INSTRUCTION MANUAL

Norsonic

Geophone

nor1292

Introduction

The tri-axial geophone Nor1292 is a sensitive transducer for vibration velocity based on a rugged geophone construction used by seismologists and geophysicists for decades. One main application is for the measurement of vibrations in buildings. The frequency response is essentially flat from the resonance frequency 4,5 Hz and up to at least 500 Hz. However, by using the frequency compensation found in some Norsonic instruments like Nor133 and Nor136, the applicable frequency range may be extended downwards to 1 Hz.

The transducer is a passive device and needs no power for operation.

Operation

Connecting to an instrument

The geophone Nor1292 plugs directly into the input socket of the six channel vibration analyzer Nor136. It will then connect directly to channel 1, 2 and 3. A second geophone may be connected to channel 4, 5 and 6 of the same Nor136 instrument by the use of an adapter. By the use of adapters, the unit may be connected to the tri-axial vibration analyser Nor133.

The unit may also be applied in connection with a suitable sound level meter like Nor140. Only one direction can then be measured at the time by a one-channel instrument.

Important: Do not plug the geophone Nor1292 into a Norsonic sound level meter without using a suitable adapter. Ask the factory for recommended adapters!

Mounting

Place the geophone on the surface to be measured and turn the unit so the x-y axis is in a suitable direction. Adjust the adjustable feet until the spirit level at the top indicate that the transducer is in level.

Calibration

The unit is delivered with a calibration certificate specifying the sensitivity at 1 Hz, 4 Hz, 16 Hz and 80 Hz. We propose that you use the sensitivity at 16 Hz or 80 Hz to adjust the sensitivity of the instrument. Due to the weight of the transducer, a calibration in the field is normally not achievable and normally not needed. However, a soft tapping at the side of the geophone while simultaneously reading the response is good practice for verifying proper operation and connection.

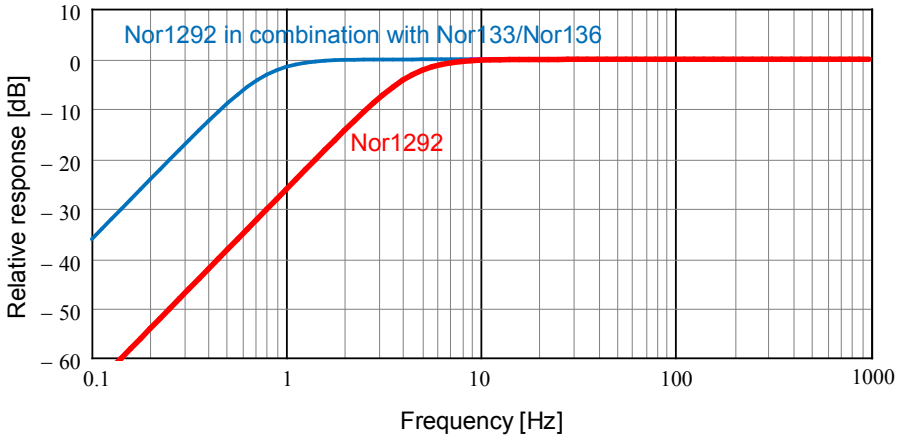
Technical description

Principle of operation

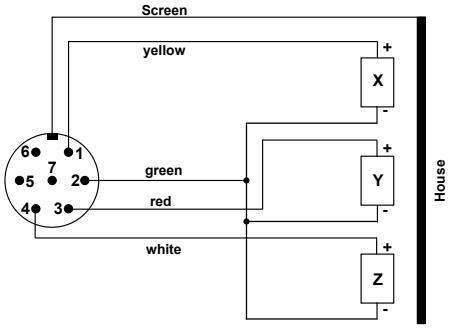
The geophone is based on a spring mounted coil which moves in a magnetic field. The spring is very soft giving a resonance frequency of the mounted coil of about 4,5 Hz. Above the resonance frequency, the coil will be in rest due to the inertia of the coil. The magnet creating the magnetic field is fixed to the transducer housing and will move with the applied vibration. Due to the law of induction, a voltage proportional with the velocity between the coil and the magnetic field will be generated.

