INSTRUCTION MANUAL

Outdoor microphone

nor1216

Norsonic

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Nor1216 – User Guide
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Introduction

The outdoor microphone Nor1216 is a measurement microphone for all-weather conditions. It is intended for temporary as well as permanent outdoor applications. The microphone contains elements for protecting the microphone cartridge from rain and snow, dust and insects, satisfying IP 55 requirements.

Further, compared to a standard measurement microphone, the Nor1216 improves the measurement accuracy by reducing the wind noise and by improving the directional response for sound from different directions.

Combined with a suitable sound level meter instrument including a frequency response correcting function, the Nor1216 satisfy Class 1 specification requirements according to IEC61672-1 and similar national standards for a sound level meter class 1.

The microphone is intended for vertical mounting only since the act of gravitation forms a part of the rain protection system. The reference direction may, however, be selected to be vertical or horizontal based on the applied frequency response compensation in the sound level meter.

The outdoor microphone may be calibrated with a normal sound calibrator suitable for ½" working standard microphones (WS2) and without the need for extra accessories. Access to the microphone cartridge is easily gained by dismounting the upper part of the outdoor microphone.

The base of the Nor1216 is made of an electrical insulating material. The microphone body will be fully insulated from the mounting mast thereby reducing pick-up of electrical hum and noise.

For verification of proper operation, the microphone is equipped with a system check facility, where an electrical signal applied on one of the terminals are returned after passing through the complete signal chain, thus verifying proper operation of the microphone cartridge, preamplifier and microphone cable.

The Nor1216 is equipped with the standard 7-pin Lemo connector for microphone preamplifiers. However, the current consumption has been increased in order to raise the temperature above the ambient. Nor1216 is mainly designed to be used with the Nor140 and Nor150 Sound Analyser . These instruments have the requested frequency compensation and deliver the required current.

Please note that Nor140 instruments with serial number lower than 1405079 may need to be upgraded in order to deliver the required current. Contact your supplier for further information.

Assembling

The outdoor microphone Nor1216 is shipped fully assembled. However, in order to mount the microphone cable the unit has to be opened.

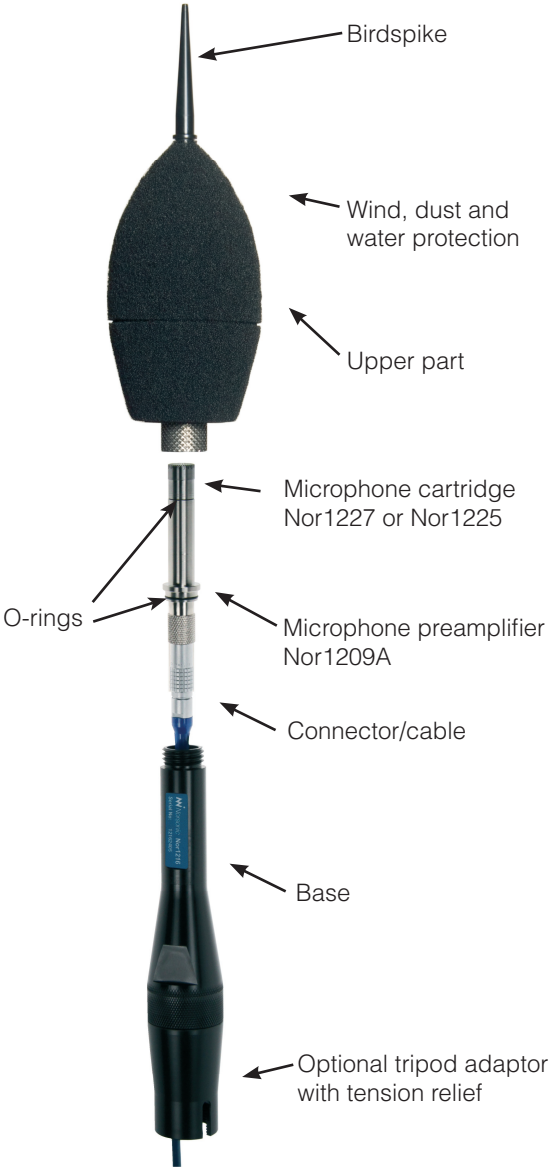
Depending on the application, you will need a mast or tripod for mounting the microphone system and possibly devices for proper grounding and lightning protection, see below.

We recommend cable type Nor1408A, which comes in standard lengths of 5, 10, 15, 20, 30 and 50 metres – other lengths are available on request. This cable is Teflon®-insulated and hence absorbs very little water, which is important to retain high insulation in all weather conditions. The mantle is made of polyurethane to ensure a robust cable, yet flexible at low temperatures. If you need weather-protected connectors, we recommend cable type Nor1485.

Unscrew and remove the upper part of the microphone consisting of birdspike and windscreen as one unit. Do not remove the windscreen from this upper part as this may destroy the weather protection and alter the acoustic performance.

Pull up the assembly of microphone cartridge and preamplifier: See picture on this page. This assembly is mounted to the base unit by the friction of an O-ring and may be pulled straight up.

If the microphone is to be mounted on a mast, mount the base unit and let the microphone cable go through the base unit. Connect the cable to the



preamplifier and mount the assembly of microphone cartridge and preamplifier. After mounting of the upper protection part, the outdoor microphone is ready for use. However, we recommend you to test the unit together with the measuring instrument by applying a calibrator before the upper part is mounted.

The unit is delivered with an adaptor for mounting on a tripod. The cable is then led through a slot in the side of the adaptor. The base screw has a threaded hole like those commonly used for cameras (3/8" UNC). The base screw also forms a tension relief for the cable.

