

BK Connect Acoustic Camera

Consisting of Acoustic Camera Type 9712-W-FEN and BK Connect Array Analysis Type 8430

BK Connect™ Acoustic Camera is a complete system for real-time noise source identification (NSI) that can be used for both stationary and non-stationary measurements. It is a versatile tool designed for use in the aerospace and automotive industries, but has applications in many other industrial environments. BK Connect Acoustic Camera is equally suited to NSI troubleshooting in aircraft; buzz, squeak, and rattle (BSR) detection in vehicle cabins; and high-frequency leak detection.

Use BK Connect Acoustic Camera to locate and view transient sound sources on site using an aim, shoot and measure procedure. The system allows you to take, save and share screenshots using the functionality of your tablet; make, save and review recordings using BK Connect Array Analysis; and analyse recordings using BK Connect Data Processing (available separately.)



Uses, Benefits, Features

Uses

- NSI troubleshooting in aircraft cabins, cockpits, avionics and cargo bays
- Locate on industrial machinery and household appliances
- Detection and documentation of BSR in vehicle cabins
- Leak detection
- Measure and record an event
- Non-stationary measurements, walk and stream
- Stationary measurements, mount the array on a tripod

Benefits

- Easy to use, minimal training required
- View measurements on site in real time
- Locate sound sources, take screenshots of problem areas
- Make and review recordings, adjust the frequency range
- Perform both beamforming and acoustic holography measurements with one system
- Analyse recordings in BK Connect Data Processing (available separately)
- Capture screen as picture or video for rapid reporting

Features

- Complete system, includes hardware and software
- Spectrogram displays sound frequencies as a function of time
- Portable, hardware comes in custom-made case
- Battery life of up to 2½ hours
- Source map superimposed on video images
- BK Connect Array Analysis Type 8430
 - Up-and-running in under ten seconds (from BK Connect project menu)
 - Continuous buffering provides real-time images
 - Simple, easy-to-use interface
 - Optional remote control mode via tablet
 - Transfer recordings to PULSE™ Array Acoustics Post-processing
- Hand-held Array
 - Small size for use in confined spaces, diameter 35 cm
 - Removable reflective plate allows measuring in either the near or far acoustic field
 - Microphones flush with reflective plate
 - Integrated video camera, films 15 to 20 frames per second
 - Integral cables keep system tidy, mobile, and easy to set up
 - Built-in tablet holder

BK Connect Acoustic Camera – A Complete System

Fig. 1
Acoustic Camera
Type 9712-W-FEN in
its custom case

Description

BK Connect Acoustic Camera is a portable solution for transient noise detection in almost any acoustic environment. It is capable of stationary and non-stationary measurements in both near and far acoustic fields, and can be used as either a detection tool or a measurement device.

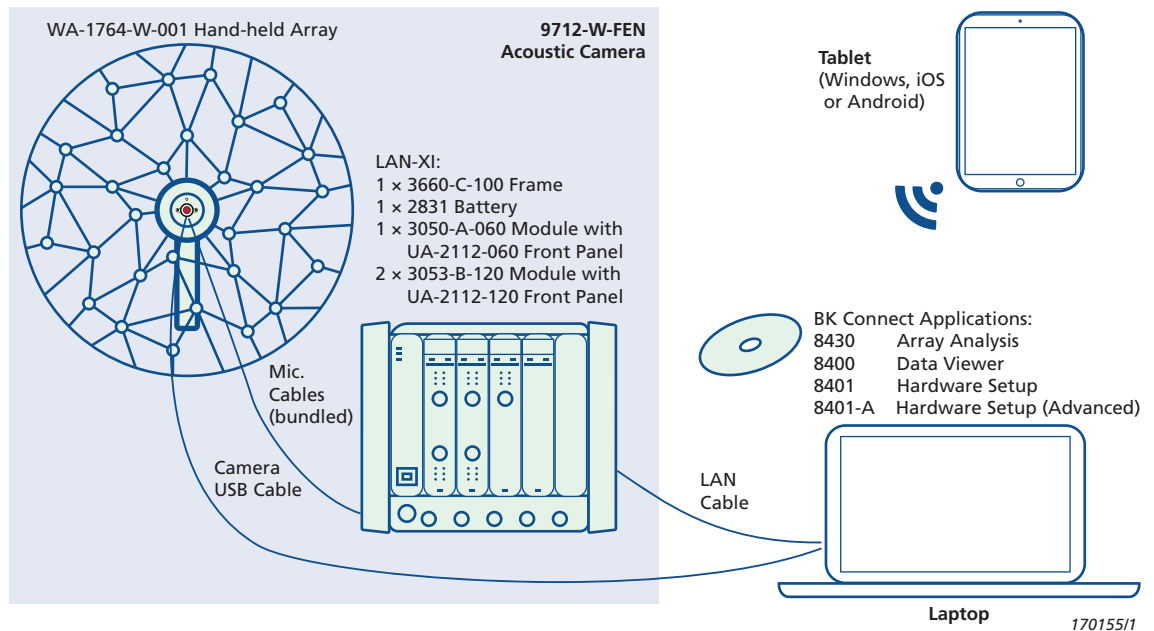
The system consists of a hand-held array, LAN-XI Data Acquisition Hardware for PULSE, BK Connect software, and a custom-made, waterproof case for transporting the hardware to and from measurement sites.



