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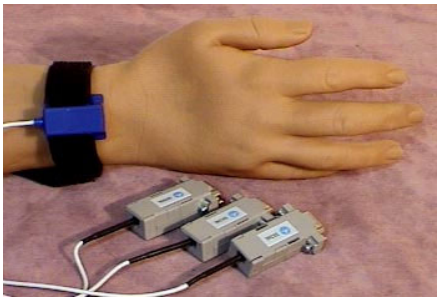
TRI-AXIAL ACCELEROMETERS

SS26LA and TSD109C2 (±5 g)
SS27L and TSD109F (±50 g)
BN-ACCL3



Tri-axial accelerometer uses 3 channel inputs

Tri-Axial Accelerometers connect directly to BIOPAC hardware and require no additional amplification. They provide three outputs, each simultaneously measuring acceleration in the X, Y, and Z directions. They are the same size and can be used on any part of the body or on external equipment. The pliable and unobtrusive design conforms readily to body contours. They come with a Velcro® strap for easy attachment.

- ±**5 g** accelerometers are optimal for measuring accelerations when performing slow movements, such as walking.
- ±**50 g** accelerometers are optimal for measuring quick movements, such as swinging a tennis racket.

The transducers can be used on any part of the body or attached to external equipment. The pliable and unobtrusive design conforms readily to body contours and includes a Velcro strap for easy attachment. The frequency response extends from DC to 500 Hz. The accelerometers are extremely accurate and can easily be calibrated by simply changing their orientation in three-dimensional space, so that gravity (G=1) acts only upon the desired axis.

EQUIPMENT

- The SS26LA/SS27L accelerometers connect to the MP36/35 Data Acquisition Unit.
- The TSD109 series accelerometers connect to the HLT100C High Level Transducer module.

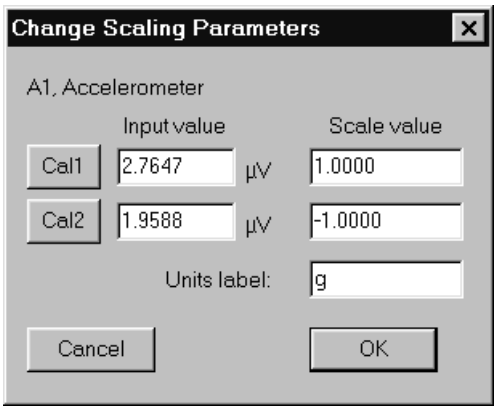
ACCELEROMETER SPECIFICATIONS (SSL/TSD)

	SS26LA / TSD109C2	SS27L / TSD109F
Range (Output):	±5G (400 mV/G; 1 mV/G; 0 G is at 5 mV DC)	±50G (40 mV/G; 100 mV/G; 0 G is at 5 mV DC)
Noise:	0.5 mG/SQRT(Hz rms)	6.6 mG/SQRT(Hz rms)
Interface:	MP36/35 Data Acquisition Unit	HLT100C High Level Transducer Module
Bandwidth:	DC - 500 Hz (-3dB)	
Nonlinearity:	0.2% of Full Scale	
Transverse axis sensitivity:	±2%	
Alignment error:	±1°	
Package:	Compliant silicone housing	
Dimensions:	33mm (long) x 28mm (wide, at base) x 19mm (high)	
Weight:	17 grams	
Power:	+5V @ 25 mA (via TEL100)	
Sterilizable:	Yes (contact BIOPAC for details)	
Cable length:	3 meters	

NOTE: The SS26LA was discontinued in November of 2012.

HARDWARE SETUP

The accelerometers have three output connectors, one each for the X, Y, and Z axes. Each output connector must be connected to an **MP3X** input channel (SS26LA/SS27L,) or to the appropriate HLT100C input channel (TSD109 series). For example, connect the X-axis to channel 1, the Y-axis to channel 2, and the Z-axis to channel 3.



IMPORTANT

Make sure that the chosen channel is **not** already assigned to any other BIOPAC module; up to 5 Accelerometers can be used with a single MP System. **If contention exists, the channel data will be corrupted.**

See also: Setup notes for external devices and channel contention issues.

SOFTWARE SETUP

SS26LA/SS27L: Select **MP3X > Set Up Channels** and enable three analog channels, one for each axis, with the appropriate **Accelerometer Preset** (5g or 50g).

TSD109 Series: Select **MP150 > Set Up Channels** and enable 3 analog channels, one for each axis.

a) Click on **Setup** and then click on **Scaling**:

b) In the **Scale value** fields, enter the scaling factors required, 1 for Cal1 and –1 for Cal2.

c) Enter "g" for the **Units label,** as shown.

d) Take the accelerometer and rest it in the upright position on the tabletop.

e) Calibrate the device by rotating it through 180° and taking a calibration reading at each point.

f) To calibrate the Y-axis, start with the transducer sitting on the table, face up, and click CAL1. Rotate the transducer 180°, so that it is now sitting upside down, and click the CAL2 button. This procedure must be followed for each axis. A label on the front of the transducer displays the X- and Y-axes. The Z-axis rotates from the end with the label and the end with the cable.

