

# DNG-2300

Digital white noise generator



## User Manual

# Introduction

It is well-known that sound permeates through walls, doors, water, windows and other constructions as well as through voids, cavities and ventilation shafts. This property of materials makes it possible to intercept conversations conducted within premises with the help of highly sensitive contact microphones (electronic stethoscopes), window laser systems or conventional microphones without entering the target area.

Wall contact microphones can pick up vibrations from the plumbing, structures, walls, windows, doors, floors, ceilings and more. The listening device may be in an adjacent room, or even several floors or rooms away attached to a wall, pipe or other fixture. Cavities such as air ducts, ventilation shafts or other voids can be used for intercepting sound from an adjacent premises with a help of conventional microphones. Window laser systems are able to "read" conversations from the premises by sending visible, or invisible, infrared beams to the glass and extracting the sound vibrations from the reflected rays.

The DNG-2300 generator, together with its transducers and speakers, counteracts all the above mentioned methods of listening by creating powerful, non-filterable interference on the structure of a building and within its voids.

The TD2300 transducers are perfectly suited for the DNG-2300. They have an attractive design, combine a high power output with compactness and fit equally well on windows, walls and other structures. The included mounting set makes it possible to install the TD2300 transducer on any surface. The transducer passes most of the generated noise into the desired construction in the form of vibration, while also producing less audible interference. The frequency characteristics optimally correspond to the spectrum of human's speech.

While transducers inject their generated noise into surfaces and structures, stopping the distribution of sound through them, the role of a speaker is to fill voids, cavities and ventilation shafts with audio interference to prevent leakage of sound through the air. The SP2300 is the recommended speaker for the DNG-2300.

## Features

- Creates powerful protection against the leakage of all types of vibro-acoustics by injecting non-filterable noise into surrounding structures and cavities
- Suppresses wall contact microphones, window laser systems and wired microphones inside walls, voids and ventilation shafts (air ducts)
- Is a key part of the protection system which also includes wire-connected transducers and speakers
- Generates white noise – the output interference is evenly distributed through the spectrum of a human's voice
- Has 3 independent output channels: 2 x TRANSDUCERS and 1 x SPEAKERS
- All 3 channels have individual level adjustment
- Each TRANSDUCERS channel can feed up to 12 transducers mounted on solid structures (concrete/cement/bricks) and up to 24 transducers on light structures (glass, pipes, drywall,

wood)

- The SPEAKERS channel can feed up to 12 speakers
- The MUTE control input allows the user to turn off the speakers temporarily

## Specification

|  |  |
|--|--|
| Power source                             | 110-220 V, 50-60 Hz                            |
| Dimensions                               | 6 x 17,5 x 25,4                                |
| Weight                                   | 2.2 kg   |
| Output channels                          | 2 x TRANSDUCERS<br>1 x SPEAKERS                |
| Peak output voltage                      | 12 V   |
| <u>TRANSDUCERS output</u>                |  |
| Max. output power                        | 2 x 10 W                                       |
| Frequency response                       | 180-5600 Hz                                    |
| Minimal impedance of load                | 3 Ohm  |
| Max. quantity of transducers per channel | 24 (light structures)<br>12 (solid structures) |
| <u>SPEAKERS output</u>                   |  |
| Max. output power                        | 1 x 8 W  |
| Frequency response                       | 180-7000 Hz                                    |
| Minimal impedance of load                | 8 Ohm  |
| Max. quantity of speakers                | 12   |

## Supplied set

The DNG-2300 is a key part of the protection system consisting of a noise generator, transducers and speakers. While the generator creates the noise, the wire-connected transducers and speakers pass it onto the constructions and cavities. Since the quantity of the transducers and speakers may vary, depending on the dimensions of the room, possible vectors of attack and type of the construction (windows, water pipes, cavities, etc.), it is possible to order the standard set, which includes only the generator, and additionally order any quantity of the transducers and speakers. Another option is to purchase the DNG-KIT1 set which includes the quantity of transducers and speakers suitable for most common cases (small or medium-sized room with 1 window).

|                          | <b>Standard*</b> | <b>DNG-KIT1</b> |
|--------------------------|------------------|-----------------|
| Noise generator DNG 2300 | 1                | 1               |
| AC power cord            | 1                | 1               |
| Transducer TD2300 4 Ohm  |                  | 12              |
| Speaker SP2300           |                  | 2               |
| Carry case               |                  | 1               |