Mounting on a mast

For permanent installations we recommend to mount the Nor1216 on a pole rather than using the 3/8" camera tripod treads. Remove the optional tripod adapter with tension relief to gain access to the pole mount threads. The pole mount threads are standard 1" according to ISO228-BSP (British Standard Pipe)

If the mast is high and you need to make regular calibrations or other service operations, we recommend to use a mast that can be tilted or a telescopic mast. Norsonic can supply different masts on demand.

We recommend to place the cable to be mounted inside the mast for protection. A cable flapping onto the mast in windy conditions may create excessive noise and ruin the accuracy of the measurement.

Grounding and lightning protection

If the outdoor microphone assembly is the highest object in the vicinity when mounted, it may be exposed to lightning strokes. We recommend to use a conductive mast and to ground it properly. A rod in proper contact with the conductive mast should be made at the side and 50 cm above the tip of the microphone. The rod should be placed at least 25 cm to the side of the microphone assembly and have a diameter less than 10 mm to avoid interference with the directional properties of the microphone.

Safety considerations may require the screen of the microphone cable to be properly grounded and that the internal conductors are clamped for high voltage protection.

We recommend making the combined grounding for the cable and instrument at one point only in order to reduce the risk of pick-up of hum and electromagnetic noise.

Verify the noise floor of the complete system after installation is completed to ensure it is below the lower end of the required measurement range. If a quiet location is not available, the noise floor may be measured by substituting the microphone with a dummy microphone like Nor1448. As an alternative the Nor1447 adaptor terminated with a short-circuit or a 50 ohm BNC termination is also a suitable device for making this test. A sound calibrator in OFF-mode may also be used to attenuate the external noise. A ½" microphone normally requiring polarization voltage may also be used without polarization voltage. It will then have a very low sensitivity.

Microphone calibration

The Nor1216 can be calibrated with a sound calibrator for ½" microphones without the need for special couplers. We recommend using Nor1251 (1000 Hz) or Nor1253 (250 Hz).

Unscrew the upper part of the microphone to gain access to the microphone cartridge. Mount the calibrator slowly and carefully while turning the calibrator and switch it on. See figure.

If the calibrator frequency is 250 Hz, adjust the reading to be the level stated for the calibrator, e.g. 124,0 dB for Nor1253 with 124 dB specified level.

If the calibrator frequency is 1000 Hz, adjust the reading to be 0,1 dB below the stated calibrator level, e.g. 113,9 dB for Nor1251 calibrator with a stated level of 114 dB.

Mount the upper part after finishing the calibration.

Technical description

The outdoor microphone Nor1216 is based on a ½" working standard microphone type WS2F according to IEC 61094-4.

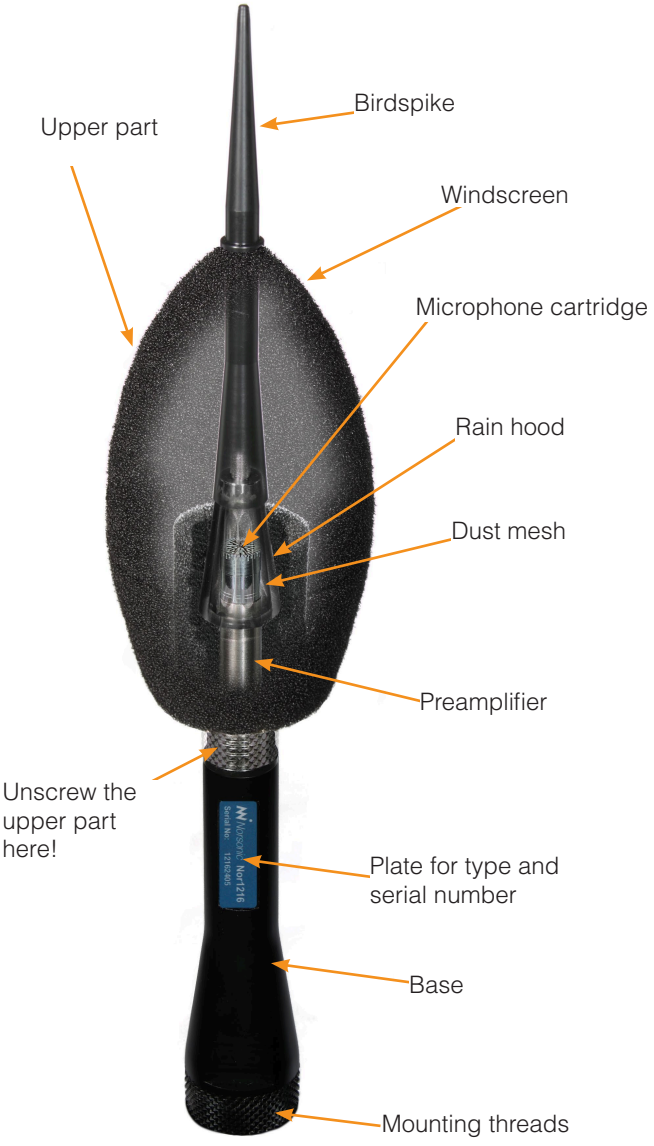
Two types of microphones are offered;

- Nor1225, a free field microphone requiring 200V polarisation voltage.
- Nor1227, a free field self polarised microphone.

Both microphones have a nominal sensitivity of 50 m V/pa. However, each microphone is individual calibrated and may differ slightly from this value.

The upper part of the Nor1216 consists of windscreen, rain hood, dust mesh and birdspike and protects the microphone from rain, snow, dust and insects. Both the rain hood and the dust mesh are made of a water-repellent fabric open for the sound. The sound is reaching the microphone through nine slots placed equidistantly around the circumference of the circular body of the upper part. The mechanical parts with the birdspike is also important for the directional response of the complete microphone system.

The upper part may be removed as one unit and will thus give easy access to the microphone cartridge for testing and calibration.



