Pendants by Pocket Neurobics

(i) Product Suite

- Pendant EEG USB: 2 eeg channels, connects to a PC by USB cable. Also connects by wireless (3m range) with the optional wireless pack
- Pendant EEG AAA: 2 eeg channels, connects to a PC by wireless (10m range)
- Pendant HEG nIR: near-infrared blood oxygenation biofeedback, connects to a PC by wireless
- Pendant HEG pIR: passive-infrared forebrain temperature (metabolism) biofeedback, connects to a PC by wireless

(ii) General Installation and Startup

Driver Installation

Pendants communicate with PC-based biofeedback applications such as BioExplorer or BioEra via a Windows driver.

All Pendants (except the Pendant EEG USB) communicate with the PC via wireless, utilising a Wireless Dongle (supplied) which is plugged into the PC's USB port. When the wireless dongle is plugged into the USB port for the first time, Windows' 'New Found Hardware' wizard will recognise the new device and install the driver automatically from Windows' on-line driver repository.

The Pendant EEG USB, when directly connected to a USB port for the first time, will also invoke the 'New Found Hardware' wizard and automatically install the driver.

Note that driver installation needs to execute twice. On each occasion prompts are issued by the 'New Found Hardware' wizard. During this installation process, Windows will allocate a COM port (eg COM4). At completion of driver installation, this COM port number needs to be manually entered into the PC-based biofeedback application to associate the application's Pendant driver with the relevant COM port.

Non-wireless Devices (Pendant EEG USB)

Plugging the device directly into a USB port using the connecting cable provided will cause the device to immediately enter operating mode, with the blue light blinking once every four seconds. Actual passing of data to an application running on the PC is signified by the light changing color to acqua.

There are three buttons on the side of the device. These change the mode of operation. The Pendant powers up in 'operating' mode and for normal operation, these buttons are not needed. Pressing the mode button, which is the button furthest away from the USB connector, will change to Program mode and this will be signified by the light changing to off, blinking on every 4 seconds. In Program Mode the firmware of the device can be updated over the wireless link and the serial number of the device inspected. This requires that the PC application support this function. The other two buttons are device specific – see the section for the particular device.

Wireless Devices (Pendant EEG AAA, Pendant nIR, Pendant pIR)

The Pendant operates from a single AAA battery. This can be a rechargeable battery or alkaline. If using rechargeable batteries, leave the batteries overnight in the USB charger provided to ensure that they are fully charged.

A push button at the top of the Pendant turns the device on and off. During start-up, the light will rapidly blink a few times, and then change to blinking every 4 seconds. The number of blinks indicates the wireless channel that the device is transmitting on. The default id channel one, so the Pendant light blinks once every 4 seconds.

There are three buttons on the side of the Pendant. These change the mode of operation. The Pendant powers up in 'operating' mode and for normal operation, these buttons are not needed. Pressing the mode button, which is the button closest to the Push-button on the top, will change to Program mode and this will be signified by the color of the light changing. In Program mode, the two other buttons become operational, one changing the wireless channel number upwards, the other changing the wireless channel number downwards. Also, when in Program Mode, the firmware of the device can be updated over the wireless link, and the serial number of the device can be inspected. This requires that the PC application support this function. As data is being uploaded, the light on the Pendant and dongle will flash rapidly. Success will be indicated by the Pendant immediately switching to normal Operating Mode, executing the new code. Failure will be indicated by the Pendant continuing to sit in Program mode, awaiting another attempt to upload firmware.

With a wireless dongle plugged into the PC's USB port and its driver correctly installed, the light on the wireless dongle will change from 'mostly off' to 'mostly on' when the Pendant is switched on. This signifies that the wireless dongle is correctly receiving the wireless signal from the Pendant.

If this does not happen, check that the lights on the Pendant both blink the same number of times (default is once) to signify that they are on

the same wireless channel number. If not, see above for a description of changing the wireless channel number of the Pendant. To change the wireless channel number of the dongle, using a ball-point pen, momentarily press the small switch on the side of the dongle, once for channel 1 etc.

Unless more than one Pendant is being used in a room, default wireless channel 1 is recommended, since it is guaranteed to be free of wireless LAN interference. Where multiple devices are in use, each must be assigned a separate wireless channel. There are eight available. If there is a wireless LAN in the vicinity, then some experimentation may be required to find a clear channel, however wireless channel 2 is also usually clear. Range is typically 10m.