\*Transducers and speakers to be ordered separately

# Controls

## Front panel

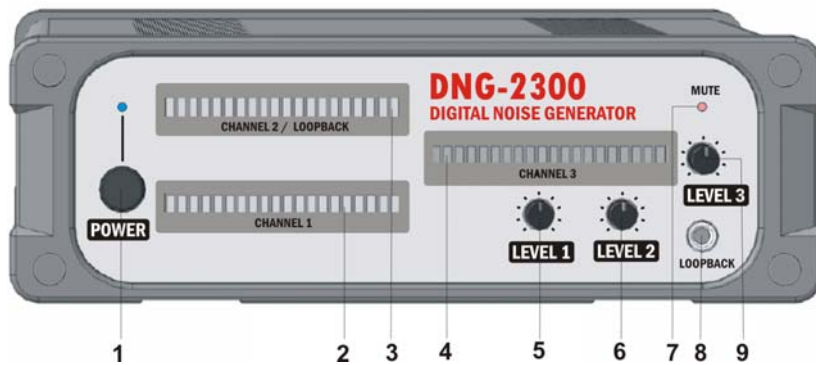


Figure 1

1. Power switch
2. Level indicator - Channel 1 (TRANSDUCERS 1)
3. Level indicator - Channel 2 (TRANSDUCERS 2)
4. Level indicator - Channel 3 (SPEAKERS)
5. Level 1 adjustment - Channel 1 (TRANSDUCERS 1)
6. Level 2 adjustment - Channel 2 (TRANSDUCERS 2)
7. Mute state of Channel 3 (SPEAKERS)
8. Level 3 adjustment - Channel 3 (SPEAKERS)

## Rear panel

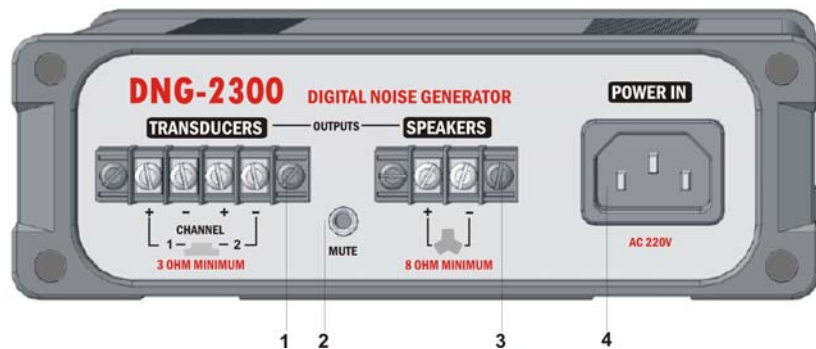


Figure 2

1. TRANSDUCERS output terminals – Channels 1 and 2
2. Muting for Channel 3 (SPEAKERS): contacts open – channel on, contacts closed – channel off
3. SPEAKERS output terminals – Channel 3
4. AC power input

# Installation

The complete protection system consists of the generator and a number of transducers and speakers uniformly installed in a room on the structures and within the air cavities. While transducers inject the generated noise into surfaces and structures, stopping the distribution of sound through them, the role of the speakers is to fill voids, cavities and ventilation shafts with audio interference to prevent leakage of sound through the air.

Carefully study the premises for any potential points of acoustic leakage. Note the most sensitive points for the placing of the transducers and speakers. Pay attention to the following details:

- Structure of the boundary walls, ceiling and floor and their accessibility from outside
- Acoustic isolation of the entrance door
- Windows and their orientation
- Presence of pipes (the heating system, water supply, fire extinguishing system)
- Presence of voids connected with the adjacent rooms
- Ventilation shafts going out of the premises
- Presence of any other acoustic leakage channels

## Quantity and arrangement of transducers

There are 2 available versions of the TD2300 transducers. The high-power, 4 Ohm TD2300, is especially good for solid surfaces such as concrete, cement or brick ceilings and floors, although it is universal and can be mounted on lighter surfaces.

The easy-to-wire 16 Ohm TD2300 suits light surfaces such as window glass, wood, drywall, plaster and pipes.

