

# SCS9020B\_28S

## Portable Impedance Tube for Porous Materials Sound Absorption and Insulation

### Main features

Portable Tube SCS9020B-28S can be used with various DAQ devices and scientific software to manage impedance tube measurements (for absorption and/or for transmission) allowing full measurements features according to ISO 10354-2, ASTM E-1050E-12, ASTM E-2611-09.

#### Surface properties:

- absorption coefficient,
- surface impedance,
- reflection coefficient
- admittance,

#### Bulk properties (transmission):

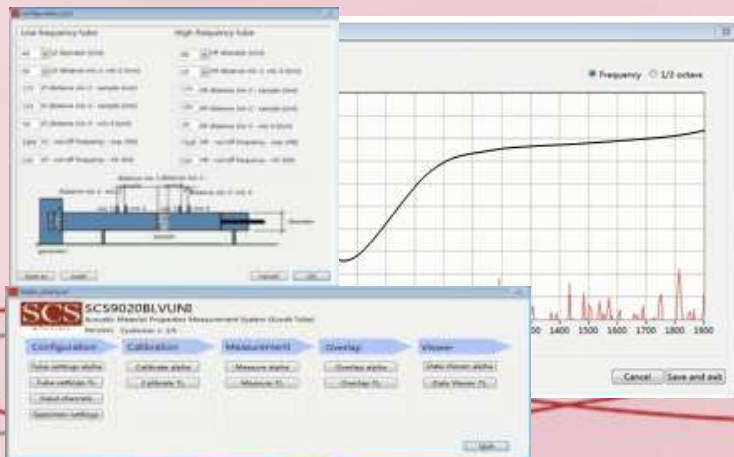
- Propagation constant
- dynamic mass density,
- dynamic bulk modulus,
- characteristic impedance,
- characteristic wave number)



### Software available as Standard

Using SCS9020B-LVDT software from SCS & Partners it is possible to measure *surface properties* for plane waves at normal incidence and *bulk characteristic properties*.

The software guide step-by-step the user from initial setup, microphones position exchange for calibration process, and for controls the measurement itself. The same GUI handle all possible type of measurement on porous sample, non-porous thin layers as well as mufflers, air filter and fluid canal (air ventilation) elements.



### Applications

On top of classical application of normal incidence sound properties, the portable version of the Impedance tube allows on-site easy test for Benchmarking and/or Quality assurance, directly from installed sample or from production line, and in all cases in which it would be easy to get samples directly at the source instead of having them sent to laboratory.

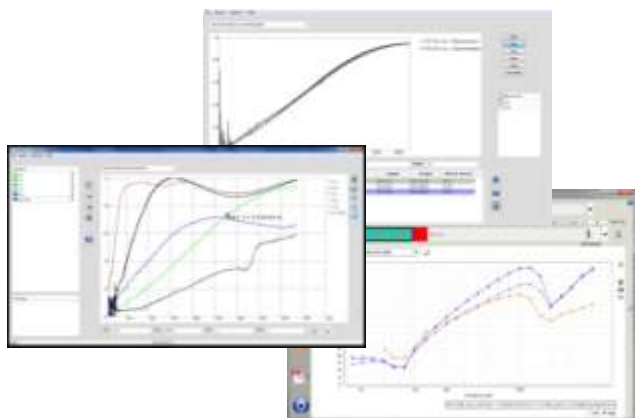
The various Impedance and transmission parameters which are measured in the Impedance tube, are the bases to estimate all other parameters of porous-materials using analytical inverse matrix determination of porosity, airflow resistivity, tortuosity, viscous and thermal characteristic lengths, static thermal permeability. See next page for dedicated software R-cell.

#### SCS902A suite for material testing.

To measure individual parameters as: Elastic modulus, Poisson ratio, Damping loss factor, Flow-Resistance, Porosity, Tortuosity, Statistical  $\alpha$ , Random incidence  $\alpha$  and TL, Bulk Modulus, etc.

