HOTTINGER BRÜEL & KJÆR

USER MANUAL

HBK 4250
Volume Velocity Source

BB 1253 – 13
English

HBK 4250 Volume Velocity Source

User Manual

BB 1253–13
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Health and Safety Considerations

This apparatus has been designed and tested in accordance with IEC/EN 61010-1 and ANSI/UL 61010-1 *Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use*. This manual contains information and warnings which must be followed to ensure safe operation and to retain the apparatus in safe condition.

Safety Symbols and Signal Words Used

The apparatus will be marked with this symbol when it is important that you refer to the associated danger or warning statement given in this manual

The manual uses this symbol when a danger or warning statement is applicable

Hazardous Voltage/Electricity. Both the apparatus and manual use this symbol when there is a risk for shock or electrocution

Hot Surface. This manual will use this symbol when there is a risk for burning or scolding

Earth (Ground) Terminal. The apparatus will be marked with this symbol when applicable

Protective Conductor Terminal. The apparatus will be marked with this symbol when applicable

Alternating Current. The apparatus will be marked with this symbol when applicable

Danger Signals an imminent hazardous situation, which, if not avoided, will result in death or serious injury

Warning Signals a possibly hazardous situation, which, if not avoided, will result in death or serious injury

Caution Signals a hazardous situation, which, if not avoided, could result in minor or moderate injury or damage to the apparatus

Notice Signals a situation or practice that requires attention, but does not directly result in personal injury if ignored

Risks and Hazards

Explosion Hazards

Danger: The apparatus is not designed to be used in potentially explosive environments. It should not be operated in the presence of flammable liquids or gases

Electrical Hazards

Warning: Any adjustment, maintenance and repair of the open apparatus under voltage must be avoided as far as possible and, if unavoidable, must be carried out only by trained service

Warning: The apparatus is capable of producing hazardous output voltages. To avoid electrical shock, do not touch any exposed loudspeaker wiring while the apparatus is operating

Caution: Switch off all power to equipment before connecting or disconnecting their digital interface. Failure to do so could damage the equipment

Caution: The apparatus is very powerful and can be potentially dangerous. As loudspeakers can easily be damaged or destroyed by applying too much power, always check the loudspeaker's continuous and peak power capabilities

Mechanical Hazards

Caution: Whenever it is likely that the correct function or operating safety of the apparatus has been impaired, it must be made inoperative and be secured against unintended operation

Noise Hazards

Caution – high sound pressure: Hearing protection should always be worn when operating the apparatus or place the apparatus a distance away from the operator control position. Otherwise, operation could result in hearing loss or injury

Waste Handling

HBK complies with the EU's Waste Electrical and Electronic Equipment (WEEE) Directive, which issues the following waste handling instructions:

- Do not dispose of electronic equipment or batteries as unsorted municipal waste
- It is your responsibility to contribute to a clean and healthy environment by using the appropriate local return and collection systems
- Hazardous substances in electronic equipment or batteries may have detrimental effects on the environment and human health
- The symbol shown to the left indicates that separate collection systems must be used for any discarded equipment or batteries marked with that symbol
- Waste electrical and electronic equipment or batteries may be returned to your local HBK representative or to Hottinger Brüel & Kjær A/S for disposal

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Chapter 1

Introduction

1.1 About volume velocity sources

Volume velocity sources (VVS) are used as acoustical shakers to measure acoustic transfer functions, typically in connection with noise source contribution analysis.

The principle of the VVS uses a single high-power loudspeaker radiating through a cylindrical nozzle to a circular orifice. The size of the orifice and the shape of the nozzle are carefully engineered to radiate sound evenly in all directions within the defined working range of the specific nozzle.

Uses

- Measurement of acoustic volume velocity
- Measurement of reciprocal noise transfer functions (P/F) and acoustic transfer functions (P/Q)
- Structure-borne and airborne source path contribution analysis

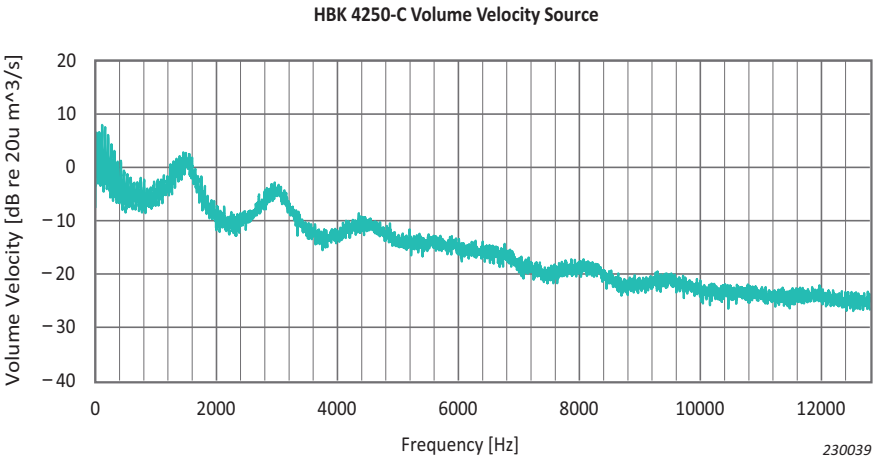
1.1.1 HBK 4250 VVS design

As transfer function measurements require accurate measurement of the applied excitation signal, HBK 4250 Volume Velocity Source is equipped with two microphones, which have been added to the acoustic output of the nozzle to measure the direct output volume velocity.

Within the operating frequency range of HBK 4250, high order modes in the adaptor's tube (with non-zero pressure on the axis) are not contributory as the first on-axial mode in the probe is occurring at 20 kHz. The probe does not produce a volume velocity signal above 16 kHz due to the spacing of the two microphones.

