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Individual devices and integrated systems.

Equipment and Software Information.



Serving Psychophysiology for 25 years.

C-NTACT
PRECISION INSTRUMENTS

PsychLab: Index.

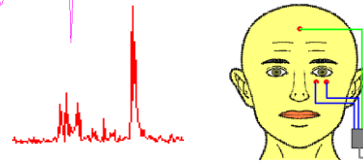
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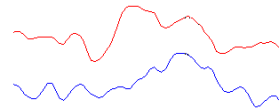
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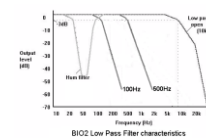
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See our leaflets on specific topics, download them from our web site.

PsychLab software supports synchronized video capture.

This catalogue was last modified in October 2009.

Disclaimer.

Information is supplied in this catalogue in the spirit of providing helpful guidance to assess suitability of the products described. Contact Precision Instruments and its owner / president Roger Dow are not responsible for any errors that may be found. Specification is subject to change at any time.

No device made by Contact Precision Instruments is suitable to be used for showing vital signs. When used in the United States of America, equipment described herein is intended only for research use with volunteer subjects. While all human connected devices are safe to medical isolation standards, devices are not 510k approved and should not therefore be used for diagnostic or medical purposes, except where 'IDE process', Investigatory Device Exemption, is obtained by the relevant ethics committee.

PsychLab Integrated laboratory systems.

Based on our high quality amplifier technology developed over 25 years, this PsychLab range eliminates the need for expensive 'base station' and power supply units. It simply plugs in and powers itself directly from the USB.

The devices come in 1, 2 or 4 channel models, and represent a considerable financial saving over previous systems. They are also smaller, and more convenient to use. An internal microcontroller organizes data conversion and transmission to the host computer via USB. A unique synchronization system allows multiple devices to be used together, so that a large integrated laboratory with a variety of measures can be implemented with precise timing at high sample rates.



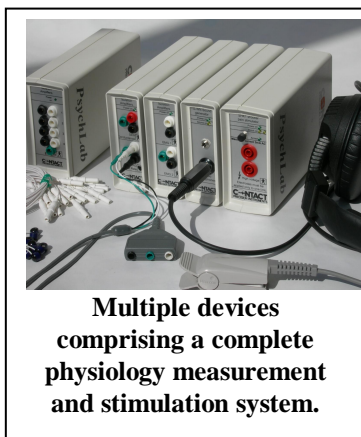
2 channel amplifier.

PsychLab Software.

Devices are compatible with our existing software previously used with our SAM range, including our PCC stimulus control language. Please see our other leaflets for further details of specific applications, such as Startle, Emotion studies and so on.

Video synchronization.

PsychLab software also permits synchronized video recording directly on the hard drive. It allows web-cams or professional cameras to be used to monitor the subject while the experiment proceeds. The video image may be replayed when data are analyzed, synchronized with physiology wave-forms.



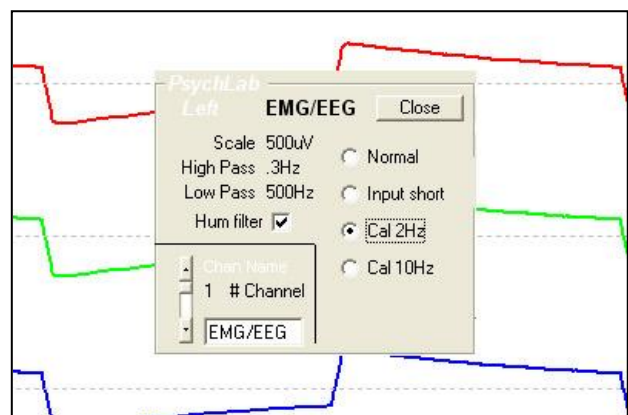
Multiple devices comprising a complete physiology measurement and stimulation system.

Third party software.

Data are stored in EDF format which may be read by other programs. Each device can provide analogue output for use with other data acquisition systems.

Filter, Gain and Input control.

Where appropriate, devices include remote adjustable filter gain and input control. A panel in the PsychLabAcquire shows the setting of these parameters, and allows it to be changed by clicking on the value. This setting is then stored in the hardware device, so that if it is turned off or disconnected from the computer, it will retain whichever setting has been chosen.



Event synchronization.

An event synchronization port is provided at the rear of each amplifier. It allows synchronization with other programs and equipment by providing an 8 bit I/O channel. We provide purpose designed connectors to link up to a computer parallel port, used by programs like MatLab* and E-Prime*, or it can be linked to another device like the I/O card

used with SuperLab*. These stimulus applications can be programmed to present cues via the I/O medium which are thus registered in the PsychLab event channel. Subsequently when data are analyzed these cues are used to section data for analysis, under macro control.

The event synchronization port also allows multiple devices to be linked together. They will then synchronize with each other, so that they all sample data at the same rate. Files collected at the host computer from each device are therefore synchronized, sample by sample.

*MatLab, E-Prime and SuperLab are trademarks of their respective companies.