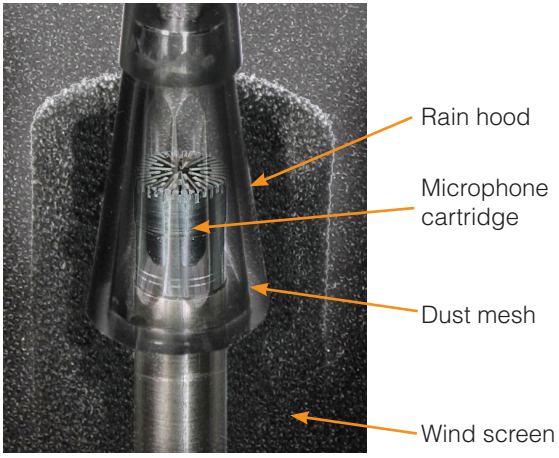
The lower part consists of the base, the microphone cartridge and the preamplifier Nor1209A. A normal microphone cable supplied with Norsonic sound level meters, like Nor1408A, should be used for connection to the sound level meter instrument. An adaptor for mounting the outdoor microphone on a tripod is included.

The base is made of black polyacetal (POM). The material is durable and insulating, thus preventing electric noise from ground loops through the mast.
Drops of water from rain are kept away from the microphone diaphragm by the combined act of the tubular windscreen, the rain hood and the dust mesh. The upper part of the microphone cartridge is air- and water tight, and the backside is vented to the air through the preamplifier. The electrical power consumption is increased in the Nor1209A preamplifier compared to an ordinary Nor1209 preamplifier. This increases the temperature of the microphone some degrees Celsius above the ambient temperature and prevents condensation and humidity problems.

The Ingress Protection Category for the assembled microphone is IP55 according to IEC 60529.

Consider the assembly of microphone, and preamplifier as a single unit when operated in the field. If disassembled in the field, the performance may be reduced due to contamination from dust and humidity.

When Nor1216 substitute a normal measurement microphone on a sound level meter, a correction of the frequency response is normally needed to retain the class of accuracy for the sound level meter, see Specifications. Based on the correction, the reference direction may be selected to be either horizontal or vertical. Horizontal reference direction is usually selected for sound approaching the microphone mainly along a horizontal axis like noise from industry or vehicles.



A vertical reference axis is usually used for measuring the noise from aircraft.

The sound analyser Nor140 and Nor150 have correction network where the reference axis for the outdoor microphone Nor 1216 may be selected to be horizontal or vertical

See separate description in this manual on how to configure the Nor140 or Nor150.

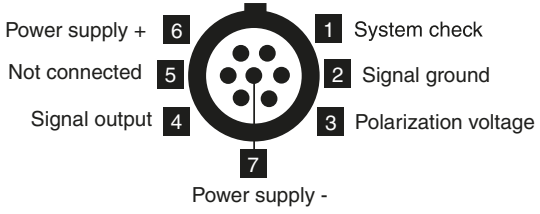
Electrical description

The power to the Nor1216 will normally be supplied from a Norsonic sound analyser Nor140 or Nor150 instrument and the user does not need detailed knowledge of the interconnection. Alternatively, the microphone unit may be supplied either from a single supply in the range 28 V to 32 V or a symmetric supply in the range ±14 V to ±16 V. The latter alternative is recommended. The connection is shown on the adjacent figure. (Outside view for the connector).

Pin 3, allocated for polarization voltage, shall be terminated to signal ground (pin 2) for the microphone cartridge Nor1227. When the microphone unit is equipped with the Nor1225 microphone cartridge where polarization voltage is needed, 200 V must be supplied to this terminal.

The supply voltage will affect the maximum sound pressure that can be measured. For ±15 V or +30 V supply, the maximum peak value exceeds 10 volt corresponding to 140 dB peak sound pressure level for the Nor1227 / Nor1225 microphone cartridge (50mV/Pa).

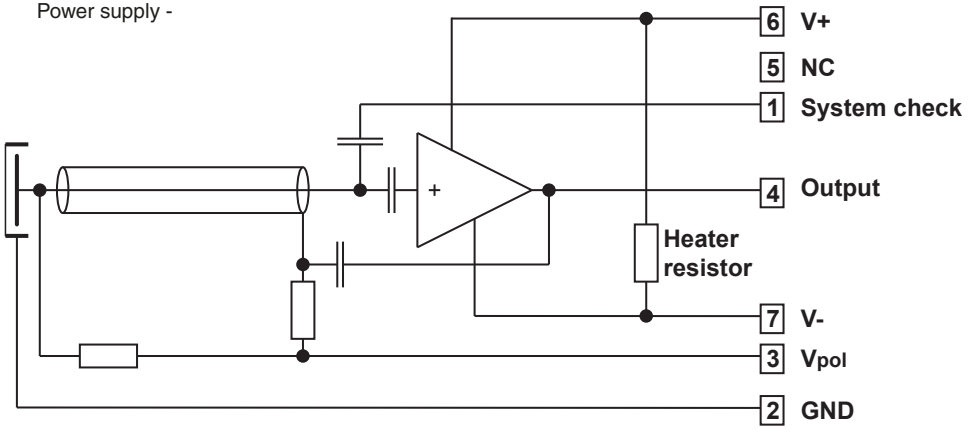
By the use of the "high level" option in Nor140, signals with peak values up to 150 dB may be measured with the microphone Nor1225.



The figure below shows a simplified electrical circuit diagram of the complete outdoor microphone. The microphone cartridge is connected to the preamplifier input terminal. The figure below shows the output connector seen from outside.

NOTE: Nor140 with serial number below 1405079 must be upgraded in order to deliver the required current for the heater resistor which is used in Nor1216 to rise the temperature of the microphone and preamplifier some degrees above the ambient temperature.

NOTE: The high current consumption due to the heater resistor requires that the Nor140 is powered externally. Using the internal batteries may lead to increased self noise.