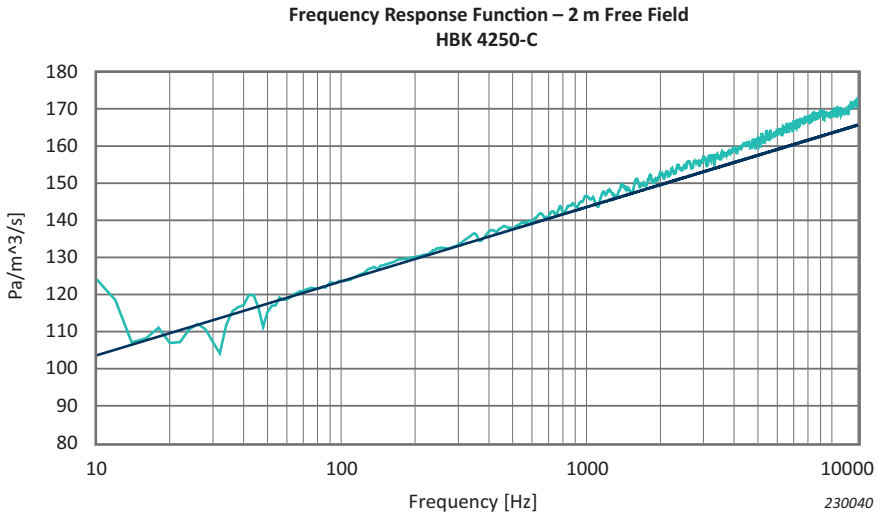
The volume velocity at the probe opening can be estimated as a virtual signal using BK Connect® software, which estimates volume velocity as a time signal based the sound pressure measured in the adaptor (using a plane wave model). A source to response frequency response function (FRF) is then calculated using a measured response signal and the estimated volume velocity signal.

Fig. 1.1 *Typical output volume velocity spectrum (Q). White noise input: 100 Hz – 12.8 kHz. Volume velocity spectrum estimated from the two microphones in the probe using BK Connect*



The high-frequency FRF and volume velocity are shown below. The FRF is compared to the theoretical FRF (solid line).

Fig. 1.2 *Typical frequency response function (FRF)*



1.1.2 HBK 4250 VVS features

- Wideband omnidirectional acoustic radiation for assessment of both structure-borne and airborne generated phenomena
- Accurate in situ measurement of the output volume velocity using a pair of low-noise, ¼-inch microphones
- High-power output levels for measurement on vehicles with high transmission loss or when background noise conditions are sub-optimal
- Measurement of transfer functions at vehicle source systems (engine bay, exhaust, intake, etc.) with the use of low-emission 3-meter extension hose
- Hidden (invisible) microphones with cables that are securely placed in order not to break the signal chain
- Electrical protection circuit that prevents overloading the driver
- Adaptor to easily remove the 3-meter hose

1.2 About this manual

This manual contains important information on operating your HBK 4250 Volume Velocity Source correctly and safely. Please take the time to read this manual and familiarize yourself with the safety considerations and features.

Descriptions of HBK 2755 Power Amplifier, LAN-XI data acquisition front ends and BK Connect software for calculation of VVS spectra, are not part of this manual.

Chapter 2

HBK 4250 Variants

HBK 4250 VVS covers relevant frequency ranges for vehicle noise applications: from 32 Hz to 17 kHz.

The VVS exists in three variants depending on the desired frequency range:

- Operating in the low frequency part of the acoustic spectrum, that is 32 – 1600 Hz, it would be sensible to use HBK 4250-A
- The mid-frequency range, 50 – 6400 Hz would be a job for HBK 4250-B
- For the full frequency range 100 Hz – 17 kHz, HBK 4250-C would be the perfect choice

For the full set of data for the VVS system please refer to the Specifications.

2.1 HBK 4250-A Low-frequency VVS

Fig. 2.1 *HBK 4250-A*

HBK 4250-A Low-frequency VVS is equipped with a coaxial driver consisting of a 10-in sound source driver and a compression driver. The hose is approximately three metres in length and has a probe opening of Ø76 mm.

The sound source is fitted with a crossover filter and a protection circuit to prevent overvoltage damage. The crossover has a 3 dB cut-off at 2.4 kHz and the protection circuit cuts off the signal when the rms value exceeds 27 V for more than three seconds.

Measuring a transfer function with an almost omnidirectional source for low frequency spectrum, 32 – 1.6 kHz, requires a hose diameter of 76 mm. The sound source works from an amplified pink noise signal. For signal types, see Chapter 5.

2.2 HBK 4250-B Mid-frequency VVS

Fig. 2.2 *HBK 4250-B*

HBK 4250-B Mid-frequency VVS is equipped with coaxial driver consisting of a 10-in sound source driver and a compression driver. The hose is approximately three metres in length and has a probe opening of Ø38 mm.

The sound source is fitted with a crossover filter and a protection circuit to prevent overvoltage damage. The crossover has a 3 dB cut-off at 2.4 kHz and the protection circuit cuts off the signal to the 10-in driver when the rms value exceeds 27 V for more than three seconds. There is also protection for the compression driver working above 2.4 kHz when the applied signal has an rms level of 19 V equivalent to 36 W, for more than three seconds.

Measuring a transfer function with an almost omnidirectional source for low- to mid-frequency spectrum, 50 – 6.4 kHz, requires a hose diameter of 38 mm. The sound source works from an amplified pink noise signal. For signal type and details, see Chapter 5.

2.3 HBK 4250-C High-frequency VVS

Fig. 2.3 *HBK 4250-C*

HBK 4250-C High-frequency VVS covers the frequency range, from 100 Hz to around 12 kHz, which is relevant for vehicle noise applications including hybrid and electrical vehicles.

This VVS consists of a compression driver with a protection circuit and an approximately 3-metre hose with two microphones mounted in a Ø10 mm nozzle.

Protection for the compression driver when working above 100 Hz sets in when the applied signal has an rms level of 21 V equivalent to 44 W, for more than three seconds.

Measuring a transfer function with an almost omnidirectional source for high-frequency spectrum, 100 – 12.8 kHz, requires a hose diameter of 10 mm. The sound source works from an amplified white noise signal. For signal type and details, see Chapter 5.

2.4 Combo VVS packs

2.4.1 HBK 4250-D Low- and Mid-frequency VVS

Fig. 2.4 *HBK 4250-D*

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The frequency ranges of HBK 4250-A and HBK 4250-B are available in one system HBK 4250-D Low- and Mid-frequency VVS. This means that measurements covering the frequency range 32 Hz to 6.4 kHz can be obtained using the low-frequency/mid-frequency (LF/MF) sound source with the Ø76 and Ø38 mm hoses. The system consists of one sound source, two hoses and four microphones.

2.4.2 HBK 4250-E Wideband VVS

Fig. 2.5 *HBK 4250-E*

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The entire range from 32 Hz to 12.8 kHz can be obtained using the combined system of HBK 4250-C and HBK 4250-D. This system consists of two sound sources, three hoses and six microphones.