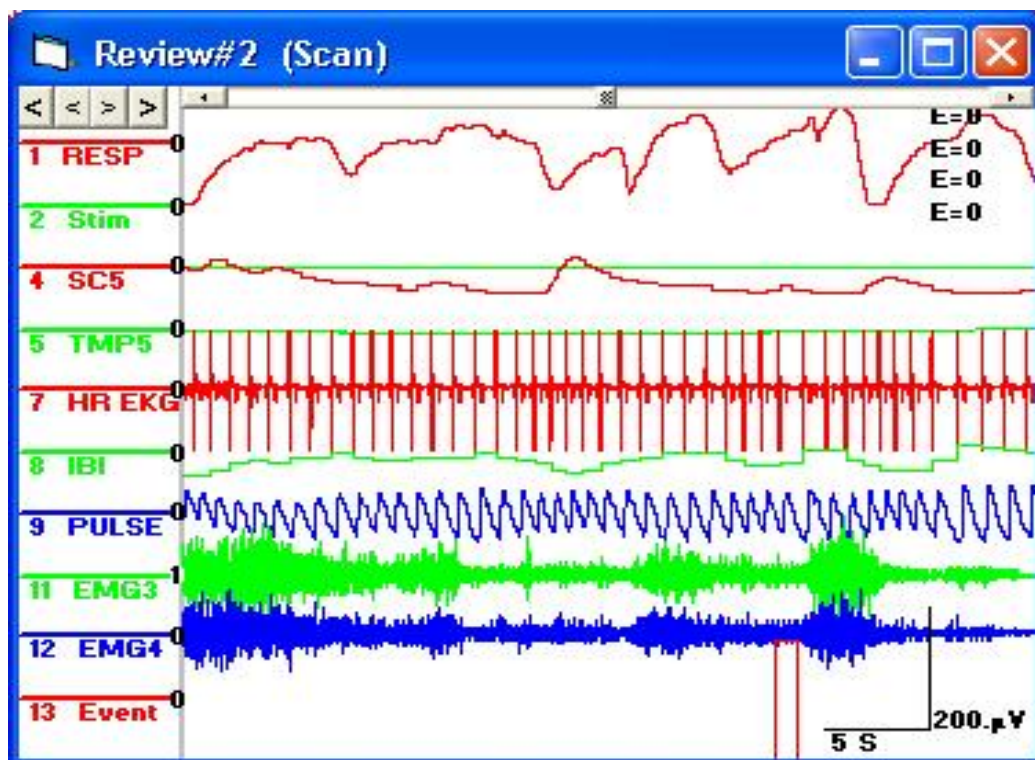
Analogue input and output.

External devices (e.g. eye track systems) may produce analogue output. This can be routed into the PsychLab amplifier via the rear event port socket (not isolated) and registered on a spare channel of the internal A-D converter.

All PsychLab amplifiers can also be configured to produce analogue output $\pm 5V$, for use with other data acquisition systems and such like if required. Note that control of amplifier functions, if any, requires connection to a computer. Once set, however, functions remain in the device even when it is turned off and on again. Also note that the amplifiers obtain power from the USB connection. If the amplifier is to be used without the presence of a computer, it may be powered by a USB hub which does not need to be hooked up to the computer. There may be an additional charge for analogue input and output provision because it involves some internal modification of the standard units.



USB socket at rear of each amplifier. Also the event synchronization port which allows synchronization with programs such as Superlab, E-prime, etc.

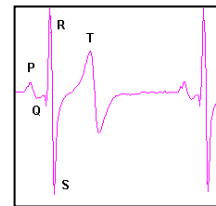


Measures from a variety of amplifiers are synchronized together, and with video, if recorded.

EKG and Heart Rate.



EKG (ECG). The EKG Amplifier allows high quality measurement with minimum possible noise. Analogue filters are normally set to provide bandwidth 10Hz 100Hz, to admit the R wave but attenuate T and other components of EKG. Electrodes are attached to the body in convenient positions either side of the heart. They can be placed on the collar bone and waist (see picture), alternatively they may be positioned on the wrists, although this produces a smaller signal and is more

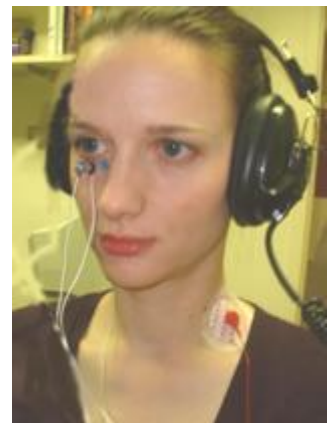


subject to artefact. Electrodes are plugged into the white and black sockets on the pre-amplifier. For data analysis purposes, it is advisable to standardize connection, so that EKG is always recorded with the same polarity. The green socket may be connected to a third electrode positioned anywhere on the body.. A CL31 lead is used in conjunction with EL2 dot snapper leads and EL4 electrodes (standard disposable hospital type dot snapper).

EMG and Startle blink.



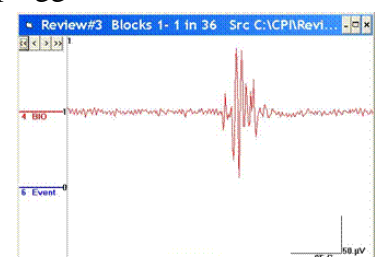
Facial EMG and eye blink are some of the more demanding applications requiring wide bandwidth and extremely low background interference at very high gain. The EMG Amplifier is ideally suited to these applications. Filtering is normally set to admit bandwidth 28Hz – 500Hz. The EMG amplifier is available in 2 and 4 channel options. It provides 4 remote control settings of gain (max = 100,000), 5 remote controlled filter settings and remote



Startle electrodes

control of hum filter and calibrator / input switching.

