Noise Excitation Equipment for Building Acoustics Measurements

Loudspeaker Systems Nor275 and Nor276
Power Amplifier Nor280
Tapping Machine Nor277

Norsonic is the leading supplier of sound measuring systems for building acoustics. With more than 50 years of experience and by carefully listening to our customer's requirements, we have developed a complete range of noise excitation equipment designed for the optimal performance in conjunction with transmission loss measurements. In addition to low weight, these products fulfill the technical requirements set in the international Standards ISO 10140, ISO 16283 and ISO 3382 as well as various national Standards such as ASTM and the former Standard ISO 140.

A field assessment often requires the equipment to be carried up several floors. It is therefore important that the equipment is as small and light weighted as possible. However, new building constructions have a better sound insulation than previous constructions. It is therefore important that the emitted sound power is as high as possible in order to get a good signal to noise ratio in the receiving room. These are contrary requirements not easy to achieve with standard commercial equipment. Norsonic has therefore designed extremely powerful and lightweighted loudspeakers and a power amplifier with equalization, ensuring that the power is distributed to the frequencies that are required.

The Tapping Machine Nor277 follows the same design philosophy; light weighted, small and robust, with a weight of only 10 kg including the battery option. It is the first tapping machine with a build in self calibration test for hammer fall speed and rotational speed.

Features Nor276

- ISO 10140-1:2010 (replaces ISO 140-3 Annex C (Laboratory measurements))
- ISO 16283-1:2014 (replaces ISO 140-4 Annex A (Field measurements)
- ISO 3382 Annex A (Reverberation Time measurements).
- High acoustic power – 120 dB sound power output
- Lightweight, portable and rugged design for field use

Specifications

Physical design:	Dodecahedron
Sound power output:	Using the Nor280 with pink noise, and equalisation: 120 dB (Lin)
Speakers:	12×6”
Power (broadband):	200 W_{RMS} Peak 1000 W
Impedance:	2,7Ω
Diameter:	332 mm (13”)
Weight:	<9 kg (19,8 lb)
Tripod mounting rod:	1” diameter
Accessories incl.:	- Speakon NL4FC plug replaced by a 5m assembled cable, if ordered with Nor280 - Tripod

Dodecahedron Loudspeaker Nor276

A multitude of applications within the field of building acoustics requires the use of isotropic sound fields. The loudspeaker Nor276 has been designed to comply with these requirements and satisfies the technical requirements in the ISO 10140-1:2010, ISO 16283-1 Annex A and ISO 3382 Annex A. The output level is up to 120 dB re. 1pW for a pink noise signal.

The speaker comes with a tripod ensuring correct placement so that unwanted reflections and structural transmissions are kept at a minimum. The rugged cabinet is made of fibre glass and the speaker elements themselves are protected by grids to further enhance the concept.

The low weight of less than 9 kg has been obtained by the use of specially designed loudspeaker elements with neodyme magnets.