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Fig. 2
BK Connect Acoustic
Camera System

System Setup

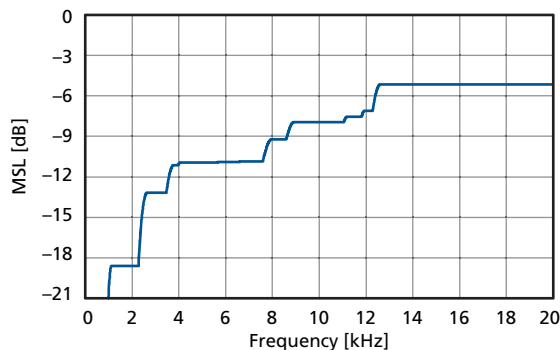


Hardware – Acoustic Camera Type 9712-W-FEN

Hand-held Array

Array WA-1764-W-001 is a 30-channel, sliced wheel array with integral cables and a removable reflective plate. It features an integrated handle with a built-in tablet holder. In the centre of the array is a video camera that films 15 to 20 frames per second.

Fig. 3
Maximum side lobe
(MSL) level of
WA-1764-W-001



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The array is a sliced wheel array with irregular microphone placement. It is optimized for both acoustic holography and beamforming measurements. Brüel & Kjær uses a patented numerical optimization method to design arrays with optimal performance for the frequency range and number of microphones. See Fig. 3 for the dynamic range, or maximum side lobe (MSL) level, of the array.

Microphones

The microphone used in Array WA-1764-W-001 is Type 4959. It is a ¼" prepolarized microphone with TEDS. It has a frequency range of 50 Hz to 20 kHz and a built in CCLD* preamplifier. See product data [BP 2202](#) for more information.

Cabling

The array has two integral cables – one that connects the array to the LAN-XI hardware and one (USB) that connects the camera to the computer. The cable that connects the array to the hardware consists of five cables that are bound together to keep the system tidy. The connectors are numbered to make connection to the LAN-XI front panels quick and easy.

Reflective Plate

The reflective plate is made of a hard, vibration-damped material. With the reflective plate in place, the array is suitable for measurements in the far field using the beamforming algorithm (Fig. 4, left). Without the reflective plate, measurements can be made in the near field using the acoustic holography algorithm (Fig. 4, right). As a comparison, a typical measuring distance for beamforming is around 40 cm, while a typical measuring distance for acoustic holography is around 5 cm.

Fig. 4 Left: Hand-held Array WA-1764-W-001 with reflective plate for use in beamforming measurements
Right: Without reflective plate for use in acoustic holography measurements



Tablet Holder

The built-in tablet holder will work with a variety of tablet sizes and manufacturers. The recommended size is 20 × 13 cm (8 × 5 in).

NOTE: When using the hand-held array without the reflective plate (as for acoustic holography measurements) noise will reflect off of the tablet. Remove the tablet from the holder to prevent the detection of such sounds.

LAN-XI Data Acquisition Hardware

Type 9712-W-FEN includes all the necessary LAN-XI hardware:

- 1 × Front-end Frame with GPS Type 3660-C-100 (5-module)
- 2 × 12-ch. Input Module Type 3053-B-120 with Array Connector Front Panel UA-2112-120
- 1 × 6-ch. Input Module Type 3050-A-060 with Array Connector Front Panel UA-2112-060
- 1 × Battery Module Type 2831

Information regarding the LAN-XI components can be found in product data [BP 2215](#), which describes LAN-XI data acquisition hardware (frame and modules), and [BP 2421](#), which describes the LAN-XI front panels.

