DATASHEET

PHYSIOsensiics™
with nanoPower Technology

LinearDimensions
SEMICONDUCTOR

LNDSP17

Complete Physiological Monitoring System & Fusion Development Kit

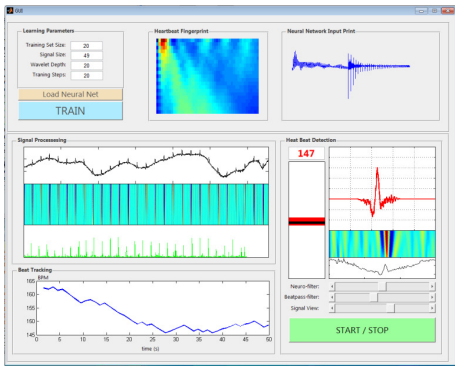
GENERAL DESCRIPTION

The engine underneath the fancy packaging of leading physiological fusion monitors, the LNDSP17 is a complete fitness targeted physiological diagnostic and acquisition fusion solution. The LNDSP17 includes all the components required to quickly launch a stand-alone commercial physiological monitoring fusion product offering. Linear Dimensions supplies all the electronics, software, algorithms, and support in a development kit to quickly implement a full solution. Linear analysis algorithms which work with the SP17 may be located in the provided microcontroller (MSP430), on a PC or mobile device, or OEMs may utilize Linear Dimensions' Cloud service through M2M cellular, Bluetooth LE, WIFI or ANT+.

The LNDSP17 includes a high CMRR terminator, INA, 6th order low pass and 8th order high pass Bessel filters, uC, dataconverters, and an advanced signal extraction system (PEAL) to eliminate outside noise, find signals within noisy environments and enable fusion analysis. The system can be used for measuring or acquiring:

- ECG heart or EEG waveforms
- Accurate beat rate
- galvanic skin response
- skin impedance
- temperature
- activity & time specific notifications
- motion (optional module)
- location (optional module)
- fusion of the above

Even extremely small signals (<50uA) embedded in noisy signals whose magnitude is hundreds of times bigger, residing in the same spectrum, may be reliably acquired. Various communications links allow continuous monitoring, analysis, extraction and feedback. Let Linear Dimensions customize a mobile or PC dashboard for your application and utilize Linear's advanced fusion algorithms, the PEAL system, to provide value and differentiation for your products.



FEATURES

- Two or Three Electrode Interface
- Operates from as little as 2.7V Vin
- Optional Right Leg Drive
- 123db CMRR Termination
- Instrumentation Amplifier (INA)
- 6 & 8th Order Bessel Filters
- <300uA Average Current
- Signal Acquisition:
  - Automatic or Programmed Gain Control (AGC)
  - Time Constant Accelerator for Quick Baseline Recapture
  - Common Mode Driver Terminal
  - AC Only or AC/DC Feedback
- Capable of Measuring signals <50uV
- PEAL extraction, analysis & fusion system
  - Finds physiological data in noisy environments even if signal is 100's of times smaller than noise, and residing in the same spectrum
  - Penetrates real world noise such as muscle noise, lighting, electrode connect & disconnect
- AGC allows inputs from anywhere on the body
- Includes SD Card and/or optional Bluetooth LE, ANT+, WIFI, M2M cellular or other RF Interfaces
- Cloud, cell phone, tablet, microcontroller or PC algorithm solutions available
- Let Linear Dimensions develop custom mobile applications and fusion solutions with you

APPLICATIONS

- Portable Heart Rate Equipment
- Portable Fitness & Wellness Products
- Non-Critical Diagnostics

DEVELOPMENT KIT INCLUDES

- Two sided electronic board
- Filter design software
- GUI interface software
- Programming interface
- Extraction, analysis & fusion algorithm
  - Finds signals in noisy environments
  - Learning filter software
  - Algorithm runtimes (PEAL system)
- Power management subsystems
- Microcontroller, dataconverter
- Accelerometer & location services (optional)
- SD Card and/or Streaming RF Interface(s)