To estimate the quantity of transducers use the following suggestions:

- **On walls** the TD2300 transducers should be installed every 2-3 meters, centered between floors and ceiling. If it is necessary to position the transducers closer to the floor or ceiling because of interior design demands, select a lesser distance between the transducers.
- **On floors and ceilings** – should be installed every 6 square meters
- **On windows** – on each window pane
- **Doors** – One, placed adjacent to the center hinge on the doorframe
- **Water pipes** – on each pipe going in and out of the premises

## Wiring and connection of transducers

When the quantity of transducers is estimated and they are grouped by the surface type, it is possible to select the wiring variant. Depending on the number of transducers needed, choose a wiring diagram from the below picture **for each channel** of the noise generator.

### TD2300 4 Ohm transducers

To provide an equal output power, and to follow the demands of output impedance, the TD2300

4 Ohm transducers are united as a combination of serial circuits (chains) connected in parallel.

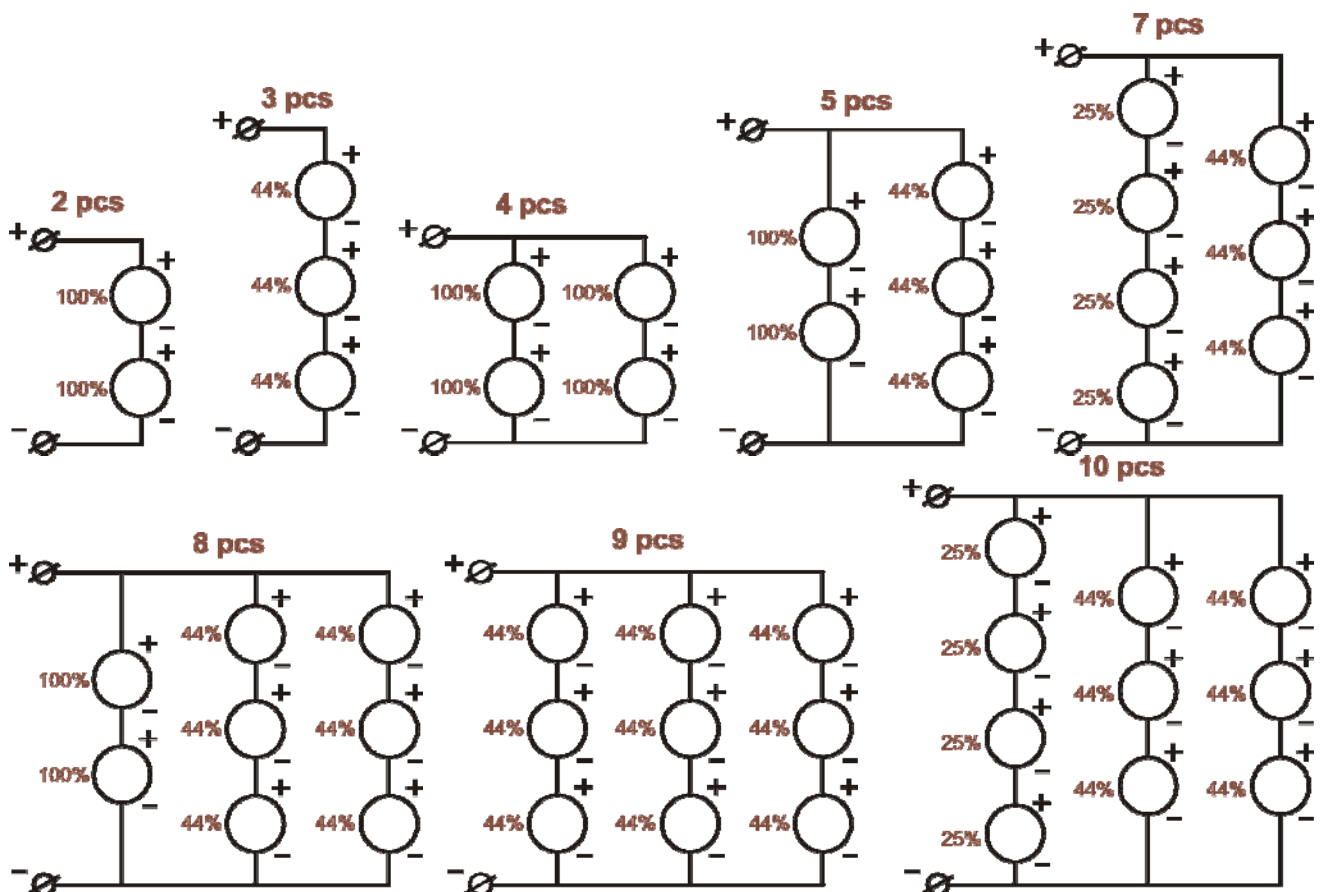
The output power is divided between the transducers and is in quadratic dependence on their quantity in a serial chain. The percentage % shows the relative power produced by a transducer, comparing to the "basic" variant with 2 serially connected 4 Ohm transducers.

