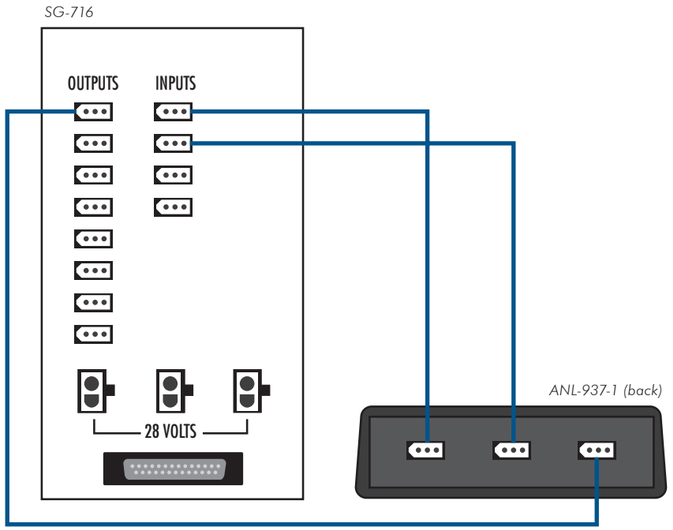
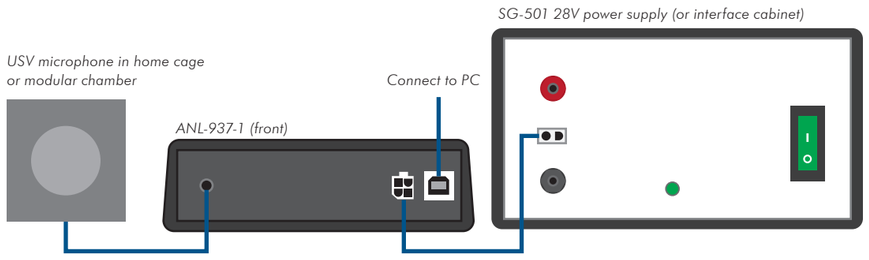
med associates inc

Instrumentation and Software for Research

ULTRASONIC VOCALIZATION DETECTION (USV)





Empirical evidence suggests that ultrasonic vocalization (USV) can be used as a measure of motivational and emotional state *(Knutson et al. 2002)*.

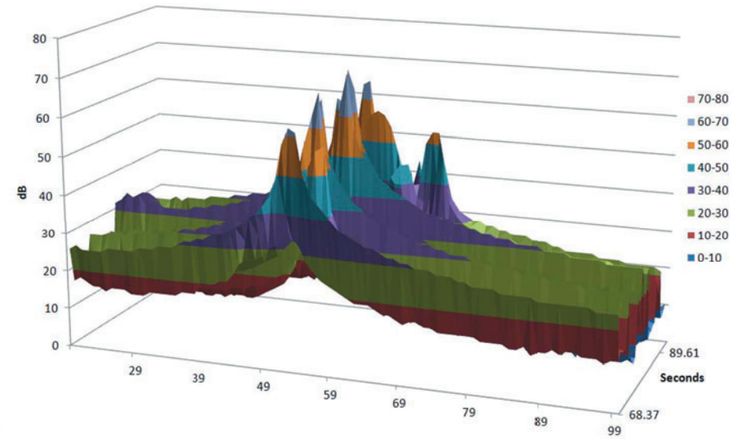
For instance, rodent pups emit distress USVs as a consequence of maternal severance or hypothermia *(Blumberg & Alberts, 1990; Hofer & Shair, 1993; Sokoloff & Blumberg, 2005)* and maternal responsiveness is proportional to the number of calls mouse pups emit *(D'Amato et al. 2005)*. Brudzynski & Pniak *(2002)* observed that mature laboratory rats emit USVs in anticipation of social contact. Furthermore, USVs are produced as a result of painful stimulation during fear conditioning *(Antoniadis & McDonald, 1999; Lee et al, 2001)* and as a result of morphine or ethanol withdrawal *(Vivian & Miczek, 1991; Moy et al. 2000, respectively)*.

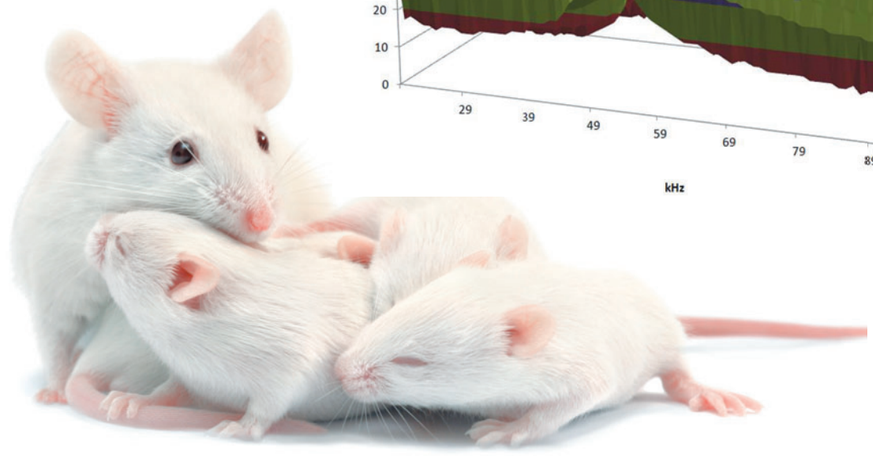
Although the empirical evidence is somewhat inconclusive, one theory of motivation states that rat USVs can be divided between two different kHz bandwidths. Vocalizations ranging between 50-70 kHz represent positive affective states, but those in the 22 kHz range are characteristic of negative affective states *(Knutson et al. 2002)*.

