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B-ALERT WIRELESS EEG HEADSET SYSTEMS

B-Alert Wireless EEG System with Acq*Knowledge*: **B-ALERT110-WA**

B-Alert Wireless EEG with Acq*Knowledge* plus Cognitive State Software: **B-ALERT110-CS-WA**

B-Alert Cognitive State Software: **B-ALERT-SFT-W** (add-on software)

B-Alert Accessories: **RXB-ALERTSTRIP-M, RXB-ALERTSTRIP-S, RXB-ALERTSTRIP-XS, RXB-ALERTCNSBLS, RXB-ALERT-10ADP, RXB-ALERT-24ADP, CBLX10**

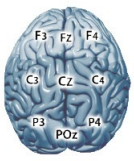
B-ALERT WIRELESS EEG SYSTEMS — B-ALERT110-WA

This complete system includes a B-Alert X10LE (9-channel) or X24LE (20-channel) for **wireless** acquisition of high-fidelity EEG plus ECG, head movement, and position, plus Acq*Knowledge* software with powerful analysis tools, including automated scoring, and reporting options.

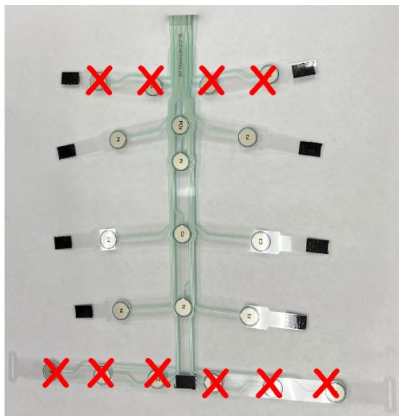
Note: Sensor strips are sold separately. Universal sensor strips provide standard and reduced setup—sensors are filled and recorded based on headset being used.

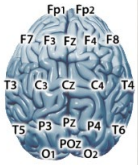
- Fast setup—X10 typically 10 minutes, X24 20 minutes
- Comfortable and nonintrusive—low profile fits comfortably under headgear
- Data quality monitoring and feedback simplifies acquisition for non-technical personnel
- Cognitive state classification for engagement, confusion/distraction, drowsiness, workload, and stress measured by heart rate (HR) metrics
- Patented real-time artifact decontamination

Standard Signals

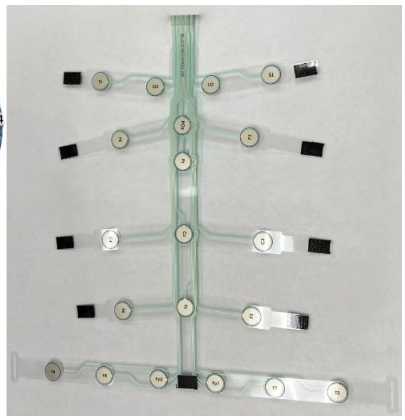


X10LE





X24LE



Mono-polar EEG with impedance, 2-lead ECG, Heart rate, Head movement, PSD by channel

Optional signals

Differential signals for B-Alert and workload

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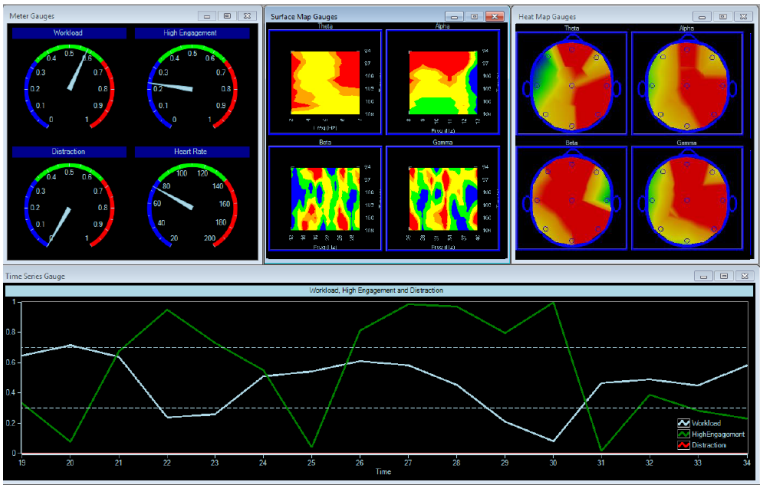
The B-Alert X10/X24 mobile-wireless EEG system delivers real-time measurements for a variety of research and engineering applications, including closed-loop performance monitoring and simulation training; HCI design assessment; situational awareness and team dynamics monitoring; tools for productivity and training enhancement; and fatigue management.