EL1 (TDE23) electrodes are positioned across the muscle site and plugged into the red and white 'active' measurement sockets. A third, separate electrode may be positioned anywhere on the body. This is an 'isolated ground' connection, not a 'reference' and does not in any way effect the measure between the two active electrodes (other than to reduce noise). For further information please see our leaflets on Startle Blink and Emotion Studies, which may be downloaded from the PsychLab website.



EEG, ERP and EOG (for blink detection).



A choice of EEG amplifiers is available, including our well loved EEG8 unit, or smaller, less costly 4 and 2 channel amplifiers. Adjustable analogue filters are provided to remove interference prior to A-D conversion



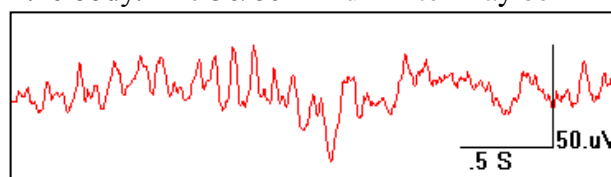
EL3 dome electrodes, suitable for many small montage EEG applications.



allowing excellent signal resolution by the internal 16 bit A-D converters. All devices including EEG8 require just a USB cord to convey both power and data.

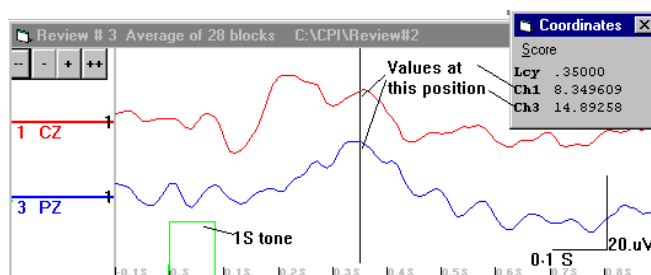
Differential or common reference input is available. Individual EEG electrodes (EL3) or the electrode cap may be attached to the active measurement sites and plugged into the white (+) input sockets of each Amplifier. In differential mode, the - electrode is positioned at the negative position and plugged into the black socket of each individual Amplifier. A third 'body' electrode must be placed at any point on the body. The 50/60Hz hum filter may be used to further reduce interference.

Maximum sample rate <4.5kHz on all channels simultaneously is available in the current model (2007). Analogue output is also available allowing the amplifier to be used with other data acquisition systems.



Amplifier units may be banked for 8, 16, 20 or 32 channel systems, for example. Each amplifier unit is small enough to be used in ambulatory applications, and can be fitted with <32Mb of internal flash memory.

EOG. True DC coupled EOG may be measured with the wide purpose single channel BioAmplifier. EOG for the purposes of blink correction in EEG measurement may be measured with a separate 2 channel EEG amplifier.

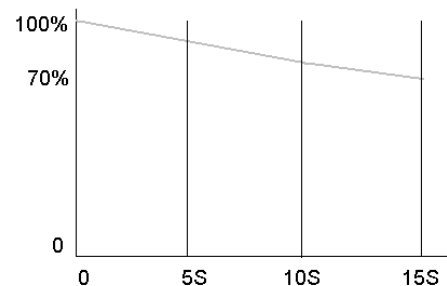


Example of auditory P300 measured in an oddball paradigm.

P300. Studies involving P300 in visual, auditory or other paradigms including novel experiment models may be accommodated using PsychLab software. Please see the PsychLab EEG-ERP information leaflet.

CNV and readiness potential. The wide purpose single channel BioAmplifier provide >0.01Hz High Pass filter setting suitable for expectancy wave detection.

The BioAmplifier specification described next also applies to these multi-channel EEG amplifiers.



Amplitude reduction effect of the 0.01Hz high pass filter on a constant level over time.

DC Coupled BioAmplifier.



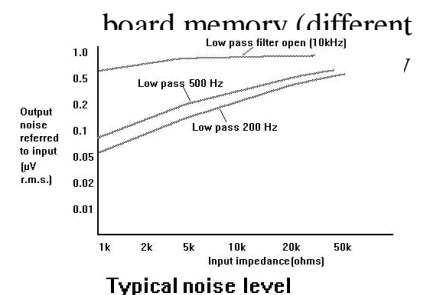
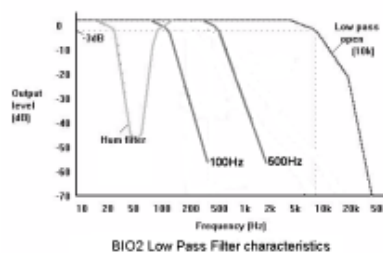
This modified version of the standard BioAmplifier was developed specifically for EOG applications where the DC voltage produced with eye movement is to be measured.

A vernier control on the front panel allows DC balancing of the input stage $\pm 0.5V$. In addition to the normal high pass filter settings provided with the standard BioAmplifier, the 0.03Hz setting is replaced with a DC setting, whereby the high pass filter is completely disabled allowing DC potentials to be measured without time constant distortion.

With the exception of the DC amplification facility, the specification of the DC BioAmplifier is identical to that of the standard BioAmplifier, described below.