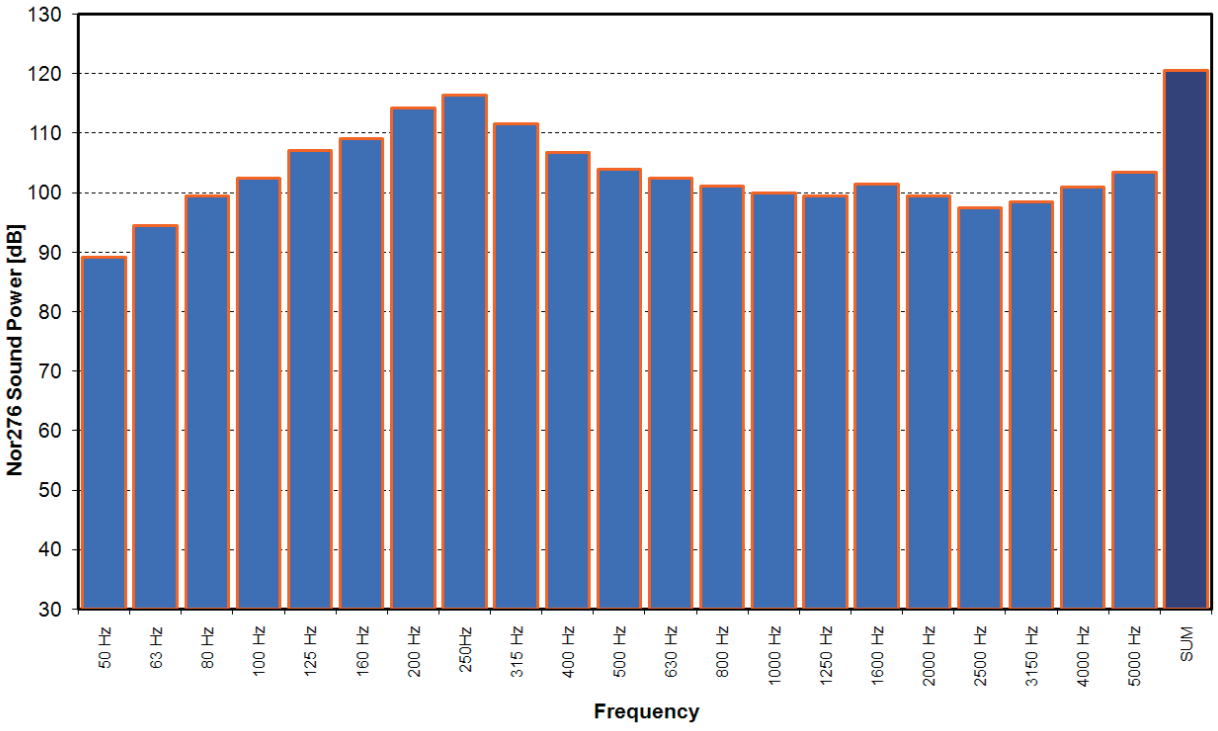
The Nor276 has been designed for continuous operation for more than one hour at full power. It is designed to be used with Nor280 Power Amplifier only. Using other amplifiers may damage the speaker and will void the warranty.

The speaker input socket accepts Speakon NL4FC connectors.

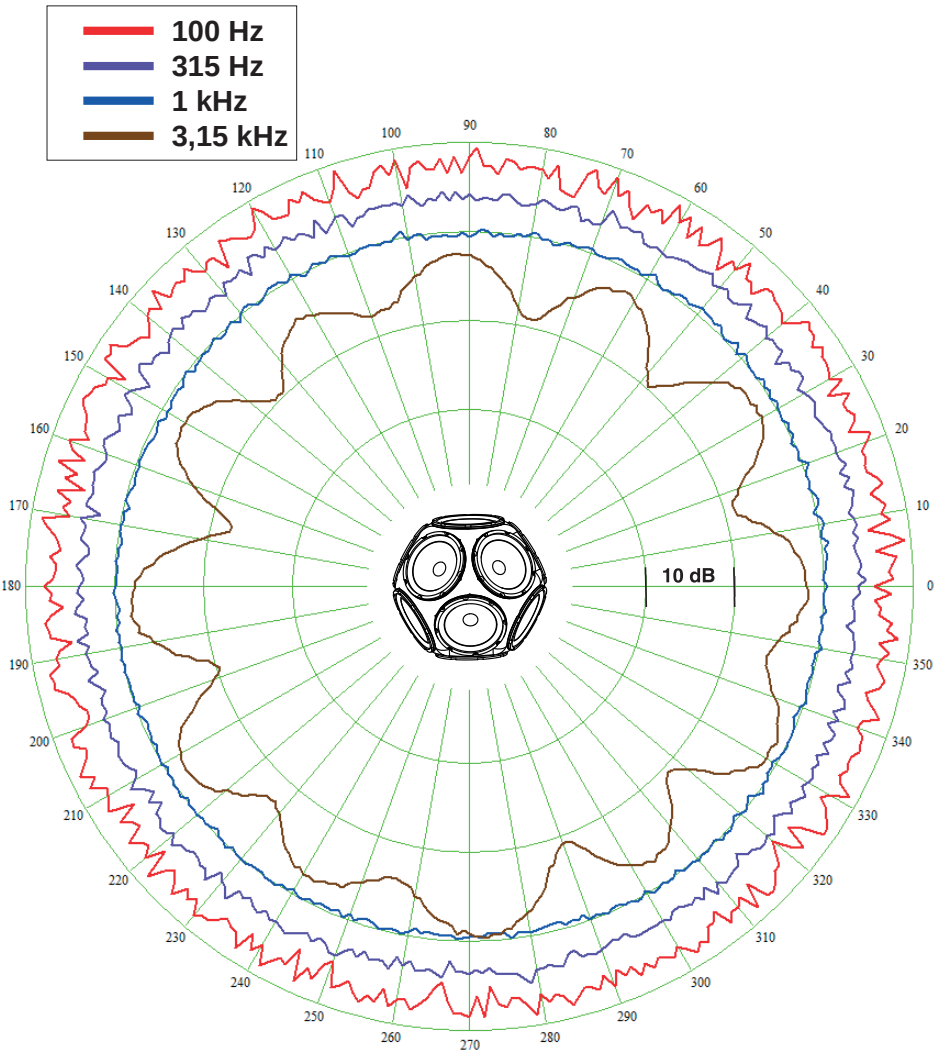
A mounting rod (Ø=1”) makes tripod mounting easy and safe.