Whether or not this theory continues to garner empirical support, the evidence is clear that USVs are good indicators of underlying motivational state.

Therefore, our USV system is designed for behavioral applications, and is an affordable solution for accurately measuring both the amplitude and frequency of these ultrasonic vocalizations emitted by laboratory rodents.

- Designed to measure motivational behavior in paradigms such as:
  - Drug addiction
  - Mother-pup separation
  - Isolation stress
  - Social interactions
  - Sexual encounters
  - ...and more





CLASSES OF VOCALIZATIONS

DISTRESS CALL

- Neonatal rat pups emit distress USVs at the average frequency of 40 kHz *(Sokoloff & Blumberg, 2005)* and this frequency decreases with age.
- Mature rats produce long calls that are just above the audible range at 22 kHz (65-85 dB), and these calls last for 300-4000 ms and have a narrow bandwidth of 1-6 kHz *(Sales 1972)*.

Alarm Call *(22 kHz)*

Communicates the presence of a predator or are produced as the result of experiencing a painful event *(Blanchard et al. 1991; Antoniadis & McDonald, 1999; respectively)*.

Short Call *(32-96 kHz, 30-65 ms)*

- Occurs during high levels of physical activity, arousal, and social contact *(Knutson et al. 1998)*.

Long Call

- Associated with sexual behavior and aggression *(Barfield et al 1979)*.

PACKAGE CONTENTS

A = MED-USV-1A-M **B** = MED-USV-1A-R **C** = MED-USV-1B

#	SKU	DESCRIPTION	A	B	C
1	ANL-937-1A-M	USV Detector *(wide) for Mouse*	A		
1	ANL-937-1A-R	USV Detector *(standard) for Rat*		B	
1	ANL-937-1B	USV Detector for Home Cage			C
1	CAB-USB-AM-BM-6	USB Type A-B Cable, M/M, 6' *(1.8 m)*	A	B	C
2	SG-216A-6	Mini-Molex Extension Cable, 3-Pin, 6' *(1.8 m)*	A	B	C
1	SG-218A-6	Mini-Molex Extension Cable, 3-Pin, M/M, 6' *(1.8 m)*	A	B	C
1	SG-937P-10	Power Cable for USV Detector, 28V, 10' *(3.05 m)*			C
1	SOF-937-1	Ultrasonic Vocalization Software	A	B	C

ANL-937-1A-R
shown in ENV-008 Chamber

(back)

ANL-937-1A-M (front)

USV DETECTION PACKAGE
FOR MODULAR CHAMBERS

MED-USV-1A-M MOUSE | WIDE | 1/4
MED-USV-1A-R RAT | STANDARD | 1/4

Includes everything you need to add USV detection to a modular chamber system.

SUMMARY OF CONTENTS

- USV Detector
- USB Cable
- Mini-Molex Extension Cables
- USV Software

NOTE: Modular chamber sold separately (ENV-307W for mouse and ENV-008 for rat)

USV DETECTION PACKAGE
FOR HOME CAGES

MED-USV-1B MOUSE+RAT | HOME CAGE

Includes everything you need to add USV detection to a home cage system.

SUMMARY OF CONTENTS

- USV Detector
- USB Cable
- Mini-Molex Extension Cables
- Power Cable
- USV Software

NOTE: Home cage sold separately (PHM-125H for mouse and PHM-126H for rat)

ANL-937-1 (front)

(back)

ULTRASONIC VOCALIZATION DETECTOR

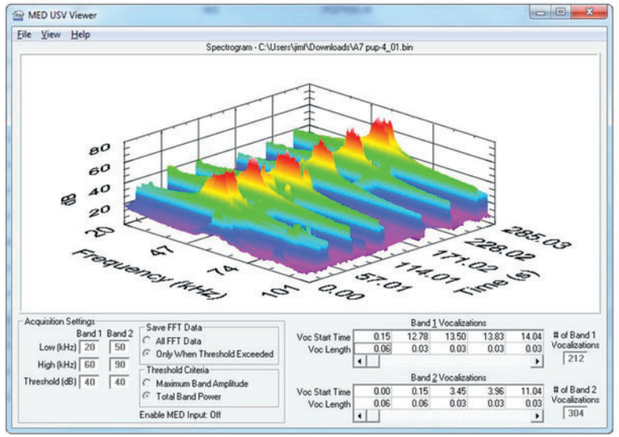
ANL-937-1A-M MOUSE | WIDE | 1/4
ANL-937-1A-R RAT | STANDARD | 1/4
ANL-937-1B MOUSE+RAT | HOME CAGE