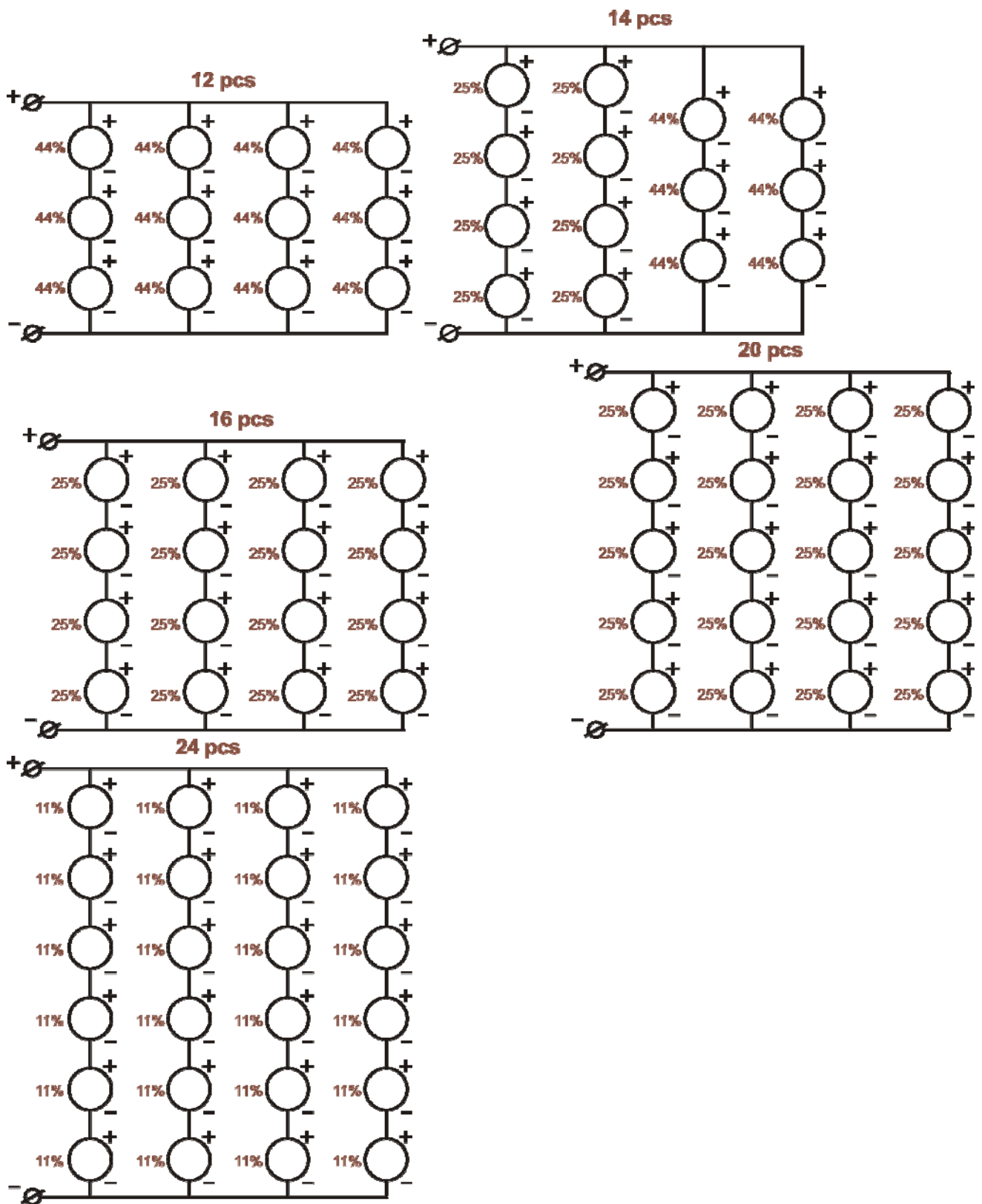
| Quantity of transducers in a serial chain | Relative power produced by 4 Ohm transducer | Type of surface |
|---|---|-----------------|
| 2   | 100%  | Solid           |
| 3   | 44%   | Solid           |
| 4   | 25%   | Solid/Light     |
| 5   | 16%   | Light           |
| 6   | 11%   | Light           |

