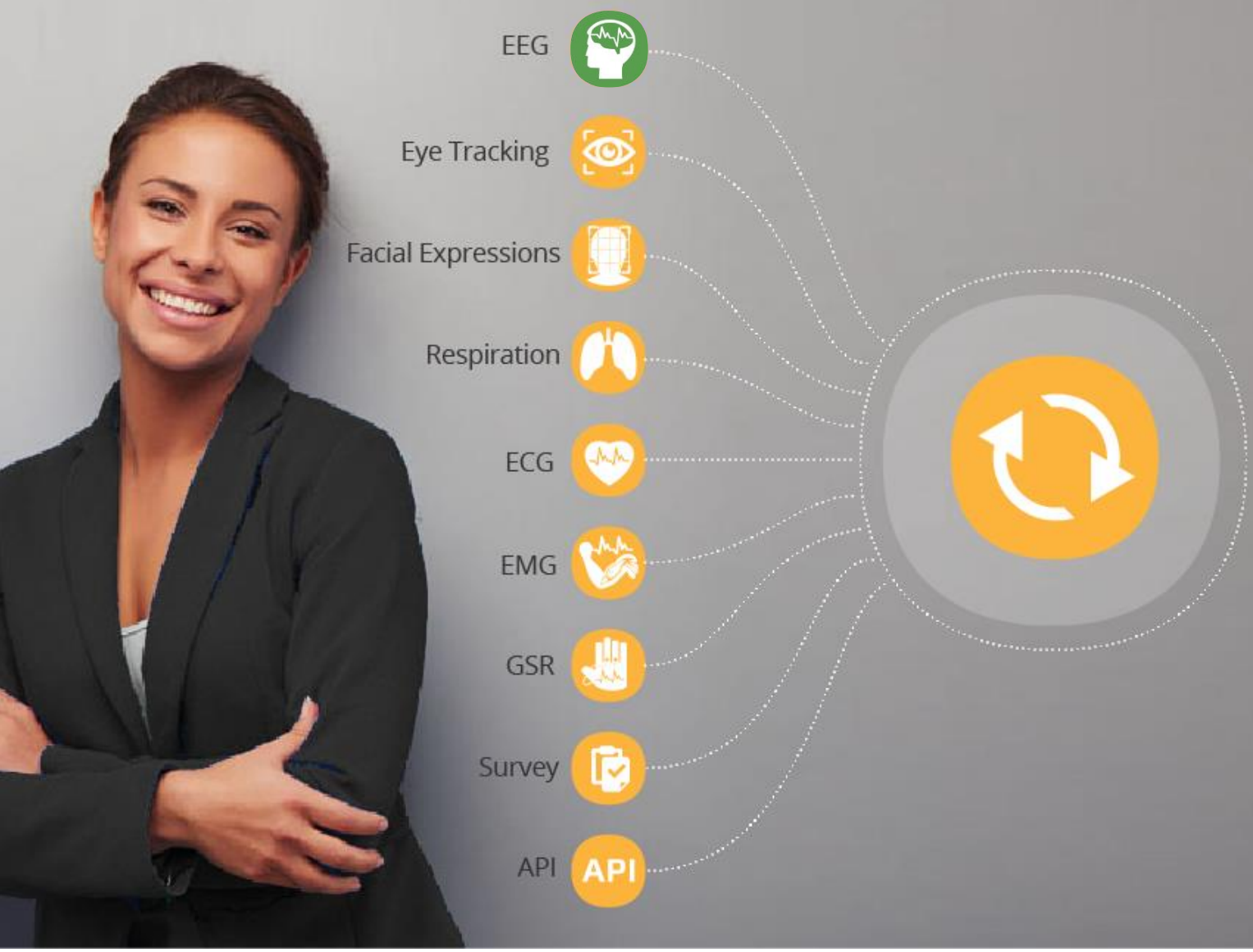
EEG Module

ABM B-Alert X10 and X24 EEG

Pre-requisite: iMotions Core License



IMOTIONS®

sales@imotions.com

EEG Module

Enables iMotions software to connect, record and live visualize EEG data and metrics from ABM or Emotiv. Full overview of metric by channel, battery level, signal strength and impedance tests are integrated.