Chapter 3

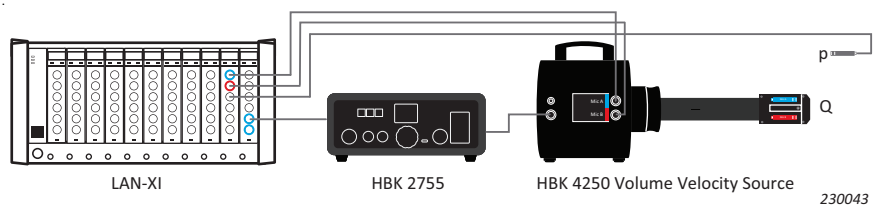
Installation and Setup

3.1 Measurement configuration

The VVS system is not a stand-alone solution. Additional hardware is necessary to obtain a viable measurement. A typical measurement setup consists of, but is not limited to, the following:

- LAN-XI front end with three inputs and one generator output
- A power amplifier such as HBK 2755
- HBK 4250 VVS including driver, hose and nozzle with two built-in microphones
- A reference microphone

The typical measurement setup is illustrated below.



The VVS microphones, denoted blue (Mic A) and red (Mic B) must be configured so that Mic A is connected to the first channel on the front-end module and Mic B is connected to the next channel. A signal from the LAN-XI generator is supplied to the amplifier. In addition, a single response microphone picking up the sound pressure (p), is also connected to the front end. With such a setup, a single acoustic p/Q transfer function is measured.

Please note:

- Blue and red indicators are present on inputs and cables thus securing correct signal integrity from microphone to the front end.
- The front end, amplifier and reference microphone are not covered in this manual.

The complete setup of HBK 4250 VVS includes connecting the input and output signal cables, connecting the hose and setting up the microphones. This will be described below. No other setup will be necessary.

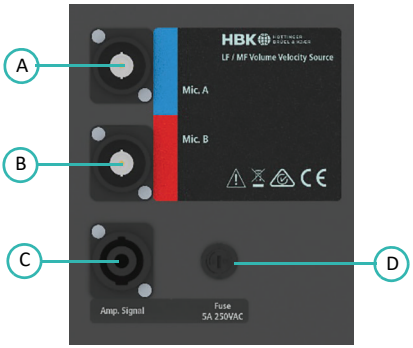
3.2 Input/Output connections

The connector panel, which connects the microphones, amplifier and front end to the sound source, is located either at the top or side of the VVS as shown below.

The red and blue colours help guide you to correctly connect the microphones.

Fig. 3.1 *Location of the connector panel:* ***a)*** *On HBK 4250-A/B;* ***b)*** *On HBK 4250-C*

Fig. 3.2 *Connector panel overview*



A. Mic A output connector: BNC socket for Microphone A signal coming from microphone in nozzle
B. Mic B output connector: BNC socket for Microphone B signal coming from microphone in nozzle
C. Input connector: Neutrik speakON® socket for signal from power amplifier. See Chapter 5 for supported signal types and levels
D. Fuse socket: Fast-acting 5 amp fuse

3.3 Hose connection

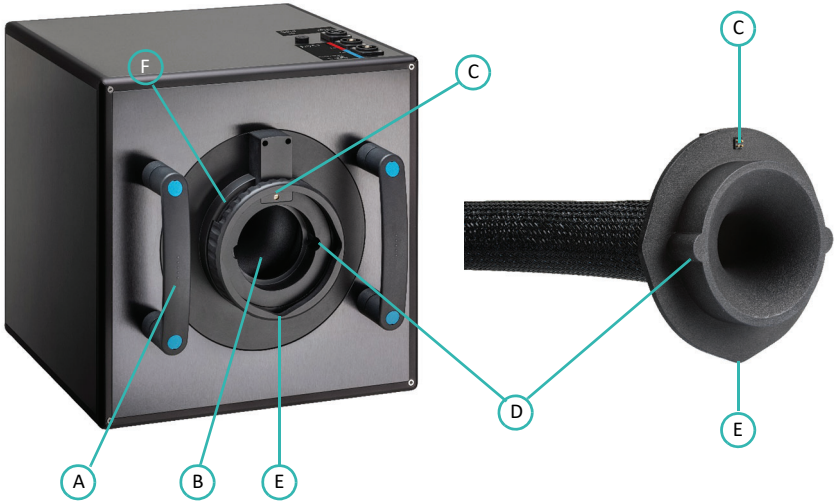
The hose contains signal cables running from the microphones in the probe to the hose adaptor. When connecting the hose to the sound source, the signal is passed through an electrical connection through the connector at the top of the adaptor.

Please note:

- Pay attention to the orientation of the hose adaptor before connecting the hose to the sound source.
- Installment of the hose is to be performed as described below. Failure to do so may severely affect the quality of the measurements, as leaks can occur.

3.3.1 Connecting the HBK 4250-A/B hoses

Fig. 3.3 *Key parts relevant for hose connection with HBK 4250-A or B*



A) **Carrying handles:** Use two hands to carry the sound source. The handles also provide protection against unintentional disconnection.

B) **Mounting socket:** Provides hose and electrical connection from the microphones in the nozzle.

C) **Electrical connector:** Provides microphone signals from the nozzle. The mid-frequency (HBK 4250-B) hose is shown, but the location is the same for the low-frequency (HBK 4250-A) hose.

D) **Lock mechanism:** Flanges on both sides of the hose hold it in place.

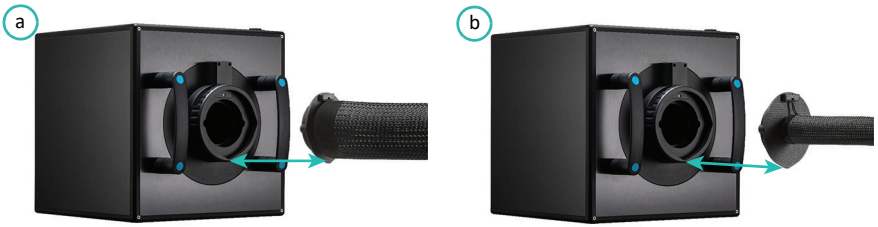
E) **Mounting guides:** Tabs on the hose adaptor and slots on the ring, indicate the correct hose orientation for mounting.

F) **Mechnical locking ring:** Turn to lock the hose in place.

How to connect a HBK 4250-A/B hose

1) Align the hose to the VVS so that the pointed tab is at the bottom (see E above).