System check

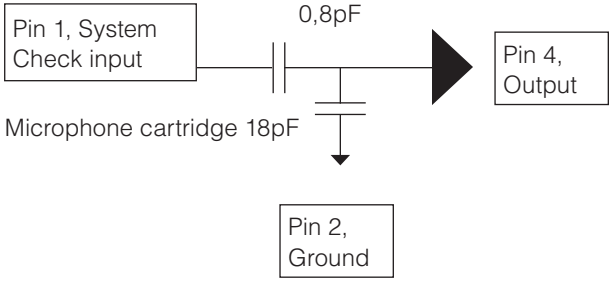
The system check terminal, pin 1, shall be terminated to signal ground or the signal output when the microphone system is in normal use. For checking the system, a test signal may be supplied, e.g. an AC signal of 1 volt – 1000 Hz. The signal is transmitted to the preamplifier input through a capacitor with a very low capacitance (about 0.8 pF) and further to the signal output.

The system check is a robust and simple method for verifying a microphone system. It measures the change in the capacity of the microphone cartridge. Nominal cartridge capacity of a ½" microphone is 18pF. The test signal is feed through a fixed 0,8pF capacitor, and the system check voltage is measured as a function of the attenuation between the 0,8pF capacitor and the microphone cartridge with a nominal capacitance of 18pF.

A typical level for the returned signal is 45 mV with an excitation of 1 volt corresponding to a sound level of 92 – 95 dB dependant of the microphone cartridge capacistance. The signal may be used for verification of correct operation of the cable and preamplifier. Even a malfunctioning microphone may be detected since this is normally accomplished by a change in the microphone capacitance. A very low signal is returned in case of a short-circuit in the microphone.

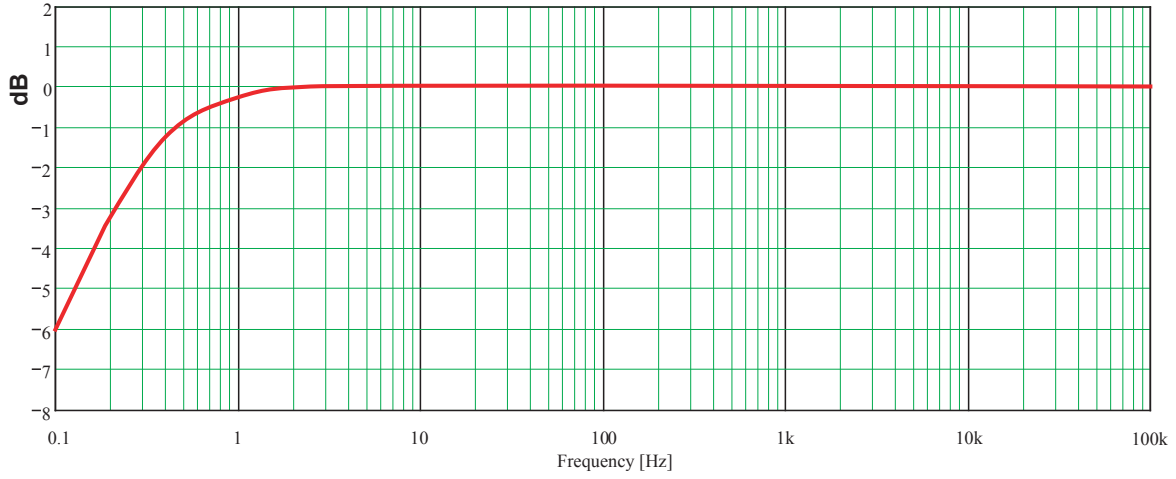
A 200V polarised microphone will show approximately 2 dB higher level if the 200V disappear due to the lost tension and thereby decreased capacity in the diaphagma when the 200V is off.

The sound analyser Nor140 and Nor150 have a build-in signal generator that deliver the required signal for system check. The signal is switched on/off from the instrument menu. See separate description.



Frequency response

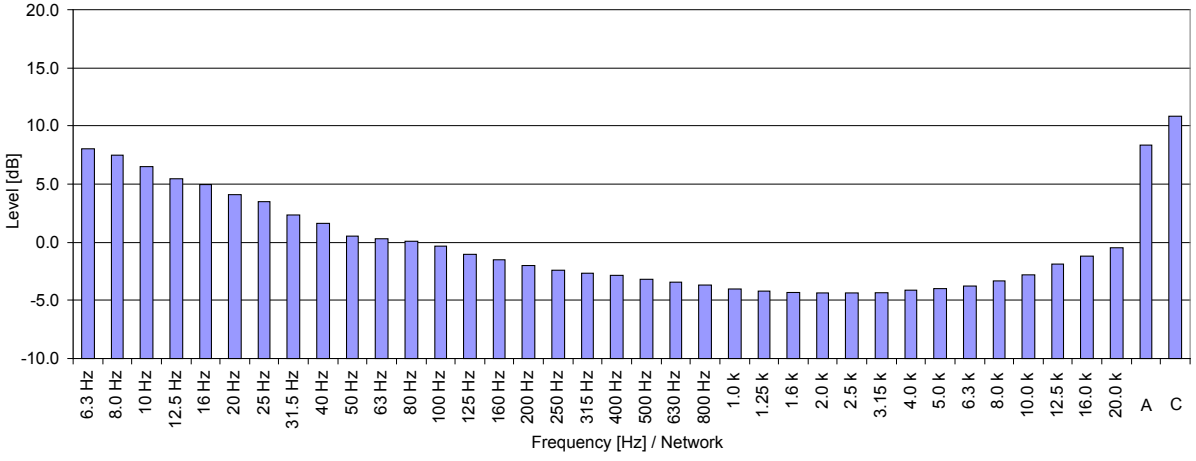
The typical frequency response for the preamplifier is shown below. The frequency response for the outdoor microphone system is therefore mainly determined by the microphone cartridge and the acoustic performance of the enclosure.



