Biofeedback 2000 *x-pert*

Computerized

**high-tech
mobile
modular**

Biofeedback - modern and flexible

Biofeedback is a "young" procedure which was developed in the 1960s. In the relatively short period since then biofeedback has become established as a training and therapy procedure with a recognized scientific basis. Clients welcome biofeedback as a gentle yet efficient procedure which is free of side effects.

How does biofeedback work?

A feedback loop enables the user to become aware of physiological processes which normally take place unconsciously.

- Sensors record **physiological signals** (e.g. heart rate, muscle tone).
- The **recorded readings** or a visual and audio feedback are **continuously reported** via a computer.
- This makes it possible to **deliberately change** physiological functions and
- helps to make aware one's **functional efficiency.**

Applications of biofeedback

- **Therapy of pain:** migraine, tension headaches, cervical syndrome, back pain
- **Neuromuscular problems:** dystonias (bruxism), partial paralysis, incontinence
- **Psychosomatic problems:** essential hypertonia, Raynaud's disease, asthma, hyperventilation syndrome, tinnitus
- **Psychological problems:** anxiety disorders (phobias, panic attacks)
- **Stress reduction and prevention**

The effectiveness of biofeedback

Numerous studies and meta-analyses demonstrate the effectiveness of biofeedback in a wide range of fields. For some symptoms (e.g. headaches, back pain, incontinence) biofeedback is one of the most effective therapies available – with the additional advantage that it has no negative side effects. It is also a procedure which is very readily accepted by patients.

Biofeedback from Schuhfried

The company G. Schuhfried GmbH has been supplying biofeedback systems for many years. Our accumulated experience and readiness to explore new ideas have secured us a leading position in the field. Our latest development - a radio biofeedback device with smaller modules, ergonomic sensors and user-friendly software – is certain to be enthusiastically received. Biofeedback sessions can now be carried out in comfort, with no tangle of cables and no restrictions on movement. New applications can be considered – for example in sporting contexts, in the workplace, or in paediatrics. In the following pages you can read more about the many and varied possible uses of **Biofeedback 2000** *x-pert*.

Contents

Photos: atelier schiffleitner

Biofeedback 2000 $^{x\text{-}pert}$ **is a modular biofeedback system with the flexibility to be adapted to your particular requirements.**

Choose from the various radio modules, special therapy modules and basic software and put together your own individual biofeedback system.

The **software** is very simple and intuitive to use and requires no specialized computer knowledge. The simple user interface is clearly designed and runs in Windows®. The training programs provided with the basic software can be supplemented by special programs.

Radio technology offers a freedom never before achieved in biofeedback training.
The readings are transferred cordlessly by radio signal (Bluetooth®) to the computer.
The radio modules can be placed on the body, so that only short sensor cables are needed. The system has become even simpler to use, and the equipment is small, light and yet extremely robust.

Three radio modules are available, measuring the following parameters:

- **MULTI:** EDA: skin conductance
  PULS: pulse amplitude and frequency
  TEMP: temperature
  MOT: motility (movement)
- **RESP:** respiration
- **EMG:** electromyography (muscle tension)

In development
- **EEG:** electroencephalogram (electrical brain activity)

The advantages at a glance

- **Cordless transmission** of readings via Bluetooth® technology
- Very comfortable for the client
- Maximum freedom of movement
- Relaxed setting
- Increased range of opportunities for use (sport and workplace medicine, paediatrics)

- **Modular system**
- The modular design enables you to put together your own individual biofeedback system
- You purchase only those components which you really need

- **Special user-friendly sensors**
- Simple plug-in connections
- Colour-coded connectors
- Can be used with all standard electrode types
- Custom-cut cables for special applications available upon request

- **Enhanced precision and sensitivity**
- Increased sampling rate, value smoothing if required
- 7 sensitivity levels and 4 filter ranges (EMG)
- Integrated movement sensor recognizes artefacts of movement (MULTI)

- **Simultaneous display of readings** from up to 7 modules
- Differentiated readings from one person
- Efficient use in group settings

- **Compatible with the Vienna Test System**
- While using the Vienna Test System (VTS) to administer a psychological test (diagnostic tool), you can simultaneously record and evaluate physiological parameters

- **MULTI MODULE with integrated 3D movement sensor**

  - TEMP: Temperature
  - PULS: Pulse amplitude and frequency
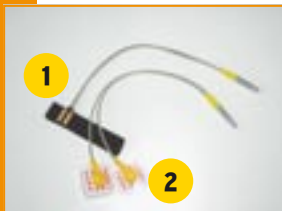 - EDA: Skin conductance

- **Temperature sensor**
  - For attaching to: hand or forehead
  - Using: Velcro strap or headband

- **Pulse sensor**
  - Pulse amplitude
  - Pulse frequency
  - For attaching to: hand or forehead
  - Using: Velcro strap or headband

- **EDA sensor (skin conductance)**
  - For attaching to: palm of hand or finger
  - Using: Velcro strap **1** or disposable electrode **2**

- **Combined sensor for TEMP, PULS, EDA**
  - For attaching to: finger
  - Using: Velcro strap or self-adhesive electrode

- **RESP RADIO MODULE**

- analysis of breathing pattern
- comparison of thoracic and
  abdominal breathing
  (with add-on module ATEM2)

- **Respiration sensor for RESP module**
- fastened to breathing belt around thorax or abdomen

- **EMG RADIO MODULE**

- measurement of muscle tension
- fastened with Velcro band, clip or headband
- 7 sensitivity settings
- 4 filter ranges

- **EMG – sensors**
- Positioning: dependent on muscle group
- 2 two-pole, 1 one-pole electrode cable
- For use with all standard electrode types

- **Anal and vaginal electrodes**
- measurement of muscle tension
- for incontinence training

Basic software

The **Biofeedback 2000** *x-pert* software consists of a basic module and individual special therapy modules. The basic module provides all the basic functions needed; additional therapy modules can be added as required. Therapies can be carried out in a wide range of situations with the basic module alone. Special therapy modules are available for more specialized applications.

BF Basic module

The user-friendly software of **Biofeedback 2000** *x-pert* provides a simple way of learning to use biofeedback therapy.

The basic software manages client data, administers therapy programs, evaluates sessions and has many functions which make your work easier. It takes just a mouse click to begin the training programs.