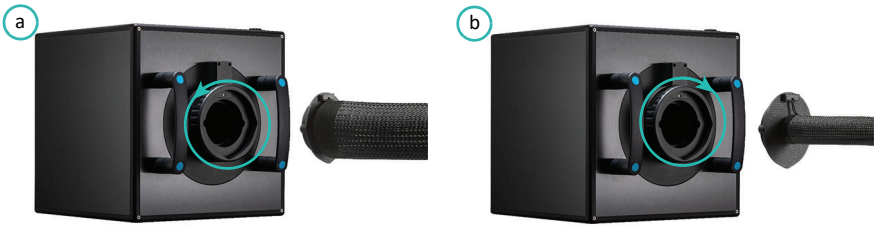
Fig. 3.4 *Align the mounting guides on the hose and ring. The pointed tab should insert into the slot at the bottom:* ***a)*** *Ø76 mm hose;* ***b)*** *Ø38 mm hose*



2) Insert the hose adaptor all the way into the locking ring.

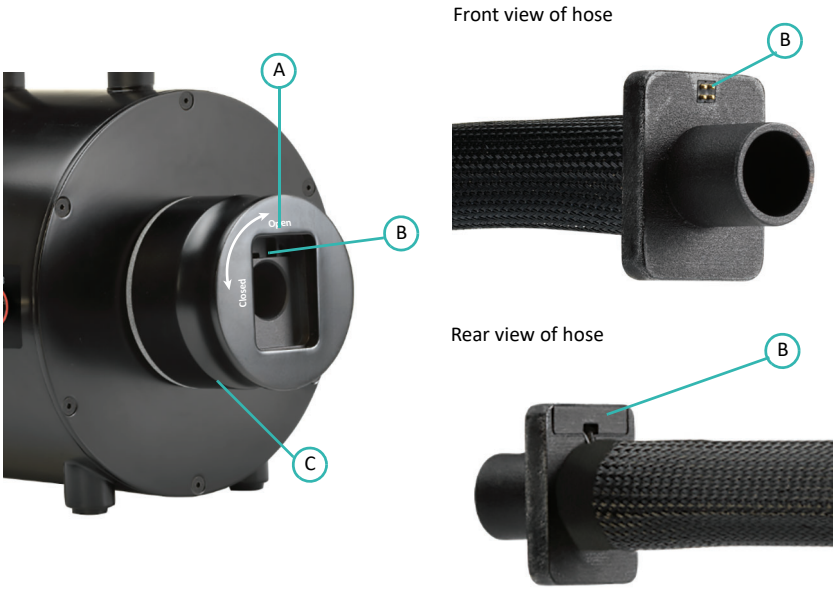
3) When fully inserted, turn the locking ring on the sound source:
   - For a **Ø76 mm** hose, turn the locking ring a quarter turn **anti-clockwise**.
   - For a **Ø38 mm** hose, turn the locking ring a quarter turn **clockwise**.

Fig. 3.5 *Turning the locking ring:* ***a)*** *Anti-clockwise with the Ø76 mm hose;* ***b)*** *Clockwise with the Ø38 mm hose*



3.3.2 Connecting the HBK 4250-C hose

Fig. 3.6 *Key parts relevant for hose connection with HBK 4250-C*



A) **Mounting socket:** Insertion point for hose. The socket provides hose and electrical connection from the microphones in the nozzle. At insertion the socket must be oriented as shown above.

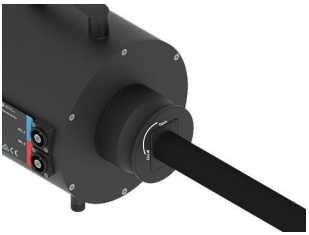
B) **Electrical connector:** Provides microphone signals from the nozzle.

C) **Mechnical locking ring:** Pull and turn to lock the hose in place.

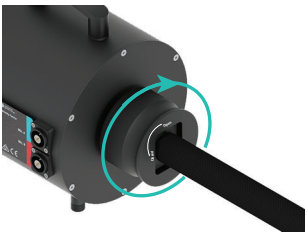
How to connect a HBK 4250-C hose

1) Ensure the hose and mounting socket are aligned as shown below, where the mounting socket and hose adaptor are in a vertical Open position with the electrical connector at the top.

2) Insert the hose all the way into the mounting socket. The hose adaptor will be flush with the surface of the mounting socket.



3) Hold the hose firmly while pulling the locking ring outwards and rotate it 90° clockwise.



Please note:

- The hose adaptor will now be 'inside' the mounting socket.
- The locking ring can rotate freely 360°.

4) When the locking ring springs back in place, it locks automatically and keeps the hose in place. The mounting socket and hose adaptor are now in a horizontal Closed position with the electrical connector to the right.

3.4 Microphone setup

All HBK 4250 systems are delivered with two pre-calibrated and pre-installed Type 4944 microphones in the hose nozzle.

The microphones are CCLD types with TEDS. The individual sensitivity for the complete microphone, including the angle piece adaptor and preamplifier, are stored in TEDS.

This means that there is no installation or setup necessary and the microphones are ready to measure.

3.4.1 Microphone variants

- Low- and mid-frequency VVS (HBK 4250-A and B): Use Type 4944-D microphone
- High-frequency VVS (HBK 4250-C): Uses Type 4944-C microphone

Fig. 3.7 *Type 4944-D (left) and Type 4944-C (right) microphones*

The microphone variants only differ in construction, wherein Type 4944-D is fitted with an extension, UA-0954, between the preamplifier and the capsule enabling it to fit and be effective in both the Ø76 mm and Ø38 mm nozzles. Type 4944-D will not fit into the Ø10 mm nozzle of HBK 4250-C.

All parts in the microphone can be ordered as spare parts. To do so, please refer to Specifications.

Chapter 4

Calibration

The microphones are delivered pre-calibrated and installed in the nozzles, with the individual calibration charts in the microphone storage boxes.

HBK recommends accredited calibrations to be performed once every year with both microphones sent together to be calibrated at the same time.

To send the microphones for accredited calibration, you will need to disassemble the nozzle and remove the microphones. Follow the procedures below to disassemble the nozzle in preparation for calibration and to reassemble the nozzle once the microphones are returned from calibration.