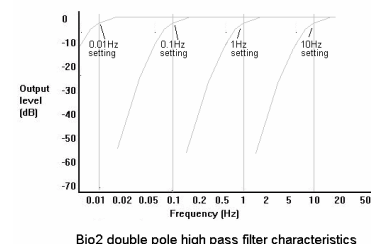
EEG & BioAmplifier: Technical details.

- 9 settings for 24dB high pass filter from 0.01Hz – 30Hz. (5 settings EEG4/2)
- 8 settings for 48dB low pass filter from 40Hz – 10kHz. (4 settings EEG8, fixed LP freq EEG4/2.)
- Bessel filters optimized for minimal phase distortion.
- Uncomplicated filter design recovers well from transients.
- 8 gain settings from 200,000 – 2000 (2 settings EEG4/2, 50,000 and 25,000).
- T notch hum filter, 50/60Hz. Selectable.
- Internal calibrator and electrode impedance checker (not EEG4/2)
- Analogue filters allow higher resolution at A-D.
- Linear analogue opto-coupling.
- Analogue output if required, after isolation barrier.
- <5kHz sample rate. (2.5kHz EEG8)
- 32Mb on gain/filter devices).
- USB interface



Specification:

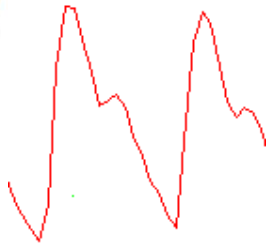
NoiseLevel < 1uV RMS unfiltered R.T.I.
 Common Mode Rejection > 100dB
 Input Impedance >100 M Ohm, 20pF
 Calibrator Accuracy 1%
 Hum Filter 50/60 Hz > 60 dB
 Voltage Output $\pm 5V$ adjustable
 Subject Isolation > 6000V, 100 M Ohm



PPA Peripheral pulse and respiration.



The Pulse coupler operates with photoplethysmograph transducers which detects changes in blood flow by passing light through the finger and picking it up with a photo-sensor. Infra-red and normal light are used. PsychLab provides two transducers, PT1 and PT2 for measuring peripheral pulse from the finger or ear. Heart Rate may be obtained from this measure, but it is more reliable when measured using EKG.



*Illustration:
Left - typical
pulse wave-
form produced
from the PT1
transducer.
Right - the
PT2 ear clip
transducer.*



Pulse gain and filtering may be adjusted in two steps from the computer control program. Additionally a manual gain control with 4 steps is provided. The amplitude of the resulting wave-form may be quantified off-line as described here for respiration, using PsychLab slope detection system (WAVE) to obtain both Heart Rate and relative pulse volume.

Respiration.

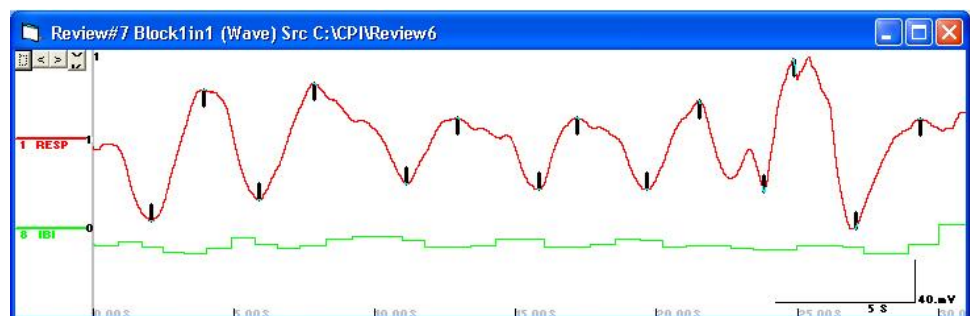
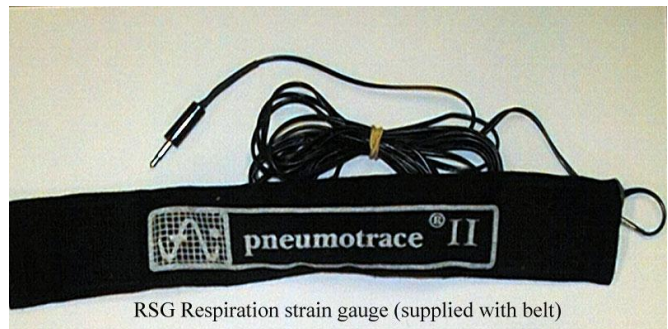


The Pneumotrace transducer is positioned around the lower chest to produce this measure. Respiration is a difficult measure when the subject is at all active or involved in speech. The graph shows a period of resting respiration, with the waves automatically detected, from which respiration rate can be calculated.

Respiration gain and filtering may be adjusted in two steps from the computer control program. Additionally a manual gain control with 4 steps is provided.

Analogue output from both pulse and respiration channels is available on the 15 way 'event synchronization' D connector at the rear

Both Pulse and Respiration amplifiers are also available individually. The unit requires just a USB cord for both power and data.



Temperature coupler.



The Precision Temperature Coupler provides very high sensitivity to changes in temperature, capable of registering better than 0.001 of a degree Celsius. Temperature reading from the probe is digitized right at the electrodes using 24 bit accuracy.



An active linearized temperature probe (TP) converts temperature into voltage levels. This is directly converted to digital, using a 24 bit A-D converter. Serial data are then transferred across the medical grade optical isolation barrier to the USB interface.