The following therapy functions are available in the basic module

• **RESP relaxation exercises:**

Breath relaxation training is carried out with the aid of a bar, the length of which varies with the subject's breathing movements.

Abdominal and/or chest breathing is measured by means of a breathing belt or of a system of two such straps. The program supplies information about the client's pattern of breathing. The aim of training is to develop a habit of relaxed abdominal breathing.

Animation of the picture bar provides feedback on abdominal/chest movement.

RESP relaxation training is a good preparation for the respiration training developed by Dr. Marx (see BF RESP).

● **Lines (multi-feedback):**

This function makes it possible to display any required parameters in line-graph form, either one at a time or simultaneously. It can be used either just for data recording or for training.

Lines (multi-feedback) feedback should always be provided before a biofeedback session. This enables the client to become accustomed to the situation, provides a measurement baseline, and enables the correct positioning of the sensors to be checked. Simple training programs can be set up by introducing changes in the display background (background picture or colour) or by using music (either background music incorporated in the program, or from a CD).

● **Threshold value training:**

The threshold (line) represents a target level which the client aims to reach. If the client succeeds in getting the parameter readings to pass the threshold level – depending on the aim of the training - he is rewarded with positive stimuli. The reward takes the form of sounds, music or (in the case of children) fairy-tales. Audio warning signals can be set to sound if the readings move in the wrong direction.
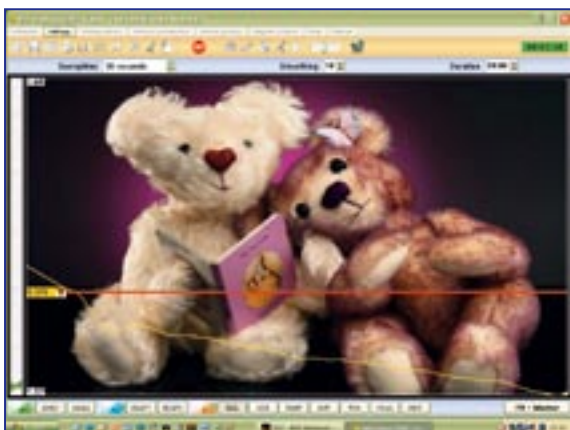
Images appropriate for children

● **Volume feedback:**

This type of feedback is provided using a circular image. In vasoconstriction training (migraine therapy) this provides feedback about the blood flow in the temporal artery. The aim of training is to make the size of the displayed circle as small as possible. The theoretical basis of this is that migraines are caused by a powerful rush of blood in the head; by deliberately constricting the blood vessels a migraine attack can be avoided.

● **Audio feedback:**

Changes in readings are fed back acoustically, by variations in the pitch of a sound. The training can be carried out either with the simultaneous use of a background picture or without any visual display (black screen). Acoustic feedback is particularly appropriate to the regulation of breathing and skin conductance.

Basic software

Functions of the basic module

Database: Storage of all client data, session data, readings, notes, comments and records of conversations, data import and export functions.

Settings: Authorisation of access, adaptation of visual displays (if required).

Therapy library: Contains all available programs, with short descriptions.

Session preselection: Enables individual training programs to be drawn up.

**Sensors position:** Detailed instructions for placement of the electrodes.

Help: Consists of two online manuals ("Technical assistance" relating to the program and "Therapeutic assistance" containing general information on biofeedback), as well as online-help accessed via the program's user interface.

Internet: Enables e-mail to be sent directly to the manufacturer.

Background pictures: A selection of different background pictures and colours means that training sessions can be modified for different individuals. Personal pictures can be implemented.

Background music: Using music from the program or from a CD can optimise the training effect.

Marker setting: The marker function makes it possible to note events that take place during the session and to add comments.
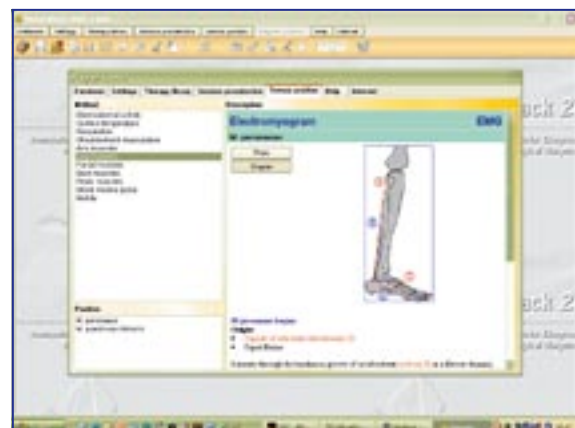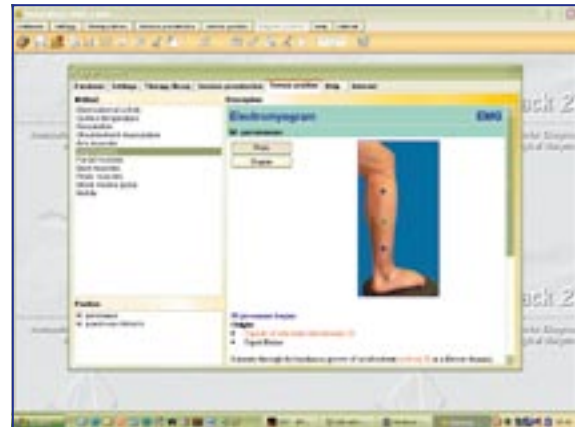
Two application examples

1. Relaxation (stress reduction) with the basic software

- The training is as far as possible carried out with only one parameter, so that the client can concentrate on the way that this changes. At the beginning of feedback therapy it is normal to use the stress test to establish which physiological parameters are most suitable for training in his/her case.
- Other parameters can be monitored out of sight of the client, with the results being displayed on-screen at the end of the session.
- In the quoted example an attempt was being made to raise the temperature of the hand as an indicator of relaxation.
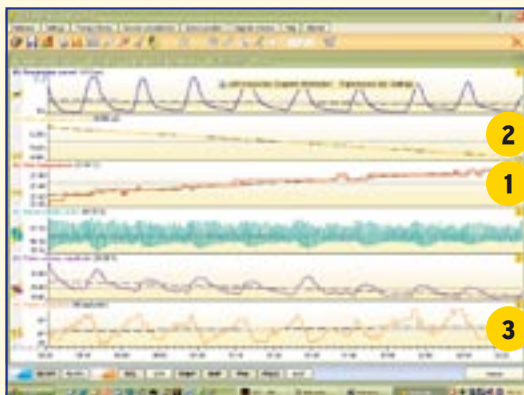
- **Evaluation:**
The extract from the chart shows that the client was successful in raising the temperature of the hand **1** At the same time, skin conductance decreased **2** . Breathing was slow and regular, leading to the development of a respiratory sinus arrhythmia – identifiable from the change in the pulse volume amplitude and pulse frequency **3** . It can be seen from the chart that the goal of the session (relaxation) was achieved.

