generate a personalized functional map of the cerebral cortex in high detail
- ◆ Can be operated at the patient's bedside
- ◆ Optimize surgical procedures
- ◆ Optimize electrical cortical stimulation (ECS) mapping
- ◆ Minimize the burden for the patient
- ◆ Reduce risk for patients
- ◆ Reduce hospital time and costs

COMPLETE SOLUTIONS

Product no.	Product name	Description
8032	cortiQ g.Hlamp 80 bundle	complete solution for passive functional mapping with ECoG consisting of 1x g.Hlamp 80 (CE approved and FDA listed); 1x g.Power-g.Hlamp; 1x g.HEADbox-passive; 1x advanced business notebook, cortiQ software; for research only; 2x cortiQ jumper cable, 1x cortiQ USB patient monitor, 1x Dongle (7001 + 7004 + 7006A + 3003B + 8050 + 2x 8040 + 8042 + 3060)
8034	cortiQ g.Hlamp 144 bundle	complete solution for passive functional mapping with ECoG consisting of 1x g.Hlamp 144 (CE approved and FDA listed); 1x g.Power-g.Hlamp; 2x g.HEADbox-passive; 1x advanced business notebook and cortiQ software; for research only; 2x cortiQ jumper cable, 1x cortiQ USB patient monitor, 1x Dongle (7002 + 7004 + 2x7006A + 3003B + 8050 + 2x 8040 + 8042 + 3060)
8036	cortiQ g.Hlamp 256 bundle	complete solution for passive functional mapping with ECoG consisting of 1x g.Hlamp 256 (CE approved and FDA listed); 1x g.Power-g.Hlamp; 4x g.HEADbox-passive; 1x advanced business notebook and cortiQ software; for research only; 2x cortiQ jumper cable; 1x cortiQ USB patient monitor; 1x Dongle (7003 + 7004 + 4x7006A + 3003B + 8050 + 2x8040 + 8042 + 3060)

cortiQ is not yet a certified medical product and must not be used for diagnostic applications in humans. The use of cortiQ is restricted to research applications.



Kyousuke Kamada, MD, PhD
Asahikawa Medical University,
Department of Neurosurgery, JP

“cortiQ enables us to make real-time functional mapping not only of motor functions, but also language-related functions at the bed side or in operating rooms. On the basis of our experience, the results of cortiQ had high sensitivity and specificity between 80 and 90%, which were sufficient for clinical practice. In addition, real-time cortiQ mapping made us free from risk of seizure caused by electrocortical stimulation and helped us to understand functional dynamics of each function. Visualization of high gamma activity using cortiQ has great potential as a less-invasive brain mapping technique in basic and clinical neuroscience.”



Gerwin Schalk, PhD
Wadsworth Center NY, US

“cortiQ mapping is based on passive recordings and statistical evaluations of ECoG, rather than on active electrical stimulation and visual observation of behavior. It can be used to map motor activity, expressive or receptive language, and other functions, and has been shown to produce results similar to results from other imaging techniques. Mapping can be completed by untrained personnel in minutes, with patients who are adults or children, in either extraoperative or intraoperative environments.”



Milena Korostenskaja, PhD
University of Florida, US

“cortiQ is electrocorticography-based real-time functional mapping technique that has strong potential to become an alternative to the current golden standard of functional mapping - electrical cortical stimulation (ESM). There are numerous advantages of cortiQ when compared to ESM, such as flexible stimulus presentation, time- and effort- effectiveness, and the possibility to work with patients that are unable actively engage in the task. In addition, cortiQ is less invasive than ESM and can be effectively used in pediatric population, which other functional mapping methodologies do not always allow.”

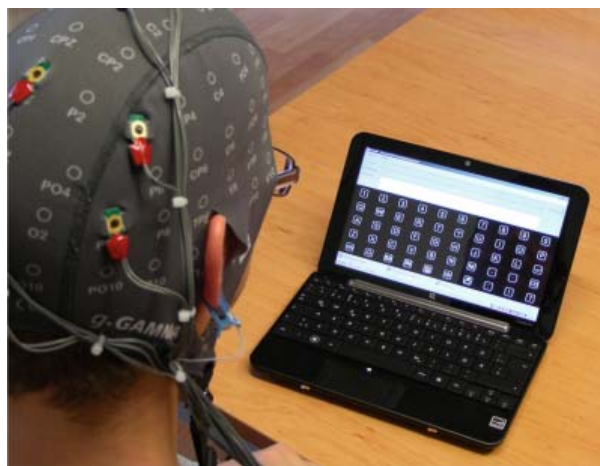


User-ready brain-computer interface applications

 See also www.intendiX.com
Microsoft®
 Innovation Award


intendiX® SPELLER

intendiX® SPELLER is designed to be installed and operated by caregivers or the patient's family at home. The system is based on visual evoked EEG potentials (VEP/P300) and enables the user to sequentially select characters from a keyboard-like matrix on the screen just by paying attention to the target for several seconds. This requires only a few minutes of training. Most subjects can use intendiX® SPELLER after only 10 minutes with reasonable performance, spelling 5 to 10 characters per minute at their first trial.



intendiX® SPELLER uses an intelligent algorithm to determine whether the user wants to use the system, so it doesn't spell accidentally. In addition to writing text, the patient can also use the system to trigger an alarm, let the computer speak the written text, print out or copy the text into an e-mail or to send commands to external devices.

To control external devices a special extension tool called "extendiX" serves as an interface. extendiX runs on a separate computer that controls other devices and applications such as TVs, music, assistive robots, games and so on. extendiX just receives commands from intendiX® SPELLER via UDP and starts/executes the corresponding application or batch.