The EEG Module integrates the ABM B-Alert X10 and X24 EEG

The B-Alert X10 and X24 are the premiere solutions for wireless EEG applications, delivering medical grade signal quality with a balance of functionality and simplicity. The 9- or 20-channel combinations of mid-line and lateral EEG sites allows for multiple analysis opportunities to meet the needs of researchers across many fields. Nine, or 20 channels of high-quality EEG, plus 1 or 4 optional channel(s) for ECG, EMG, or EOG (10 Channels @ 256Hz). Typically used for HR+HRV.

In the last two years, 9 of the Top 10 best neuroscience/neurobiology programs the US have independently chosen to bring ABM Neuro technologies into their labs.

HARVARD UNIVERSITY · STANFORD UNIVERSITY · UCSF University of California San Francisco · COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK · Massachusetts Institute of Technology · Yale UNIVERSITY · JOHNS HOPKINS UNIVERSITY · UC San Diego · Washington University in St. Louis

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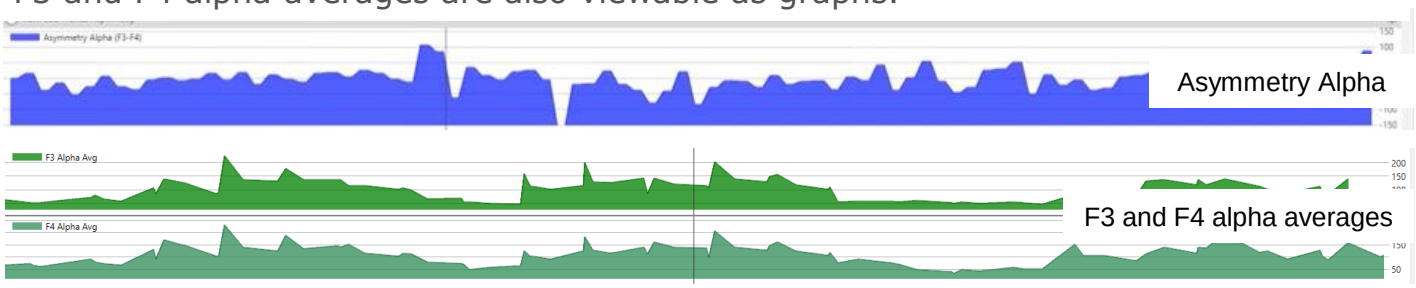
Main output

