APPENDIX - K

DESCRIPTION OF BIOFEEDBACK INSTRUMENT

A MEDICARE BIOFEEDBACK XL-12 was used to train the subjects to sustain Alpha waves. The instrument has both EEG (Electroencephalograph) and EMG (Electromayograph) feedback facility (one at a time) Detail discription of the instrument is given below:

PANEL DESCRIPTION:

1. Digital Display Meter
2. Led Bargraph (Light Display)
3. Electrode Input
4. EEG Feedback Mode Selector Switch
5. EEG Electrode Resistance Indicator
6. EMG Feedback Mode Selector Switch
7. EMG Frequency Band Selector (Narow/Wide)
8. Feedback Mode Selector Switch (Direct Tone/Multi Tone)
9. Sensitivity Selection Switch
10. Level Setting Switch
11. Balance Control
12. Volume Control
13. Head Phone Output

1. DIGITAL DISPLAY METER:

   The digital display on the front panel displays the ongoing EEG (alpha) or EMG activity.

2. LIGHT DISPLAY:

   It consists of a 21 LED bargraph (Green 10 steps, yellow 1 step, Red 10 steps). The green portion represents relaxation, yellow is the Balance position and Red portion represents tension. Each LED step is changed by a deviation from the 'BALANCE' value asper the 'SENSITIVITY' selected. As the subject achieves more and more relaxation, the green LED starts glowing one by one gradually, and as the subject goes into tension (or any other brain wave than alpha waves in case of EEG feedback), the red LED starts glowing one by one.

3. ELECTRODE INPUT:

   A five pin output connector is provided on the front panel. The connector with the electrodes can be plugged in to the connector on the front panel and secured with the threaded collar. Before inserting the connector with electrodes into the front panel the grooves on both have to be aligned.

4&6. FEEDBACK PARAMETER SELECTOR SWITCHES:

The XL-12 is a two-in-one system with the facility of feedback of EEG (Alpha) and EMG parameters. Two switches are provided to programme the instrument for the desired parameter feedback.

5. EEG ELECTRODE RESISTANCE INDICATOR:

A two way push button is provided to check the EEG electrode-to-skin resistance. If resistance is more than 50 K the red LED glows it is less than 50 K (normal) the green LED glows.

7. EMG FREQUENCY BAND SELECTOR (NARROW/WIDE)

A two way push button which facilitates EMG feedback in two ranges:

NARROW: 100 - 200 Hz
WIDE: 40 - 1000 Hz.

8. FEEDBACK MODE SELECTOR SWITCH (DIRECT TONE/MULTI TONE):

There are two mode of operation. Each mode is discussed separately as below:

DIRECT TONE: This permits the actual (raw) EMG activity to be displayed as well as the audio signal directly drived by it to be head. The controls 'LEVELS' and 'BALANCE' are not functional in this mode. This control is not functional in case of EEG (alpha) feedback.

MULTITONE: In this mode frequency and amplitude of the input signal are integrated and the resulting DC voltage decides the level of the output feedback signal. The 'BALANCE' and 'LEVEL' controls are functional in this mode.

9. SENSITIVITY SELECTION SWITCH

The instrument has a common 'SENSITIVITY' selector for the two parameters. The 'SENSITIVITY' range is + 0.3, +1, +3, +10, +30, +100 uv per bar.

10. LEVEL SETTING

In biofeedback training, the subject is required to relax, the pitch of the audiofeedback sound decreases gradually and the green 'LEDs' glow one by one.

It is also recommended for the subject to fix a goal for a particular as session. The level setting knob is marked from 1 to 10. Any level on the LED bargraph between the 1st and the 10th LED (green portion) can be set. As soon as the set level is achieved, the audio feedback will be cut off e.g. the LEVEL is set at 6. As the subject relaxes, the green LEDs start glowing. When the relaxation reached the desired level, i.e. the 6th LED glows, the audio will get cut off indicating to the subject that the set level has been achieved.

11. BALANCE CONTROL

It is used to manually drive to light bargraph.