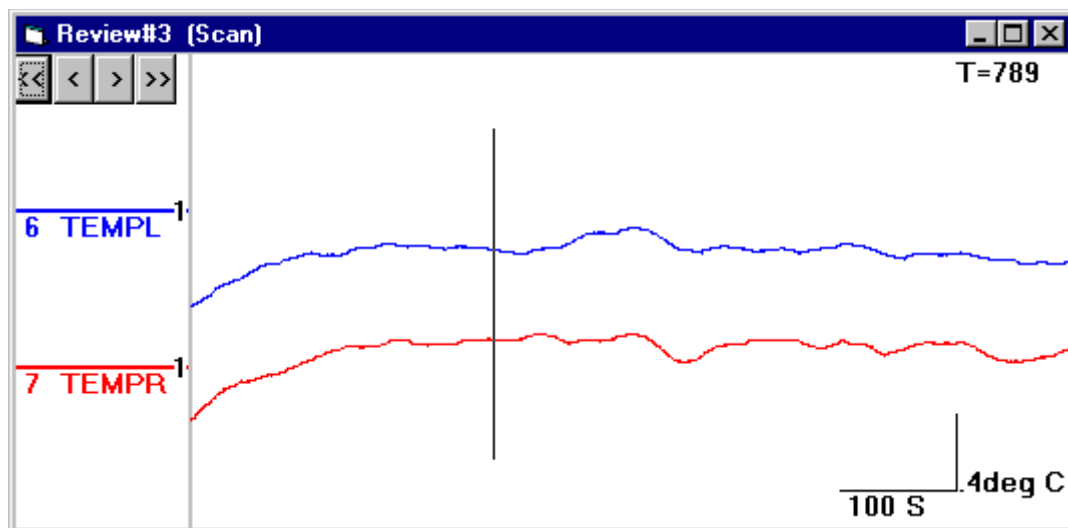
The temperature probe may be attached to the skin (e.g. finger). It should be taped in position using micropore or similar tape, with cotton wool to protect it from the air.

If it is intended to measure body temperature, the probe should be suitably adapted for internal use. The probe is suitable for positioning externally on the body; modification is needed to protect it from fluids if it is used internally.

When used externally, cotton wool will prevent heat conduction away from the probe, otherwise drafts in the room will cause noticeable temperature fluctuations.

Illustration: Temperature changes in the left and right hands during a conditioning experiment of 800 seconds duration. The co-ordinates panel (right) shows absolute temperature readout at the point where the vertical black line has been scored on the temperature traces.

Coordinates	
Score	
Lcy	299.25000
Ch6	34.327
Ch7	33.967



Specification:

Absolute accuracy:	limited only by measuring probe
Resolution:	5.96e-6 degrees Celsius (theoretically)
Safety isolation:	5000V
Frequency response:	10Hz
Internal sampling frequency:	80Hz
Analogue outputs:	18bit, +/- 5V, when fitted.

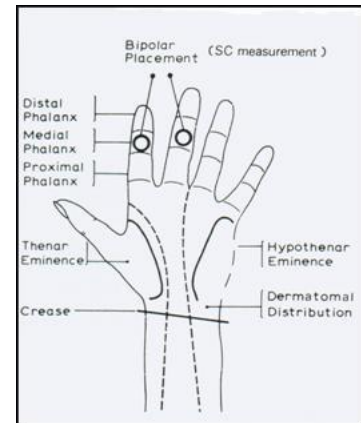
Skin Conductance coupler.



Skin Conductance is available in a separate SC only unit, or as pictured in combination with an EKG amplifier, and also as a combination unit with EMG, suitable for startle or other EMG applications. The SC amplifier requires just a USB cord for both power and data.

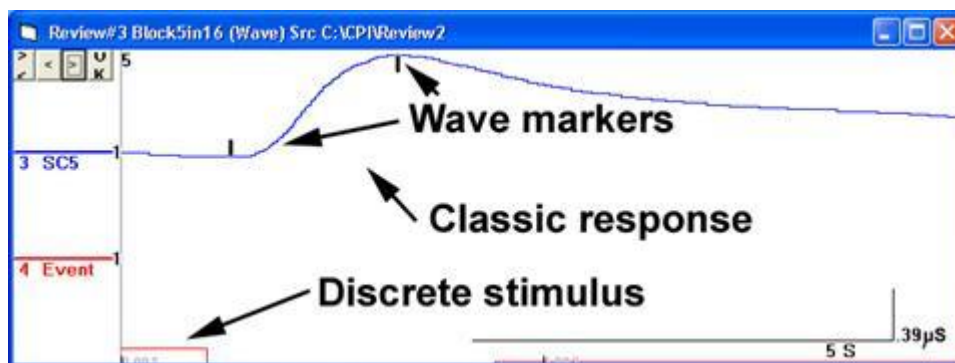
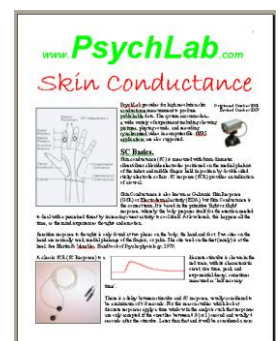
SC electrodes are applied to the medial phalanx of the middle and index finger using collars and non-saline electrode gel.

The electrodes are plugged into the red and black input



sockets. The green electrode socket is provided only for cable shield ground, if an extended input cable is required.