2. Threshold value training

- Threshold value training is carried out using a single measurement channel. The training in this example used an EMG channel.
- Other parameters can be monitored as controls and displayed on the chart at the end of the session.
- The selection of individual settings (e.g. choice of relaxing music, of a background picture, or of a children's story) facilitates the training process. It is also possible to store these changes as standard settings and to re-use them.
- The reward (music, story) is provided when the reading falls below the threshold – that is, when muscles become relaxed.
- If the training goal has been reached, the therapist can further lower the threshold in order to encourage further muscle relaxation.

Therapy programs for special applications

BFRESP Breathing exercises

Areas of application

• **Relaxation exercises:** Respiration training is particularly suitable for relaxation. Information on respiratory movement is fed back visually and/or acoustically to the client.

• **Essential hypertonia:** In many clients with essential hypertonia a shortening of the exhalation phase of breathing is observed. Where this occurs, respiratory training is recommended.

• **Bronchial asthma:** Respiration training particularly targets the exhalation phase, encouraging correct exhalation practice.

• **Migraine:** The relaxing effect of respiration training proves useful in the therapy of migraine as well as of panic attacks and agoraphobia, for which it is a particularly effective first-line crisis intervention measure.

Hardware requirements

• **Add-on for 2-channel respiration measurement, including breathing belt (ATEM 2)**

• **Breathing belt (ATEM 1)**

• **Radio module RESP**

Description

Dr. Rudolf Marx developed this procedure, which uses an ideal curve to help the client learn how to breathe effectively and correctly. The program analyses the current breathing pattern in terms of respiration frequency and amplitude, and the client is given an ideal respiration curve based on his personal readings. This enables the client's original breathing pattern to be gradually changed. To facilitate achievement of the desired training goal, the therapist can change the properties of the displayed curve, for example with regard to frequency, steepness of the curve, and percentage contributions of inhalation and exhalation.

After at the most 5 training sessions it should be possible for the client to reproduce the ideal breathing pattern, even without feedback.

The advantage of this procedure is that the more beneficial breathing pattern is internalised through "learning by doing" so that it can continue to be used to produce the relaxation effect without the need to display the curve.

During training with a displayed curve there is, paradoxically, an increase in stress, which can be explained by the fact that:

1. It is hard to give up a familiar pattern of breathing, even if it is a dysfunctional one, before the new pattern has become automatic.

2. Natural breathing tends to vary in average frequency and amplitude and is never as regular as that prescribed by the displayed curve.

The goal of respiration training is not the achievement of relaxation during training, but the learning of correct breathing, which then has a relaxing effect.

Recommended session duration: 10 minutes

## A respiration training session

Sequence of breathing exercise

• Before starting breathing exercises, it is useful to display the client's natural breathing pattern by means of lines (multi-feedback), or to monitor it using RESP relaxation exercises.

• The program calibrates itself in response to the amplitude and frequency of the client's readings.
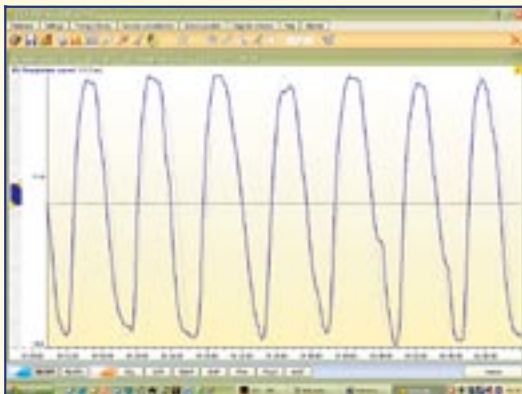
• A respiration curve is displayed, based on the readings obtained from the client. If appropriate, the therapist can make changes to the suggested breathing pattern.

• During training the client attempts to imitate the displayed curve.

• Training is based on an ideal respiration curve which allocates 30% of the time to inhalation, 60% to exhalation and 10% to a pause in breathing. In the inhalation phase heart rate, blood pressure and muscle tone increase; during exhalation they decrease. This means that if the exhalation phase is emphasized, there is a reduction in the effect of the sympathetic nervous system and in the general level of activation.

• A good indicator of relaxation is the extent of the link between heart rate and breathing (respiratory sinus arrhythmia – RSA). This produces an increase in pulse rate during inhalation and a decrease during exhalation; these effects can be observed in biofeedback.

Evaluation

It can be seen from the chart that breathing has changed to fit the displayed ideal respiration curve. The increase in hand temperature, the fall in skin conductance and the development of a respiratory sinus arrhythmia demonstrate the relaxing effect of correct breathing.

Respiration curve

Skin conductance

Hand temperature

Pulse rate
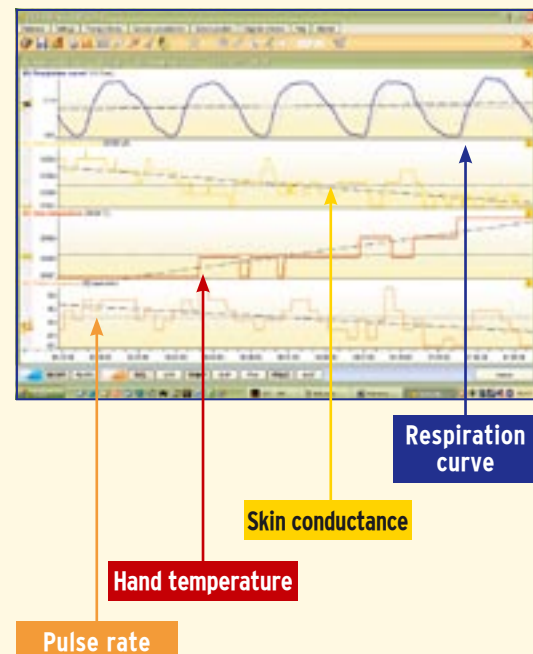
Therapy programs for special applications

BFEDA EDA relaxation exercises

Applications

- **Relaxation training and stress reduction:**
Feedback on skin conductivity is used as an aid to reducing the habitual level of arousal and the level of sympathetic nervous system activity.