The Nor280 Power Amplifier has an equalization circuitry matched to the loudspeakers Nor275 and Nor276, designed to boost the high and low frequencies to improve the system performance when used for building acoustics.The sound power graph below includes the sound power spectrum with the effects of the equalization circuitry.

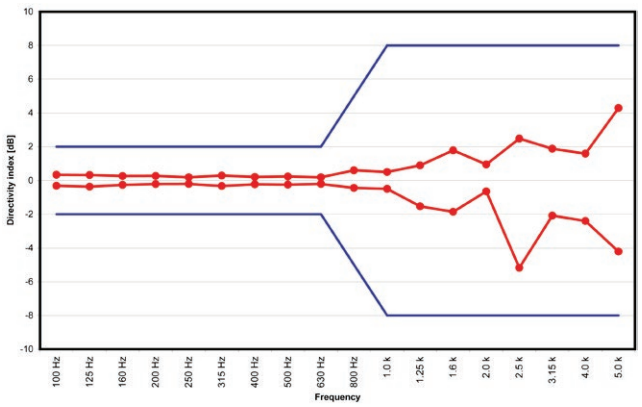
Dodecahedron Loudspeaker Nor276 and Power Amplifier Nor276 in situ with a Sound Analyser Nor140 fitted with wireless Bluetooth module for data transmission between sender and receivers room.



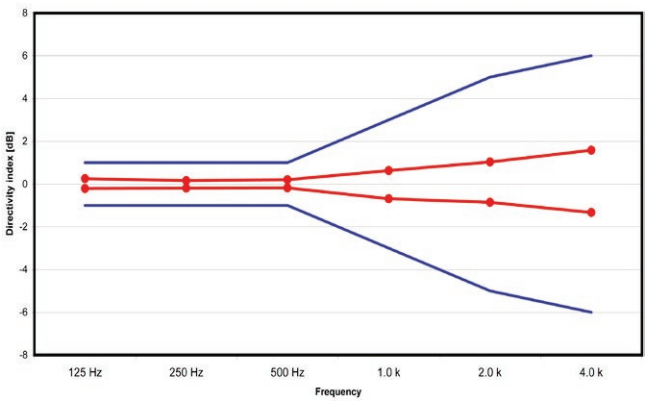
Typical sound power level vs. frequency of the Dodecahedron Loudspeaker Nor276 when used with the pink noise source and equalizer included in the Power Amplifier Nor280.



Sound power in different directions for Nor276. The measurement is done in a horizontal plane through the centre of the loudspeaker. The graph shows the respons for a sinusoidal signal at 100 Hz, 315 Hz, 1 kHz and 3,15 kHz.



Maximum and minimum directivity indices in different directions according to the requirements in ISO 140- and ISO 6283 compared to the tolerance limits.