The spring is made so the coil will only move in one direction, i.e. the sensitivity axis for the transducer. The tri-axial geophone Nor1292 is made with three single-axis sensors, one for each orthogonal direction. Since the spring is very soft in order to obtain a very low resonance frequency, the spring for the transducer with vertical sensitivity has to be pretensioned to counteract to action of gravity. Therefor, for proper operation the unit has to be mounted so that the z-axis is in vertical direction pointing upwards.

The transducers are internally terminated in a resistor making each transducer critically damped. At the resonance frequency, the transducer will therefore have a sensitivity 30% lower (-3 dB) than for higher frequencies. Below the resonance the response will be even more reduced and fall off with 40 dB per decade. Some instruments, like Nor136 and Nor133, have a frequency correction which correct the frequency response and extend the linear frequency range down to 1 Hz as shown in the graph on next pace.



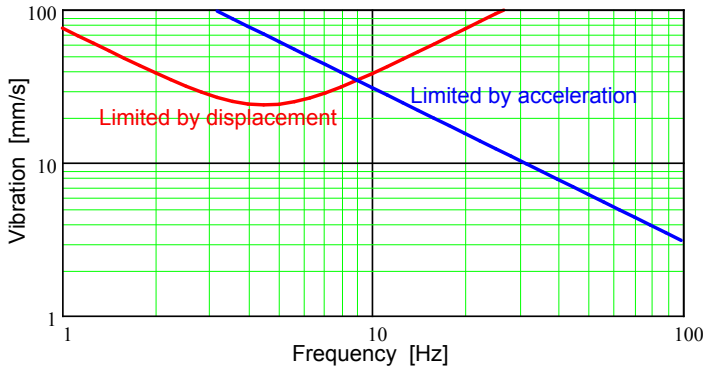
Output terminal



The figure above shows the output terminal and how the vibration sensitive elements are connected. The terminal is a Lemo connector in the end of a cable of length 3 m. Each transducer has a DC-resistance of nominal 380 ohm and is terminated in a 1740 ohm resistor to obtain a critically damped transducer. The transducers have a common signal ground insulated from the enclosure. An input impedance of at least 50 kohm for a connecting device is recommended to obtain the stated sensitivity and frequency response.

Measurement range

The measurement range is limited upwards by the maximum displacement the transducers can handle and the maximum acceleration where the transducer follows the movement of the supporting surface. The maximum displacement is 1,8 mm peak-to-peak giving an RMS-value of 0,6 mm. Below resonance this will increase since the coil will follow the movement of the housing. If the acceleration is too high, the geophone will not follow the vibrating surface to be measured. The limit in the diagram below is set to 0,2 g (acceleration of gravity) or 2 m/s^2.



The lower limit is set by the noise floor in the transducer and measuring instrument. If the instrument has an electrical noise floor of 0,3 µV – achievable for restricted frequency bands – this corresponds to a vibration level of 10^{-8} m/s or 0,00001 mm/s with the nominal sensitivity of 26 Vs/m. The noise in the transducer itself is even lower – mainly determined by the source resistance of 380 ohm which corresponds to about 0,04 µV in a bandwidth of 250 Hz.

Specifications

Function: Measures the vibration in 3 orthogonal directions; two horizontal and one vertical, marked x, y and z.

Sensitivity: 26 Vs/m (or 26 mV/mm/s) – individually calibrated.

Temperature sensitivity: Less than ±0,02% per °C

Output impedance: 312 ohm (nominal)

Resonance frequency: 4,5 Hz – damping factor 0,7

Frequency range: 1 Hz – 500 Hz with frequency compensation (– individually calibrated).

Insulation between signal terminals and enclosure: Min. 10 Mohm (Max 100 V)

Weight: 2,5 kg

Size: 14 cm x 14 cm x 9,5 cm (w x d x h)

Cable length: 3 m

Connector: 7-pin Lemo type 1B, male

Temperature range: -40 to +70 °C (operating and storing)

Humidity range: Non-condensing

Environmental protection: IP66 (with the exception of the connector)

Conforms to EN 61010-1(2001), pollution degree 2, portable equipment; IEC 68041(2004).

Warranty period: 3 years

Accessories

The normal microphone cable from Norsonic type Nor1408A may be used as an extension cable. However, the signal ground will then be connected to the screen of the cable. The cable comes in different standard lengths from 2 m to 50 m, but the maximum cable length from the geophone can be considerably longer.
Ask the factory for suitable adapters to other instruments like a sound level meter.

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