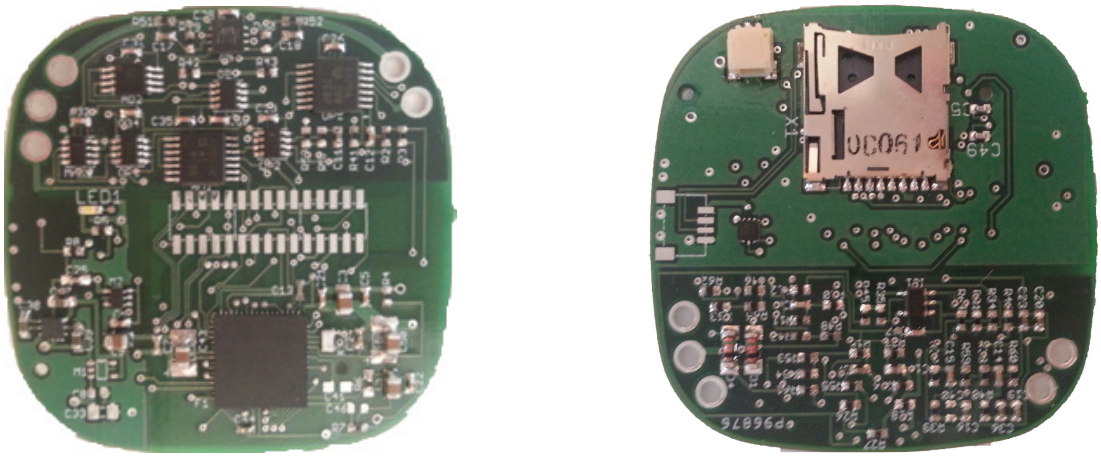


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Figure 2 – SP17 Complete Physiological Fusion System including uC based PEAL

Figure 2 shows the included electronic system which can be purchased from Linear Dimensions Semiconductor in production quantities. All that is required is adding a housing and electrodes and the system is ready to be used in real world applications.

The LNDSP17 is meant to be used with Linear Dimensions' PEAL system which provides a variety of tools for acquisition, interrogation, analysis and fusion of measured data. Custom dashboards may be created and reside on a local display using the on board microcontroller (TPS430), or may reside on a mobile, tablet, PC device.

Alternatively, Linear Dimensions' Cloud service may be utilized to peform customized extraction, analysis and fusion of data. PEAL provides OEMs the ability to differentiate and utilize measured data in their own way to provide value in their specific application spaces. Customize fusion & fashboards available.

An example PEAL implementation is shown in Figure 1 and Figure 3. The signal was being acquired from a human arm, a very difficult place to acquire signals.

The PEAL algorithms were able to cut through noise from motion and location artifacts even though the noise was hundreds of times larger than the signal of interest and had content in the same spectrum. In fact the heart waveform shown below was captured from an arm even though its magnitude was <50uV, and an athlete was running at full speed (>8 miles/hr). His arms were swinging, electrodes were connecting and disconnecting, 60Hz signals and EMI from the running track were radiating and being coupled into the SP17 device. The muscle noise amplitude was much greater than the heart rate amplitude producing interference in the same spectrum as the heart rate waveform. Additionally, the baseline would move around, regularly saturate and then recover. The result from the PEAL system after filtering, baseline extraction, and adaptive filtering is shown below. No heart rate was discernible from the data with the naked eye prior to providing the signal to the system. The heart signal below was combined with other data to produce customized fusion data for customers.

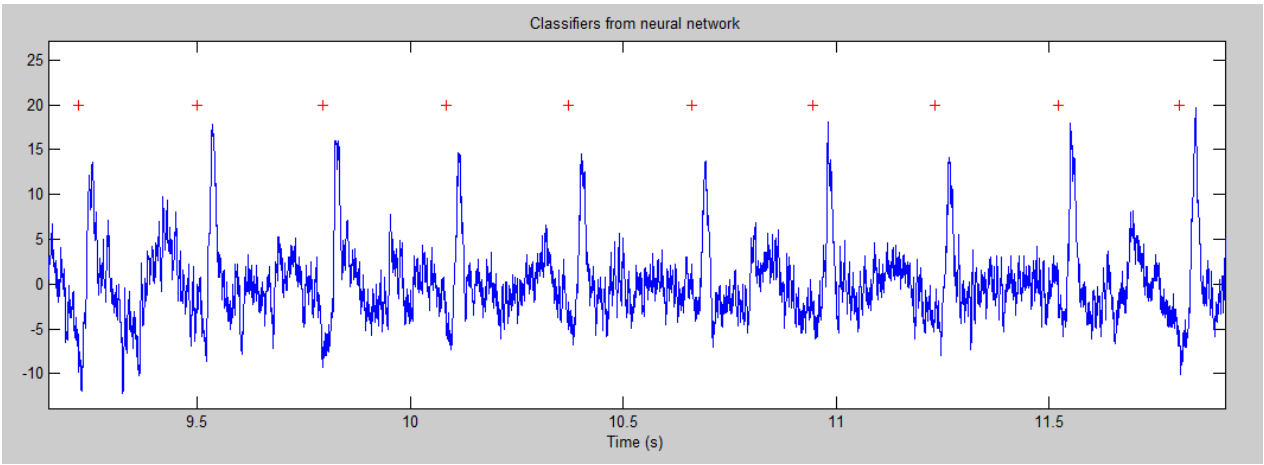

Figure 3 – An example of a fusion measurement made by the SP17/PEAL combination is shown above. A heart waveform is acquired from an extremely small heart waveform surrounded by a very noisy signal infected with multiple noise sources. Red plus signs indicate identification of beat by PEAL.