

TSD221-MRI – RESPIRATION TRANSDUCER



This MR Safe fully pneumatic respiration transducer measures subject respiration (thoracic or abdominal) in the MRI. The extremely unobtrusive design presents minimal resistance to movement and can measure arbitrarily slow to very fast respiration patterns with no loss in signal amplitude, while maintaining excellent linearity and minimal hysteresis.

The TSD221-MRI incorporates a bellows-based design. As the subject breathes, a minimum and

maximum circumference for respiratory measurement is established, and the tension and relaxation of the bellows changes the associated bellows pressure. The bellows' behavior will be a tendency to come to physical equilibrium at the mean (average) circumference. This behavior results in effective high pass filtering of a very low value (~0.001 Hz).

The TSD221-MRI includes the respiration sensor in a mesh strap with self-adhering adjustable chest band (70 cm), a pressure transducer (± 2.5 cm H₂O TSD160A), and two cascadable segments of tubing for up to 14 m (AFT30-XL 10 m and AFT30-L 4 m). TSD221-MRI has no ferrous metals or conductive parts. The TSD221-MRI connects to the DA100C and an MP160/150 system (and does not require the MECMRI-DA or MECMRI-TRANS cable sets).

MRI Use: MR Safe

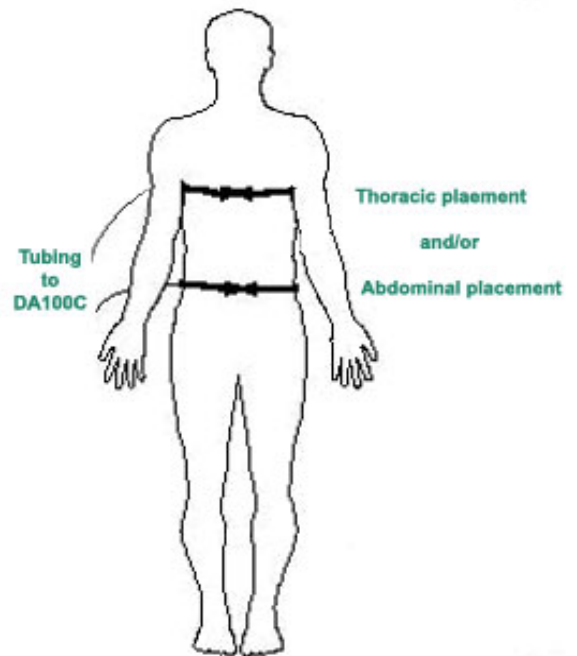
Components: Respiration sensor in compliant mesh sleeving, adjustable flexible chest band: TSD160A transducer, tubing for up to 14 meters (AFT30XL + AFT30L).

Placement and Connections

Place the transducer around the body at the level of maximum respiratory expansion, generally about 5 cm below the armpits but location will vary from the erect to supine positions. Correct tension adjustment of the respiration transducer is important. For best sensitivity, the transducer must be just slightly tight at the point of minimum circumference (maximum expiration). To obtain proper tension, stretch the belt around the body and have the subject exhale. At maximum expiration, adjust the nylon strap so there is slight tension to hold the strap around the chest.

To place TSD221-MRI on subject and connect to MP System:

1. Place sensing band around subject's chest and attach pneumatic tubing to the band as shown on right.
2. Connect TSD160A pressure transducer to the MP System's DA100C module.
3. Route tubing from the MRI table/bore through an available wave guide to TSD160A/DA100C.
4. Attach tubing to the TSD160A pressure transducer "+" port. (The "-" port is left open to atmosphere.)
5. Be careful to check all tubing junctions, as the transducer will fail to operate optimally if any leaks are present.



Software Setup in AcqKnowledge for TSD221-MRI

1. Launch *AcqKnowledge*, choose DA100C from the “What type of module should be added?” list and click “Add.”
2. Verify that the Channel Switch Position matches the physical channel switch position on the DA100C module and click “OK.” (If necessary, adjust channel position by dragging slider).
3. In the subsequent “DA100C Configuration” screen and on the DA100C module, use the following Gain and Filter settings:
 - a. Set Gain to 50 to start with and increase as necessary.
 - b. Set 10 Hz LP filter to “ON.”
 - c. Set HP filter to 0.05 Hz
4. Select “TSD221-MRI-Respiration Transducer, MRI” from the “Connected to:” drop-down list and click OK.
5. Close the Setup dialog.

TSD221-MRI Specifications

Sensor Construction:	MR Safe materials
True DC Response:	Yes
Pneumatic Design:	Attaches to TSD160A/DA100C
Sensitivity:	Linear Analog Output. Sufficiently sensitive to detect heart motion in thoracic cavity, in addition to thoracic/abdominal expansion and contraction.
Circumference Range:	50 cm x 120 cm (can be increased with a longer strap)
Attachment:	Velcro® strap (adjustable length)
Sterilizable:	Yes (contact BIOPAC for details)
Sensor Weight:	67 grams
Sensor Dimensions:	45 cm (long), 3.8 cm (wide), 1.1 cm (thick)
<i>Tubing:</i>	AFT30XL, 10 m, AFT30L, 4 m
<i>TSD160A</i>	Operational Pressure ± 2.5 cm H ₂ O Voltage Output: 327.5 μ V/cm H ₂ O (normalized to 1 V excitation) Click for detailed transducer specs
Measurement Delay:	3 ms per meter of tubing
Interface:	DA100C
Frequency Response:	0.001 – 100 Hz*
Sensor Operating Humidity Range:	0-100% (can be used under water)
Operating Temperature Range:	0° C to 50° C (compensated)
Respiration Measurement Options:	TSD201 for MP160/150 System SS5LB for MP36 or MP36R System SS5B for TEL100C Telemetry System

***NOTE:** With any pressure based system, minute leaks are possible. Air leaks will contribute to a high pass filtering of respiration data. As long as leaks are minute, associated high pass filtering action will not materially affect the quality of the respiration data. To largely circumvent high pass filtering effects of leaks on respiration data, simply record data with the 0.05 Hz HP filter selected on the associated module.