Typical frequency response for the preamplifier Nor1209A

Self-noise

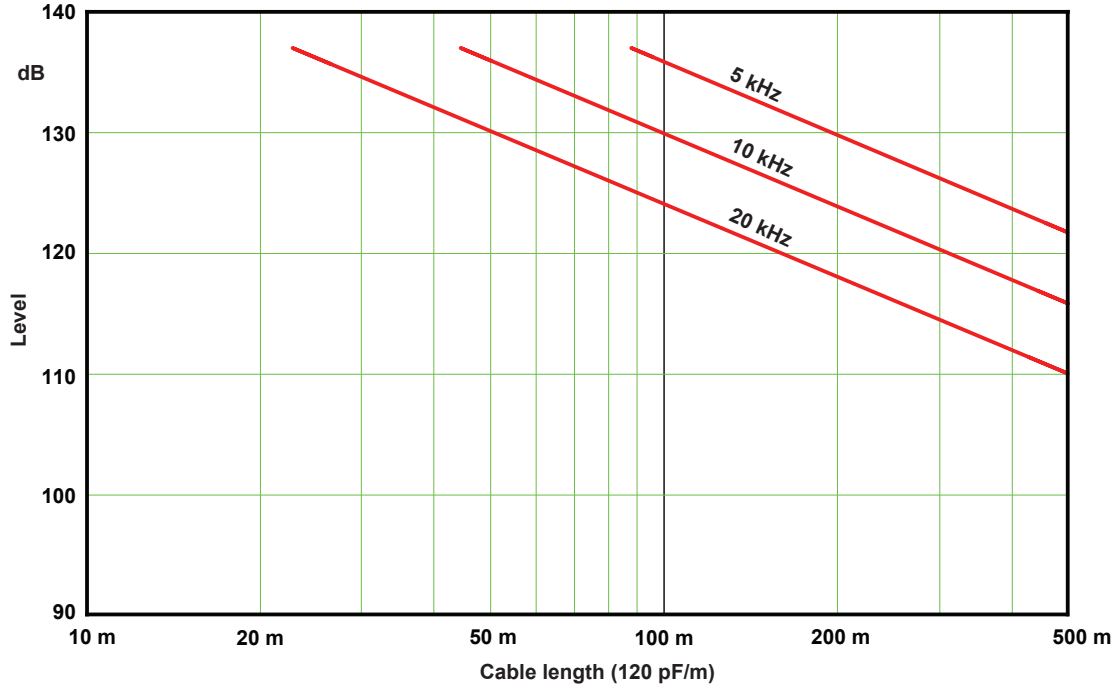
The electrical noise when the microphone is substituted by an 20 pF capacitor is shown on the graph above. 0 dB corresponds to 1 µV. For a microphone with a sensitivity of 50 mV/Pa (Nominal value of Nor1227 or Nor1225), 0 dB voltage also corresponds to the normal reference pressure for sound: 20 µPa and the noise level may be compared with sound pressure level directly.



Typical self noise of the microphone system when the microphone is substituted by a capacitor with similar capacitance as the microphone. Note that the acoustical self-noise for a real microphone will be higher due to thermal noise in the microphone cartridge.

Cables and cable length

The Nor1216 with its preamplifier Nor1209A has excellent driving capability for long cables. The signal output from the microphone preamplifier will be loaded by the capacitance of the cable between the microphone system and the instrument. The capacitance will increase proportionally with the length of the cable. A typical value for microphone cables from Norsonic is 120 pF per metre. Hence, a cable with length 100 m, will load the output with a capacitance of 12 nF. For lower frequencies there are seldom problems with long cables. However, when the signal contains the combination of high amplitude and high frequency, the capacitive loading will lead to high output current. A limited current capacity will set limits for the maximum slew-rate for the signal. The figure below shows the maximum level as function of cable length and frequency. 20 kHz corresponds to the bandwidth of the microphone system with the normal microphone Nor1225 or Nor1227.



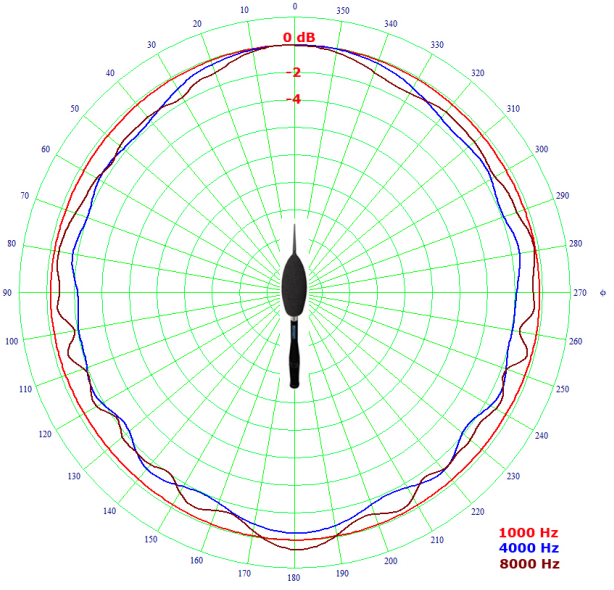
Directional response

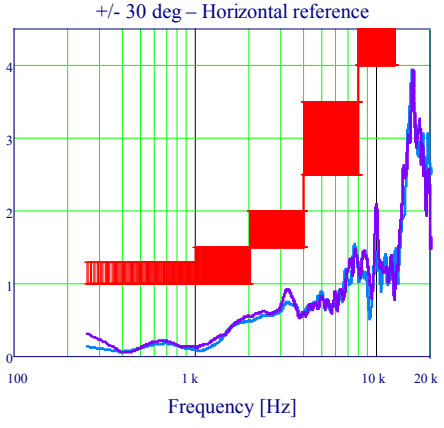
An outdoor microphone system like Nor1216 may form a part of a sound level meter when applied for environmental noise monitoring. The combination of microphone and instrument shall therefore satisfy all requirements in the international standards for sound level meters, specified in IEC 61672-1. Ideally, the microphone shall have the same sensitivity for sound from any direction. The IEC 61672-1 specifies tolerance limits for the directional response.