The percentage reflects the relative power, while the real output will depend on the generator's volume control (LEVEL). The transducers with a higher relative power can be installed on any type of surface, including the light construction if the corresponding output is set to a lower level.

It is recommended to pass more power to the transducers mounted onto **solid surfaces** such as concrete/cement/brick wall, ceiling and floor. In this case the quantity of serially connected transducers in each chain should not exceed 3-4 pcs for 4 Ohm version.

**Light surfaces** such as window glass, wood, drywall, plaster and pipes usually demand less power and allow for the connection of more transducers in a series (up to 6).



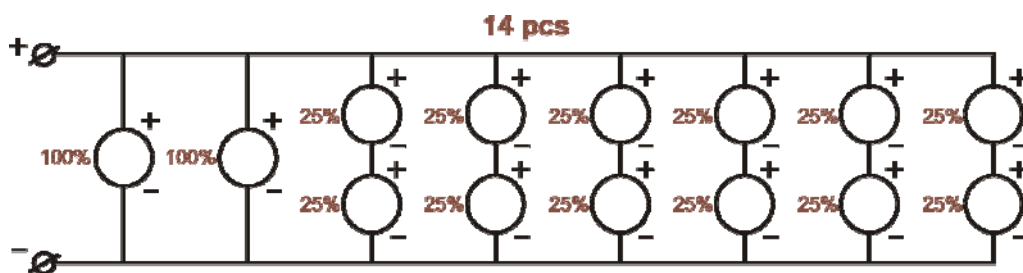
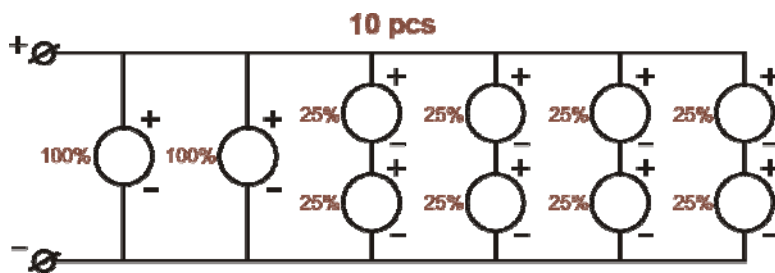
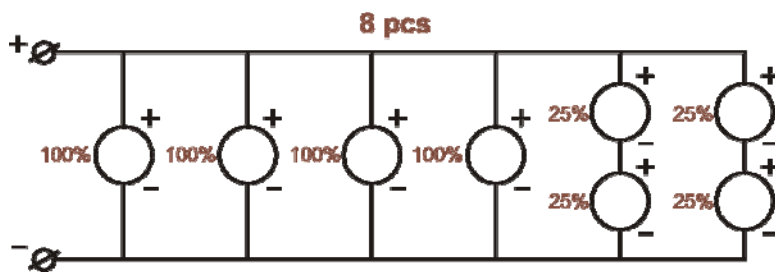
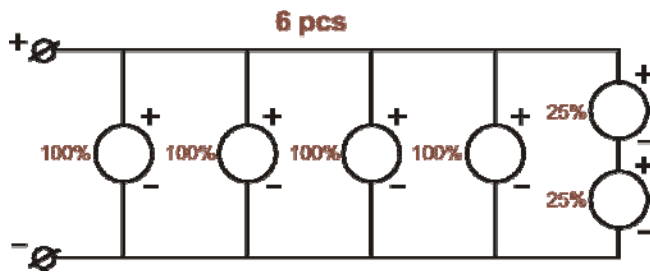
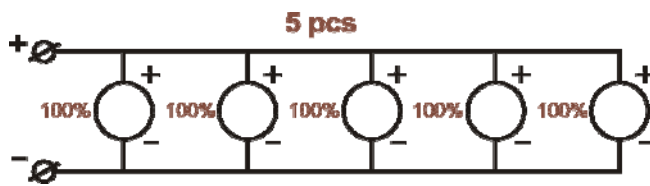
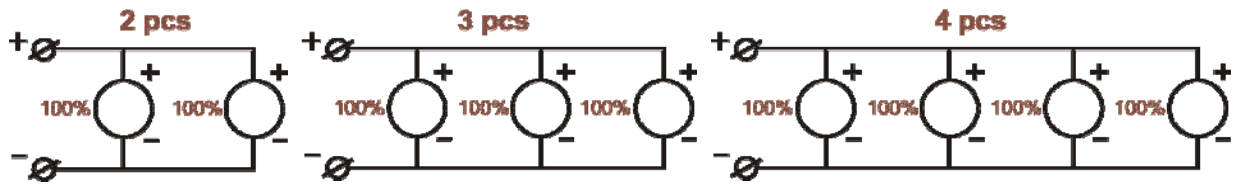