* CCLD: Constant current line drive, also known as DeltaTron® (ICP and IEPE compatible).

Powering LAN-XI Data Acquisition Hardware

Battery Module Type 2831 can power the hardware for up to 2½ hours. The battery module is located in the fifth slot (far-right module in Fig. 5) of the LAN-XI front-end frame. The battery-life indicator on this module is always visible. The exact length of battery life is given in minutes in the far-left LAN-XI front-panel display upon start up. Both features are shown in Fig. 5.

Fig. 5
Portable LAN-XI
module with battery-
life indicator



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Software – BK Connect

The software for BK Connect Acoustic Camera is as follows:

- BK Connect Array Analysis Type 8430 (includes PULSE Acoustic Test Consultant Type 7761)
- BK Connect Data Viewer Type 8400
- BK Connect Hardware Setup Type 8401
- BK Connect Hardware Setup (advanced) Type 8401-A

BK Connect is a Windows®-based analysis software platform. Licenses are delivered via DVD or USB and are either: node-locked to a PC host ID or dongle; or floating, locked to a network server.

BK Connect Array Analysis Type 8430

BK Connect Array Analysis Type 8430 is the heart of BK Connect Acoustic Camera. The application superimposes source maps and video images to create an acoustic map. Continuous buffering enables streaming of real-time images so you can quickly pinpoint problem areas. Sound source data collected with the array and data acquisition hardware can be viewed, recorded and played back.

NOTE: If you have Acoustic Test Consultant Type 7761 and a valid service contract, you will receive Type 8430 as part of the maintenance update.

Operation

Type 8430 is up-and-running in under 20 seconds from the start of BK Connect or under ten seconds from the project menu. The application can stream, record and play back. Streaming is the default operating mode and is perfect for troubleshooting. Locate a sound source, save a screenshot and use it to fix the issue – no post-processing necessary.

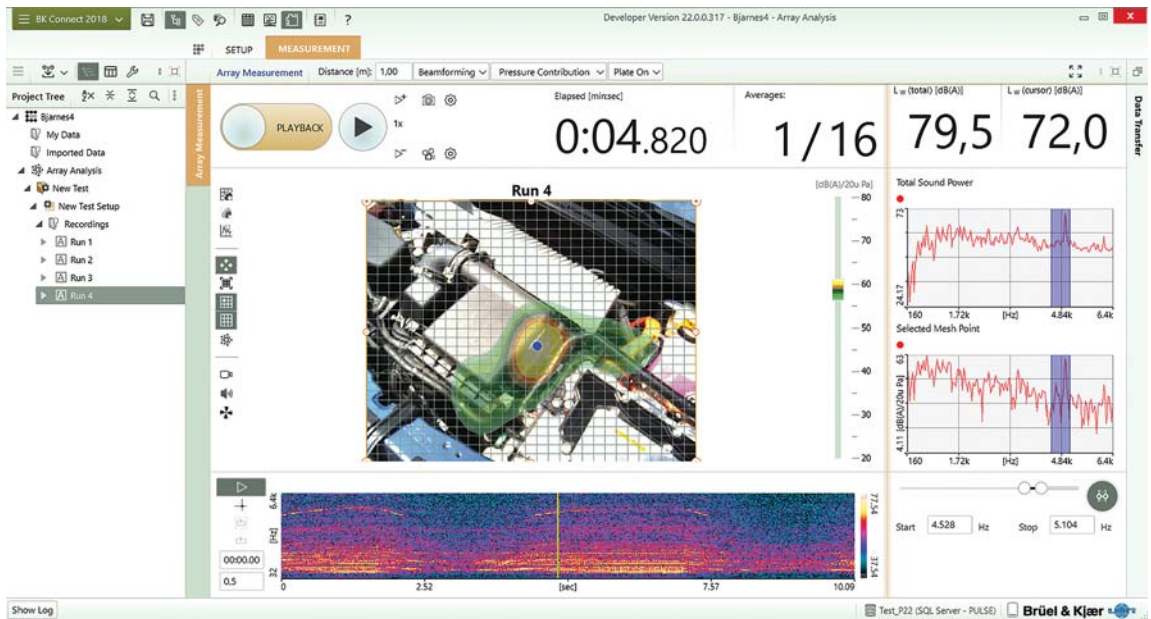
Once an area of interest is located in streaming mode, a recording can be made for further analysis. Recordings are automatically stored in the software's project tree. You can record multiple areas of interest since each recording is automatically stored separately in the project tree.