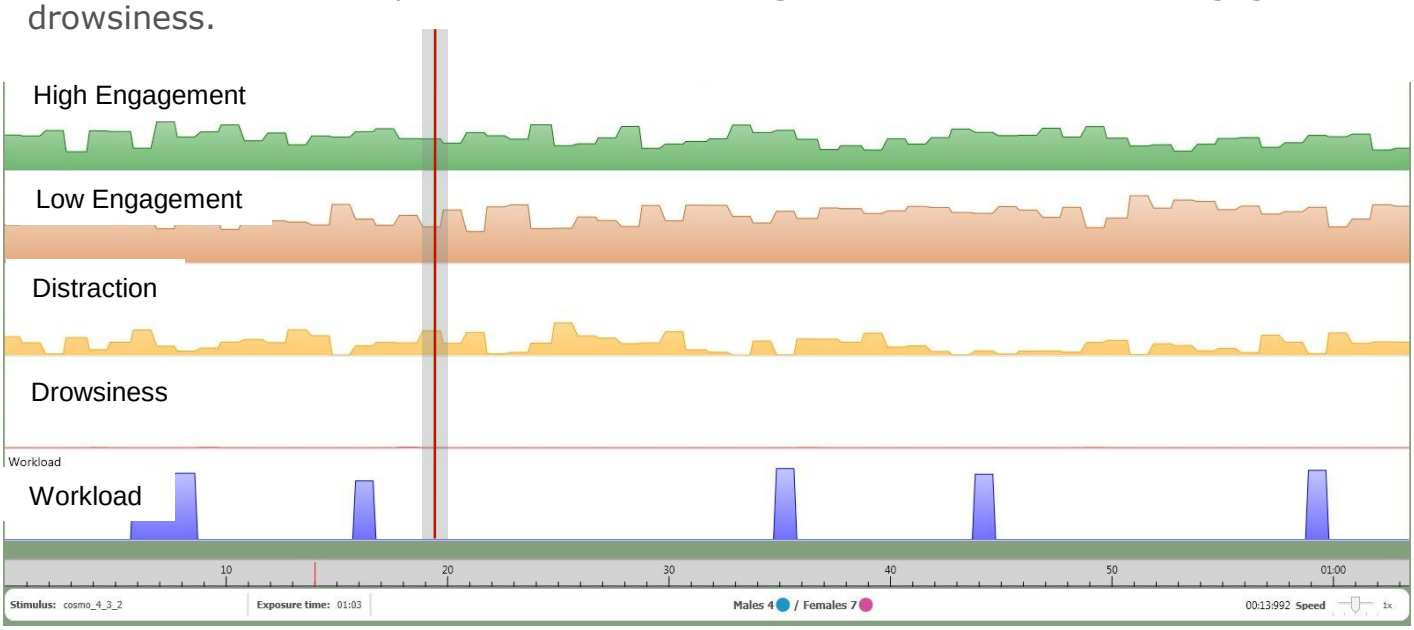
B-Alert Motivation Metric

iMotions automatically calculates in real time the pre-frontal cortex asymmetry associated with approach and avoidance behavior. This metric is generally use to gauge the motivation the person is experiencing towards a particular stimulus. The F3 and F4 alpha averages are also viewable as graphs.



B-Alert Cognitive State Metrics

Four EEG-based classifications constituting a continuum from highly engaged & processing sensory inputs to fatigued and inattentive. This is enhanced by Workload, a 2nd Metric, that compliments the B-Alert Cognitive State Metrics for engagement / drowsiness.



Export of Raw data by Channel & Metric, Power Spectral Density (PSD), Frequency and Frontal Asymmetry Data

Raw Data by Channel & Metric

POz (Raw)	Fz (Raw)	Cz (Raw)	C3 (Raw)	C4 (Raw)	F3 (Raw)	F4 (Raw)	P3 (Raw)	P4
-183.966	-184.538	-173.177	-175.987	-188.777	-187.279	-184	-183.515	-

Power Spectral Density (PSD)

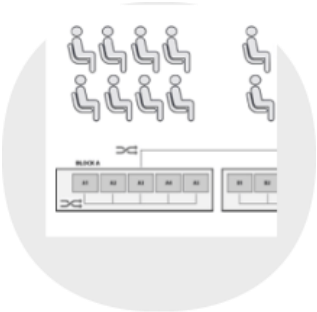
lpha_avg	beta_avg	gamma_avg	F3_alpha_a	F4_alpha_a	frontal_asymmetry_index
-17.196	8.383597	4.035501	107.1584	124.3544	-17.196

Frequency and Frontal Asymmetry

POz(3Hz)	POz(4Hz)	POz(5Hz)	POz(6Hz)	POz(7Hz)	POz(8Hz)	POz(9Hz)
208.2156	151.3177	112.5945	90.69916	229.1305	560.808	493.6632

The EEG Module has the iMotions Core License as pre-requisite, which allows you to:

Present all Type of Stimuli
Present images, videos, websites, screen & scene recordings, real world products and surveys.

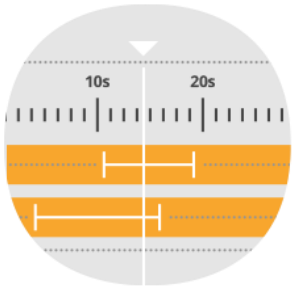


Create Sophisticated Studies
Full flexibility to design any study setup with randomizations, block designs, test plans, group rotations and more.

Real-Time Synchronization
EEG data, stimuli and any other sensor data streams are real time synchronized.

Export Raw Data
Export all collected EEG data in sync with stimuli and other sensors in .txt format for easily import into MatLab and other statistical programs.

Get Quality Assurance
Monitor data collection quality at any given time to ensure the validity of the studies.



Create Live or Post Markers
Mark important happenings during data collection or in replay mode to facilitate the analysis.

View Individual & Aggregated
Get visualisations whether individually or aggregated in any type of segmentation and export them as images and/or videos

Execute Studies in a Lab and/or Mobile Environments
iMotions EEG Module is a wireless system that allows for any study design, whether this is a controlled environment setup or a mobile scenario where respondents move freely in a space.