The transducers marked as 100%, 44% and 25% can be mounted on solid surfaces. The transducers marked as 11%, 16% and 25% - on the light surfaces.

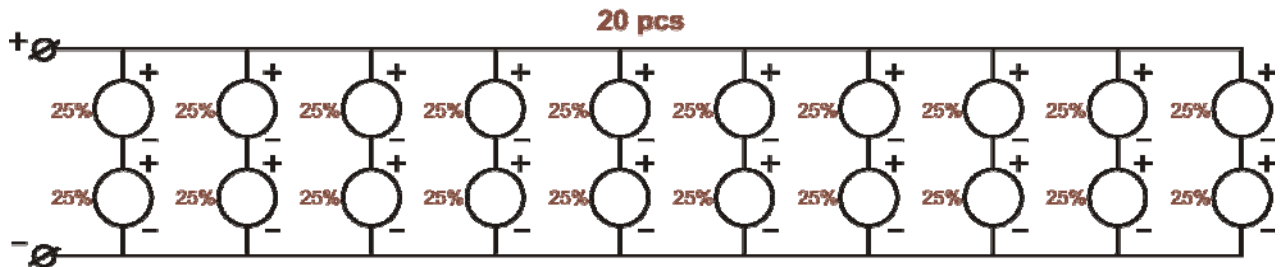
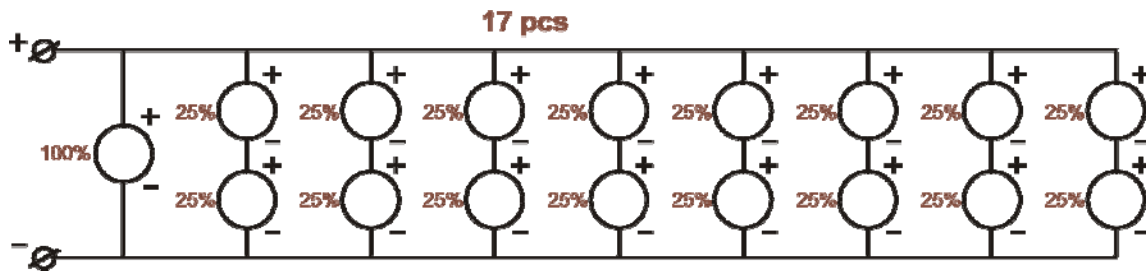
TD2300 16 Ohm transducers

| Quantity | of | Relative power produced by | Type of surface |
|----------|----|----------------------------|-----------------|
|----------|----|----------------------------|-----------------|

| transducers in a serial chain | 16 Ohm transducer |             |
|-------------------------------|-------------------|-------------|
| 1                             | 100%              | Solid       |
| 2                             | 25%               | Solid/Light |
| 3                             | 11%               | Light       |







## Assignment of TRANSDUCERS outputs

The DNG-2300 has two TRANSDUCERS outputs, each capable of feeding up to 12-24 transducers depending on the density of structures.