With radio modules the client can relax – there are no cables to get in the way.

Description

The training program aims to systematically reduce the skin conductance level, this being an indicator of relaxation and stress reduction.
The activity of the sweat glands can be measured by means of the skin conductance level (electrodermal activity or EDA). The greater the activity of the sweat glands, the higher the skin conductance level. The change in skin conductance is an almost immediate response to the stimulus, occurring within 1.5 – 6.5 seconds. The skin conductance level is therefore an excellent indicator of the relationship between physical and emotional processes – that is, of "internal" tension. A fall in the skin conductance level shows that there has also been a reduction in the level of activity of the sympathetic nervous system.

Recommended session duration: 15 minutes

In EDA relaxation exercises you can choose between the following feedbacks:

- **Face:** The client's attempts to become increasingly more relaxed make the face on the screen smile.
- **Morphing:** For example, a lowering of the skin conductance level can make a caterpillar turn into a butterfly.
- **Depiction for children:** Pictures (a dog, clown etc.) respond to a change in skin conductance by changing their position.
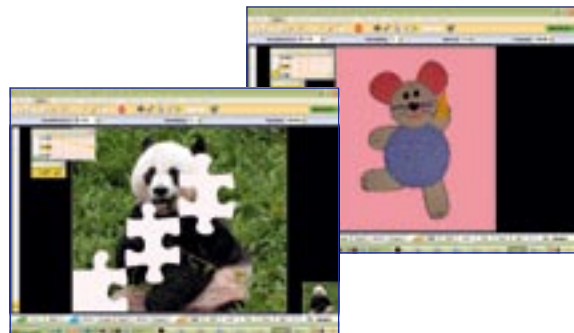
- **Jigsaw Puzzle:** A lowering of the skin conductance level adds missing pieces to a jigsaw puzzle.

- **Audio-feedback:** With eyes closed, the client attempts to reduce the frequency of an audio signal. The level of activity of the parasympathetic nervous system affects the acoustic stimulus – the deeper the note, the lower the level of activity of the sympathetic nervous system.
Music from a CD or directly from the program can also be used as an aid to deepening the state of relaxation.
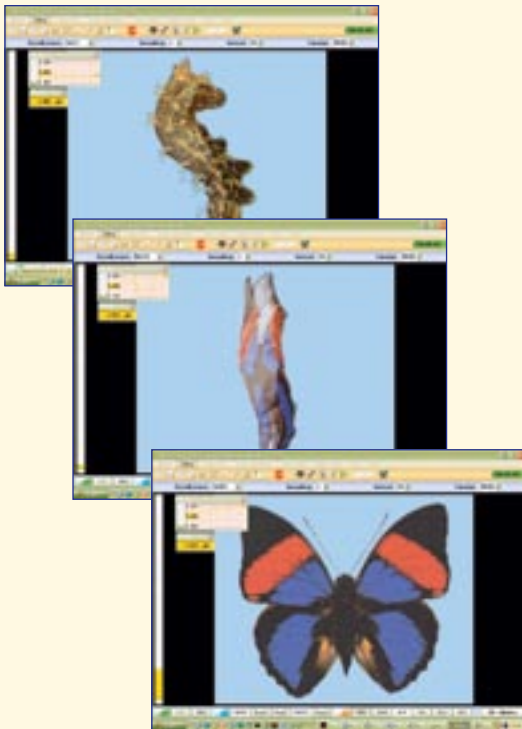
Hardware requirements

- **Radio module MULTI**
- **EDA electrode cable, 2-pole**

A BFEDA relaxation exercise session

Sequence

- The goal of training is a reduction in the skin conductance level
- The "morphing" program has been chosen for the provision of feedback.

Picture sequence MORPHING: from caterpillar to butterfly

- The caterpillar changes into a butterfly as the skin conductance level falls. Feedback is provided only by means of the changes in the picture.
The client learns how to deliberately induce a state of relaxation.

Evaluation

The skin conductance level chart demonstrates that the immediate goal of training was achieved. The skin conductance level has clearly fallen; the general level of activity has been reduced.

Therapy programs for special applications

BFKON Confrontation training with picture sequences

Applications

- **Phobias:** Training is carried out as part of a systematic desensitisation program and aims to enable the client to maintain a low skin conductance level while being shown pictures with phobia-inducing content.
- **Panic attacks:** The aim is to use relaxation exercises to reduce the general level of stress and the susceptibility to panic attacks.
- **Anxiety disorders:** Objective feedback on successful responses increases the individual's autonomy and sense of being in control. The connection between physical and emotional events can be readily seen and understood; this can provide an introduction to a psychosomatic understanding of illness, even where organic disease is present.
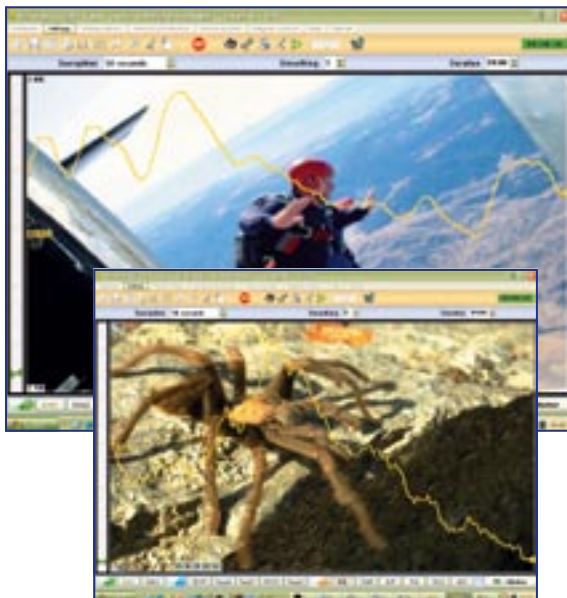
Constructing one's own picture sequences and incorporating them into the program can treat specific anxieties of particular clients.