The EEG cap is comfortable, easy to clean, and with active

electrodes that do not require any special skin preparation. Just put on the cap, inject a drop of gel into each of the electrodes and start to spell! intendiX® SPELLER includes the active electrode system, a portable EEG acquisition system and a notebook or netbook computer with the intendiX® SPELLER software installed. Also, ask for our new g.SAHARA dry electrodes.

NEW: intendiX® SPELLER now includes an alternative matrix board where celebrities' faces are displayed instead of the highlighted items for flashing. This "FACE-speller" mode seems to elicit stronger P300 responses compared to the regular flash mode. Some preliminary experiments show a clear improvement of performance using the FACE-speller mode.

intendiX® SOCI – Screen Overlay Control Interface

The system allows to overlay the PC screen with a mask that contains icons used to control the program running on the screen. The technology uses the Steady-State Visual Evoked Potential (SSVEP) approach for Brain-Computer Interfaces (BCI). The different icons on the monitor each flicker at certain frequencies. As soon as the user pays attention to one of the icons, its flickering frequency can be detected in the EEG, which is picked up by a few sensors on the back of the user's head. Then, the system executes a command that is assigned to that certain icon, such as a certain key on the keyboard. Using its advanced sensors and recently up-graded signal processing algorithms, the intendiX® SOCI can detect these different brain signals with an accuracy of up to 98%.

In March 2012, g.tec debuted its new module to control Blizzard Entertainment's World of Warcraft®, one of the most popular computer games in the world. The user sees the game running on the screen as usual, but a few extra icons appear around the edge of the monitor. For example, there are arrows pointing in different directions, which could be used for navigation in the game world. Other icons may be used to execute special commands in the game.



The goal of intendiX® SOCI is to provide a tool usable for controlling many different PC applications without requiring any muscle activity. Gaming is an interesting approach as it is a demanding task in terms of speed and accuracy of a Brain-Computer Interface. It also provides a way to connect disabled or healthy people to rich online communities with millions of people.

intendiX® PAINTING – when art overcomes disabilities

Before children start to write, they first learn to draw. Drawing is one of the oldest techniques humans have been using to communicate and visualize ideas, knowledge and emotions. There are cave paintings made 40,000 years ago, and people still use painting to express things that cannot be communicated through words. Painting can be understood in any language. That's why a picture is "worth a thousand words".

With this idea in mind, g.tec implemented the intendiX® Painting application. This user-friendly software makes it possible to draw without using any muscle activity. Based on

visual evoked EEG potentials (VEP/P300), it allows the user to paint by paying attention to symbols that flash on a computer screen. With intendiX® PAINTING, users can design different color shapes, modify the color gradient, select different transparencies or change figures' sizes. And, of course, users can perform these actions at any position on the screen by controlling the painting cursor. intendiX® PAINTING allows infinite combinations of creation, limited only by imagination. In addition to paint, the user can also undo and redo actions, save the current artwork, load previous files to continue drawing and print the finished artwork.

Like our spelling system, the intendiX® PAINTING requires only few minutes of training, allowing the user to make 5 to 10 painting actions per minute. intendiX® Painting can also



detect users' attention to avoid accidental drawing and reduce selection mistakes. intendiX® Painting uses a customized symbol matrix and runs in the standard intendiX® SPELLER application. extendiX is used to receive the commands and create the painting.

PRODUCT HIGHLIGHTS

- ◆ Complete solution comes with all required hardware and software components
- ◆ Designed to be operated by caregivers or the patient's family at home
- ◆ Based on the well known P300 component of visual evoked EEG potentials
- ◆ Intelligently detects when users are idle
- ◆ Runs with g.MOBILab+ and/or g.USBamp technology
- ◆ Highly customizable symbol collection and operation modes
- ◆ Train and store classifiers for individuals within several minutes
- ◆ Merge existing classifiers that were previously trained with several individuals to get a more general (universal) classifier
- ◆ Reads brain-written text aloud via the Microsoft Windows operating system's built-in Text-To-Speech engine
- ◆ Allows third-party applications to customize reactions to each symbol selection

COMPLETE SOLUTIONS

Product no.	Product name	Description
6040	intendiX g.MOBILab+ EEG Version, NB included	consisting of: g.MOBILab+ EEG version; Bluetooth dongle; notebook; heavy duty case; g.GAMMAcap3 size M; g.GAMMAcap2BELT; g.GAMMAearclip; 8x g.LADYbird; g.GAMMAbox; Active Electrode Driver Box Connector for g.MOBILab+ EEG; g.LADYbirdGND; 3x g.GAMMAgel and intendiX software; bundle offer (5603+3016+3003+5050+1023m+1028+1039+8*1033+1016a+1019b+1034+3*1021+6043)
6044	intendiX g.USBamp, NB included	consisting of: g.USBamp 8 channels; notebook; heavy duty case; g.GAMMAcap2 size M; g.GAMMAcap2BELT; g.GAMMAearclip; 8x g.LADYbird; g.GAMMAbox; Active Electrode Driver Box Connector for g.USBamp8; g.LADYbirdGND; 3x g.GAMMAgel and intendiX software; bundle offer (0230+0247+3003+1023m+1028+1039+8*1033+1016a+1019h+1034+3*1021+6043)
6048	extendiX Painting	single place licence
6052	intendiX additional boards	extension for the standard intendiX board

System rental options available



The revolutionary stroke therapy



See also www.recoveriX.at

In the last few years a totally novel and promising application for MI-based BCIs has gained great attention. Several recent articles have shown that MI-based BCIs can induce neural plasticity and thus serve as an important tool to enhance motor rehabilitation for stroke patients. In other words, the overall goal of the BCI system is not communication, but improved stroke recovery.