Grouping the transducers by the density of structure (solid or light) and connecting them to a separate output channel will allow you to adjust the level for each group separately. For example, output "TRANSDUCERS 1" can be dedicated to solid surfaces (up to 10-12 transducers), while the output "TRANSDUCERS 2" - to light surfaces (up to 24 transducers).

When there are many solid structures in the room, it may be necessary to install more than 10-12 "solid" transducers. In this case it is possible to share the second output between the "light" and "solid" transducers. Taking into consideration that the combined output should produce a higher power and light structures, being good conductors of sound, demand a lesser portion of noise, it is recommended to change the standard connection scheme so that the "light" transducers are connected in longer serial chains.

### Attention:

- Resistance of the entire load should not be lower than 3 Ohm per 'TRANSDUCERS' channel. Damage to your DNG-2300 may occur if improperly wired.

Before connecting to the generator, measure the resistance of the entire circuit with a multimeter. You can also calculate the resistance of the entire load by considering the resistance marked on the transducer and by using the following formulas:

- Resistance of a serial circuit is calculated as  $R = R_t * n$ , where  $R_t$  is the resistance of transducer and  $n$  is the quantity of transducers.  
Example: resistance of 3 transducers (each 4 Ohm) connected in series is  $4+4+4=12$  Ohm
- Resistance of a parallel circuit is calculated as  $R = 1 / (1/R_1 + 1/R_2 \dots 1/R_n)$   
Example: resistance of 3 parallel circuits each consisting of 3 serial 4 Ohm transducers is  $R = 1 / (1/12 + 1/12 + 1/12) = 1 / 0.25 = 4$  Ohm

## Mounting the transducers

The TD2300 transducers are supplied with a number of accessories allowing different methods of installation. The method of mounting is selected depending on the type of surface.

- Direct screw (wood)
- Plastic dowel (cement, concrete, bricks)
- Wall anchor (bricks, drywall, fragile materials)
- Mounting disk (window glass)

The accessories for mounting on pipes should be purchased separately: interlocked hose clamp 100-150 mm, bolt M4x8, washer and nut.

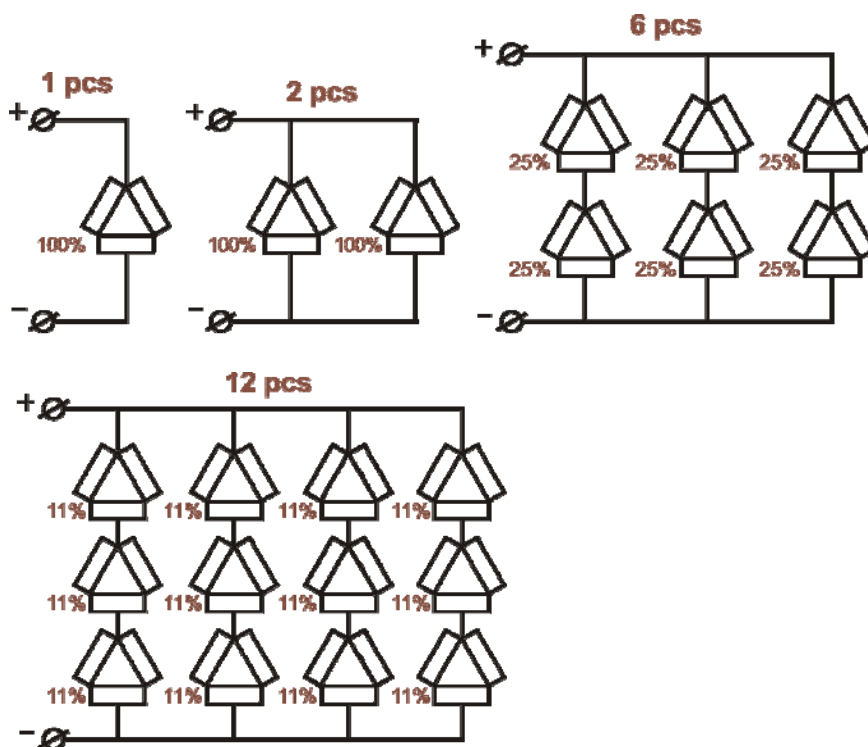
It is recommended to read the manual supplied with the transducer before starting installation.