Maximum and minimum directivity indices in different directions according to the requirements in ISO 3382-1 compared to the tolerance limits.

Hemi-dodecahedron Loudspeaker Nor275

A powerful sound source designed for in-situ building acoustics measurements per ISO 16283-1:2014. The source provides uniform sound radiation. When used with the power amplifier Nor280, the high sound power level ensures accurate descriptors in measurement conditions that include high background levels, high sound insulation properties and large room volumes.

Nor275 is designed for placement on the floor and uses the floor as a mirror for emitted sound.

The loudspeaker is designed to operate at full power for more than one hour continuously.

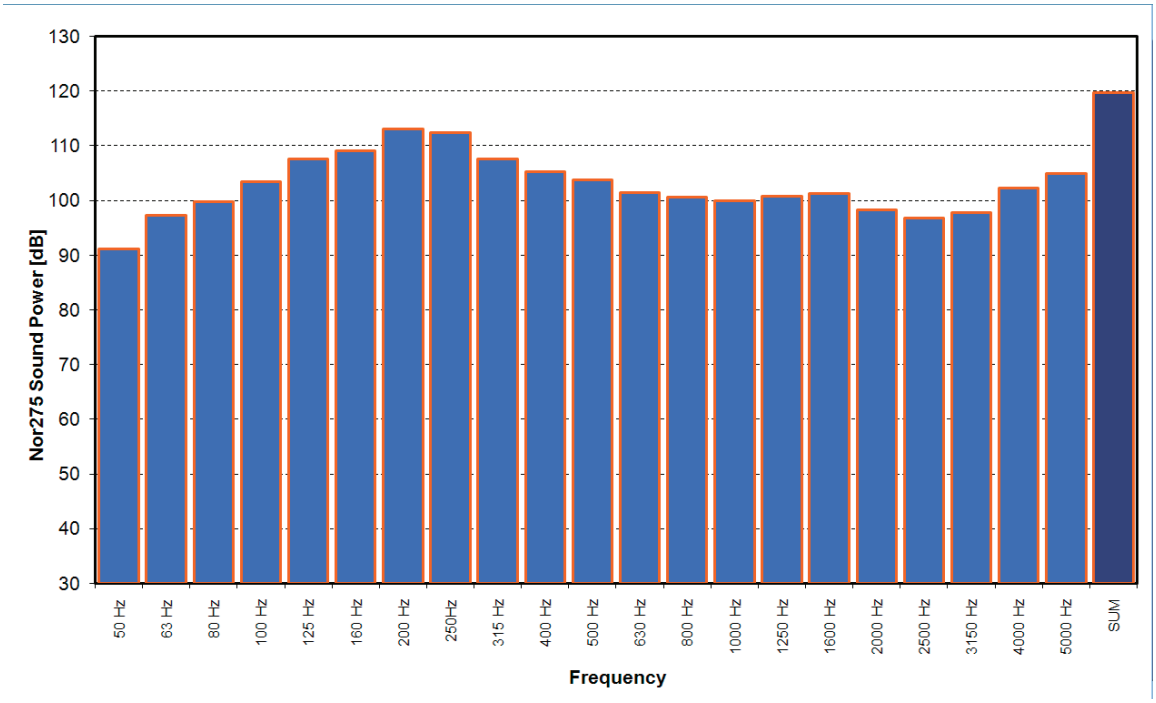
The Nor275 is designed to be used with the Nor280 power amplifier only. Using other amplifiers may damage the speaker and will void the warranty.

Features Nor275

- Nor275 fulfill ISO 16283-1 Annex A standard for airborne insulation measurements in field.
- Powerful - 120 dB Lw
- Lightweight, portable and rugged design for field use.

Specifications

Physical design:	Hemi-dodecahedron
Sound power output:	Using the Nor280 with pink noise, and equalisation: 120 dB (Lin)
Speakers:	6×6”
Power (broadband):	100 W_{RMS} (max) Peak 500 W
Impedance:	5.3 Ω
Diameter:	332 mm (13”)
Height:	195 mm (7.6”)
Weight:	6 kg (13.2 lb)
Accessories incl.:	- Speakon NL4FC plug replaced by a 5m assembled cable, if ordered with Nor280



Typical sound power level vs. frequency of the Hemi-dodecahedron Loudspeaker Nor275 when used with the pink noise source and equalizer included in the Power Amplifier Nor280.