Furthermore, other work has shown that this rehabilitation can be even more effective when combined with immersive graphical environments that can help users interact effectively and naturally with the BCI system. Immersive BCI stroke rehabilitation is an ongoing research

effort in numerous American and European research projects, many of which involve g.tec.

recoveriX[®] is a highly integrated ready-to-use system for use with patients in a daily rehabilitation setup scenario. It consists of a EEG system, a laptop computer with the recoveriX software, a patient monitor for instructions and 3D-feedback and an electrical muscle stimulator controlled via the recoveriX[®] software. All steps from data processing, signal analysis, classifier computation to neurofeedback generation and muscle stimulation are automated to allow for an easy operation of the system.

PRODUCT HIGHLIGHTS

- ◆ BCI based stroke rehabilitation
- ◆ Repeated neurofeedback training increases the plasticity of the brain and leads to a faster recovery after stroke-caused impairment
- ◆ Easy to use
- ◆ Complete solution comes with all required hardware and software components
- ◆ Effective training via direct real-time feedback (visual, functional electrical stimulation)

COMPLETE SOLUTIONS

Product no.	Product name	Description
6400	recoveriX	motor-recovery neurotechnology; complete system for motor rehabilitation after stroke with neurofeedback



Prof. Marian Poboroniuc
Technical University of Iasi, RO

“ The BCI stroke rehabilitation allows us to treat even patients in a chronic state and to improve their motor functions. These conclusions are based on the experimental data resulting from testing the recoveriX system on chronic stroke patients at the Rehabilitation Hospital of Iasi, Romania. ”



Danut Constantin Irimia PhD
Technical University of Iasi, RO

“ recoveriX gives disabled patients the feeling that they can move again. Motivating them in this way, to be more actively involved in the rehabilitation process, brings huge benefits to the rehabilitation process. ”



Dr. Christoph Guger
g.tec medical engineering, AT

“ recoveriX couples cognitive processes with movements, and this makes the rehabilitation so effective. ”



Co-funded by the Horizon 2020 programme
of the European Union

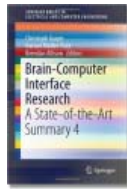




Lectures and Books

Books

Some books with g.tec contributions



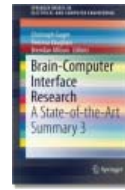
Brain-Computer Interface Research: A State-of-the-Art Summary 4

Edited by: Christoph Guger, Gernot Müller-Putz, Brandon Allison

ISBN: 978-3-319-25188-2

Publisher: Springer

Publication Date: December, 2015



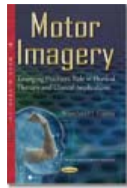
Brain-Computer Interface Research: A State-of-the-Art Summary 3

Edited by: Christoph Guger, Theresa Vaughan and Brendan Z. Allison

ISBN: 978-3-319-09978-1

Publisher: Springer

Publication Date: December, 2014



Motor Imagery: Emerging Practices, Role in Physical Therapy and Clinical Implications

Edited by: Brandon M. Garcia

ISBN: 978-1-63483-163-5

Publisher: Nova Science Publication Inc., New York

Publication Date: August, 2015



Brain-Computer Interfaces in Their Ethical, Social and Cultural Contexts

Edited by: Gerd Grubler, Elisabeth Hildt

ISBN: 978-9-401-78995-0

Publisher: Springer

Publication Date: July, 2014



Interaction of BCI with the underlying neurological conditions in patients: pros and cons

Edited by: Aleksandra Vuckovic, Jaime Pineda, Kristen Lamarca, Disha Gupta, Christoph Guger

ISBN: 978-2-88919-489-6

Publisher: Frontiers Media SA

Publication Date: April, 2015



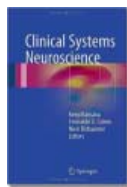
Emerging Theory and Practice in Neuroprosthetics

Edited by: Ganesh R. Naik and Yina Guo

ISBN: 978-1-466-66094-6

Publisher: IGI Global

Publication Date: May, 2014



Clinical Systems Neuroscience

Edited by: Kenji Kansaku, Leonardo G. Cohen, Niels Birbaumer

ISBN: 978-4-43155-036-5

Publisher: Springer

Publication Date: March, 2015



Brain-Computer Interface Research: A State-of-the-Art Summary-2

Edited by: Christoph Guger, Brendan Z. Allison and E.C. Leuthardt

ISBN: 978-3-642-54707-2

Publisher: Springer

Publication Date: April, 2014



BNCI HORIZON 2020: TOWARDS A ROADMAP FOR THE BCI COMMUNITY

Edited by: Clemens Brunner, Niels Birbaumer, Benjamin Blankertz, Christoph Guger, Andrea Kübler, Donatella Mattia, José del R. Millán, Felipe Miralles, Anton Nijholt, Eloy Opisso, Nick Ramsey, Patric Salomon & Gernot R. Müller-Putz

DOI: 10.1080/2326263X.2015.1008956

Publisher: Taylor & Francis

Publication Date: Februar, 2015



Workshops of the Fifth International Brain-Computer Interface Meeting: Defining the Future, Brain-Computer Interfaces, Volume 1, Issue 1, 2014

Edited by: J.E. Huggins, C. Guger, B. Allison, C.W. Anderson, A. Batista, A. Brouwer, C. Brunner, R. Chavarriaga, M. Fried-Oken, A. Gunduz, D. Gupta, A. Kübler, R. Leeb, F. Lotte, L.E. Miller, G. Müller-Putz, T. Rutkowski, M. Tangermann & D. E. Thompson

ISSN (printed): 2326-263X

Publisher: Taylor & Francis

Publication Date: March, 2014



Brain-Computer Interface Systems - Recent Progress and Future Prospects

Edited by: Reza Fazel-Rezai

ISBN: 978-953-51-1134-4

Publisher: InTech

Publication Date: June, 2013



ELECTROENCEPHALOGRAPHY: Basic Principles, Clinical Applications, and Related Fields