## Quantity and arrangement of speakers

- Behind dropped ceiling - 1 x SP2300 speaker for each 9-10 square meters
- In ventilation shafts, air ducts and other voids – 1 x SP2300 for each void

Since the SP2300 is assembled from 3 parts, each being a separate speaker, it is possible to use the 3 individual parts for smaller voids. Disassemble the SP2300 by removing the triangular holder, cut the cables, place the separate speaker parts where necessary and reconnect them in series.

Connect the SP2300 speakers in parallel when there is 1, 2 or 3 pieces. For a larger quantity combine speakers in serial pairs. You can connect up to 6 pairs (12 pcs total)



**Attention:** Consider the minimum load of 8 Ohm for the ‘SPEAKERS’ outputs when using the modified wiring. Damage to your DNG-2300 may occur if improperly wired.

## Mounting the speakers

In most cases the speakers do not require mounting and should be placed inside voids or shafts. If the void is not large enough to accommodate the speaker as is, the speaker can be disassembled and placed inside without the triangular holder.

If there is no horizontal space sufficient for the speaker, it can be hung on a steel cable.

## Adjustment of level

After the transducers and speakers have been installed and connected to the generator, it is necessary to adjust the level of noise. The front panel of the DNG-2300 contains the corresponding regulators:

- LEVEL 1 – TRANSDUCERS 1
- LEVEL 2 – TRANSDUCERS 2
- LEVEL 3 – SPEAKERS

For the TRANSDUCERS channels it is recommended to select the level depending on the type of structure and quantity of transducers.

| Structure              | Quantity | LEVEL   |
|------------------------|----------|---------|
| Solid                  | 1...6    | 50-70%  |
| Solid                  | 7...12   | 70-100% |
| Combined solid + light | 10...24  | 70-100% |
| Light                  | 1...6    | 30-50%  |
| Light                  | 7...12   | 50-70%  |

For the SPEAKERS output (LEVEL 3) it is recommended to select the level depending on how many speakers are connected and what space they cover with the noise. Larger spaces typically need a higher level of noise.

| Quantity | Level   |
|----------|---------|
| 1...4    | 50-70%  |
| 5...8    | 70-80%  |
| 9...12   | 80-100% |

## Minimizing audible interference

When the generator is active and the transducers are injecting the generated noise into the structures, a certain portion of vibrations is sent into the air so the user can hear the noise. Despite being audible, this is just a small part of the noise and most of the energy is being sent into the structures, however, the user may want to minimize the audible interference. This can be achieved

by setting the optimal level of noise which is sufficient for jamming all perimeter-bound bugging devices. (Please note this is only possible by using auxiliary equipment)

With the help of auxiliary equipment (an acoustic leakage probe) it is possible to verify if the DNG-2300 is producing a sufficient level of noise and minimize the audible level in certain cases. An acoustic leakage probe is similar to a wall stethoscope and is designed for the evaluation of how sound is distributed through structures.

Create a recognizable sound source in the room by turning on a TV, radio or portable speaker with the volume proportional to that of human voices, or ask an assistant to read a magazine out loud.

Use the acoustic leakage probe (from an adjacent room or from outside the building) and listen to the sound inside the protected room. Probe different structures – walls, floor, ceilings and other constructions adjacent to the target room. Probe the ventilation shafts and other voids going from the protected room. Search for the most sensitive points with the signs of sound leaking from the room.

Once set up, activate the generator and repeat the audio probing at the most sensitive points. Try to find the optimal level of noise for each channel by increasing and decreasing its level. If during probing you can recognize the speech present inside the protected room, it is necessary to increase the level of noise on the channel responsible for the corresponding transducer/speaker.

Sometimes it is not possible to probe the room from all sides or behind all structures due to limited access. In this case it is recommended to keep the default recommended levels for the channels, which cannot be verified fully but should be sufficient to offer protection.

If during probing you can still hear the voice/voices and can recognize what is being said after the level has been set to 100%, it may mean the quantity of transducers/speakers is insufficient or their placement is incorrect. Increase the quantity of transducers/speakers to achieve uniform coverage of all constructions/surfaces/voids as described in this manual.

**Please note:** The DNG-2300 system was designed as a reliable countermeasure against vibro-acoustic leakage; it should not be, in any way, expected to perform as protection against other ways of eavesdropping.