Playback allows you to view recordings immediately within Type 8430. This feature can be used to determine if another recording is necessary or to investigate the sound source further. You can adjust the frequency range during play back.

User Interface

Type 8430 is a BK Connect application and features the same ease-of-use achieved through the platform's innovative graphical user interface (GUI) and logical workflow. Displays include graphs of sound pressure (or sound intensity) and sound power, as well as a spectrogram. The interface has been refined so that the software can easily be viewed and manipulated on both computer (desktop or laptop) and tablet screens.

Fig. 6
Interface of Type 8430; the acoustic map, spectrogram and sound power are shown



The sound power and spectrogram displays can be used to edit what is displayed in the sound pressure (or intensity) display. The sound power display is interactive in either streaming or playback mode and can be used to view a specific frequency (or a range of frequencies). The spectrogram, however, is only interactive during playback. Pinpoint sound events using the cursor, zoom in on selected regions and loop the playback.

Using a Tablet

With a wireless connection, BK Connect Array Analysis can be displayed on a tablet that runs Windows®, iOS®, or Android™ operating systems*. Enable the remote control mode to control the system from the tablet. This feature makes it possible for one person to operate the entire system.

BK Connect Core Applications

The core applications of BK Connect that are required for using Array Analysis Type 8430 are Data Viewer Type 8400 and Hardware Setup Type 8401 with the advanced license option (Type 8401-A). Data Viewer Type 8400 enables the management, viewing and reporting of data collected with Type 8430; and Hardware Setup Types 8401 and 8401-A enable the set-up of your front-end hardware.

Analysing Recordings

BK Connect Data Processing

If you have a license for Data Processing Type 8403, you can analyse recordings made with Type 8430.

PULSE Array Acoustics

Recordings made using Type 8430 can be analysed in PULSE Array Acoustics applications. Transfer the data from the recording to access all the relevant calculations and display possibilities in, for example, PULSE Array Acoustics Refined Beamforming Calculations BZ-5639 (product data [BP 2543](#)).

* Requires software for remote support and online meetings, such as TeamViewer or similar. Commercial use of TeamViewer requires a license.

Supported Arrays

BK Connect Array Analysis Type 8430 can be used with other Brüel & Kjær sliced wheel arrays (see Table 1) and all other planar, irregular arrays and regular grid arrays. Type 8430 does not work with double layer or half-wheel arrays. For multi-armed, foldable arrays (such as the pentangular array) only beamforming is supported.

Table 1
Beamforming and holography are supported with sliced wheel arrays. Frequency range is for an MSL level of at least 7 dB





| Number of Channels | Physical Diameter (in metres) | Item Number | Frequency Range (in hertz) | Resolution at Optimal Distance (in metres) |
|--------------------|-------------------------------|---------------|----------------------------|--|
| 18 | 0.40 | WA-1558-W-021 | 125 to 7 k | 0.09 to 0.08 |
| | 0.55 | WA-1558-W-019 | 100 to 3.9 k | 0.13 to 0.07 |
| 30 | 0.35 | WA-1764-W-001 | 140 to 12 k | 0.05 to 0.03 |
| 36 | 0.55 | WA-1558-W-020 | 100 to 8.4 k | 0.09 to 0.04 |
| | 0.70 | WA-1558-W-004 | 100 to 6.6 k | 0.12 to 0.05 |
| | 1.05 | WA-1558-W-014 | 100 to 4.4 k | 0.17 to 0.07 |
| | 1.22 | WA-1558-W-017 | 100 to 3.8 k | 0.20 to 0.07 |
| 60 | 0.55 | WA-1558-W-003 | 100 to 19 k | 0.07 to 0.01 |
| | 0.75 | WA-1558-W-010 | 100 to 14 k | 0.09 to 0.02 |
| | 1.05 | WA-1558-W-006 | 100 to 10 k | 0.13 to 0.03 |
| 84 | 0.55 | WA-1558-W-023 | 100 to 20 k | 0.06 to 0.01 |
| | 1.05 | WA-1558-W-022 | 100 to 20 k | 0.11 to 0.01 |
| | 1.10 | WA-1558-W-009 | 100 to 20 k | 0.11 to 0.01 |
| 108 | 0.78 | WA-1558-W-015 | 100 to 20 k | 0.14 to 0.01 |

Microphone Calibration

On-site microphone verification can be preformed using Sound Calibrator Type 4231 and Single-channel Array Adapter WA-0728-W-006. If needed, factory standard calibration is also available.