The directional response of a microphone is the ratio of the free field response at a particular frequency as a function of angle of sound incidence to the response in the reference direction.

The upper adjacent figure shows the directional response for Nor1216, when the reference axis is vertical, for the frequencies 1000 Hz, 4000 Hz and 8000 Hz.

IEC 61672-1 specifies tolerance limits for any frequency. The limits are depending on the angle from the reference axis and the standard specify tolerance limits for angles up to ± 30°, up to ± 90° and up to ± 150° from the reference axis. The lower adjacent figure shows the typical max. deviation for the sector up to ± 30° from a horizontal reference axis together with the applicable tolerance limits for a Class 1 sound level meter.





Frequency response

The figure below shows the typical frequency response for sound approaching the microphone in two directions. The response marked “Vertical” is the response for sound approaching the microphone from above along the bird spikes, when the microphone is in the recommended vertical direction. The response marked “Horizontal” is the response for sound approaching the microphone in a horizontal direction when the microphone is mounted in the same recommended vertical direction.

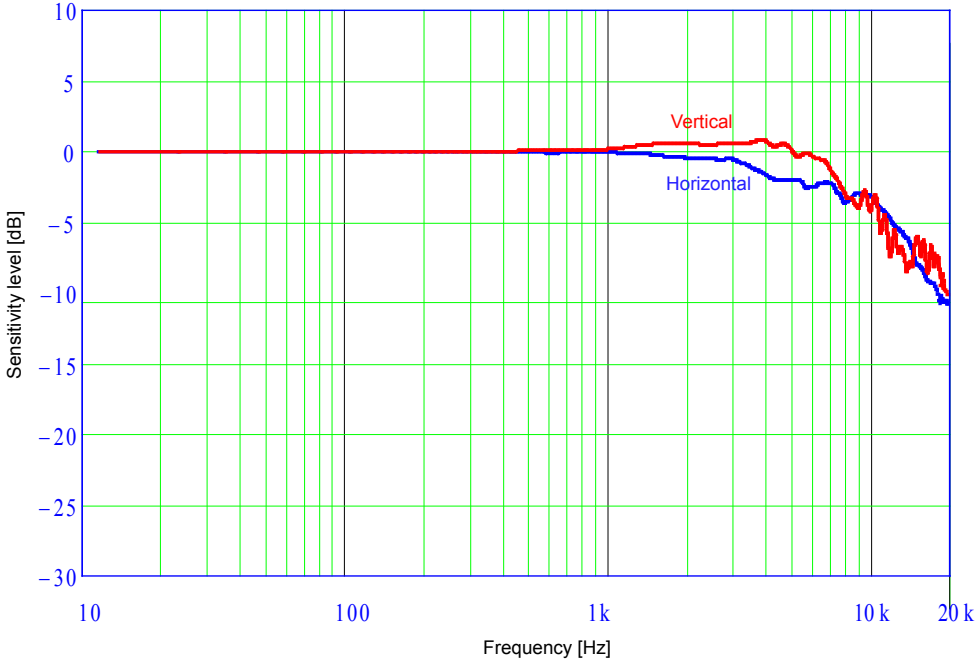
Due to the lower sensitivity for higher frequencies, as shown on the figure, it is recommended to correct the frequency response to ensure that the response is within the requirement for Class 1 sound level meters specified in the international standard IEC 61672-1.

When the microphone system is used in connection with the precision sound analyser Nor140 (for program version 2.0 and above), just select Nor1214/Nor1216 in the input setup menu. When used with Nor118 (and power supply) we recommend the following corrections:

Vertical: Random response correction (R) and Windscreen correction (W)

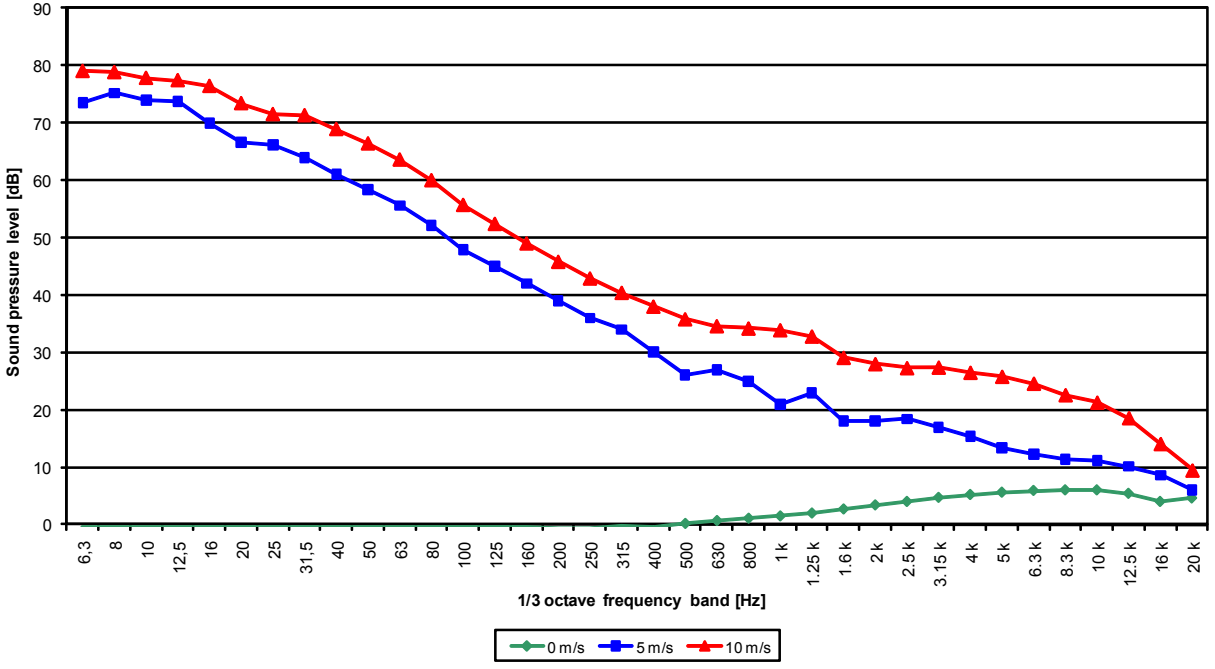
Horizontal: Random response correction (R)