4.1 What you will need

You will need:

- An M2 Allen (hex) key
- Secure place to store screws and covers that are removed (they will be re-used to re-assemble the nozzle)
- Notation of the individual microphone's placement – for example, noting the position per serial number. Do not switch the positions of Mic A and Mic B in the nozzle as this may corrupt measurements:

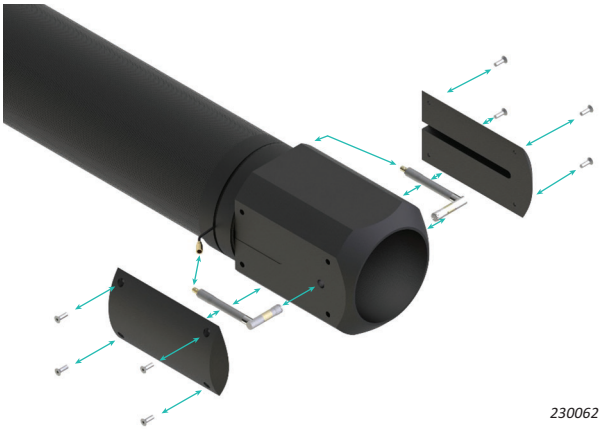
  Blue label = Mic A

  Red label = Mic B

4.2 Disassembly and reassembly overview

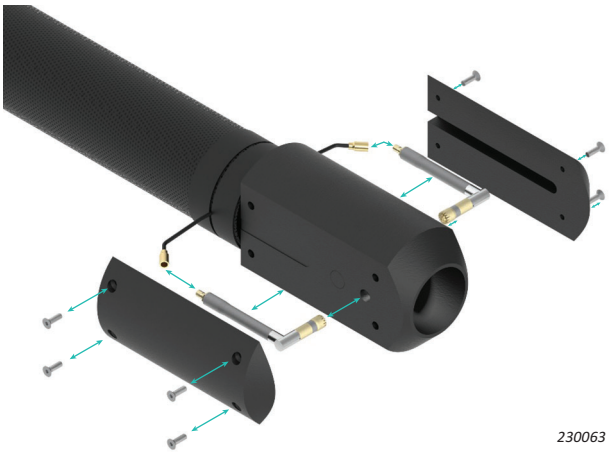
Disassembly and reassembly of the low-frequency nozzle

Fig. 4.1 *The complete process of disassembling and reassembling the low-frequency nozzle (Type 4250-A-003) in an exploded view*



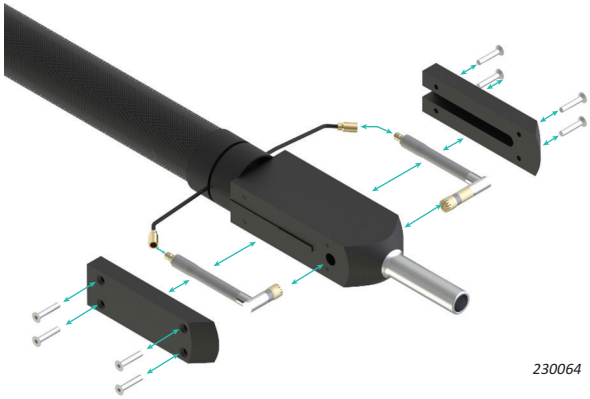
Disassembly and reassembly of the mid-frequency nozzle

Fig. 4.2 *The complete process of disassembling and reassembling the mid-frequency nozzle (Type 4250-B-003) in an exploded view*



Disassembly and reassembly of the high-frequency nozzle

Fig. 4.3 *The complete process of disassembling and reassembling the high-frequency nozzle (Type 4250-C-003) in an exploded view*



4.3 Disassembly for calibration

Please note: The instructions below describe the removal of just one microphone. However, both microphones should be removed using the same method and sent for calibration together.

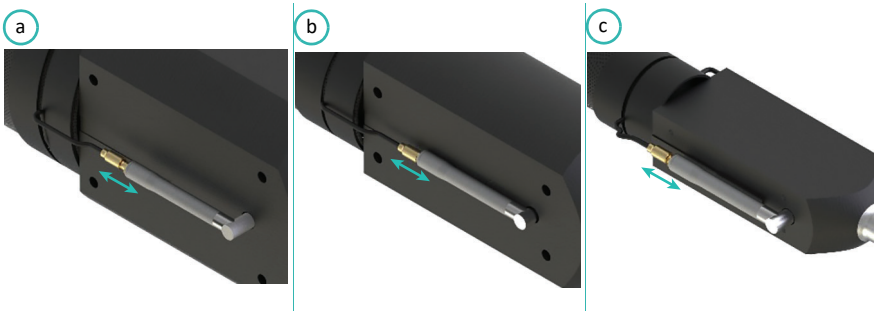
1) Disconnect the hose from the sound source and place it on a level surface. This will avoid strain on the hose and prevent the nozzle from moving around during the disassembly process.

2) Using an M2 hex key, loosen the four screws on the nozzle's side cover.
   a) With the low-frequency nozzle, Type 4250-A-003
   b) With the mid-frequency nozzle, Type 4250-B-003
   c) With the high-frequency nozzle, Type 4250-C-003

Please note: Put the screws in a safe place as you will need them again to reassemble.

3) Remove the cover to expose the microphone.
   a) With the low-frequency nozzle, Type 4250-A-003
   b) With the mid-frequency nozzle, Type 4250-B-003
   c) With the high-frequency nozzle, Type 4250-C-003

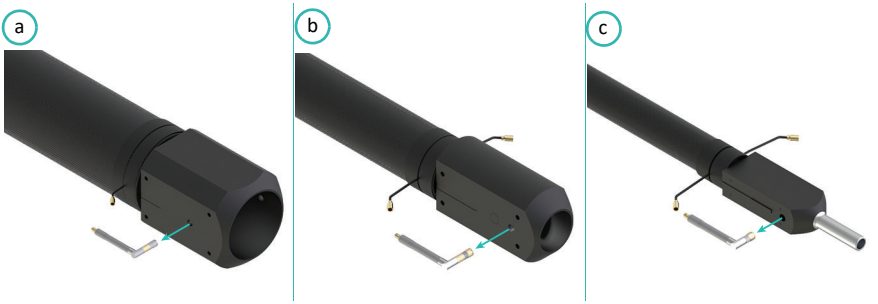
4) The signal cable is secured at the hose-nozzle connection to keep it fixed in place. With one hand, hold the signal cable adaptor and with the other hold the bottom of the preamplifier. Disconnect the adaptor from the preamplifier.
   a) With the low-frequency nozzle, Type 4250-A-003
   b) With the mid-frequency nozzle, Type 4250-B-003
   c) With the high-frequency nozzle, Type 4250-C-003



NOTICE:

- During this process, avoid excessive bending of the angle connector, which is connected to the microphone.
- Under **NO** circumstances should the microphone capsule be detached from the preamplifier. Contamination within the electrical connector will severely degrade the sensitivity of the microphone.