Edited by: Ernst Niedermeyer,
Fernando Lopes da Silva

ISBN: 978-0-7817-5126-1

Publisher: Lippincott Raven

Publication Date: 5. Edition, November 22, 2004



Towards Practical Brain-Computer Interfaces: Bridging the Gap from Research to Real-World Applications

Edited by: Brendan Allison, Stephen Dunne,
Robert Leeb, José Del R. Millán, Anton Nijholt

ISBN: 978-3-642-29745-8

Publisher: Springer

Publication Date: 1. Edition, August 31, 2012



A Practical Guide to Brain-Computer Interfacing with BCI2000

Edited by: Gerwin Schalk, Jürgen Mellinger

ISBN: 978-1-84996-091-5

Publisher: Springer

Publication Date: 1. Edition, April 15, 2010



Introduction to Neural Engineering for Motor Rehabilitation

Edited by: Dario Farina, Winnie Jensen,
Metin Akay

ISBN: 978-0-470-91673-5

Publisher: John Wiley & Sons

Publication Date: 1. Edition, July 29, 2013



Springer Handbook of Medical Technology

Edited by: Rüdiger Kramme, Klaus-Peter
Hoffmann, Robert Steven Pozos

ISBN: 978-3-540-74657-7

Publisher: Springer

Publication Date: 1. Edition, September 18, 2011



Brain-Computer Interface Research: A State-of-the-Art Summary

Edited by: Christoph Guger, Brendan Z. Allison,
Günter Edlinger

ISBN: 978-3-642-36082-4

Publisher: Springer

Publication Date: 1. Edition, April 30, 2013



RECENT ADVANCES IN BRAIN-COMPUTER INTERFACE SYSTEMS

Edited by: Reza Fazel

ISBN: 978-953-307-175-6

Publisher: InTech

Publication Date: February, 2011



Coping with Blast-Related Traumatic Brain Injury in Returning Troops: Wounds of War III

Edited by: Brenda K. Wiederhold

ISBN: 978-1-60750-796-3

Publisher: IOS Press, US

Publication Date: 1. Edition, November 15, 2011



BRAIN-COMPUTER INTERFACES: Revolutionizing Human-Computer Interaction
The Frontiers Collection

Edited by: Bernhard Graimann, Brendan Allison,
Gert Pfurtscheller

ISBN: 978-3-642-02090-2

Publisher: Springer

Publication Date: 1. Edition, July 01, 2010



BRAIN-COMPUTER INTERFACES: PRINCIPLES AND PRACTICE

Edited by: Jonathan R. Wolpaw,
Elizabeth Winter Wolpaw

ISBN: 978-0-195-38885-5

Publisher: Oxford Univ Pr.

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Lectures

g.tec introduces lectures for biosignal recording and analysis. The lectures are divided into a manual which contains the theoretical background, hands-on examples and several tasks to solve. The second part is a manual which contains only the solutions for the tasks.

The lectures allow researchers to get a quick start in the specific field and to perform already state of the art experiments after just a few hours. The lectures are also perfectly suited for teaching because of the separation of tasks and solution manuals.

LECTURE 1: THE ELECTROENCEPHALOGRAM

The Electroencephalogram (EEG) is a tutorial which introduces the reader into EEG recordings and analysis methods. The reader will learn how to assemble electrodes correctly, how to setup the recording equipment appropriately and how to make high-quality EEG recordings. Furthermore several EEG experiments have to be performed which give already a deep insight into state-of-the-art EEG analysis topics.

Objectives

- ◆ Learn to assemble electrodes according to the 10-20 system
- ◆ Learn to assemble electrodes with EEG caps and screwable electrodes
- ◆ Test the impedance of the EEG electrodes
- ◆ Learn how to connect the electrodes to the amplifier to make monopolar and bipolar recordings
- ◆ Learn how to test the recording setup
- ◆ Learn to recognize alpha and beta rhythms
- ◆ Learn to recognize artifacts in the EEG recording
- ◆ Learn to eliminate artifacts from the EEG recording
- ◆ Investigate the alpha block during a mental task
- ◆ Investigate hemispheric differences during language and spatial processing
- ◆ Learn how hyperventilation affects the EEG
- ◆ Learn the EEG differences of introverts and extraverts

Average time to perform the lecture:	450 min
Pages of lecture:	47
Pages of solutions for lecture:	24

LECTURE 2: THE BRAIN-COMPUTER INTERFACE

The Brain-Computer Interface (BCI) is a tutorial which introduces the reader into BCI experiments and analysis methods. The reader will learn how to analyze BCI data in off-line and on-line mode and to set up real-time Simulink models for BCI experiments. Experiments will be introduced which can be used to acquire EEG data for training the computer on subject specific patterns and also for real-time feedback in order to control a cursor on the screen. Several examples of parameter extraction algorithms like bandpower, Hjorth and adaptive autoregressive models (AAR) will be explained. Classification algorithms like linear discriminant analysis (LDA) and neural networks (NN) are also subject of the lecture. The reader has to perform several tasks which give a deep insight into state-of-the-art BCI processing steps.

Objectives

- ◆ Learn pre-processing steps for BCI data analysis
- ◆ Calculate the power spectrum and event-related desynchronization of EEG data
- ◆ Extract features of the different EEG channels
- ◆ Train different classifiers to discriminate the features
- ◆ Compare feature extraction and classification algorithms
- ◆ Contact BCI experiments without feedback to get data for pattern recognition
- ◆ Perform real-time BCI experiments with cursor feedback
- ◆ Learn to write processing batches for fast off-line analysis
- ◆ Extract reactive frequency components out of the EEG data
- ◆ Modify real-time analysis models for optimal performance
- ◆ Train yourself to reach a high BCI classification accuracy

Average time to perform the lecture:	465 min
Pages of lecture:	89
Pages of solutions for lecture:	28



LECTURE 3: THE ELECTROCARDIOGRAM

The ECG lecture is intended to give a practical entry to state-of-the-art ECG processing. In the course of 6 lessons, the reader is confronted with common tasks of modern ECG analysis and it is shown how to practically solve the problems. Each lesson starts with a theoretical part to provide enough knowledge to solve the tasks.