Instruction for using the Nor1217 together with Nor150 is given later in this manual



Self-noise and wind

The figure below shows typical self-noise for the microphone system as levels for the various 1/3-octave frequency bands re. 20 µPa when the microphone is placed in a horizontal, laminar flow of air with speed 0, 5 and 10 m/s, respectively. The levels are measured without frequency compensation. The corresponding A-weighted levels are 16 dB, 40 dB and 48 dB. Depending on the wind speed, the noise levels are typically 20 dB to 30 dB lower than for an unprotected microphone.



Connecting the Nor1216 to Sound Analyser Nor140 and Sound & Vibration Analyser Nor150

The Nor1216 is designed to be used with the Sound Analyser Nor140 and Sound & Vibration Analyser Nor150. These analysers support all the needed corrections, system check facilities for the two types of microphones.

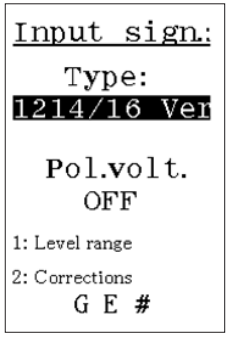
NOTE: Please note that the heating resistor in the Nor1216 is consuming more current than can be sourced from the Nor140 power when powered with the internal batteries. Hence, The Nor140 should always be powered from an external DC source, such as a car battery or the Mains Adapter Nor340, when connected to a Nor1216. Using the internal batteries may increase the self noise level, resulting in wrong measurement results.

NOTE: Nor140 with serial number below 1405079 must be upgraded in order to deliver the required current for the heater resistor.

NOTE: The Nor140 should be fitted with firmware version 3.0 or above to fully support all the feature of the Nor1216.

Connecting to Nor140

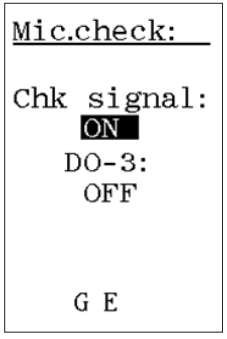
In the **SETUP** – **1** (Instrument menu) – **4** (Input menu), you select which type transducer you have connected. Select either "1214/16 Ver" for Nor1216 with vertical frequency correction applied and "1214/16 Hor" for Nor1216 with horizontal frequency correction applied. If the Nor1227 is used as microphone cartridge, the polarization voltage should be set to OFF. Set it to ON if Nor1225 is used



It is not needed to do any settings in the "2:corrections" in this menu. This is all preset when selecting the 1216 as transducer.

The point 1: "Level range" should not be used, unless high levels above 140dB need to be measured. This requires the use of the Nor1225 which is a 200V polarised microphone cartridge. Please also consult the instruction manual for the Nor140 for further information about the use of the "high level" setting.

To activate the System Check push **SETUP** – **1** (Instrument menu) – **9** (Misc. Parameters) – **7** (Microphone check)



Switch the menu point "Chk signal:" ON.

This will activate the calibration tone (1KHz – 1Vrms) each time you enter into the calibration menu.

NOTE: Please note that the System Check signal must be deactivated when you want to calibrate the microphone with an acoustical calibrator. Unless deactivated, you will read unstable values due to the interference between the Sytem Check signal and the signal from the sound calibrator.

Connecting to Nor150

Goto the input selection menu (**Setup – Input)** and select Sound Channel 1 (or 2 if applicable).

The **Select Sensor** menu contains several choices of sensors. The available Outdoor Microphones is listed separately. Select the Nor1216 if available. If not see below how to add the Nor1216 to the available sensor list.

In the **Sound channel** menu you select horizontal or vertical correction.

The horizontal correction gives you the option to switch on correction for a larger windscreen that can be added, the Nor4576.

Hint! The **Select Sensor** menu is a dynamic menu. You may add a new sensor if needed.

Adding a new sensor;
This is done in the input selection menu (**Setup - Input - Transducers**). A list of available sensors appears. Push the **ADD** softkey to make a new sensor. The **Add Tranducer** menu appears where you enter needed information.

Name; Use Nor1216 as a part of the name to easily identify it later.

Type; Select outdoor microphone. Make sure predefined Sensor is ticked on.

Select outdoor microphone type to Nor1216.

Serial Number; Key in serial number of the 1216

In the outdoor frame, select microphone capsule type and serial number. Legal selections are; Nor1225, Nor1227 or Nor1228. The two latter are prepolarised. The system automatically selects polarization voltage according to the selected microphone.

It is possible but not mandatory, to key in an under scale spectrum to give warning if the measured levels are influenced by the microphone's self-noise spectrum.

Once you have selected capsule type, a list of preamplifier data have to be entered.