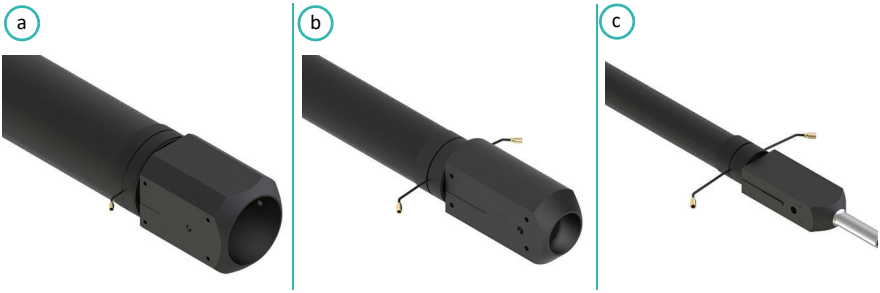
5) Gently retract the microphone from the nozzle, again being careful not to bend or break any parts.
   a) With the low-frequency nozzle, Type 4250-A-003
   b) With the mid-frequency nozzle, Type 4250-B-003
   c) With the high-frequency nozzle, Type 4250-C-003



4.4 Re-assembly after calibration

Once calibration is performed and the microphones are returned to you, you can re-assemble the nozzle as described below.

Fig. 4.4 *The nozzles without microphones and covers:* ***a)*** *Type 4250-A-003,* ***b)*** *Type 4250-B-003 and* ***c)*** *Type 4250-C-003*



Be careful to mount the microphones in their correct positions:

Blue label = Mic A (signal 1)

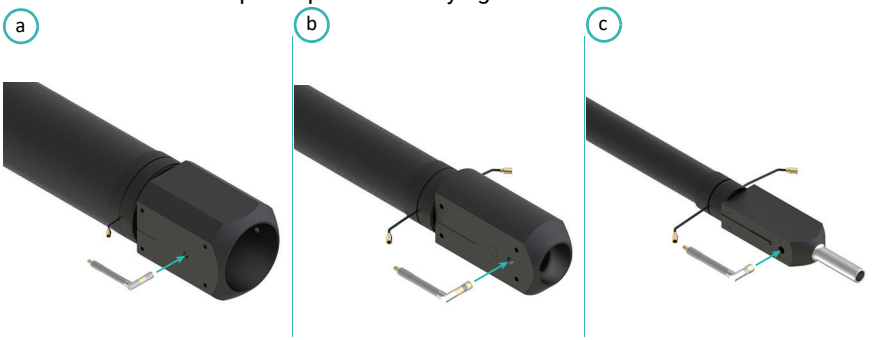
Red label = Mic B (signal 2)

If the microphones are not installed correctly, signals may be corrupt and the calculations for the volume velocity estimation will most likely be incorrect.

Please note: The instructions below describe the reattachment of just one microphone. Use the same method for both microphones.

1) Carefully insert the microphone (and extension, where relevant) into the hole at the side of the nozzle.
   a) With the low-frequency nozzle, Type 4250-A-003
   b) With the mid-frequency nozzle, Type 4250-B-003
   c) With the high-frequency nozzle, Type 4250-C-003

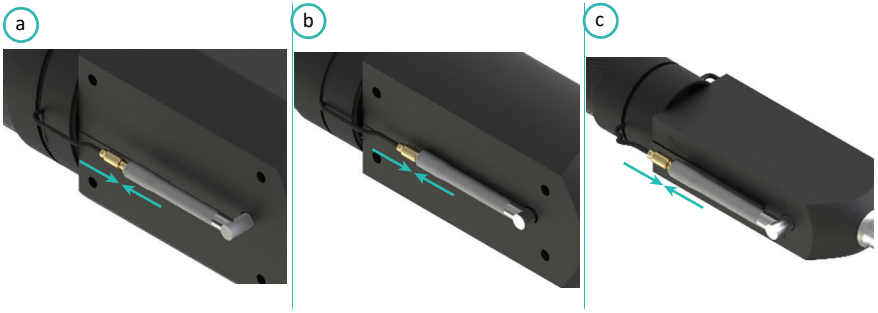
   Ensure the preamplifier is firmly against the wall of the nozzle.



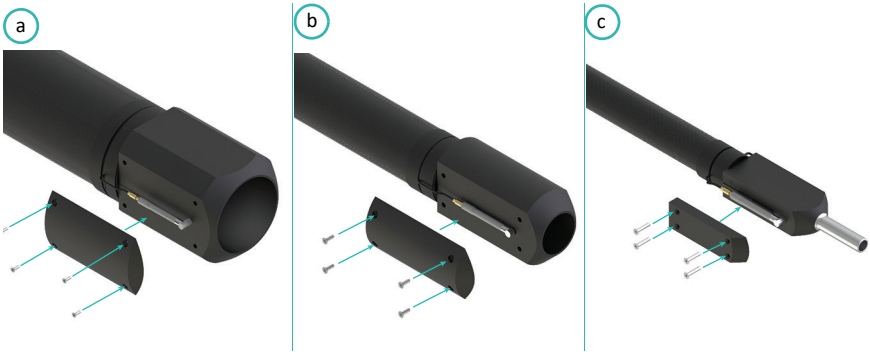
NOTICE:

- During this process, avoid excessive bending of the angle connector, which is connected to the microphone.
- Under **NO** circumstances should the microphone capsule be detached from the preamplifier. Contamination within the electrical connector will severely degrade the sensitivity of the microphone.

2) Using both hands, connect the signal cable adaptor onto the microphone assembly, by gently pushing the adaptor onto the preamplifier. Be careful not to bend or break any parts.
   a) With the low-frequency nozzle, Type 4250-A-003
   b) With the mid-frequency nozzle, Type 4250-B-003
   c) With the high-frequency nozzle, Type 4250-C-003



3) Place the lid back on the nozzle and insert the screws one by one and tighten.
   a) With the low-frequency nozzle, Type 4250-A-003
   b) With the mid-frequency nozzle, Type 4250-B-003
   c) With the high-frequency nozzle, Type 4250-C-003



4) Connect the hose to the sound source.

Chapter 5

Operation and Maintenance

5.1 Operation of the VVS

For correct operation of the VVS, follow all installation, usage and maintenance instructions found in this guide. It is also important to heed all warnings.

