Science Division
Thought Technology Ltd

RESPIRATION SENSOR SA9311M

Measure **More**
Sense **Better**

Technical Note Series

RESPIRATION SENSOR (SA9311M)

WARNING

- Type BF Equipment
- Internally powered equipment
- Continuous operation

- If the sensor is interfaced to non-Thought Technology devices without the use of a TT Sensor Isolator SE9405AM, an elevated risk of electrical shock may be present. In particular, if a client-connected sensor is connected to any line powered device(s) or equipment(s), it will be the responsibility of the qualified user to ensure the electrical safety in the setup.
- Explosion Hazard; Do not use in the presence of a flammable anesthetic mixture with air, or with Oxygen or Nitrous Oxide.
- Not to be immersed in water.

CAUTION

- Connection of customer supplied circuits to Thought Technology sensor products has the potential to damage the sensor. Such damage is not covered by warranty.

ATTENTION

- For research only. Not for use in diagnostic procedures.
- To prevent voiding warranty by breaking connector pins, carefully align white guiding dot on sensor plug with slot on sensor input.

LATEX
CAUTION

- This product contains natural rubber latex which may cause allergic reactions

MAINTENANCE AND CALIBRATION

- Wipe with a clean cloth
- Factory testing and calibration ensure equipment accuracy and frequency response.
- No preventative inspections required;

STORAGE

- Temperature -23C – +60C
- Humidity (non-condensing) 10% – 90%
- Atmospheric pressure 700 – 1060 KPa

TRANSPORTATION

- Temperature -23C – +60C
- Humidity (non-condensing) 10% – 90%
- Atmospheric pressure 700 – 1060 KPa

The respiration signal is a relative measure of abdomen expansion.

The Respiration Sensor is a sensitive girth sensor using an easy fitting high durability latex rubber band fixed with self-adhering belt. It detects chest or abdominal expansion/contraction and shows the respiration waveform and amplitude. It can be worn over clothing.

Warning: The tube is made of natural rubber and some people may be allergic to rubber. Please verify your examinee's allergy conditions before using the respiration sensor.

The rubber strap stretches when the abdomen expands during breathing.

SENSOR PLACEMENT

Two-sensor placement

The respiration sensor is fixed to a long hook and loop strap that is placed around the chest or abdomen. For most applications, placing one sensor around the abdomen is necessary. Optionally, you can place a second respiration sensor around the chest. Using two sensors is helpful for abdominal breathing exercises.

Unravel the strap and attach it around the abdomen (or torso) so that the sensor is in the front. Ask the client to breathe out as fully as possible and attach the sensor so there is minimal tension. The fit should be snug enough that the strap stays fixed when the subject is relaxed.

There should also be enough slack in the rubber strap of the sensor so that expansion of the abdomen causes this rubber strap to expand without being overextended.

Size (approx.) 132cm (52" long)

Weight 30g (1.0 oz)

Range 30% – 65%

INTERFACING WITH 3RD PARTY DATA ACQUISITION SYSTEM

Recommended Connectivity for Electrical Safety

To ensure electrical safety in the user setup, Thought Technology recommends the use of TT Sensor Isolator SE9405AM when interfacing client connected sensor(s) to line powered equipment(s) or devices.

The TT Sensor Isolator SE9405AM is an interface device providing medical grade electrical isolation between the client connected sensors and the acquisition system. It provides the equivalent of Two Means of Client Protection under IEC 60601-1, and supplies battery power to the sensors. Using this device ensures Thought Technology sensors are safely interfaced to the analog inputs of line-powered systems such as computers with DAQ cards.

Note that this device isolates only between sensors and the DAQ interface, not between different sensor channels.