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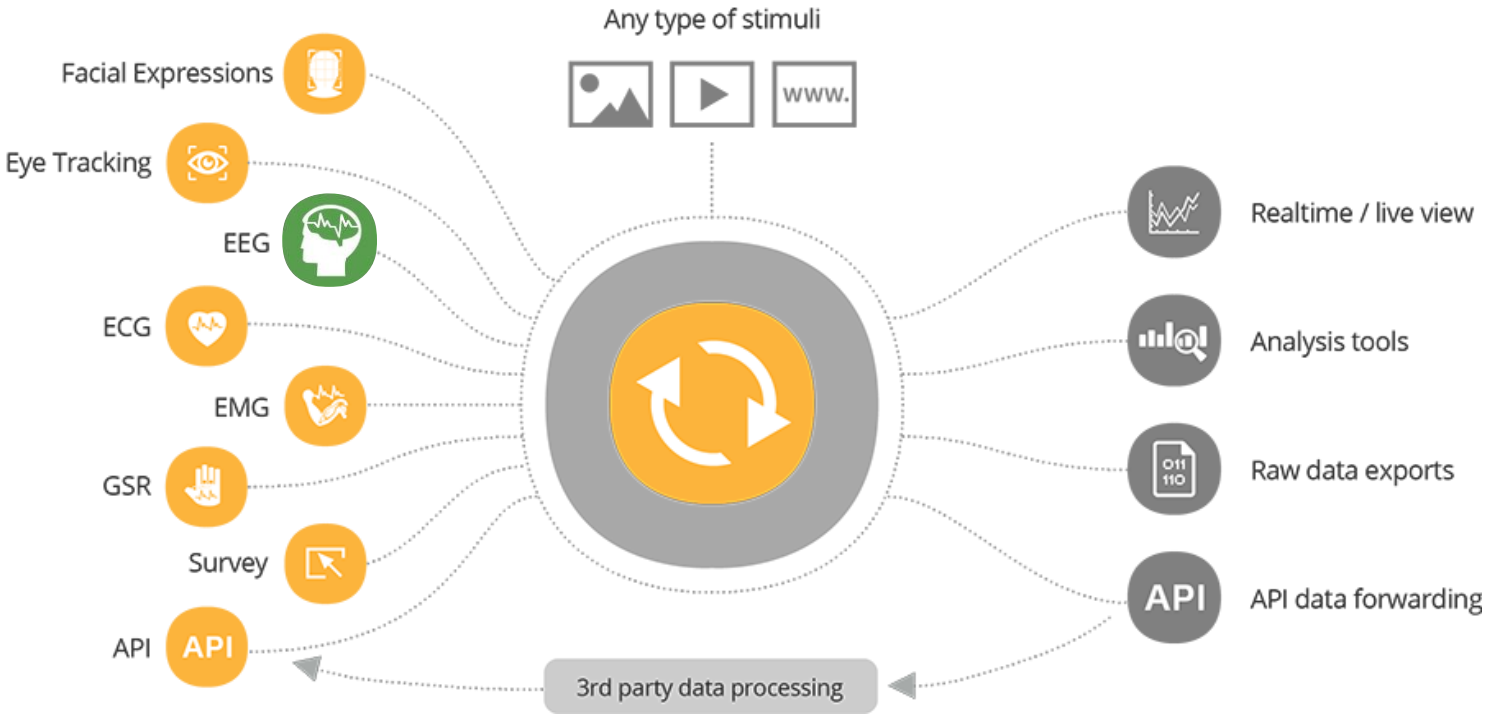
Optionally combine EEG measurements with:

Eye Tracking, Facial Expression Recognition, GSR, ECG, EMG & Surveys



Standard Lab view with combination of sensors

ABM B-Alert X10 and X24 EEG

Key Performance Feature	Why It Matters to Researchers
Medical-grade EEG Signals	The high-quality signals are consistent, reliable, and accurate at the level required for physicians to rely on them for evaluating, diagnosing, and treating patients.
256 Hz Sampling Rate	Enables acquisitions across Power Spectral Density frequency bins from Delta (1-3 Hz) through Gamma (up to 40+ Hz) which expands analysis opportunities including neural signatures of emotion reported in the Gamma range. This sampling rate also enables computation of single trial event-related potentials
Raw Signals in .EDF File Format	Researchers are provided raw data streams with exceptional signal-to-noise ratios.
Automatic Decontamination of EEG	Validated algorithms are available to automatically detect and remove artifacts introduced by EMG, EOG, spikes, saturations, and excursions, delivering more usable EEG signals.
Peer-Review Validated Metrics	Peer reviewed published reports affirm the accuracy and authenticity of the Metric outputs.
Individualized Fit for Every Subject	Each B-Alert system adjusts to fit the size of the user's head. Subjects often report that they forget they are wearing the headset.
Ease of Use	Any proficient technician or researcher can easily learn to apply the system and consistently acquire high-quality signals.
Set-up Time for High-Throughput Studies	Preconfigured sensor strips apply all sensors to 10- 20 sites and a simple impedance checking GUI with headmap provides straightforward signal quality assurance.
Bluetooth Wireless Connectivity	Ensures virtually no signal drop-outs or lost packets, even during mobile applications.