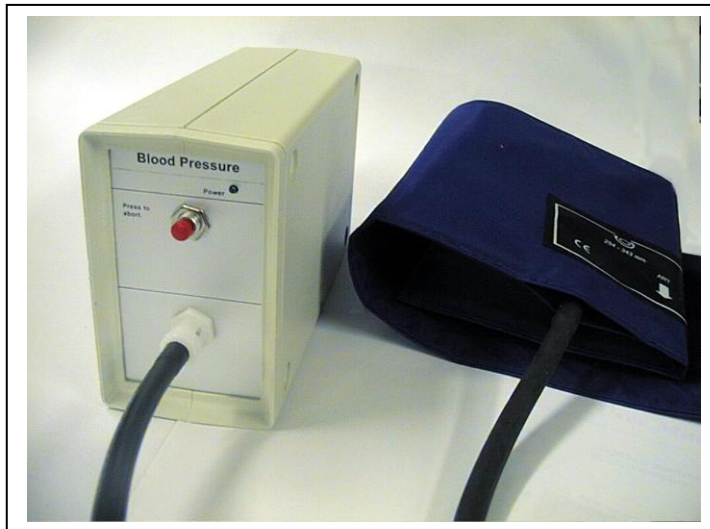
PsychLab SC is developed to comply with the recommendations of Lykken and Venables. Further useful information, including recommendation of electrode type, conductive paste etc. may be found in pages 4 – 62 of “Techniques in Psychophysiology”; Martin & Venables (published by Wiley, 1980). Useful information is also provided in our Skin Conductance leaflet.



PsychLab software provides automatic SCR analysis using a WAVE detection system to detect and quantify responses.

The SC5 uses a high resolution 24 bit digital converter to ensure full accuracy. Skin conductance has a range up to 100 micro Siemens, and within that range it is necessary to be able to resolve very small responses. The standard criterion for a skin conductance response is 0.02 micro Siemens, and to properly detect such a response it should be resolved to at least 0.002. With 24 bit accuracy SC5 easily achieves this, and can show responses below levels previously considered viable. SC5 uses the preferred constant voltage method (0.5V).

Blood Pressure measurement.



PsychLab Blood Pressure is a conventional arm cuff automatic inflation device. The amplifier / controller connects directly to the computer via USB. Cuff inflation is controlled from the computer. This provides maximum flexibility, catering for a variety of situations, such as simple manual operation whereby a key press is used to start BP cuff inflation or programmed operation whereby inflation may be automatically timed to avoid critical periods in the stimulation procedure when it would disrupt trial data. The

device may be used in combination with any other of the amplifiers and stimulators in the PsychLab range. Following the inflation command, the device takes 1 - 2 minutes to complete the reading.

Diastolic and Systolic pressures are produced as separate readings sent to the computer via USB. A manual abort button is provided, to protect against circumstances such as inflation of the cuff when it is not attached to the arm, which can damage the cuff. For more information please consult CPI.

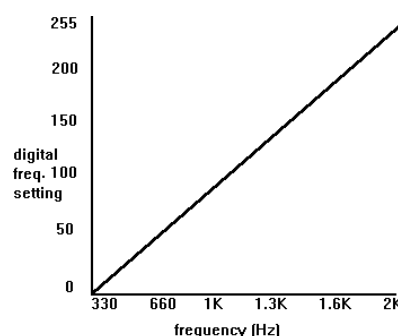
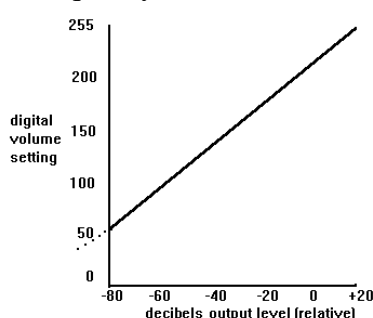
Auditory: Tone, Click and Noise.



PsychLab TG/WN provides both noise and tones with control over volume, ear switching, frequency (for tone) and attack/decay time. Noise well in excess of 100dB produces reliable blinks when used as the probe in a startle paradigm. Accurate control over noise duration can produce clicks down to less than 1mS, with facility for accurately timed dual clicks which may be used in N50 type paradigms. The unit requires a single USB cord for both power and control data.

TG/WN includes a single white noise source and a single digitally controlled frequency generator with range 30 to 2000 Hz. Volume setting for either source is digitally controlled in 255 steps. 0 is completely off, 255 is maximum. Maximum level is a powerful stimulus when the output is connected to standard stereo headphones. Volume,

frequency and Noise or Tone selection is controlled from the host computer via USB. When



used stand-alone, stimulation may be triggered using selected bits of the event port. When used with the host program additional control is possible to select right, left or both ears.

External equipment connection: Event Synchronisation port.

An event synchronization port is provided at the rear of each amplifier. It allows synchronization with other programs and equipment by providing an 8 bit I/O channel. We provide purpose designed connectors to link up to a computer parallel port, used by programs like MatLab* and E-Prime*, or it can be linked to another device like the I/O card used with SuperLab*. These stimulus applications can be programmed to present cues via the I/O medium which are thus registered in the PsychLab event channel. Subsequently when data are analyzed these cues are used to section data for analysis, under macro control.



Other examples of use of the event port is connection of remote buttons such that the operator or the subject can indicate an event, response or reaction time, and the addition of a subject rating dial.

A simple adaptor is available allowing direct buffered connection between a computer printer port and the event port.



BIN8 unit.