The TT Sensor Isolator can interface up to 4 sensors to a DAQ card. TT Sensor Isolator can be connected to the DAQ card in two ways:

- via two stereo jacks, or
- via a DB-15 connector; a BNC interface cable (SA9409BNC) or a pigtail cable (SA9409PGT) can be provided with the unit.
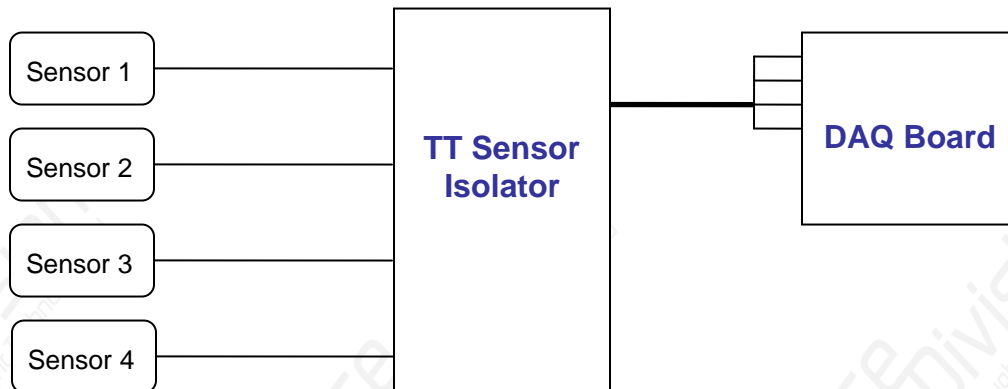
For more detailed information on the Sensor Isolator 4∞, consult the Thought Technology Science Division website or contact the sales department or an authorized distributor.

**Direct Connectivity for Electrically Isolated Systems**

The following notes are provided for qualified users to directly interface Thought Technology sensors with external systems.

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particular, if a client-connected sensor is connected to any line powered device(s) or equipment(s), it will be the responsibility of the qualified user to ensure the electrical safety in the setup and to ensure that the device or equipment provides sufficient isolation.

To interface with a sensor, a single sensor cable may be cut in half. Both sides can then be used to make custom interfacing cables by stripping the outer insulation of each required conductor. The sensor cable contains 4 color coded conductors. The table below shows the color coding and pin connector assignment.

Pin	Color code	Function	Note
1	metal (shield)	ground	Signal and power ground, connection required.
2	yellow	auxiliary (sensor ID)	No connection required.
3	green	signal	Sensor output signal
4	red	sensor power	Supply voltage, +7.26V referenced to ground. Note: sensor performance may be sensitive to supply voltage.
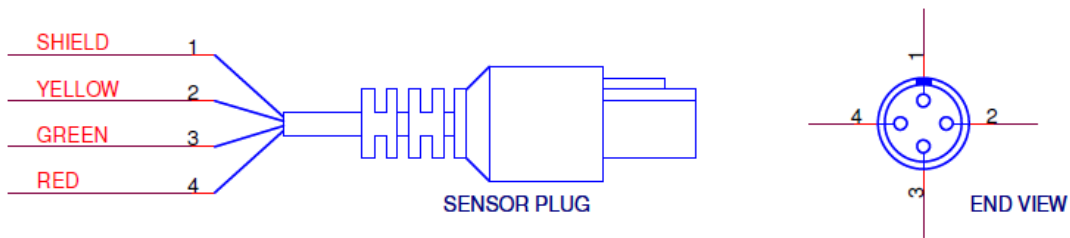
Notes:

1. The nominal supply voltage for this sensor is 7.26V. The sensor can safely be used with a supply voltage of up to 9V. However, as the sensor is calibrated with a 7.26V supply voltage level, changes in gain and offset is expected when operating at a different supply voltage.

Recommended Specifications for DAQ Hardware

- Recommended resolution of 0.15mV (16-bit ADC over 10V span) or better
- Minimum input range:
  - If connected via SE9405AM Sensor Isolator, choose 0-5V (unipolar) or ±5V (bipolar)
  - If directly connected to DAQ, choose ±5V (bipolar).

Simplified Transfer Function

$$\text{Respiration\%} = 58.923 V_{out} - 115.01$$ Conversion of voltage [V] to respiration sensor elongation [%]

The simplified transfer function assumes the sensor is used with the Sensor Isolator, or the supply voltage provided in the user setup is 7.26V nominal.