Objectives

- ◆ Measure Einthoven-, Goldberger- and Wilson-derivations
- ◆ Perform 12 lead derivations
- ◆ Learn to identify and avoid artifacts in the ECG signals
- ◆ Calculate single beat intervals and amplitudes
- ◆ Perform automatic QRS complex detection
- ◆ Program an off-line and on-line QRS complex detector
- ◆ Analyze tilt table experiments
- ◆ Detect arrhythmias and abnormalities

Average time to perform the lecture: 700 - 760 min

Pages of lecture: 58

Pages of solutions for lecture: 71

LECTURE 4: EVOKED POTENTIALS

The Lecture Evoked Potentials explains the recording and analysis of auditory steady-state responses (ASSRs), the auditory P300 response and brainstem auditory evoked potentials (BAEP). Each of these methods is important in clinical Electroencephalography. The auditory P300 response furthermore can be used as interaction method within a Brain Computer Interface (BCI).

Objectives

- ◆ Configure the auditory stimulator correctly for EPs
- ◆ Record and analyze P300 responses
- ◆ Record and analyze MMN
- ◆ Record and analyze ASSRs
- ◆ Record and analyze BAEPs
- ◆ Record and analyze SSEPs
- ◆ Perform step-by-step the off-line analysis
- ◆ Run analysis batches to evaluate the captured EPs

Average time to perform the lecture: 430 min

Pages of lecture: 85

LECTURE 5: PHYSIOOBSERVER

This lecture explains the recording and evaluation of physiological and cognitive parameters. With biosignals like ECG, GSR, Respiration, EEG, physiological parameters like heart-rate and cognitive like the EEG band power it is possible to recognize various mental and physical states of a person in real-time. This leads to a better human-computer interaction and human-robot cooperation.

Objectives

- ◆ Configure the physio observer to run experimental paradigms
- ◆ Perform a circle training experiment
- ◆ Perform high altitude medicine experiments

Average time to perform the lecture: 240 min

Pages of lecture: 65

Pages of solutions for lecture: 19

LECTURE 6: G.NAUTILUS SPORTS

This lecture demonstrates how the g.Nautilus wireless biosignal amplifier can be used to record EEG signals during sports exercise. It uses an auditory paradigm similar to the ones presented in the Evoked potentials lecture to demonstrate the stability and low number of artefacts achievable with the g.Nautilus device during physical exercises.

Objectives

- ◆ Configure the g.Nautilus device to run experimental paradigms
- ◆ Record the EEG while the subject simultaneously performs physical exercise and follows EP paradigm
- ◆ Calculate the jitter in displaying the auditory stimuli and display the observed EP signals.

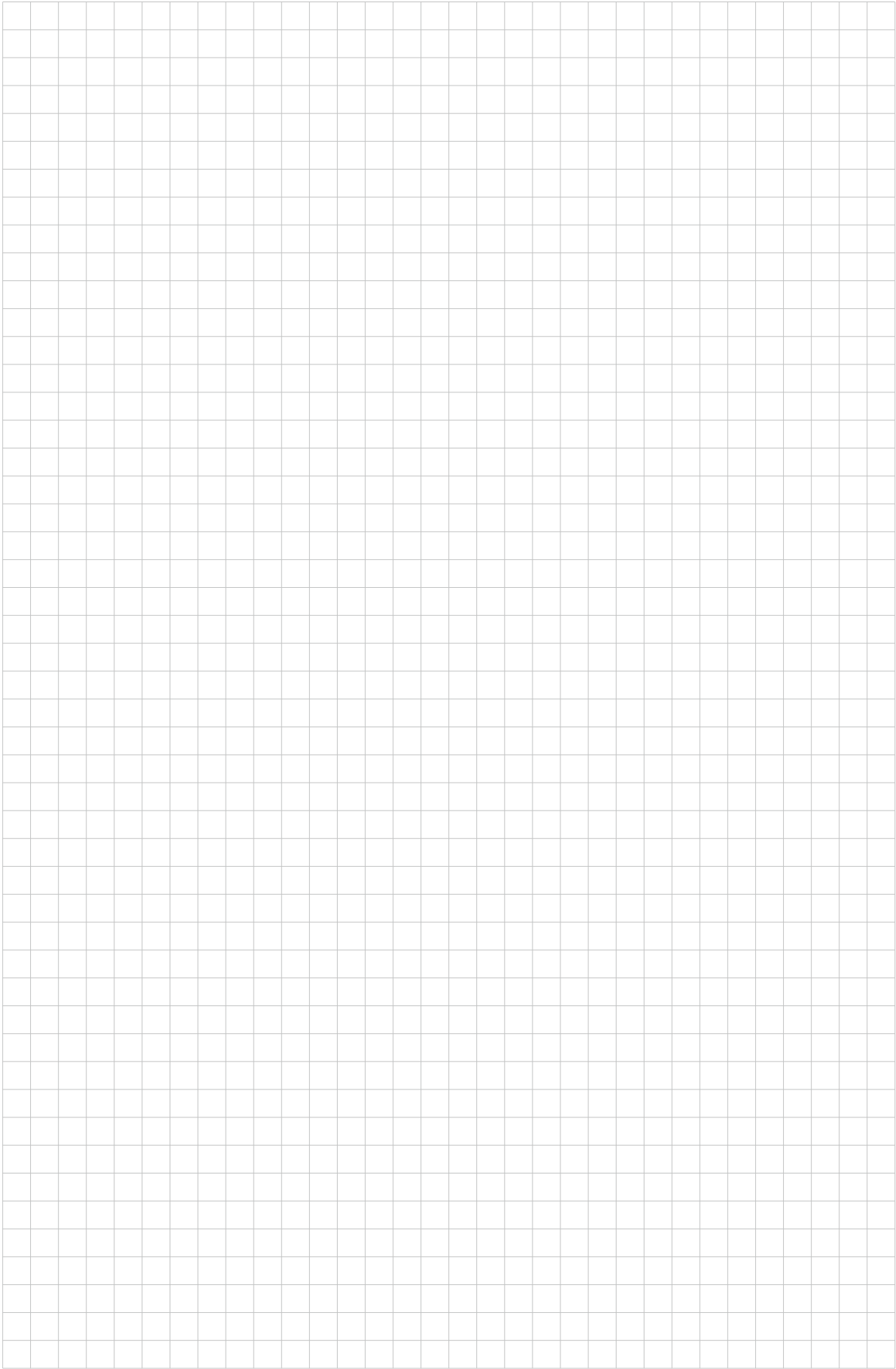
Average time to perform the lecture: 120 min