5.1.1 Proper usage

- Install the VVS in accordance with instructions.
- The input and output signals must comply with the specifications given in Table 5.1 below.
- Only use accessories specified by HBK.
- Do not use the VVS near water.
- Do not spill water or other liquids into or on the VVS.
- Do not operate the VVS while it is wet or standing in liquid.
- Do not operate the VVS near any heat-producing devices such as radiators, heat registers or stoves.
- Do not use VVS if the power cable is broken or frayed.
- Protect the power cable, do not stand on it or pinch it, particularly at the plug and the point where it meets the VVS.
- Do not block the air outlet aperture.
- Unplug the VVS during lightning storms or when not in use for long time periods.
- Do not remove the housing, top cover or the front panel. Removal of any of these components will void specifications. There are no serviceable parts inside and removal may void the warranty.
- An experienced user should always supervise the use of this professional audio equipment

5.1.2 Signal handling

When operating the VVS using an external amplified signal, it is important that the signal is filtered correctly and is in accordance with signals specified in the table below:

Table 5.1 *HBK 4250 VVS input and output signals*

SIGNAL NAME	TYPE	F_L [Hz]	F_H [kHz]
Low-frequency	Pink	10	1.6
Mid-frequency	Pink	20	6.3
High-frequency	White	100	12.5

When connecting microphone signals between the VVS and the LAN-XI front end, you must ensure that signal cables follow this colour scheme:

Blue label = Mic A (signal 1)

Red label = Mic B (signal 2)

All signals are generated for specific usage and any deviations can corrupt the calculations.

5.1.3 Troubleshooting

The VVS is a fully passive device. If no sound is coming from the sound source please try the following:

1) Correctly insert the amplifier cable into the Amp. Signal socket on the connector panel of the sound source.
2) Inspect the fuse and remove if burned out.
3) Turn on the test signal to the amplifier.

If the transfer function is not being displayed or is miscalculated, please try the following:

1) Inspect that all signal cables from the microphones to the LAN-XI front end are correctly connected.
2) Ensure that Mic A and Mic B are correctly connected from the VVS to the front end.

5.2 General maintenance

To maintain the VVS:

- Clean only with a dry cloth.
- Protect all cables running to and from the source. Do not stand on or pinch the cables, particularly at the socket and connection points, where it meets the housing.

If the VVS is damaged in any way, contact your local HBK service personnel. Only qualified service personnel may attempt to service the VVS.

5.2.1 Replacing the fuse

If needed, you can easily replace the fast-acting fuse on your own.

1) Remove all connections to and from the sound source, including signal cables and connection to an amplifier.
2) Locate the fuse holder on the VVS connector panel.

Fig. 5.1 *Location of the fuse holder. Turn anti-clockwise to open*

3) Using a standard screwdriver, unscrew the fuse holder by turning the screwdriver a quarter turn anti-clockwise.
4) Replace the fuse with another 5 A fast-acting fuse.
5) Reinsert the fuse holder in the socket and turn it a quarter turn clockwise.

5.3 Built-in electrical protection

The VVS features a passive protection circuit, preventing breakdown of the driver by overvoltage. However, there is a difference in the power handling for the low-frequency/mid-frequency sources and the high-frequency source.

Electrical protection in HBK 4250-A and B

The VVS sound source used in HBK 4250-A and HBK 4250-B includes a coaxial driver capable of handling 300 W of electric power. Its protection circuit will allow 50% of this limit in order to protect the driver from failure. The protection circuit is a dual-protection circuit, such that the two drivers within are protected individually according to their power-handling capability.

With low-frequency applications (< 2 kHz), the protection circuit is fitted with a magnetic relay that cuts the power when the voltage exceeds 27 Vrms for a period of more than three seconds.

When using the mid-frequency hose and driving the VVS at higher frequencies, the protection will cut the compression driver if any power above 2.4 kHz exceeds 18 Vrms for a period of more than three seconds.

Electrical protection in HBK 4250-C

HBK 4250-C is equipped with a compression driver and a protection circuit. Power-handling of the sound source is rated to 21 Vrms for a period of three seconds.

The protection circuit re-engages automatically when the power is lower than the levels described above for more than three seconds.

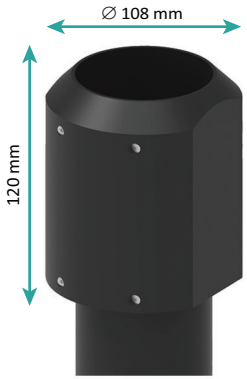
Chapter 6

Specifications

Compliance with Standards

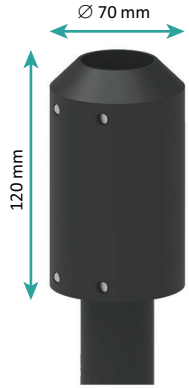
	The CE marking is the manufacturer's declaration that the product meets the requirements of the applicable EU directives. For this product, it is the Radio Equipment Directive 2014/53/EU. RCM mark indicates compliance with applicable ACMA technical standards – that is, for telecommunications, radio communications, EMC and EME. China RoHS mark indicates compliance with administrative measures on the control of pollution caused by electronic information products according to the Ministry of Information Industries of the People's Republic of China. WEEE mark indicates compliance with the EU WEEE Directive
ELECTRICAL SAFETY	EN/IEC 61010-1, ANSI/UL 61010-1 and CSA C22.2 No.1010.1: Safety requirements for electrical equipment for measurement, control and laboratory use, part 1: General requirements
EMC EMISSION AND IMMUNITY	EN/IEC 61326: Electrical equipment for measurement, control and laboratory use – EMC requirements. EN/IEC 61000-6-2: Generic standard – Immunity for industrial environments. EN/IEC 61000-6-3: Generic emission standard for residential, commercial and light industrial environments, class B CISPR 32: Radio disturbance characteristics of multimedia equipment. Class B Limits. 47 CFR FCC Part 15 subpart B **NOTE:** The above is only guaranteed using accessories listed in this document
TEMPERATURE	IEC 60068-2-1 & IEC 60068-2-2: Environmental Testing. Cold and Dry Heat Operating Temperature: –10 to +50 °C (14 to 122 °F) Storage Temperature: –25 to +70 °C (–13 to 158 °F)
HUMIDITY	IEC 60068-2-78: Damp Heat: 93% RH (non-condensing at +40 °C (104 °F)). Recovery time 2 ~ 4 hours
MECHANICAL	Non-operating: IEC 60068-2-6: Vibration: 0.15 mm, 20 m/s^2, 10 – 500 Hz IEC 60068-2-27: Bump: • HF Transducer: 4000 bumps at 400 m/s^2, 6 directions • LF Transducer: 1000 bumps at 150 m/s^2, 6 directions IEC 60068-2-27: Shock: • HF Transducer: 1000 m/s^2, 6 directions • LF Transducer: 500 m/s^2, 6 directions EN 60068-2-32: Free fall: • Portable Equipment: 25 cm, 10 directions • In Intended Package: 75 cm, 10 directions