Compliance with Standards

HAND-HELD ARRAY TYPE WA-1764-W-001

| | |
|---|--|
|     | <p>The CE marking is the manufacturer's declaration that the product meets the requirements of the applicable EU directives</p> <p>RCM mark indicates compliance with applicable ACMA technical standards – that is, for telecommunications, radio communications, EMC and EME</p> <p>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</p> <p>WEEE mark indicates compliance with the EU WEEE Directive</p> |
| Safety | <p>EN/IEC 61010–1: Safety requirements for electrical equipment for measurement, control and laboratory use</p> <p>ANSI/UL 61010–1: Safety requirements for electrical equipment for measurement, control and laboratory use</p> |
| EMC Emission | <p>EN/IEC 61000–6–3: Generic emission standard for residential, commercial and light industrial environments</p> <p>EN/IEC 61000–6–4: Generic emission standard for industrial environments</p> <p>CISPR 22: Radio disturbance characteristics of information technology equipment. Class B Limits</p> <p>FCC Rules, Part 15: Complies with the limits for a Class B digital device</p> <p>This ISM device complies with Canadian ICES–001 (standard for interference-causing equipment)</p> |
| EMC Immunity | <p>EN/IEC 61000–6–1: Generic standards – Immunity for residential, commercial and light industrial environments</p> <p>EN/IEC 61000–6–2: Generic standards – Immunity for industrial environments</p> <p>EN/IEC 61326: Electrical equipment for measurement, control and laboratory use – EMC requirements</p> <p>Note: The above is only guaranteed using accessories listed in this Product Data sheet</p> |
| Temperature | <p>IEC 60068–2–1 & IEC 60068–2–2: Environmental Testing. Cold and Dry Heat</p> <p>Operating Temperature: –10 to +55 °C (14 to 131 °F)</p> <p>Storage Temperature: –25 to +70 °C (–13 to +158 °F)</p> |
| Humidity | IEC 60068–2–78: Damp Heat: 93% RH (non-condensing at 40 °C (104 °F)) |
| Mechanical | <p>Non-operating:</p> <p>IEC 60068–2–6: Vibration: 0.3 mm, 20 m/s², 10 – 500 Hz</p> <p>IEC 60068–2–27: Shock: 1000 m/s²</p> <p>IEC 60068–2–29: Bump: 1000 bumps at 250 m/s²</p> |

LAN-XI DATA ACQUISITION HARDWARE

See product data [BP 2215](#)

Specifications – BK Connect Acoustic Camera

Acoustic Camera Type 9712-W-FEN

HAND-HELD ARRAY WA-1764-W-001*

Frequency Range: 140 Hz to 12 kHz

- Near field, without reflective plate (SONAH): 140 Hz to 3 kHz
- Far field, with reflective plate (beamforming): 1 kHz to 12 kHz[†]

Weight: 1 kg (2.2 lb)

Diameter: 35 cm (13.8 in)

Number of Microphones: 20

Camera:

- Frame rate: 15 per second
- Pixels: 1280 × 1040
- Angle of view: 76°

WATERPROOF STORM CASE

Dimensions: 60 × 34 × 64 cm (24.6 × 13.4 × 25.2 in)

Weight (hardware and case): 22 kg (48.5 lb)

FRONT END

Specifications for LAN-XI Data Acquisition Hardware used in BK Connect Acoustic Camera are given in product data [BP 2215](#)

BK Connect Array Analysis Type 8430

MEASUREMENTS

Analysis (Narrow band): 1/1-, 1/3-, 1/12-octave

Acoustical Weighting: Linear, A, C

Time Constraint (Exponential): 1/8 s (fast), 1 s (slow), 8 s

* Specifications for MSL of at least 7 dB

† Frequency range can be extended up to 20 kHz with reduced MSL

System

SYSTEM REQUIREMENTS

- Microsoft® Windows® 10 Pro or Enterprise (x64) with either Current Branch (CB) or Current Branch for Business (CBB) servicing model; or Windows® 7 Pro, Enterprise or Ultimate (SP1) (x64) operating systems
- Microsoft® Office 2016 (x32 or x64) or Office 2013 (x32 or x64)
- Microsoft® SQL Server® 2014 Express (SP2) (included in installation), Microsoft® SQL Server® 2014 (SP2), SQL Server 2012 R2, SQL Server 2008 or 2008 R2 Express Edition SP1