Pages of lecture: 39

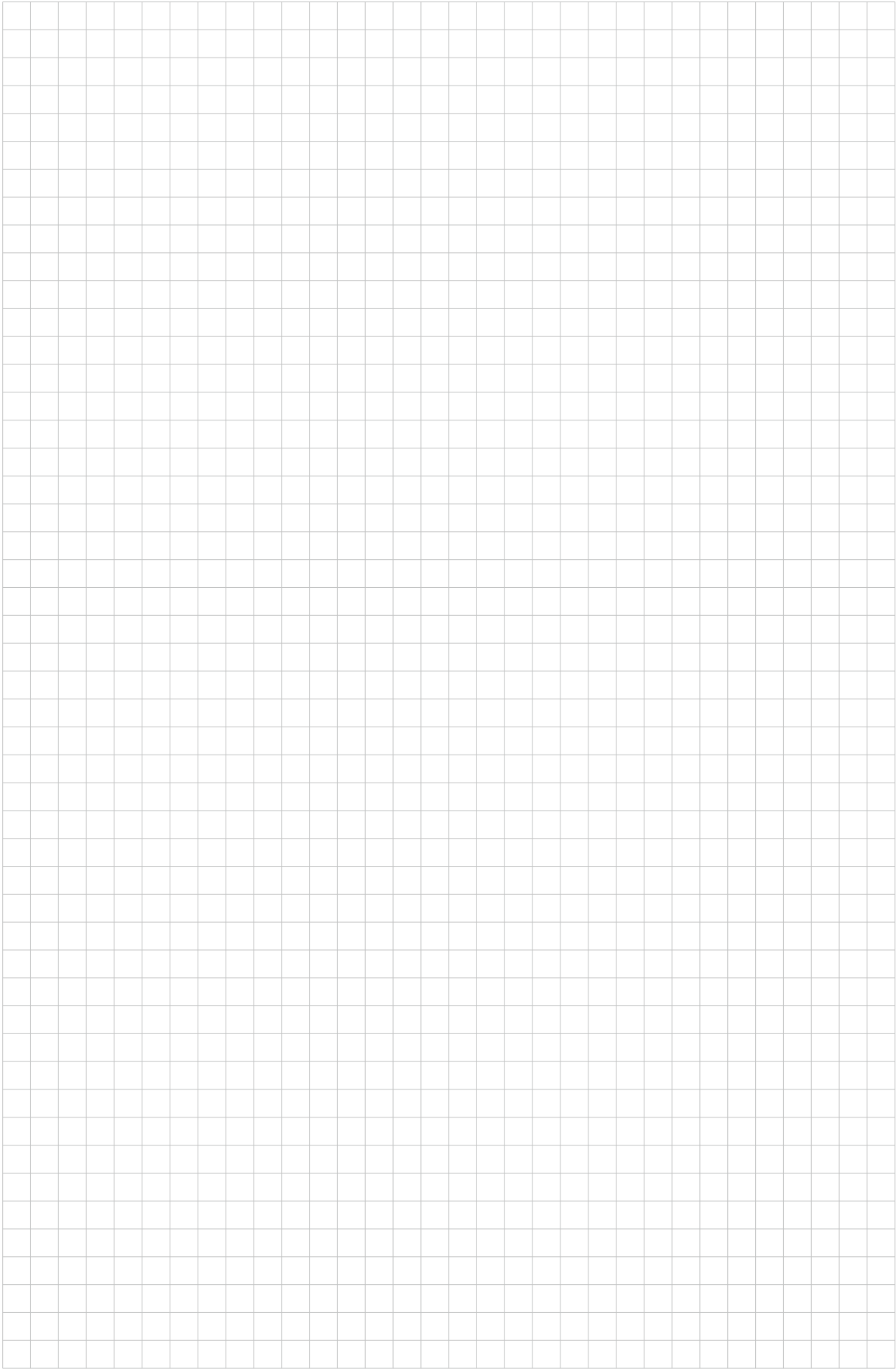
Pages of solutions for lecture: 15

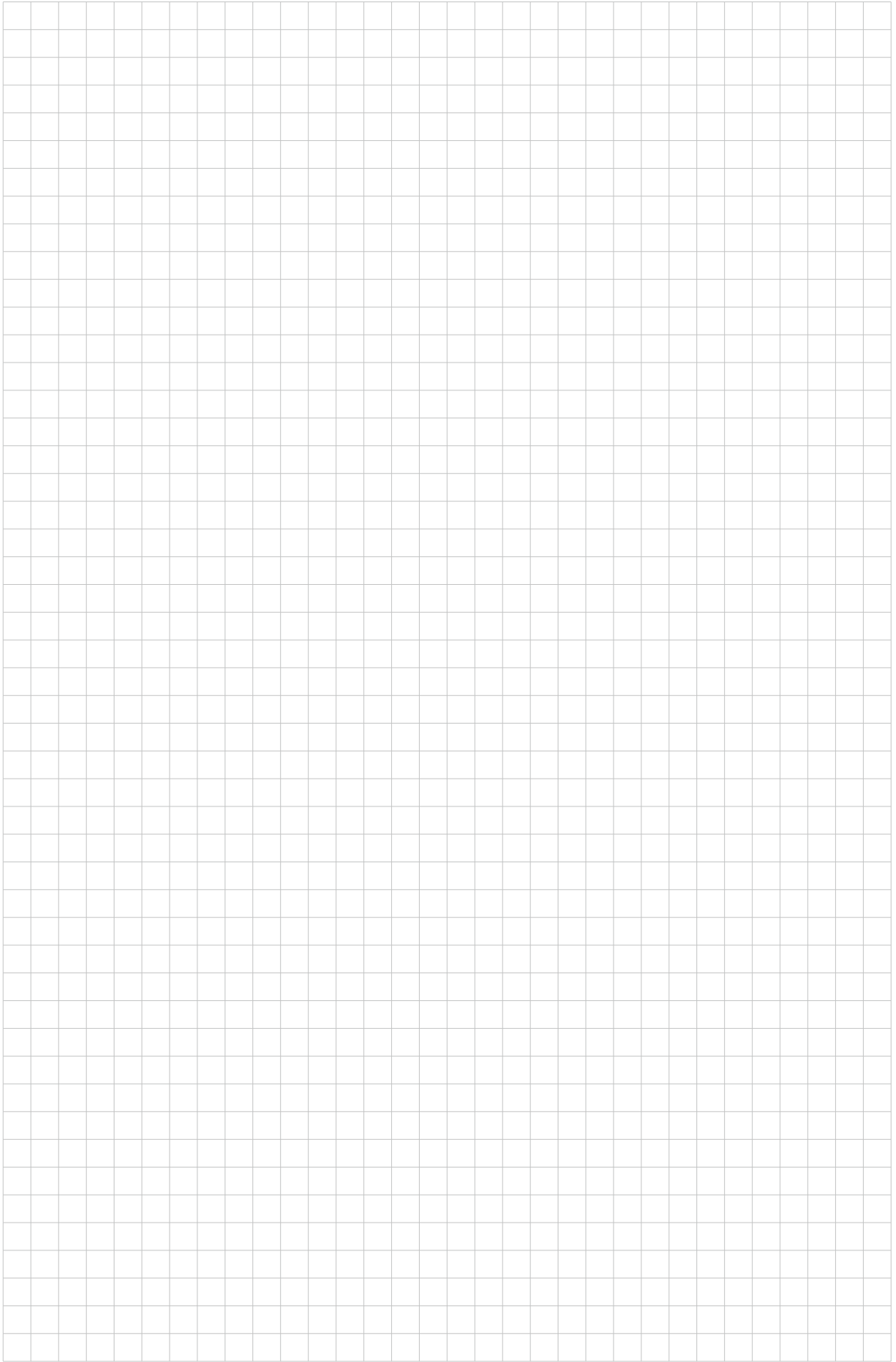
LECTURES

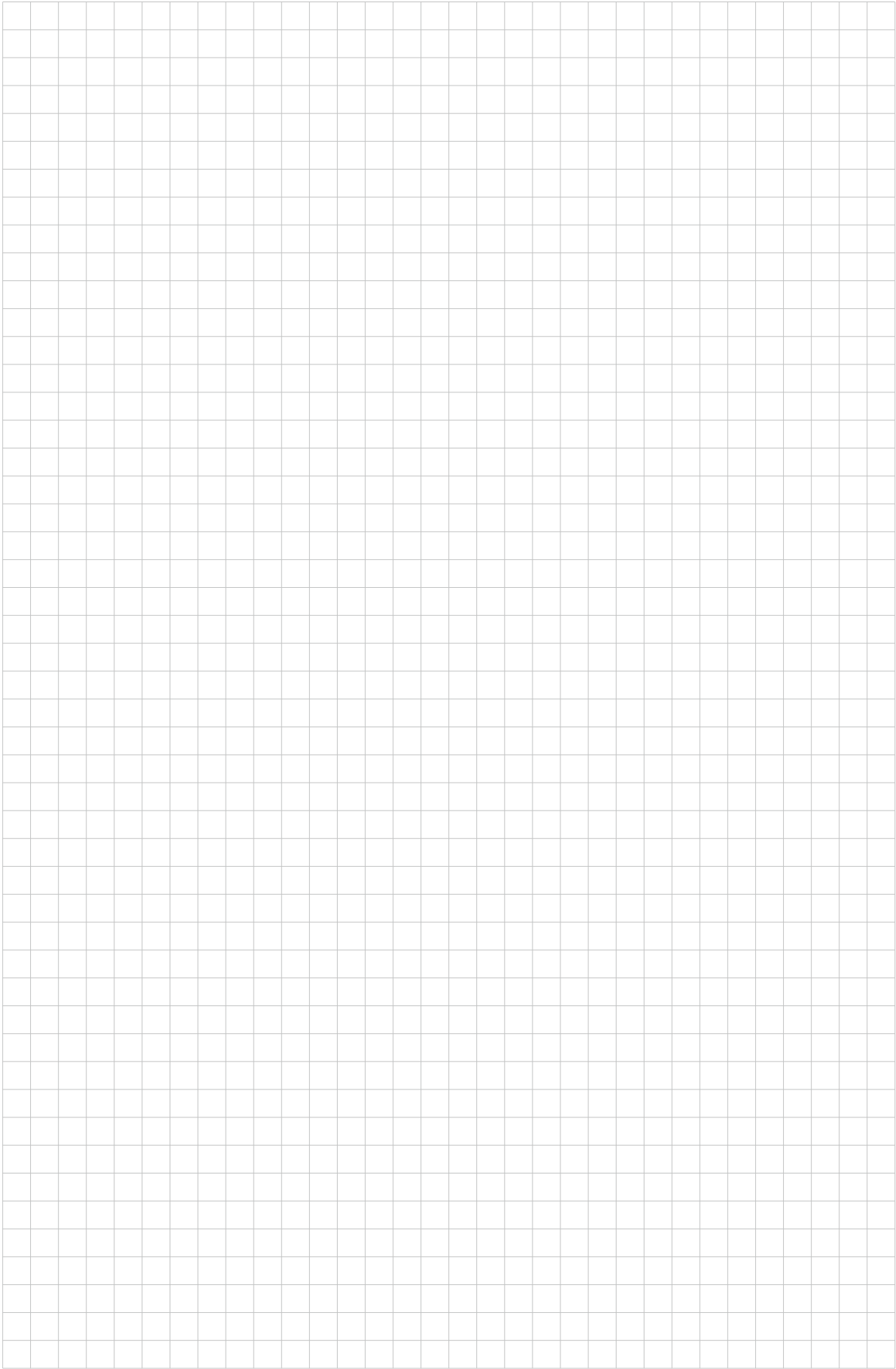
Product no.	Product name	Description
4050	Lecture 1: EEG	EEG teaching lecture
4051	Lecture 2: BCI	BCI teaching lecture
4052	Lecture 3: ECG	ECG teaching lecture
4053	Lecture 4: Evoked Potentials	Evoked Potentials teaching lecture
4054	Lecture 5: Physioobserver	Physioobserver teaching lecture
4055	Lecture 6: g.Nautilus Sports	EEG signals recording during sports













Dr. Ales Holobar
University of Maribor, SI

“ g.tec is undoubtedly the most responsive company I've worked with. Customer support is among their highest priorities and their professional care for EEG society by far surpasses pure economic interests. With g.tec, it's about the science! ”



Dr. Eloy Opisso
Guttmann Institute, ES

“ We have used g.tec equipment for several years, and collaborated with them on different projects to help people with disabilities. Their hardware and software provide top-quality data, even in hospital settings, and our collaborations have produced several papers. We look forward to working with them further. ”



Prof. Jing Jin
East China University of
Science and Technology, CN

“ I used many different g.tec products over several years, and collaborate with them on research. Their equipment works well in real-world settings, and I have many good publications with their senior staff. ”