Power Amplifier Nor280

Our aim is to take the latest technology available to help our customers complete their measurements faster but without loss of precision. With the Nor280 we have again met this objective. This power amplifier is the 4th generation of specially designed units for building acoustic measurements from Norsonic. It is less than half the size and weight, but twice as powerful as its predecessors; it replaces the Nor260 as the preferred amplifier to drive the Norsonic range of full and hemi dodecahedron instrumentation loudspeakers.

Unique design

The ISO 10140 and ISO 16283 Building Acoustics Standards place heavy demands on loudspeakers and as such many may be destroyed if traditional PA power amplifiers are used to drive them. These amplifiers are normally very powerful and designed to give a flat frequency response covering a much wider frequency range that the speaker system can handle. Feeding these systems with broadband pink or red/white noise may destroy the speaker; the low frequency content of the noise causes the speaker cone to move with much higher amplitude than its design limits. Hence, the speaker coil or the cone itself may be destroyed. In addition a lot of energy is wasted in the low frequency area below 15Hz.

To overcome this problem, and to optimise the power where it is needed, a unique built in equalization network compensates for the falling frequency response of the speaker system in both the low and high frequency areas. This also ensures that the 5 dB requirement between neighbour frequency bands are met when used in combination with the Nor275 or Nor276 loudspeakers. A part of the equalization network is a high pass filter that removes low frequency signals that lie below the required frequency range for building acoustic measurements and a low pass filter that removes all frequencies above 12kHz. This feature protects the speakers from distortion and concentrates power into the frequency bands where it is needed.

Powerful

The class D amplifier construction ensures low weight, high power output and low heat dissipation. The amplifier delivers up to 500 W_{RMS} into a 4 ohm load and an output current of up to 35 Amp!

Protection circuits

Both the input and output of the amplifier are short circuit protected and an automatic system will guard against overheating and too high signal voltage on the input. The built in cooling fan is normally not running. Only at high room temperatures or prolonged use of the amplifier at full power will the fan switch on. It will however, immediately switch off when the input signal goes off; this feature makes the unit well suited to reverberation measurements in areas of low background noise.

Features Nor280

- Specially designed for Building Acoustic measurements
- Lightweight and rugged construction
- Self contained noise generator
- 500 Wrms output power
- Emits 120 dB sound power level in the 50—5000 Hz frequency range when used with Norsonic dodecahedron loudspeakers types Nor275 or Nor276
- Wireless remote control of noise generator (optional)
- Equalization network to optimise acoustic output from speaker
- Balanced signal input for low noise and limited cross talk problems

Applications

- Sound insulation measurements
- Reverberation time measurements
- Absorption coefficient measurements

Noise generation

The internal noise generator features both Pink, White and Red/White noise excitation signals. The noise or line signal can be attenuated in 5 dB steps to –35dB . By adding option 1, you may switch on/off the signal remotely and wireless from another room. The balanced line input ensures minimum cross talk and induced noise when using long signal cables.

Specifications

Output:	Short-circuit and over-temperature protected
Output connector:	Speakon NL4MP
Output power:	500 W_{RMS} into 4ohm 250 W_{RMS} into 8ohm THD+N < 0.1% The built-in LP and HP filters ensure that the output power matches the Norsonic Nor275 and Nor276 series of dodecahedron loudspeakers
Peak power:	>1 kW_{PEAK} into 4ohm
Output current:	Maximum 35 A
Input:	Balanced input to avoid ground loops and cross talk to signal cables
Input connector:	XLR
Input sensitivity:	1.0 V_{RMS}
Input impedance:	10 kΩ//220 pF
Dimensions: (D x W x H)	275 × 110 × 246 [mm] 11 x 4,3 x 9,7 [inch]
Weight:	3,5 kg
Temperature:	–20 to +35 °C
Rel. Humidity:	0–90%
Enclosure class:	IP20
Mains:	220 VAC (±10%) or 110 VAC (±10%)
Fuse:	T 3,15A (220 V), T 6A (110 V)
EMC and Safety Standards:	EN 55103-1, EN 55103-2, IEC 61340-5 part 1&2, IEC 61010, FCC part 15b part 1&2
Accessories incl.:	Mains cable, Output connector
Ordering info:	Option 1: Wireless on/off remote control (must be specified when ordering)
CE conformity	EMC compliance according to EN 50081-1 and EN 50082-1, Safety according to EN 61010-1-1993 and Machine directive 89/392
Optional accessories:	Nor1494/5: Cable (5m) for connecting Nor275 or Nor276 to Power Amplifier Nor280. Nor1494/01: Opt. 1 : Special length; add/subtract per metre (maximum length is 25m).