RECOMMENDED SYSTEM CONFIGURATION

- Intel® Core™ i7, 3 GHz processor or better
- 32 GB RAM
- 480 GB Solid State Drive (SSD) with 20 GB free space, or better
- 1 Gbit Ethernet network[‡]
- Microsoft® Windows® 10 Pro or Enterprise (x64), CB
- Microsoft® Office 2016 (x32)
- Microsoft® SQL Server® 2014 (SP2)
- Screen resolution of 1920 × 1080 pixels (full HD)

TABLET REQUIREMENTS

Operating system: Windows®, iOS®, or Android™

Recommended size: 20 × 13 cm (8 × 5 in)

REMOTE CONTROL/DISPLAY REQUIREMENTS

TeamViewer or similar

‡ A dedicated data acquisition network (LAN or WAN) is recommended; a network that only handles data from the front end improves the stability of the data

BK Connect Acoustic Camera

HARDWARE

9712-W-FEN BK Connect Acoustic Camera

Including:

- **WA-1764-W-001**: 30-ch. Hand-held Array
 - 1 × Array frame with handle, integral cable and tablet stand
 - 1 × Camera
 - 30 × Type 4959: Short 20 kHz Array Microphone
 - 1 × Reflective panel
 - 1 × WE-0313: Storm Case
- **LAN-XI Data Acquisition System**
 - 1 × Type 3660-C-100: 5-module LAN-XI Front-end Frame with GPS
 - 1 × Type 3050-A-060-X: 6-ch. Input Module LAN-XI 51.2 kHz (Mic, CCLD, V), excluding accessories
 - 2 × Type 3053-B-120-X: 12-ch. Input Module LAN-XI 25.6 kHz (CCLD, V), excluding accessories
 - 1 × UA-2112-060: LAN-XI Front Panel, detachable, 6-ch., mic. arrays, 1 × circular 7-pin (F) connector
 - 2 × UA-2112-120: LAN-XI Front Panel, detachable, 12 ch., mic. arrays, 2 × circular 7-pin (F) connectors
 - 1 × Type 2831: Battery Module for LAN-XI

SOFTWARE

- Type 8430-X*** BK Connect Array Analysis
- Type 8400-X*** BK Connect Data Viewer
- Type 8401-X*** BK Connect Hardware Setup
- Type 8401-A-X*** BK Connect Hardware Setup (Advanced)

SOFTWARE MAINTENANCE AND SUPPORT (REQUIRED)

- M1-8430-X*** Software Maintenance and Support Agreement for BK Connect Array Analysis Type 8430
- M1-8400-X*** Software Maintenance and Support Agreement for BK Connect Data Viewer Type 8400
- M1-8401-X*** Software Maintenance and Support Agreement for BK Connect Hardware Setup Type 8401
- M1-8401-A-X*** Software Maintenance and Support Agreement for BK Connect Hardware Setup (Advanced) Type 8401-A

* 'X' indicates the license module, either: node locked (N) or floating (F)

Options

Custom arrays are ordered through the Customized Projects Department or Project Sales Office[†]
Individual components of the BK Connect Acoustic Camera can be purchased as needed

Supported Brüel & Kjær Products

SOFTWARE

Type 8403-X* BK Connect Data Processing
Software Maintenance and Support Agreements are available for all BK Connect applications

HARDWARE

UA-0750 Tripod with ball head, 40 to 131 cm (15.7 to 51.6 in)
Type 4231 Sound Calibrator
WA-0728-W-006 Single Channel Array Adapter for Type 4231

Calibration Services

ANA-LNXI-CAF Accredited Calibration of LAN-XI Modules
WA-1764-W-001-TCF Standard Factory Calibration of WA-1764-W-001, includes calibration and TEDS update of 30 × Array Microphones Type 4959, and a (BK Connect Acoustic Camera) system test

[†] Contact information for local Brüel & Kjær offices can be found at bksv.com/contact