12. VOLUME CONTROL:

The audio feedback from the equipment is available through a pair of headphones.

At BALANCE value, a Sinusodial pulse at 500 Hz is fed to the headphones. The pulse frequency decreases gradually as more and more relaxation is achieved. Similarly it increases with increasing tension.

E.E.G.:

The XL12 monitors the alpha components of EEG of a subject and feeds it back to the subject through a light bargraph or through headphones. By learning to enhance the generation of Alpha EEG activity, the patient suffering from a chronic mental posture constituting a component psychosomatic and physiological disorders can cultivate a more normal mental posture.

* The EEG signal is picked up from the scalp through silver electrodes. The electrode's resistance can be checked with an impedence check indicator provided on the front panel.

* The signal is amplified using a low noise differential amplifier followed by notch filter to eliminate mains interference.

* The bend pass filter is used to segregate the EEG (Alpha) activity of interest in the frequency range of (8-12 Hz).

* The change in EEG activity (signal strength) can be seen on the light bargraph or through headphones.

Fig. K(a) shows the instrument (Biofeedback XL-12).

Fig. K(b) shows the instrument at work.

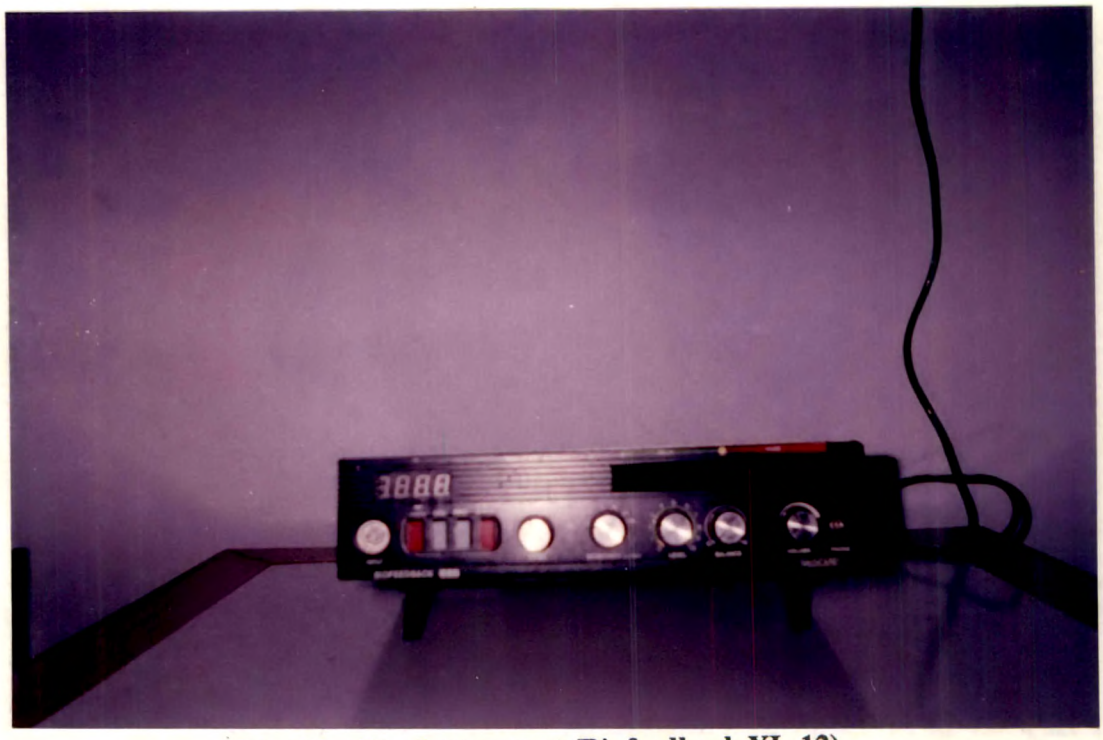

Fig. Ka : The Instrument (Biofeedback XL-12)

Fig. Kb : The Instrument at Work