HBK 4250-A Low-frequency Volume Velocity Source

SPECIFICATION	UNIT	VALUE
Operating frequency range* (Sufficient power and valid volume velocity estimation)	Hz	16 to 2000
Omni-frequency range (Omnidirectionality within ±5 dB threshold))	Hz	16 to 2000
Nominal impedance	Ω	8, coaxial driver
Power consumption (Amplifier protection circuit)	W	150, maximum continuous
Sound power level (with HBK 2755 Smart Power Amplifier)	dB	**Broadband:** 115, re 1 pW
		Spectral: Min. 90, f >31.5 Hz re 1 pW in each 1/3-octave band
Connection		Four-pin Neutrik® speakON® socket, pins 1+ and 1–
Dimensions, W × H × D	cm (in)	35.0 × 35.0 × 40.5 (13.7 × 13.7 × 15.9)
Weight	kg (lb)	19 (41.9)
Included hose dimensions	m (ft)	**Length:** 3 (9.8)
	mm (in)	**Diameter:** 76 (3.0)
Included nozzle dimensions		 220114
Nozzle orifice dimensions	mm (in)	**Radius:** 38 (1.50) **Length:** 30 (1.18) **Spacing** Δ: 20 (0.79)
	mm^2 (in^2)	**Area:** 4536 (7.03)
Nominal temperature range	°C (°F)	5 to 50 (41 to 122)
Relative humidity	%	85

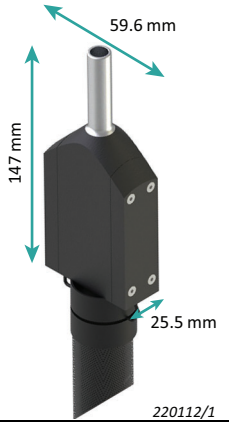
* Actual operating frequency is determined by the hose in use. The stated values are based on the included default hose

HBK 4250-B Mid-frequency Volume Velocity Source

SPECIFICATION	UNIT	VALUE
Operating frequency range* (Sufficient power and valid volume velocity estimation)	Hz	32 to 8000
Omni-frequency range (Omnidirectionality within ±5 dB threshold))	Hz	32 to 3150
Nominal impedance	Ω	16, coaxial driver
Power consumption (Amplifier protection circuit)	W	130, maximum continuous
Sound power level (with HBK 2755 Smart Power Amplifier)	dB	**Broadband:** 116, re 1 pW
		Spectral: Min. 85, f >31.5 Hz re 1 pW in each 1/3-octave band
Connection		Four-pin Neutrik® speakON® socket, pins 1+ and 1–
Dimensions, W × H × D	cm (in)	35.0 × 35.0 × 40.5 (13.7 × 13.7 × 15.9)
Weight	kg (lb)	19 (41.9)
Included hose dimensions	m (ft)	**Length:** 3 (9.8)
	mm (in)	**Diameter:** 38 (1.5)
Included nozzle dimensions		
Nozzle orifice dimensions	mm (in)	**Radius:** 19 (0.75) **Length:** 30 (1.18) **Spacing** Δ: 20 (0.79)
	mm^2 (in^2)	**Area:** 1134 (1.76)
Nominal temperature range	°C (°F)	5 to 50 (41 to 122)
Relative humidity	%	85

* Actual operating frequency is determined by the hose in use. The stated values are based on the included default hose

HBK 4250-C High-frequency Volume Velocity Source

SPECIFICATION	UNIT	VALUE
Operating frequency range* (Sufficient power and valid volume velocity estimation)	Hz	100 to 16000
Omni-frequency range (Omnidirectionality within ±5 dB threshold))	Hz	100 to 10000
Nominal impedance	Ω	16
Power consumption (Amplifier protection circuit)	W	50, continuous
Sound power level (with HBK 2755 Smart Power Amplifier)	dB	**Broadband:** 108, re 1 pW
		Spectral: Min. 80, f >0.8 kHz re 1 pW in each 1/3-octave band
Connection		Four-pin Neutrik® speakon® socket, pins 1+ and 1–
Dimensions (W × H × D)	cm (in)	23.2 × 20.1 × 23.1 (9.1 × 8.3 × 9.1)
Weight	kg (lb)	5 (11)
Included hose dimensions	m (ft)	**Length:** 3 (9.8)
	mm (in)	**Diameter:** 20 (0.79)
Included nozzle dimensions		
Nozzle orifice dimensions	mm (in)	**Radius:** 5 (0.20) **Length:** 75 (2.95) **Spacing Δ:** 10 (0.39)
	mm^2 (in^2)	**Area:** 78.5 (0.12)
Nominal temperature range	°C (°F)	5 to 50 (41 to 122)
Relative humidity	%	85

* Actual operating frequency is determined by the hose in use. The stated values are based on the included default hose

Software and accessories available separately

VVS SUB-SYSTEMS

Type 4250-A-003	LF VVS Hose & Probe
Type 4250-B-003	MF VVS Hose & Probe
Type 4250-C-003	HF VVS Hose & Probe
Type 4250-A-004	LMF VVS Driver
Type 4250-C-004	HF VVS Driver

AMPLIFIERS

2755-X	Smart Power Amplifier, with Wi-Fi
2755-A-X	Smart Power Amplifier, without Wi-Fi

MEASUREMENT SOFTWARE

Type 8403-X*	BK Connect Data Processing
Type 8442-X*	BK Connect VVS Measurements

CABLES

AO-0824-D-100	Red Coax Cable
AO-0825-D-100	Blue Coax Cable
AQ-0649-D-100	Shaker Drive Cable

CARRYING CASES

For HBK 4250-A, B and D:

KE-4250-A	Carrying Case for Low-frequency and Mid-frequency VVS. Can hold 1 LF/MF VVS

For HBK 4250-C:

KE-4250-C	Carrying Case for High-frequency VVS

For HBK 4250-E:

Both KE-4250-A-and KE-4250-C carrying cases would be needed

* "X" indicates the licence model can either be N: Node-locked or F: Floating

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