Relevant links:

Links to articles, videos and academic publications that have used the ABM B-Alert X10 and X24 EEG.

1. Video: BBC Horizon profiles B-Alert X10 enabled achievements
2. Interview: This Week in Med IT - Advanced Brain Monitoring - YouTube
3. Publication: Diabetes Motor Control Assessment with EEG
4. Summary Document: Alertness, Fatigue & Workload across Drivers, Pilots, & Operators (Summary of fatigue and workload related studies run in-house)
5. Summary Document: Operational Neuroscience Applications brochure (Additional examples of research that the B-Alert systems enable)
6. Other Projects: For an introduction to other recognized academics leading active studies with B-Alert, here is a list of US News & World Reports Top Neuroscience Programs with details on each project.

More relevant links:

Links to articles, videos and academic publications that have used the ABM B-Alert X10 and X24 EEG.

Defense:

- Publication: EEG-derived estimators of present and future cognitive performance (ABM Authors provide insight as to how you can leverage the B-Alert Cognitive State and Workload Metric to improve training systems).
- Book Chapter: Neural Systems in Intelligence and Training Applications (James Giordano's book features a chapter describing research enabled by B-Alert systems).

Expert vs. Novice:

- Publication: Accelerating Training Using Interactive Neuro-Educational Technologies - Chris Berka's (CEO and Co-Founder of Advanced Brain Monitoring) paper in the International Journal of Sport & Society.
- New Scientist Cover Story: Zen and the Art of Genius - Chris Berka (CEO and Co-Founder of Advanced Brain Monitoring) interviewed in the New Scientist Magazine.
- Conference Proceeding: The Effect of Fatigue on Cognitive and Psychomotor Skills of Surgical Residents - Dr. Kanav Kahol (Arizona State University).

Human Factors/ Driving, Fatigue, Workload:

- Findings Report: The Real-Flight Approach to Assess Flight Simulator Force Cueing Fidelity (Dr. Klyde at Systems Technology, Inc. and our own Dr. Johnson provide assessment outcomes for pilots based on the B-Alert systems. Summary Slides available here: EEG @ 15,000 ft).
- Publication: EEG-derived estimators of present and future cognitive performance (ABM Authors provide insight as to how you can leverage the B-Alert Cognitive State and Workload Metric to improve training systems).
- Publication: Using a simulated environment to investigate experiences reported during space travel (Dr. Reinerman-Jones at UCF created a virtual reality to assess the experience and responses of astronauts).

BCI:

- Abstract: Non-invasive EEG-based motor and language mapping while playing a Kinetic based computer game - Asst. Prof Reinhold Scherer at the Graz University of Technology (Austria).
- News Story: BCI to aid spinal cord injury patients in rehabilitation of damaged neural pathways - Dr. Justin Sanchez at the University of Miami.

Teaming/ Metrics:

- Abstract: Cognitive Neurophysiologic Synchronies: What Can They Contribute to the Study of Teamwork? - Prof. Ronald Stevens at UCLA.
- Paper in review: Assessing Neural Synchrony in Tutoring Dyads. (The research team at ABM's in-house study assessed synchronous psychophysiological measures of tutors and tutees during a spatial reasoning game)
- News Story: Accurately predict student errors on math exams - Prof. Carole Beal at the University of Arizona

Medical:

- Media Coverage: WebMD profiles recent findings by Loma Linda University's Dr. Lee Berk - Serves as a chance to see how comfortable the systems are for subjects and the analysis opportunities they provide researchers.
- Keynote Presentation: Biogen Idec's Dr. Ajay Verma (VP, Experimental Neurology) highlights recent work with ABM technologies (abbreviated; 90 seconds)
- Findings Publication: Postural sway and Rhythmic Electroencephalography analysis of cortical activation during eight balance training tasks (Dr. Petrofsky, professor of physical therapy at Loma Linda University, looked at changes in Power Spectrum Density in common sensorimotor balance exercises).
- Panel Discussion: CureTalk - "Wearable EEGs in Clinical Trials: Now & Beyond" Interview discussion panel featuring Biogen Idec VP of Experimental Medicine, Dr. Ajay Verma and ABM CEO & Co-Founder Chris Berka