Keep up with our development and visit the g.tec BLOG at <http://blog.gtec.at>



Customer Training

CUSTOMER TRAINING IN G.TEC OFFICE

g.tec's research systems are powerful tools and open a wide range of possible applications. For our customers, we can provide personal training at g.tec's facilities here in Austria. Get a general introduction to your systems, see some basic experiments and application examples or discuss special hardware- and software solutions with our developers, programmers and application engineers. The training is most effective if you come with your own g.tec system to guarantee that all the settings are performed correctly on your system.

We offer space for groups of up to 40 people of your team for the training.

Just contact us about a schedule for your training. We can also help you to organize your travel and accommodation. Hope to see you in Austria!

TRAINING AT YOUR INSTITUTION

If multiple lab members are interested in operating g.tec systems, it is more effective to send a g.tec team member directly to your institution to train the whole group.

Just contact us to schedule a training event suitable for your team.

WORKSHOPS AT YOUR INSTITUTION

If your lab plans to organize a workshop or satellite event at your institution, we will be happy to send a researcher who can talk about brain-computer interfaces, spike recordings, real-time physiology analysis, Virtual Reality systems, functional mapping with ECoG, and related topics. Typically such workshops last for about 2 hours up to 2 days.

TRAINING TOPICS

- Course 1:** Off-line biosignal analysis (EEG, ECG, GSR, respiration) with g.BSanalyze – 1/2 day course
- Course 2:** Measuring biosignal data (EEG, ECG, GSR, respiration, EMG, EOG, ECoG, pulse, SpO₂, etc.) with g.USBamp/g.MOBllab+ – 1/2 day course
- Course 3:** Running BCI (P300, motor imagery, SSVEP) experiments in real-time – 1 day course
- Course 4:** Measuring EPs (BAEP, ASSR, P300, N200,...) – 1/2 day course
- Course 5:** Extending the biosignal analysis with custom software modules under MATLAB/Simulink – 1/2 day course
- Course 6:** Acquiring and analyzing spikes – 1/2 day course
- Course 7:** Run Virtual Reality and physiology experiments successfully – 1/2 day course
- Course 8:** Coma assessment and communication with BCIs – 1/2 day course
- Course 9:** Passive functional mapping with ECoG – 1/2 day course
- Course 10:** Motor rehabilitation with BCIs – 1/2 day course

WORKSHOP TOPICS

- Workshop 1:** Brain-computer interface – 1/2-1 day workshop
- Workshop 2:** Spike and ECoG recordings – 1/2 day workshop
- Workshop 3:** Coma/Consciousness assessment – 1/2 day workshop
- Workshop 4:** Passive functional mapping – 1/2 day workshop
- Workshop 5:** Stroke rehabilitation – 1/2 day workshop

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