PsychLab BIN8 connects to the computer USB. It allows more convenient connection of external equipment via 4mm banana sockets, as well as a 25 way D connector which allows direct link up to the printer port of a windows computer. BIN8 provides 8 separate TTL outputs, 8 inputs and 4 relay closures. The top double row of 4 sockets are the relays, with associated LED on/off indicators, the next row of 8 sockets are TTL output, the lower row of 8 sockets are TTL input, and the bottom row of 4 sockets are two ground and two 5V. The 25 way parallel connector is at the front.

Shocker.



PsychLab Shock is an electrical pain stimulator for use in stressor tasks etc. The maximum output limit switch prevents excessive shock; current levels up to 5mA (RMS) are more than sufficient for normal pain stimulation tasks. The shocker was designed with reference to recommendations by Tursky and Watson. 60Hz, constant current AC stimulation is provided by an internal oscillator, independent of the AC power supply. Shock level and duration is controlled from the experiment control file; a number between 0 and 255 sets output level in the range chosen by the maximum limit switch. The device is medically isolated and has a safety cut-out which prevents the shock occurring unexpectedly after temporary power out.

EC Electro-cutaneous stimulator (somatosensory).



PsychLab EC stimulator produces brief pulsed output suitable for use in direct nerve stimulation. Uses include eye blink, ERP, Nerve conduction, etc.

The EC stimulator provides pulse current of up to 20mA, with a manual control to limit maximum level. As a safety feature, this control must be turned to the zero position after the unit is powered on, before the device will operate. This prevents unexpected currents occurring in the event of interruption of power, and also ensures operator consideration before using this high voltage electrical stimulation device.

Computer control of pulse duration is provided as 0 – 1023 micro Seconds in steps of 4 micro Second, and control of level

is 0 – max in 256 steps.

Electrodes.

Electrodes are available for most purposes:

EL122	Skin conductance 8mm.
EL122	
EL123	EMG 4mm
EL125	EEG dome electrodes (SLE)
EL126	ECG (EKG)
EL204	ECG disposable pads (use with EL2) (3M)
CAP	10-20 electrode cap (ECI) complete kit
EL245	EEG/EMG Electrode gel (SLE)
EL246	SC Electrode gel.



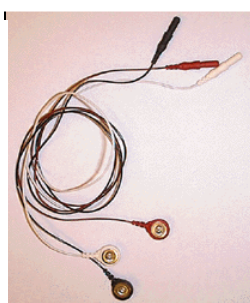
EL123



CAP EEG 10-20 ECI



EL125 EEG dome electrodes



EL126 leads for EKG



EL204 disposable ECG electrode pads

Software.

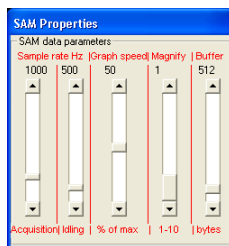
PsychLab software provides data acquisition, stimulus control or event monitoring, and data analysis using tools designed specifically to reduce physiology wave-forms.



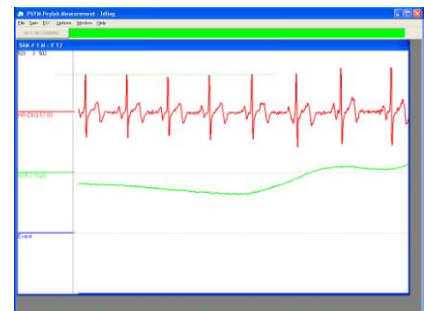
Data acquisition links up to whichever PsychLab amplifiers and stimulators are attached to the computer and opens a View window to control and view wave-forms from each device.

Wave-forms shown in the windows are not stored on the hard drive until the 'Start Recording' button is clicked. Sample rate and other properties are adjusted from the properties window. Each View window includes an

event channel, registered from each device. This is a low resolution channel connected directly to the event port on each device, allowing external events to be registered. The event port may also



be controlled by commands in a stimulus script file, or for straightforward procedures a simple button click may be used to encode a range of values into the event channel. When recording is started,



all wave-form channels and the event channel for each device are stored to disk continuously until stopped.

Stimulus control. PsychLab supports PCC stimulus script files, which have been used with our software for about 15 years. These scripts provide a list of mnemonics that may be used to control the various stimulator devices available, others related to timing issues, and so on. They can be arranged in the script to organize stimulus delivery in logical sequence, but because the script is essentially a simple program, it allows enormous flexibility in experiment design.