Description

During the session, pictures with phobia-inducing content are shown on the screen. These produce symptoms of anxiety or arousal, enabling the client to observe the reactions of his autonomic nervous system under extreme conditions and to attempt to control them. Systematic desensitisation can be achieved by ordering the pictures according to the strength of the anxiety or arousal response which they induce.

Because of its responsiveness, the skin conductance level can be taken as an indicator of anxiety or "internal" tension. However, as the various vegetative systems (EDA, pulse, etc.) respond differently in different clients, care should be taken to monitor a range of different parameters.

Recommended session duration: 10 minutes

Hardware requirements

- **Radio module MULTI**
- **2-pole EDA electrode cable**
- **Can be used in conjunction with all other modules and recording devices**

BFVID Confrontation training with video

The following topics are covered:

- **Claustrophobia**
- **Acrophobia (vertigo)**
- **Anxiety in traffic situations**
- **Fear of animals**
- **Fear of flying**
- **Fear of medical examinations**

Hardware requirements

- **Radio module MULTI**
- **2-pole EDA electrode cable**
- **Can be used in conjunction with all other modules and recording devices**

Description

BFVID uses video clips rather than picture sequences for confrontation training. Through our partnership with the company "Psycho-Vision", a series of psychologically relevant videos has been integrated into the software. While the video is being shown, psychophysiological responses can be monitored and the results displayed, and training can take place. The video clips are 30 seconds long. Longer video sequences lasting up to an hour can be ordered from Psycho –Vision GmbH (www.psycho-vision.de).

Therapy programs for special applications

BFMUSK Neuro-muscular rehabilitation

Applications

Biofeedback from muscles is used primarily in the therapy of floppy paralysis, injuries and disorders affecting mobility, torticollis, and radicular headaches.

• **Incontinence:** Vaginal and anal electrodes are used to record the EMG of the pelvic floor muscles. Training in relaxing and contracting these muscles gradually strengthens them and leads to a reduction in symptoms.
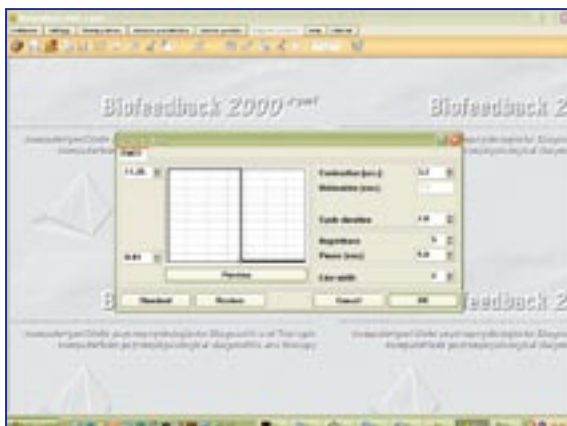
Neuromuscular rehabilitation: calibration

Description

Specific muscle groups are contracted in accordance with instructions displayed on a chart (see illustration). The program is based on readings obtained from the client in the calibration phase.

Only 75% of the maximum reading obtained during calibration is required in the training phase; this ensures that the training is not too demanding for the client. There are 7 sensitivity settings and 4 different filters which ensure that the client receives encouraging feedback even if only weak muscle signals are received. In order to make training easier in the early sessions, changes can be made in the duration of the contraction phases, the number of repetitions and the length of pauses, to suit the individual client.

The aim of training is to increase the degree of control over muscle tension and to gradually develop the strength of the muscles involved.

Recommended session duration: 10 minutes

Neuromuscular training phase

Hardware requirements

- **Radio module EMG**
- **EMG-Set (2 two-pole and 1 one-pole electrode cable)**
- **Can be used in conjunction with all other modules and recording devices**

Vaginal and anal electrodes for incontinence training

Therapy programs for special applications

BFEMG Electromyography

Applications

- **Cervical syndrome:** The aim of training is to reduce the difference between the tone of the left and right sides of the trapezius muscle.
- **Back pain:** The electrodes are positioned on either side of the spine, level with the site of the pain or muscle tension. The aim is not only to lower the readings obtained but also to minimize the difference between the two EMG channels.

It is also possible to request the client to take up different physical positions and then in subsequent discussion of the session to analyse the positions in which pain appeared.

- **Tinnitus:** EMG relaxation training is recommended for the therapy of tinnitus. Depending on the initial diagnosis and the exact site of the problem, readings can be taken from the masseter, trapezius or sterno-cleidomastoideus muscles. This should ideally be combined with progressive muscle relaxation in order to ensure a generalization of the relaxation effect.
- **Bruxism:** Either EMG relaxation training incorporating lines (multi-feedback) or EMG feedback with threshold value training can be used. Biofeedback records the electrical potential of the masseter muscle during sleep.

The radio module and easy-to-wear self-adhesive electrodes mean that therapy is very patient-friendly.

Hardware requirements

- **Radio module EMG**
- **EMG set (2 two-pole and 1 one-pole electrode cable)**

Description

A fall in muscle tone is accompanied by a reduction in the activity of the sympathetic nervous system. This training can therefore also be used for general relaxation.

Using the "comparative values" method of training, the client is shown how muscle tension varies between two muscle groups – for example, between the left and right sides of the trapezius, or when positioning the electrodes at the same level on either side of the spine. Showing both readings calibrated in the same way on one chart makes training

considerably easier. Since radio modules are used there are no limitations on where the electrodes can be placed. The sensor cables can be supplied in lengths to suit the user's requirements.

With 4 different frequency ranges (for slow twitch and fast twitch muscle fibres) and 7 different recording ranges (adjustable amplification) the requirements of any type of training can be met.