Enter Serial number and Gain. Gain is the attenuation in the preamplifier. You may leave this to 0 and adjust the overall sensitivity by an acoustical calibrator to correct reading. However, it is recommended to use a value to have a better match between the verified sensitivity given in the microphone capsule calibration certificate and the real calibration you perform with an acoustical calibrator. A typical value is -0,3dB

In the Verification frame you enter name of the calibration laboratory of the microphone capsule, date of verification, microphone sensitivity and the time interval between each verification. When the verification date is due, the instrument will display a warning at start up.

Maintenance

The need for maintenance depends largely on the environmental conditions where the microphone system is used. Contamination of dust, ice or snow on the windscreen may alter the acoustic performance. For most applications, it will be sufficient to check the microphone periodically by using the system check facility, e.g. every night. For permanent operation we recommend to inspect the microphone and check the microphone sensitivity with a calibrator at least two times a year. The frequency for checking may be increased in places with difficult weather conditions or excess of dust.

The windscreen consists of two parts. The outer part is hollow and sealed by a lower ring-shaped part. Remove the upper part of the windscreen with care (see figure). When the upper part is lifted upward, ensure that the lower part stay fixed – otherwise the rain hood above may be harmed.

The outer part of the windscreen may be cleaned by washing by hand using standard household washing up detergents. Ensure that it has been thoroughly rinsed in clean water and is completely dry before it is remounted. Do not use excessive heat for the drying: 85°C maximum. However, we recommend to replace the whole upper part every second year. In some locations, near to chemical complexes or in coastal installations it may be necessary to replace the windscreen earlier (spare part Nor4529).

The lower part of the windscreen, the dust mesh and rain hood are not parts that can be serviced by the user. In case of wear or strong contamination we recommend to order a replacement unit (Spare part Nor4560) or send the part to the factory for refurbishment.

Do not disassemble the assembly of microphone and preamplifier outdoors. Contamination from humidity or dust – or from your finger sweat – may lower the performance.

Specifications

Mounting direction

The microphone shall be mounted with the tip pointing upwards and the axis of symmetry shall be vertical. The acoustic reference axis for the microphone may either be horizontal or vertical.

Acoustic performance

General

Sensitivity: typically 50 mV/Pa (-26 dB re 1V/Pa) – individually calibrated

Measurement range: From noise floor up to at least 140 dB re. 20 µPa (peak). Up to 150 dB peak for Nor1225 and "high level" option in Nor140.

Self-noise:
A-weighted: < 18 dB re. 20 µPa
Z-weighted: < 22 dB re 20 µPa (22.5 Hz - 22.5 kHz)

Frequency response

See Technical description

Frequency correction is recommended for conformance with the requirements in IEC 61672 for class 1 sound level meters.

Directional response

The directional response satisfies the requirements for a Class 1 sound level meter according to IEC61672-1. See section 4.4 Directional response for further information.

General

Mounting on a pole: 1" thread according to ISO 228 BSP (British Standard Pipe).
Mounting on a tripod: 3/8" UNC (photo-tripod)

Temperature range: -40°C to +85°C
Satisfies requirements in IEC 61672-1 when operated with a suitable instrument.

Air pressure: 85 kPa to 108 kPa

Humidity/rain: Up to 100%, IP55
Height: 375 mm (without tripod adapter)
Diameter: Approx 78 mm with windshield
Weight: 280 g (without tripod adapter)

Conformity

The microphone satisfy the requirements for a Class 1 sound level meter according to IEC 61672-1 when combined with Nor140 with sofware version 2 and above or Nor150 equipped with software version 1.2 and upwards.

Contact the supplier for Nor140 to verify that the instrument are able to supply the requested current. An external DC supply for powering Nor140 is assumed

The device is in conformity with the following standards:

EN-50081-1
EN-50082-1

Protection provided by the enclose

The microphone satisfies the requirements for Ingress Protection Category IP55 according to IEC 60529.

(DnV report No 2009-3124)

Accessories and spare parts

Windshield upper part: Norsonic part no. Nor4529

Assembled upper part with windscreen:
Norsonic part no. Nor4560

Microphone: Nor1227 or Nor1225

Microphone preamplifier: Nor1209A

Sound calibrator: Nor1251 or Nor1253

Microphone cable: Nor1408A
Standard lengths 5, 10, 15, 20, 30 and 50 metres – other lengths on request.

Dummy microphone: Nor1448 (18 pF) or Nor1447 with a short-circuit (BNC).

Large windscreen: Nor4576

Norsonic

Declaration of Conformity

CE

We, Norsonic AS, Gunnersbråtan 2, Tranby, Norway,
declare under our sole responsibility that the product:

Outdoor microphone Nor1216

to which this declaration relates, is in conformity with the following standards or other normative documents:

Safety: EN61010-1: February 2001 for portable equipment and pollution degree 2.

Enclosure	IEC60529 - IP55
EMC:	**EN 6100-6-3; 2007, EN 6100-6-2; 2005,** EN-50081-1 and EN-50082-1
Sound:	Applicable parts of IEC 61672-1 when combined with Nor140 equipped with software version 2.0 and upwards as well as Nor150 V1.2
Ingress Protection Category:	IP55 according to IEC 60529. (DnV report No 2009-3124)

Configuration for test: Connected to Nor140 sound level meter.

This product has been manufactured in compliance with the provisions of the relevant internal Norsonic production standards.

All our products are tested individually before they leave the factory.

This Declaration of Conformity does not affect our warranty obligations.

Tranby, February 2014

Dagfinn Jahr
Quality Manager

The declaration of conformity is given according to EN 45014 and ISO/IEC Guide 22.

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Norsonic AS supplies a complete range of instrumentation for acoustics – from sound calibrators, microphones and preamplifiers; via small handheld sound level meters to advanced, yet portable, real time analysers, but also building acoustics analysers and complete community, industry and airport noise monitoring systems. Contact your local representative or the factory for information on our complete range of instrumentation.