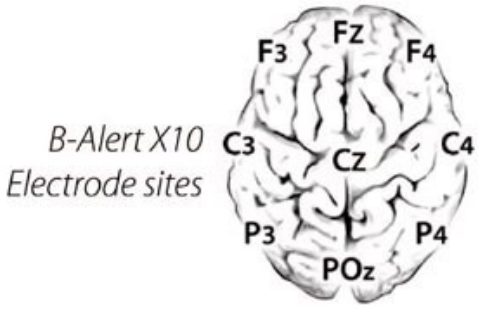
B-ALERT WIRELESS EEG HEADSET SYSTEMS

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, see page 3

B-ALERT WIRELESS EEG 9- AND 20-CHANNEL SYSTEMS

This complete system includes a B-Alert X10 or X24 for **wireless** acquisition of 9 channels (20 on the X24) of high fidelity EEG plus ECG, head movement & position, Acq*Knowledge* software with powerful analysis tools, including automated scoring and reporting options, one (1) size small and one (1) size medium sensor strip, and B-Alert Cognitive State software.

- Set up in less than 5 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

9/20 mono-polar EEG with impedance
2-lead ECG
Heart rate
Head movement
PSD by channel

Optional signals

Differential signals for B-Alert and workload

B-ALERT X10/X24 WIRELESS SYSTEMS

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.

➲ Click to view the B-Alert System Sample Diagram

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OVERVIEW

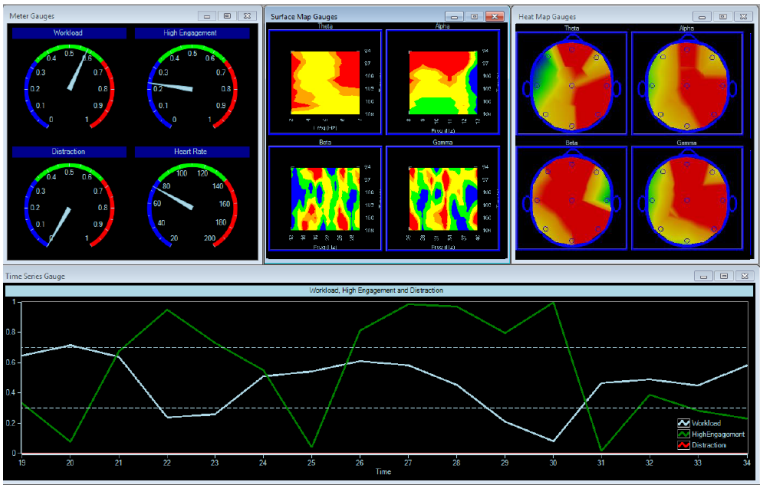
1. Prepare the B-Alert System.
2. Fill the foam sensors.
3. Apply X10/X24 System to Participant.
4. Applying Mastoid and ECG Sensors.
5. Start Data Collection.
6. Remove X10/X24 from Participant.
7. Clean X10/X24 System.

PLUS—CLASSIFY COGNITIVE STATES

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 is the measure of 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 bio-metrics 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 (ADD-ON, SOFTWARE ONLY)

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

B-ALERT ACCESSORIES

Disposable Study Kits

For X10:

RXB-ALERT-KIT-S or RXB-ALERTKITA-S	small	32.0-34.5 cm (approx. 12.6-13.6”)
RXB-ALERT-KIT-M or RXB-ALERTKITA-M	medium	> 34.5 cm

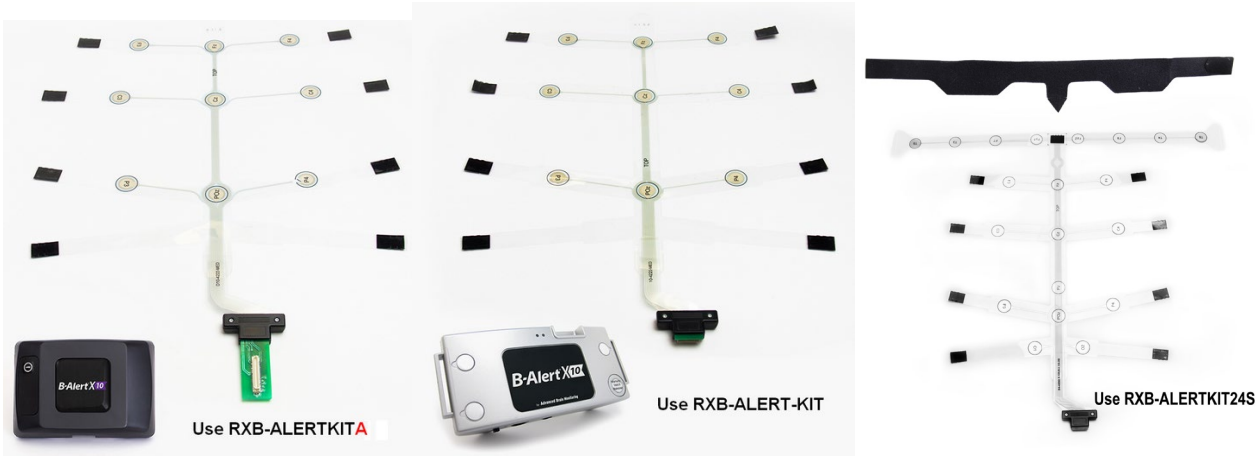
For X24:

RXB-ALERTKIT24S	small	32.0-34.5 cm (approx. 12.6-13.6”)
RXB-ALERTKIT24M	medium	> 34.5 cm

Each disposable study kit for the B-Alert X10/X24 Wireless EEG System contains:

- one sensor strip
- foam sensors
- one Neoprene sensor strap with Velcro
- disposable electrodes (for mastoid) for 25 studies
- gel and pads for 25 studies

Order kit based on size and B-Alert headset style:



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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:	Referential: Fz, F3, F4, Cz, C3, C4, POz, P3, P4
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