Recommended session duration: 15 minutes
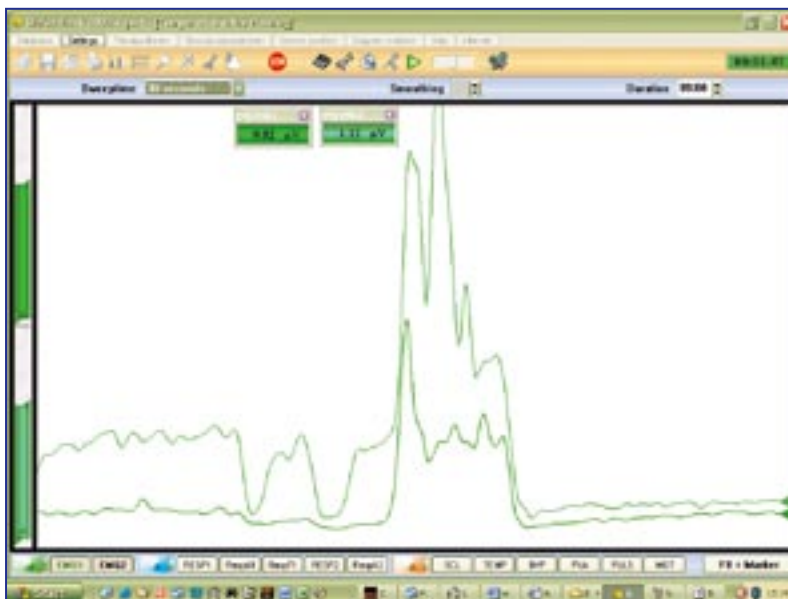
"Comparative value" training aims to achieve not only a reduction in muscle tone but also an equilisation of the readings obtained from the two different channels.

Therapy programs for special applications

BFVASO Blood circulation

Applications

- **Raynaud's disease:** This is triggered by hyperactivity and vasospasm in the blood vessels as a result of exposure to cold and/or emotional stress. The first step should be to carry out handwarming training using the "sun" training program. Subsequently the client should attempt to maintain vasomotor control in temperature conditions which normally trigger the symptoms (cold situations are portrayed on the screen), since the peripheral vasospasm usually occurs when the ambient temperature is very low.
- **Migraine:** Temperature feedback from the non-dominant hand is used to help the client acquire control over his vasomotor activity. A combination of temperature feedback and relaxation training is particularly effective and should be combined with detailed recording of attacks and medical investigation of the symptoms.
- **Essential hypertonia:** The aim is to reduce the activity of the sympathetic nervous system. One of the most reliable signs of physical relaxation is the sensation of warmth in the hands. These feelings are a consequence of vasodilatation (widening of the blood vessels) in the extremities, which leads to a fall in blood pressure. Alongside the classic handwarming training it is worth using relaxation training, respiration training, and a lowering of the resting pulse.
- **Temperature training:** One of the most reliable signs of physical relaxation is the sensation of warmth in the hands. The client is taught how to warm his hands. Techniques involving imagination, involving for example pictures of a sunrise, have proved very useful.

Description

Changes in the peripheral blood supply are controlled by the blood vessel mechanism – that is, by the sympathetic arousal of the vasoconstrictor fibres. Feedback can be effected either via the temperature sensor or via the pulse sensors. The temperature sensor measures the current skin temperature at one of the extremities (e.g. the hand). The pulse sensor calculates the pulse volume amplitude – that is, the difference between maximum and minimum blood flow within one heart cycle. This value is larger when the blood vessels are wider (i.e. when blood flow is increased) than when the vessels are constricted. An increase in pulse amplitude and a rise in skin temperature are both indicators of increased relaxation.

In addition to the choice between lines (multi-feedback) and threshold value training, a choice can also be made between the "sun" training and the "visual stimulus presentation" training. Both types of training are carried out with temperature sensors.

Recommended session duration: 15 minutes

Hardware requirements

- **Radio module MULTI**
- **Temperature sensor**

"Sun" feedback mode (handwarming training). Warming the hand produces a "sunrise". An overrun function makes it possible to continue the relaxation training even when the training goal has been reached – i.e. the process re-starts after the sunrise.

Visual stimulus presentation (only possible with BFKON): The subject has to raise his hand temperature even when cold images (e.g. snow scenes) are displayed. It is of course possible to incorporate one's own pictures into the program.

Therapy programs for special applications

BFSTR Activation screening (stress test)

Applications

- **Stress management**
- **Psychosomatic stress-related problems**
- **Analysis of response-related physiological parameters**

Preparatory phase and confrontation phase with a stress inducer.

Hardware requirements

- **for investigative purposes as many as possible of the available monitoring devices should be used**

Unfavourable profile ① *and favourable profile* ② *of the skin conductance level during a stress test*
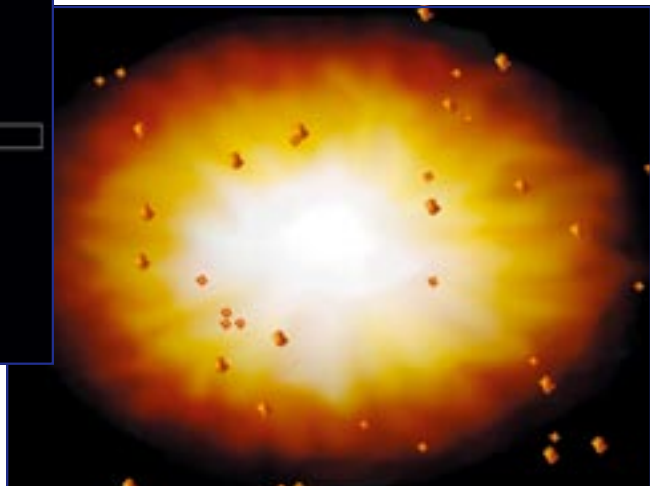
Description

Activation screening is divided into 4 phases
- Relaxation phase (baseline)
- Preparatory phase
- Confrontation phase with stress inducer (visual and acoustic)
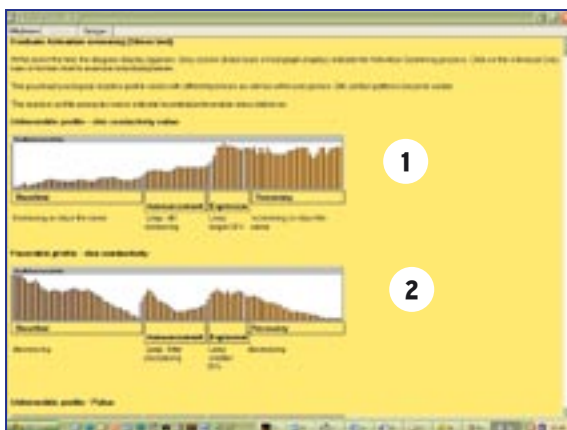- Relaxation phase

During the four phases it is desirable, so far as possible, to record all the client's physiological parameters. The subsequent evaluation reveals the vegetative systems (cardiovascular, skin conductance, muscle tone etc.) which show the most marked response for that client. Further training sessions are then carried out in these particular areas. In addition, the BFSTR program can be used to gather information about the way in which emotional processes relate to time (e.g. anticipatory anxiety) and about how stressful situations are dealt with.