B-ALERT WIRELESS EEG WITH COGNITIVE STATES — B-ALERT110-CS-WA

This system includes the B-Alert Cognitive State software with proprietary metrics for real-time monitoring of subject fatigue, stress via HR metrics (see below), confusion, engagement, and workload (classify data from B-Alert Wireless EEG systems). The GUI intuitively represents both the raw and processed data for easy understanding by even the untrained user and up to six systems can run simultaneously on a single PC—Windows 10/8/7 OS only.

Stress is monitored through heart rate (HR), heart rate variability (HRV), and LF/HF ratio. HR increases are associated with arousal; HRV is used to indicate healthy vs. unhealthy cardio responses during stress and the ratio has been related to the balance of sympathetic vs parasympathetic activation. These measures are all related to stress and responses to stressful situations.

To facilitate both real-time and offline analysis, the B-Alert Athena gauges are fully customizable to fit the requirements of the user. In the standard format (shown below), the easy-to-read dashboard gauges (*Top Left*) and time series (*Bottom*) windows present B-Alert's highly validated second by second metrics: Engagement, Workload and Drowsiness (along with Heart Rate). Heat maps (*Top Right*) display EEG power spectral densities (PSD) in both spatial and temporal maps for the traditional Hz bands (Beta, Alpha, Theta, Gamma).



Baseline task	Action	B-Alert Class probabilities
3-choice vigilance task (~7-min; optional 20-min)	Choose between primary vs. secondary or tertiary task every 1.5 to 3-seconds	High Engagement
Eyes open (5-min)	Respond to visual probe every 2-seconds	Low Engagement
Eyes closed (5-min)	Respond to audio tone every 2-seconds	Distraction if episodic Drowsy if sequential
None	Derived by regression from other three tasks	Sleep Onset

B-Alert Wireless EEG biometrics are normalized to an individual subject using 5-minutes of baseline data from three distinct tasks with the sleep onset class predicted from the baseline PSD values. A probability-of-fit is then generated for each of the four classes for each epoch with the sum of the probabilities across the four classes equaling 1.0 (e.g., 0.45 high engagement, 0.30 low engagement, 0.20 distraction and 0.05 sleep onset). Cognitive State for a given second represents the class with the greatest probability. B-Alert cognitive state metrics are derived for each one-second epoch using 1 Hz power spectra densities (PSD) bins from differential sites FzPO and CzPO in a four-class quadratic discriminant function analysis (DFA) that is fitted to the individual's unique EEG patterns. The table briefly describes each baseline task and the B-Alert classification.

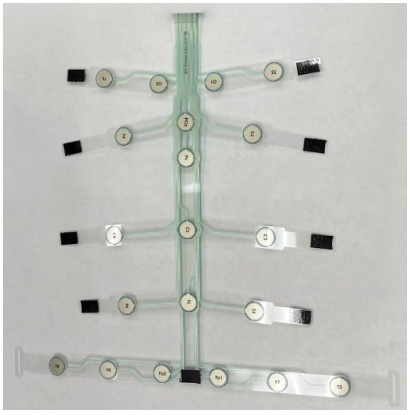
B-ALERT COGNITIVE STATE SOFTWARE — B-ALERT-SFT-W

Classify Cognitive States with this analysis software add-on for B-Alert Systems (Windows 10/8/7 OS only)

B-ALERT ACCESSORIES

NOTE: B-Alert sensor strip packs require consumables kits (**RXB-ALERTCNSBLS**) and may also require adapter depending on the version of the B-Alert X-series headset used.