Technical documents available at: <http://www.vibro-acoustic.com/Materials.htm>

**Specific Software suite available to match experiment and simulation on porous-material**



A valid alternative to standard software SCS9020B-LVDT is T-cell software provided by our Partners or from Matelys. There are not big difference between the T-cell and SCS9020B as both perform measurement using 2, 3 or 4 microphone position configuration, and can work also using a single microphone moved in each position concerned to the specific measurement setup.

Additional predicting software PAM-RC (R-cell from Matelys) add many more materials Characterisation to determine the visco-inertial and thermal parameters of porous materials and facing screens, while PAM-P software (A-cell from Matelys) predicts the sound absorption and sound transmission performances of complex multi-layer systems.

Physical Models which can be used for study of Acoustic properties of porous-materials with SCS9020B-28S Portable Tube experimental results are based on Research work of Delany-Bazley, Miki, Hamet, Attenborough (4 parameters), Johnson-Champoux-Allard-Lafarge -Pride-Lafarge.

**SCS9020B Impedance tube available:**

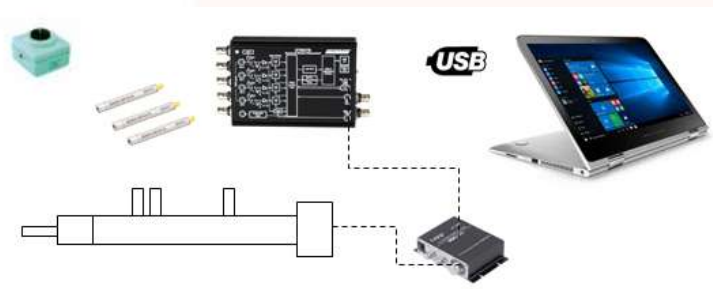
A complete set of Impedance tubes with different diameter  $\Phi$  are available, to match specific application: materials with gross and thin granulometry, textile and foam base, asphalt, light concrete screen, curtains, thin film, non-woven, etc.

While the Upper Frequency Limit UF is given by the tube diameter  $F$ , the low frequency depends from the quality of the overall system: DAQ dynamic range, residual phase, microphones distances, tube wall insulation. All of our Impedance tube can easily go down at a Lower Frequency Limit LF of 40Hz for 100mm tube or 60Hz for 28mm tube.

$\Phi$ mm	UF kHz
28	7.1
45	4.4
60	3.3
80	2.5
100	2



**SCS9020B\_28S**



**SCS9020B-28S Portable kit (Basic version):**

- Very thick anodized aluminum tube elements 28mm inner diameter, Loudspeaker, 4 microphone positions, Extended Frequency interval 80Hz-6.4kHz, sample holder;
- Signal amplifier 30w;
- Audio cable from amplifier to Tube loudspeaker;
- Set of 3 microphone sealed holders and 1 empty holes-tap;
- Power unit 10A-12VDC;
- Grid and Collars for supporting soft sample;
- Test samples are available, upon request, for check-up and reference.
- *Important Note. It has to be noted that International standard do not mention the use of sample test reference as the boundary conditions and environmental conditions significantly modify the results, they recommend instead to measure the residual sound absorption of an empty tube which shall be possibly below 0.05 in the usable Frequency Range. Similar measurement of an empty tube TL can be applied, in this case the empty tube TL shall be below 3 dB.*

**DAQ system and Software (Full version):**

- Input/Output Module SCSDT4, USB powered, 4 channels Input IEPE-24 bits (>51.2 kHz), Output channel (Generator);
- 3 microphones 1/4" 0V type with IEPE preamplifiers, (also works using 2 or single microphone);
- 3m cables SUB clips to BNC connectors;
- Sound Calibrator with 1/4" microphone adaptor;
- SCS9020BLVDT DAQ and Analysis software for both

The SCS suite of Impedance tube includes several configurations using 2, 3 or 4 microphones, the special version T60 able to measure directly and "energy correctly" in 1/3 octave bands sound absorption and TL, and cover also the experimental measurement of Acoustic properties of air filters, Mufflers, air silencer, sound traps, etc.