Test length (pre-set): 6 minutes

BFBEL Tolerance test

Applications

- **Stress management**
- **psychosomatic stress-related problems**
- **psychophysiological stress tolerance**

Description

The program aims to identify the psychophysiological components of the client's responses.

During a session the client, using clicks of the mouse, has to make assessments of factors such as the shape, colour and acoustic pitch of a moving geometric shape. The computer calculates the difficulty of the task and adapts it in response to the client's performance, thus subjecting the client to the optimum level of persistent stress. Depending on the client's performance, the level of difficulty can also be adapted to the client by reducing the number of selection criteria (e.g. removing the audio signal).

As this procedure makes use of the mouse, the effects on the musculature of working position and stress can also be observed.

Test length (pre-set): 3 minutes
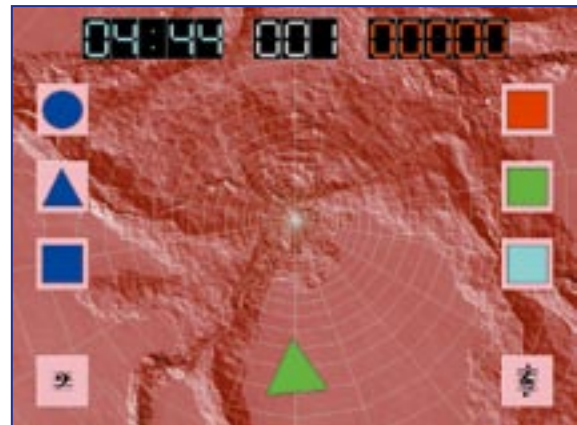
Geometric shapes have to be sorted according to colour, shape and accompanying acoustic signal.

Hardware requirements
- **for investigative purposes as many as possible of the available monitoring devices should be used**

Therapy programs for special applications

BFREC   Voice recorder

Applications

- **Taking case history**
- **Investigations**
- **Sessions treating anxiety disorders**

Description

During discussions with a therapist (history taking, investigation of a problem) the conversation itself can be recorded at the same time as the physiological parameters. To avoid undesired feedback effects, the screen should be placed out of sight. At the end of the session the therapist and client together can analyse in more detail the areas of conversation which produced an increased response in the autonomic nervous system. As the speech recording is played back, it is possible to pick out the points in the chart at which the physiological parameters show the most significant response and to match these to the corresponding speech sequences.

Hardware requirements

- **MIKRO (microphone for speech recording)**
- **Radio modules and sensors depending on the issue to be addressed**
- **for investigative purposes as many as possible of the available monitoring devices**

Application in group settings

Biofeedback 2000 $^{x\text{-}pert}$ can transmit signals from up to 7 modules or 20 channels simultaneously. This makes it possible to monitor physiological parameters in a group setting and subsequently to discuss the content of the conversation and the physiological responses with the participants.

BFSTAT   Statistical module

Application

The statistical module is a program which enables data acquired with **Biofeedback 2000** *x-pert* to be processed for further statistical purposes.

Description

BFSTAT provides a simple means of selecting a session's physiological parameters which are to be statistically recorded and processed. Both standard and filter values can be individually set.

The program can remove artefacts and smooth out data. It enables parts of a session to be compared by dividing the session into intervals (e.g. defined by markers). The required parameters can then be calculated for these units of time. Intervals can be of any type; a selection menu is used to determine which interval parameters will be calculated.

Since **Biofeedback 2000** *x-pert* can be combined with the Vienna Test System (the computerized psychological diagnostic tool produced by the company Dr. G. Schuhfried), it is possible, for example, to record physiological responses during a performance test or reactions in response to errors and to include these data in the statistical evaluation. Data can be exported in a form compatible with the SPSS statistics program or in "tab separated" form (e.g. for Excel). The information is therefore ready for use in all standard statistical applications.

Selection of intervals to be evaluated

Accessories

Microphone

High-quality microphone for speech recording (BFREC) – for practical recording during sessions.

Charger

For charging the module batteries.
Charging time: 2-3 hours
Operating time: up to 10 hours

Headband

The headband is used to attach the pulse sensor in the region of the temporal artery (vasoconstriction training).

Storage and transport bag with shut-down plug

Shut-down plug prevents the battery from discharging. The practical storage and transport bag with shut-down plug prevents accidental discharging of the modules.

Disposable electrodes

The sensor cables of our modules have new clip connectors which can be used with all standard disposable electrodes.

Marker cables

The marker cable is used to link the biofeedback system to the Vienna Test System, making it possible to observe physiological responses under conditions of performance pressure.

Connection to the VTS or another external device requires a free RS232 (serial) port.

Velcro strips

The Velcro strips for attaching the sensors and modules are easy to change.

USB radio dongle

Receives signals from the radio mudules

29

Technical data

MULTI	Notch filter	2	50 / 60 Hz
	Temperature	Range	10 – 40 °C
		Accuracy	0,5 °C
		Resolution	0,01 °C
	Pulse	Range	0 – 100 %
		Amplification	Automatic adjustment
		Heart rate	30 – 200 bpm
	EDA (skin conductance)	Range	0 – 50 µS
		Max. error	0,65 µS
		Resolution	0,001 µS
	MOT (3-axis acceleration)	Range	0 – 20 m/s^2
		Sensitivity	0,006 m/s^2
		Resolution	0,05 m/s^2

RESP	Channels	2
	Resolution	0,2 mm
	Measurement range	20 cm

EMG	Channels	2
		Frequency ranges
	Slow-twitch muscle fibres	25 –80 Hz
	Fast-twitch muscle fibres	100 – 200 Hz
	Slow-twitch and fast-twitch muscle fibres	25 – 200 Hz
	Overall range	25 – 500 Hz
	Anti Aliasing Filter	8th order
	Notch range	50 / 60 Hz
	Measurement range	0 – 15 µV
	(Adjustable amplification)	0 – 30 µV
		0 – 60 µV
		0 – 125 µV
		0 – 250 µV
		0 – 500 µV
		0 – 1000 µV