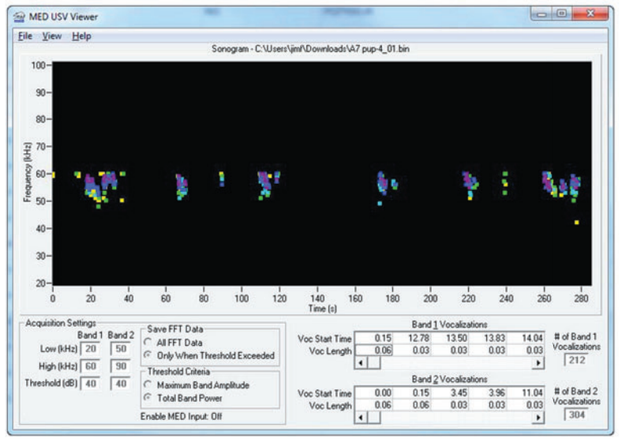
Compact design provides all the benefits of professional sound recording equipment in an easy to use, affordable unit.

- Actual frequency (KHz) and amplitude (dB) measurements for advanced digital signal processing
- Detect ultrasonic vocalizations in any two user-defined bands ranging from 20 – 100 KHz, for example:
  - Band 1 captures events between 20 – 40 KHz above 60 dB
  - Band 2 captures events between 30 – 100 KHz above 40 dB
  - *NOTE: Bands can overlap in frequencies or amplitudes*
- Scans the environment every 30 milliseconds

NOTE 2: Power Supply (SG-501) will be required when using the USV detector without a Med Associates interface system.

Spectrogram





Sonogram

USV OCCURRENCES

The USV data illustrates the onset and duration of vocalizations occurring within two user-defined frequency bands above an amplitude threshold.

CUMULATIVE RECORD

Data can be viewed as an event plot or in a cumulative fashion to represent the rate of USV occurrences as a method of estimating the rate of USV occurrences. Each occurrence of an ultrasonic vocalization causes an increase on Med-PC®'s SoftCR Pro® cumulative plot.

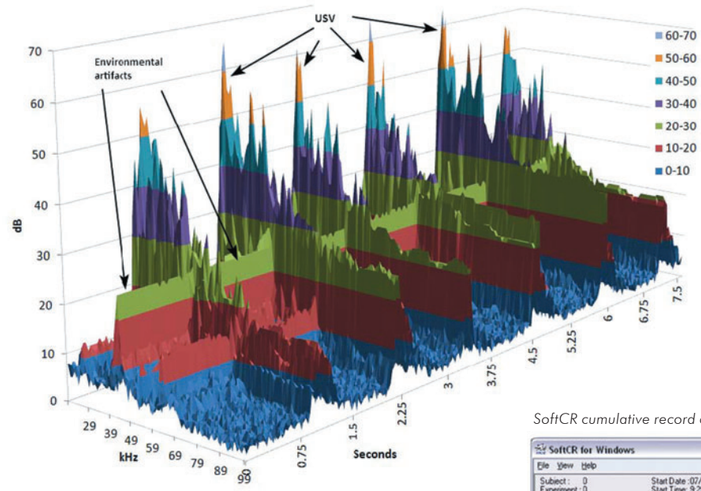
SONOGRAM

Graphs USV occurrences (in kHz) over time, providing information on the duration and frequency of a USV, as well as relative changes in pitch.

SPECTROGRAM

A three-dimensional surface plot that illustrates frequency (in kHz) by time and amplitude (in dB). Particularly useful for revealing ultrasonic artifacts in the testing environment, such as ultrasonic vibrations created by some fluorescent lamps or computer monitors. Once artifacts are recognized, the bandwidth can be adjusted to isolate USVs from other ultrasonic events.

MBA, 40 dB threshold, all FFT data recorded



SoftCR cumulative record of ultrasonic events

ULTRASONIC VOCALIZATION SOFTWARE

SOF-937-1 MOUSE+RAT

- Samples ultrasonic frequencies every 30 milliseconds and differentiates between two user-defined bandwidths
- Med-PC® can be used in conjunction with the USV detector to turn on the detector, and correlate events such as food or shock delivery with the data acquisition
- Use with up to 16 devices
- Software has graphing utilities for:
  - Spectrograms *(KHz x Time x dB)*
  - Sonograms *(KHz x Time)*
- Text data file includes a vocalization's:
  - Time of onset
  - Duration
  - Quantity *(in each band)*

DATA COLLECTION OPTIONS

Low: (20 - 100 kHz) Vocalizations at frequencies below this cut-off value will be disregarded

High: (20 - 100 kHz) Vocalizations at frequencies above this cut-off value will be disregarded

Threshold: (10 - 150 dB) Vocalizations must occur at an amplitude greater than this value in ordered to be recorded by the software.

Band 1: The first frequency range of interest

Band 2: The second frequency range of interest

NOTE 1: To represent the data as a cumulative or event plot, use in conjunction with Med-PC (SOF-736) and SoftCR Cumulative Recorder (SOF-721) software.

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