If the light on the Pendant or the wireless dongle does not blink at all, this signifies that the device is faulty.

Low battery indication is given by the Pendant's light reverting to rapid blinking.

There are other functions associated with the side buttons which are device specific (like setting the device's Profile, or doing a calibration). Information on this can be found in the section related to the specifics of the device.

(iii) Pendant EEG USB, Pendant EEG AAA

The Pendant EEG USB acquires two channels of EEG data and transports the data via a cable supplied to a USB port and on to an application running on a PC.

The Pendant EEG AAA also acquires two channels of EEG data, transporting it to the PC application over a wireless link with a wireless range of about 10m.

EEG channel 1 uses Red (+) and Black (-) electrode sockets, whilst EEG channel 2 uses Blue (+) and White (-) electrode sockets. Neutral/Ground uses the Green electrode socket and must always be connected. If using just one of the two EEG channels only, then channel 1 must be used.

Electrodes can be pure silver, pure tin, or Ag/AgCl, however they *must not* be gold.

The Pendant EEG USB can also communicate via a wireless link when fitted with the optional wireless kit. The wireless kit consists of a wireless dongle and a USB portable power pack which supplies the power to the Pendant. The Pendant will automatically sense whether it is connected to a regular USB port (and so communicate via cable), or whether it is connected to a USB portable power source (and so communicate wirelessly) . Wireless range is up to 5m.

When operating wirelessly, the Pendant EEG USB will behave similarly to the Pendant EEG AAA: the three buttons on the side of the unit allow it to be set into Program mode and the wireless channel number to be increased and decreased. The current wireless channel number is indicated by the number of blinks of the light.

Program mode also allows the 'Profile' of the Pendant EEG to be changed. This function needs to be supported by the application running on the PC. Profiles available for the user to set include:

- EEG signal bandwidth: 40Hz, 48Hz, 56Hz
- Sampling Rate: 128sps, 256sps, 512sps.

Status information sent over the wireless link includes:

- Battery: OK/ not OK (Pendant EEG AAA only)
- EEG channel 1, EEG channel 2: OK/ not OK (tests for excessive signal levels)
- Side Button Up, Down: Pressed/ not pressed

(iv) Pendant HEG nIR

The near-infrared Hemo-encephalography Pendant (Toomim system) uses a headband to acquire blood oxygenation levels (or blood color) at the forehead using Photoplethysmography techniques, and transports this data to a PC application via a wireless link.

The Pendant HEG nIR can be connected to a HEG headband directly, allowing the Pendant to sit comfortably to the side of the head, or to be remotely connected via the cable supplied.

The Pendant HEG nIR transmits two data channels over the wireless link. The first channel contains the Red/IR ratio signal usually used for training. The second channel contains the automatic gain control signal which is a measure of the strength of the red and infrared light sources at the receiver.

As well as Operating Mode and Program Mode, the mode button cycles through a third, Test mode. In Test mode (light changes color to aqua), wireless channel 1 transmits the Red light signal and channel 2 transmits the IR light signal. The Red/IR ration signal can be re-constituted in the PC application software using the formula Ratio = Red/IR. Nominal value of Ratio = 100.

Status information sent over the wireless link includes:

- Battery: OK/ not OK

- HEG nIR (ch 1) valid/ not valid (based on signal strength)
- Side Button Up, Down: Pressed/ not pressed

(v) Pendant HEG pIR

The passive infrared Hemo-encephalography Pendant (Carmen system) uses a headband to acquire a measure of metabolic activity at the forehead and to transmit it to a PC application over a wireless link. It is nominally measured in degrees (temperature).

The Pendant HEG pIR can be connected to a HEG headband directly, allowing the Pendant to sit comfortably on top of the sensor, or to be remotely connected via the cable supplied.

The Pendant HEG pIR transmits two data channels over the wireless link. The first channel contains the temperature information usually used for training. The second channel contains a reading of the current battery voltage.

As well as Operating Mode and Program Mode, the mode button cycles through a third, Calibrate mode. In Calibrate mode (light changes color to aqua), The two buttons on the side of the Pendant, otherwise used to change wireless channel number, will increase or decrease the Temperature reading. Calibration is usually achieved by utilising a Type K Thermocouple placed under the tongue. The temperature reading is thin adjusted to about 98.5deg F.

Status information sent over the wireless link includes:

- Battery: OK/ not OK
- HEG pIR (ch 1) valid/ not valid (based on whether signal is out of range)
- Side Button Up, Down: Pressed/ not pressed