System requirements

- Pentium III or compatible 800 MHz processor
- 128 MB RAM
- 200-500 MB free hard disk space, depending on which product modules are to be installed
- CD-ROM drive
- 16-bit MIDI-capable sound card
- 32 MB graphics card
- Windows 98SE/ME/2000/XP

Minimum requirements for the radio modules

- One free USB port

Products of the company Dr. Gernot Schuhfried GmbH. are developed and produced in accordance with the requirements of EU directive 93/42/EWG. They comply with the Medical Devices Act and therefore bear the CE mark. This confirms that they meet the requirements of the safety regulations and electromagnetic compatibility guidelines for electrical medical devices (EN60601), the biocompatibility guidelines (EN30993) and other product-specific regulations. The company Gernot Schuhfried GmbH. is certified in accordance with EN ISO 13485:2003 which guarantees that the required quality management procedures are implemented.
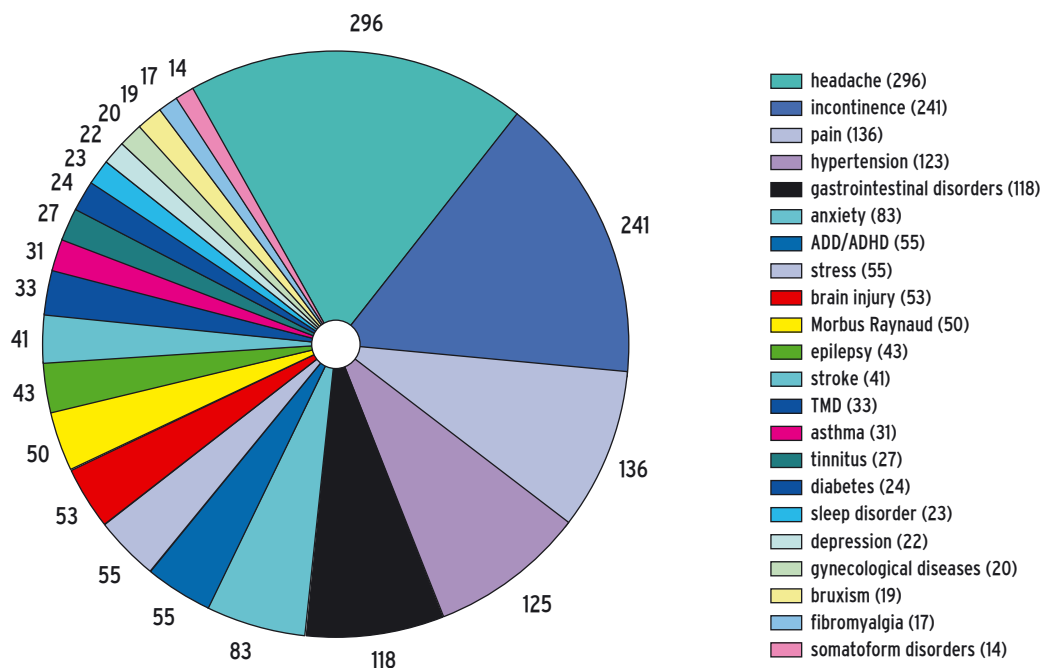
Scientific studies of biofeedback

A wide range of scientific studies have investigated the therapeutic effect of biofeedback and confirmed the usefulness of the procedure. A survey of the literature carried out by the **Deutsche Gesellschaft für Biofeedback** (German Society for Biofeedback) found that the literature databases **PsychInfo** and **Medline** alone yielded 1606 references for the period 1972 – 2004 which dealt with the therapeutic application of biofeedback. A particularly large number of studies related to the topics of headaches, incontinence, general pain and blood pressure. The diagram gives an overview of the number of studies and the topics covered in biofeedback research.

More detailed information can be obtained from the Association for Applied Psychophysiology and Biofeedback **www.aapb.org**

For a more detailed introduction to the subject of biofeedback, and for further information about it, we recommend the following publications:

Schwartz, M. S. (Pub.) (1995): Biofeedback: A Practitioner's Guide. 2nd edition. New York.

James W. Kalat (2003): Biological Psychology. Wadsworth Publishing; 8th edition, ISBN 0534588166

- headache (296)
- incontinence (241)
- pain (136)
- hypertension (123)
- gastrointestinal disorders (118)
- anxiety (83)
- ADD/ADHD (55)
- stress (55)
- brain injury (53)
- Morbus Raynaud (50)
- epilepsy (43)
- stroke (41)
- TMD (33)
- asthma (31)
- tinnitus (27)
- diabetes (24)
- sleep disorder (23)
- depression (22)
- gynecological diseases (20)
- bruxism (19)
- fibromyalgia (17)
- somatoform disorders (14)

Customer support

Company headquarter, Mödling / Austria

Branch office Mannheim / Germany

We take customer service seriously and aim to offer the best possible support in all areas.

• Specialist consulting

A team of experienced experts is always available to answer your technical questions.

• Product information

Our consultants are happy to provide information about all our products. Please ask for a **product presentation.** We also offer **workshops on biofeedback**, providing a useful introduction to our systems.

• Support

For hardware- and software-related questions please contact our **Support** or our overseas agents.

Austria:
Dr. Gernot Schuhfried G.m.b.H., Mödling
Tel.: +43 (0) 2236/423 15-0
info@schuhfried.at

www.schuhfried.at

SCHUHFRIED
Qualität durch Kompetenz

DEMO – CD

If you wish a **Biofeedback 2000** *x-pert* Demo CD please contact your dealer or the Schuhfried Company.

Other computerized systems

Computerized psychological tests with the Vienna Test System

Computerized cognitive training procedures with RehaCom

We have used the most up-to-date technology available to make sound psychological diagnostic tools available in a simple and practical way in the form of the Vienna Test System. The principal areas of application are health psychology, traffic psychology, aviation psychology, work and organisational psychology and sport psychology.

In rehabilitation following head or brain injury, in age-related performance impairment, in psychiatry and in children's concentration problems – RehaCom designs and carries out individual training sessions in areas of cognitive performance such as attention, memory, logical thinking, visual-motor skills and responsiveness.

Austria:

Dr. Gernot Schuhfried G.m.b.H.

2340 Mödling

Hyrtlstraße 45

Tel.: +43(0)2236/423 15

Fax: +43(0)2236/465 97

e-mail: info@schuhfried.at

www.schuhfried.at

SCHUHFRIED

Qualität durch Kompetenz