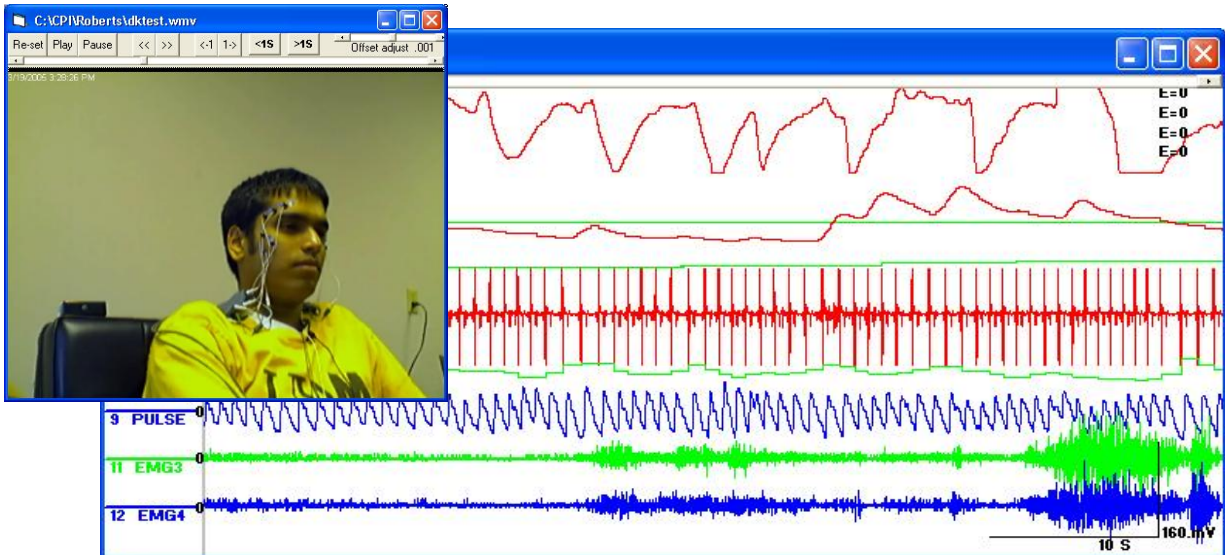
```

C:\CPINest.PCC
File Edit Help
t1 = 5
MAIN
if time > t1 then gosub LongSC
goto MAIN

LongSC
setTone 3, 200, 50, 255, 0, 0, 1 *ears.
Latency = 0: delay until latency > .1
startStim

setNoise 3, 250, 57, .05
setTone 3, 200, 52, 255, 0, 0, 1
latency = 0: delay until latency > 4
startStim
  
```

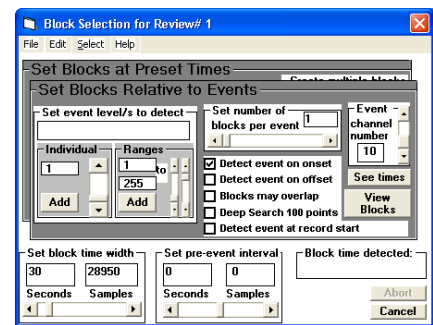
Synchronized video. Multi-media computer systems have a lot to offer modern Psychophysiology. Huge hard drive capacity and high speed internet allow almost unlimited storage and ease of movement of raw data and programs. Video and sound recording and play facility makes it practical to monitor the subject by video in addition to measuring physiology. It is possible to capture synchronized video images from one or two cameras directly onto computer disk while simultaneously recording physiology on the same computer. Inexpensive web-cameras, or professional devices like the high resolution tracking camera shown, may be used.



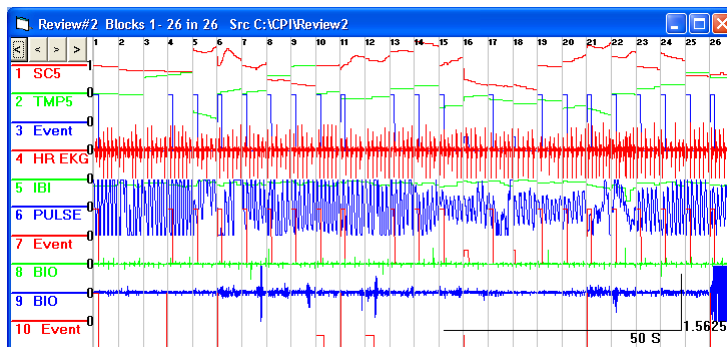
Data analysis.

The analysis program uses a series of windows 'Reviews' to graphically depict each analysis stage. Each Review window shows data from all devices that were recorded, synchronized together. Facility is provided to modify the event channel manually for the purpose of encoding the record, from manual notes that may have been made or while observing the recorded video image.

Blocking data. The analysis tools are designed to work with data in blocks of fixed time period. Blocks may be created on the basis of events that are detected in the event channel, or at fixed times. The block settings panel is used to define how blocks should be made. A 'MultiBlock Review' is then shown, depicting all the blocks.



Analysis. A variety of algorithms may then be applied to each block in turn.



Wave detection. Ability to identify and quantify responses such as SCR, startle blinks, EKG R wave, etc.

Mean Find average value, minimum, maximum, standard deviation and absolute deviation of data within block.

Average. Perform signal averaging on blocks, as in

averaged evoked potentials. **User Process.** Allow user written intelligent script to mathematically manipulate data found in each point for each channel in each block.

Macro Control. All stages of an analysis may recorded and then be automated. Additionally intelligent script allows the format of result data to be controlled with great flexibility so that result data will fit for subsequent analysis in spread sheet or statistical software. Results are normally produced as numerical data normally organized in rows representing the different numerical fields, for example trial number, subject number, physiological parameter 1, parameter 2, etc.

Trial	dom	event	subject	group	SCLevel	SRlatency	PLatcy	SRamptd	NSR	PreNSR	PstNSR	Habit	AvgSCL	Key
043	001	040	82091	00000	05.586	3.0920	4.1900	00.5913	000	00.7103	00.0000	0	05.492	000
044	002	040	82091	00000	04.752	2.8410	5.2390	00.6382	000	00.0000	00.0000	0	04.989	000
045	003	040	82091	00000	05.097	2.7950	4.2430	00.5764	000	00.0000	00.0000	0	05.263	000

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