Rugged flight case Nor1327B with room for the Dodecahedron Loudspeaker Nor276, tripod, Power Amplifier Nor280, Sound Analyser Nor140 and miscellaneous accessories. Photos just for illustration – the flightcase can differ a little in newer version.

! Self calibrating test!

Tapping Machine Nor277

The tapping machine Nor277 is the third generation of tapping machines from Norsonic for performing standardised impact noise tests (foot fall noise). It incorporates all the experience from the former generations into a compact, light, yet a rugged unit with the construction based on an extruded aluminium chassis. The hammers are made of harden stainless steel, ensuring non deformation of the hammer shape even after years in use. The unit weight is only 10 kg including the optional battery. Retractable feet ensure easy transportation and storage

The unit has the required five hammers each weighting 500g, with a fall height of 40 mm and 100 ms between each hammer impact. A crystal controlled servo system ensures the correct tapping frequency is maintained at all times and temperatures. A level gauge mounted on the top helps the user to align the unit when adjusting the fall height.

An electronic self calibration test system monitors the speed of the falling hammers as well as the frequency of impacts. Errors are indicated on the front by a LED for each hammer. A gauge is included to facilitate verification of the fall height. Fall height adjustments are carried out by adjustments of the tapping machine's three feet.

In its standard version the Nor277 is operated off mains, but battery operation off an internal battery is available as an optional extension (Option 1). This optional extension must be specified on ordering.

Nor277 is equipped with RS232 serial interface for controlling the operation. As an option the unit may be equipped with a wireless hand-switch for remote start and stop (Option 2). In this way, the hammer operation can be switched on and off from the receiving room where the measuring instrumentation normally is located.

The Tapping Machine Nor277 is a rugged and light-weight construction – the weight is not more than 10 kg – designed with field applications in mind.

(Separate Product Data sheet is available)

Features Nor277:

- Remote operation from hand switch or PC
- Mains or battery operation
- Low weight
- Compact
- Rugged construction
- Built in self check of hammer fall speed, and tapping sequence.
- Retractable feet

Applications

- Impact sound transmission testing according to ISO 10140-5, ISO 16283-2, ASTM E492 and ASTM E1007

Specifications

Hammers:	5 hammers @ 500 g. Effective falling height 40 mm (adjustable)
Tapping sequence:	10 impacts per second, rpm controlled via servo feedback loop.
Power:	84 – 264 V, 47 – 63 Hz
Battery operation:	Optional built-in Li-Ion rechargeable battery. Battery capacity: Typical 1 hour with intermittent use and 45 minutes of continues operation. Battery de-rating: <5% loss in capacity per 100 discharge/charge cycles. Battery charging time: 2 hours
Power consumption:	Less than 30 W
Dimensions: H x L x W	230 x 495 x 165 (265 feet extended) mm. Add 50 mm to the height for handle.
Weight:	10 kg (22 lb) including battery and wireless remote option
Ordering info:	Option 1: Battery operation, must be specified when ordering Option 2: Wireless remote control, must be specified when ordering
Acc. incl.:	Instruction manual, mains cable, small rod used for the verification of the fall height.
Optional acc.:	Carrying case/Shipping case Nor1336
CE conformity:	EMC compliance according to EN 50081-1 and EN 50082-1, Safety according to EN 61010-1-1993 and Machine directive 89/392