Strips



RXB-ALERTSTRIP-M, RXB-ALERTSTRIP-S, RXB-ALERTSTRIP-XS

B-Alert Sensor Strips can be used for a variety of wireless EEG applications (e.g., human factors, ergonomics, neurogaming, neuromarketing, neuroleadership, team neurodynamics, brain computer interfaces, etc.) and IRB-approved human subject research.

Strips are available in M (medium), S (small), and XS (extra small).

M – 10 per pack, S – 10 per pack, XS – 5 per pack

Consumables

RXB-ALERTCNSBLS

This pack provides typical items for acquisitions done with 10-packs of the Small and Medium Single-Use Universal Strips. Extra Small is a 5-pack, providing 2 x what is needed for a typical setup.

Packs include:

- 40 x disposable electrodes for ECG/Mastoids
- 10 x 30g tubes conductive cream
- 10 x 12cc syringes w/built in curved tip

Universal Strip Adapters

These adapters allow B-Alert X-series legacy X10T or X24T black headsets to accept the new universal EEG electrode strips (not compatible with older silver headsets).

RXB-ALERT-10ADP

- X10 Reduced 10-20 LM Universal Strip Adapter

RXB-ALERT-24ADP

- X24 Standard 10/20 LM Universal Strip Adapter

Connecting B-Alert Universal EEG Strips to the adapter and then the adapter to the headset.

Analog Out Cable

CBLX10

CBLX10 is required to use B-Alert X-Series Headsets with the "Master Sync Device" mode available in Acq*Knowledge* 4.3 or above. For additional information see product page.

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HARDWARE SPECIFICATIONS:

Channels:	Up to 20 EEG with fixed gain referenced to linked mastoids; 1 auxiliary differential channel with programmable gain
Sampling rate:	256 samples/second – all channels
Dynamic range:	± 1,000-2000 µV
Resolution:	16 bit, CMRR 105 dB
Input impedance:	500 MΩ, typical
Common mode rejection ratio:	-115 dB, typical
Bandpass characteristics:	0.1 Hz HPF Firmware, and 67 Hz LPF hardware
Noise:	3 µV peak-to-peak typical
Head movement/position:	Angles obtained with 3-axis 12-bit accelerometer
RF Band:	Bluetooth 2.4 to 2.48 GHz (ISM band), latency < 340 ms
Transmission mode:	Bluetooth SPP 2.0 via USB dongle or external synching unit
Data transmission range:	~ 10 meters, line of sight with onboard antenna
Transmission power:	Class 2 +4 dBm
System power consumption:	~ 60 mAh
Battery capacity:	Standard 2 x Li-ION batteries - 600 mAH, 11-hours of continuous use
Battery charging:	Via USB cable connected to USB port or USB wall charger
On-line impedance monitoring:	Initiated by host computer using Bluetooth
Head unit dimensions:	Size 6.83 cm (L) x 4.83 cm (W) x 2.03 cm (H); Weight 57 g
User control:	On/Off
Indicator LEDs:	Green/Amber
Software Compatibility:	Windows 10, 8 and 7, PC with 2.0 GHz or higher processor 1 GB of RAM

Sensor Headset & Accessories

Sensor sites:	X10 Referential: F3, Fz, F4, C3, Cz, C4, P3, POz, P4 X24 Referential: Fp1, Fp2, F7, F3, Fz, F4, F8, T3, C3, Cz, C4, T4, T5, P3, Pz, P4, T6, POz, O1, O2
Sensor strip sizes:	X-small, Small, & Medium – each site ±1 cm of 10-20 system Medium = Nasion to Inion ~36 cm
Electrode cream:	Highly conductive, electrolytes and preservatives in hypoallergenic base, buffered to skin pH