TESTING CALIBRATION

To see if the calibration is correct:

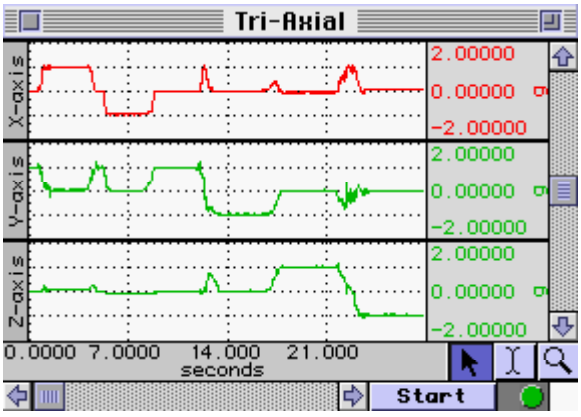
a) Start acquiring data (for the test procedure, a sample rate of 50 samples per second should be used)

b) Rotate the accelerometer 180° through each axis.

c) Set the vertical scale to 1 and the midpoint to 0 for all channels.

d) Repeat the calibration procedure (by rotating the transducer 180°) through each axis.

e) Visually confirm the correct calibration.



The screen shot above shows a tri-axial accelerometer being rotated through each axis. Channel 1 (X-axis) shows the signal moving from 1g to -1g as the transducer is rotated. Likewise, Channel 2 (Y-axis) shows the same phenomenon as previously described. Finally, Channel 3 (Z-axis) has also been tested and the calibration confirmed.

BIONOMADIX WIRELESS ACCELEROMETER

The BioNomadix wireless Tri-axial Accelerometer (BN-ACCL3) is a broad spectrum acceleration measurement system. The transmitter can be attached to any part of the subject's body to measure three-axis acceleration associated with movement in that particular location.

The system comes factory preset to support an operational range of ±16 G, with a maximum system bandwidth of 400 Hz. Ranges can be set to as low as ±2 G with bandwidths as low as 3 Hz.

The system can also be configured to act as a "tap detector," detect either single or double taps. In this mode, the system can act as an event recorder for self-report. When "double-tapped," for example, the system will output a pulse to precisely mark the time location of the observed event.

In Acceleration measurement mode, the BN-ACCL3 will output X, Y and Z acceleration values on three associated channels. The system is very well suited for mobile applications. The system can measure the acceleration of gravity (static) for tilt-sensing and can also measure very fast-changing, dynamic acceleration resulting from rapid movement or impact.

BN-ACCL3 SPECIFICATIONS

BioNomadix	**BN-ACCL3**
Signal type:	G (X, Y, Z)
Bandlimits *Max*: *Factory preset*: *Filter Options:* Alternative signal:	±2, ±4, ±8 or ±16 G ± 16 G at 400 Hz LP DC to 3.13 Hz LP up to 400 Hz LP (in power of 2 steps) Tap Event Mark Mode (*replaces* G)
Noise (resolution)**:**	X: 5 mg rms, Y: 6 mg rms, Z: 9 mg (rms) (±2 G scale at 400 Hz LP)
Signal range:	*Selectable:* ±2, ±4, ±8 or ±16 G
Output Voltage range:	±10 V (receiver output)
Transmitter type & rate	Type: Ultra-low power, 2.4 GHz bi-directional digital RF transmitter Rate: 2,000 Hz (between transmitter and receiver)
Delay	Large fixed component (12.5 ms) and small variable component (±0.5 ms)
Operational range:	10 meters (line-of-sight) typical in standard laboratory setups. See also: *Operational Range and Characteristics*.
Operational temp:	5-45° C
Operational humidity:	95% non-condensing
Transmitter Battery: Charger:	BioNomadix transmitters use an L-ion battery: full charge takes approx. 1 hour to provide maximum operating time. A battery charger is included with each module pair. See BN-CHARGER for charge time and recharge cycle details.
Operating time:	72-90 hours
Receiver Power:	Use with an MP Research System or with isolated power supply IPS100C for 3rd-party data acquisition system.
Included strap:	33 cm - BN-STRAP33
Size & Weight:	Transmitter (approx.): 6 cm x 4 cm x 2 cm; 54 grams; Receiver (approx.): 4 cm x 11 cm x 19 cm; 380 grams
Input:	Attach BioNomadix transmitter to subject – no additional hardware input required; sensor is internal to transmitter.

See also: Tri-Axial Accelerometer Data Analysis – App Note 266