BRÜEL & KJÆR® NVH solutions

Sonoscout NVH Recorder
For noise, vibration and harshness (NVH) measurements

Sonoscout™ is a portable, multi-channel, wireless NVH recorder from Brüel & Kjær that performs real-time recording and validation. It continuously displays test information, such as tacho channel output, to maximize confidence during testing, and brings simple control and analysis to tasks such as comparing vehicles and data sets.

Sonoscout is a system comprising a control unit (an app for an iPad®) and a battery-powered wireless data acquisition front end based on Brüel & Kjær LAN-XI hardware. A wireless connection between the front end and the control unit transmits the data from up to 12 measurement transducers to the app for recording. Sonoscout can record cabin sounds binaurally when used in combination with a binaural recording headset or a head simulator. Playback connectivity via Bluetooth® allows recordings to be audited immediately through the headset, or using the car's audio system.

Sonoscout can be used for spectral or order analysis and filtering (for validation or benchmarking of rotating machinery), and data can be exported to BK Connect® or other post-processing software for further analysis.

The Sonoscout app runs on all iPad models to which data streams directly from the LAN-XI module. It supports GPS and CAN signals and recording to an SD card. It also has a demonstration feature (Virtual Front End) that allows you to try the full recording and analyzer functionality without purchasing any extra hardware.

Uses and features

Uses
- General sound and vibration measurements
- NVH characterization
- Benchmarking
- Simple troubleshooting
- Recording data for NVH Simulator models
- Binaural recordings using Binaural Recording Headphones Types 4101-B and 4965-B or Sound Quality Head and Torso Simulator (HATS) Type 4100-D

Features
- Records data – up to 12 channels (iPad or SD card storage)
- Stereo playback
- Remote control of BK Connect Time Data Recorder for larger channel-count requirements
- Narrow- and 1/3-octave band analysis (synthesized)
- Spectrogram (colour maps)
- Order slicing
- Simple sound quality metrics
- GPS tracking
- Pre-triggering, auto-stop and time history markers
- Overlaid displays – up to four
- Target curves: create, import and display
- Automated calibration procedure
- Simultaneous application of high-/low-pass and parametric equalization (EQ) filters
- Generates an rpm profile from a signal channel (RPM Finder)
- Creates speed profiles from a GPS recording
- Supports TEDS
- Export various file formats within Sonoscout app:
  - Save data as BKC, WAV, ASQ-WAV, PTI or HDF files
  - Export recorded data to SDF or 2-channel WAV files
  - Export results as BKC, CSV or ATFX ASAM-ODS files
- Intuitive touch operation
- Free download of Sonoscout app in the App Store℠
- Demonstration mode in app (Virtual Front End)
- Portable and battery powered
- Wireless LAN (via LAN-XI Frame Type 3660-A-200)
- Dyn-X compatible (excl. LAN-XI Modules Type 3053, 3058, 3676 and 3677)
- ASE3 input for digital head support (Type 3058 only)
- High-speed CAN support: ISO 11898-2. CAN 2.0 A/B (LAN-XI Module Type 3058 only)
- Low-speed CAN (fault tolerant) support: ISO 11898-3 (LAN-XI Module Type 3058 only)
- Supports J-1939 and OBD-II (LAN-XI Module Type 3058 only)

System overview

Fig. 1
Sonoscout NVH Recorder system: sensors, a LAN-XI front end and the Sonoscout control unit

A typical system consists of sensors, a LAN-XI front end and the Sonoscout control unit (an iPad running the Sonoscout app). Sensors are connected to an input module, which is installed with Sonoscout Licence BZ-5950-L. The input module is mounted, together with a battery module, in a wireless frame, enabling wireless connection to the iPad.

Control unit

The Sonoscout App is free to download from the App Store and can be installed on an unlimited number of iPad mobile devices. Use the iPad to document measurement conditions with pictures and video, then mount it onto the dashboard, connect it to the LAN-XI front end and drive. You can see all the test information as it records for maximum confidence.

After the measurement, listen to recordings via headphones, the car's audio system or the iPad, and inspect graphical data (FFT, synthesized 1/3-octave, order analysis and spectrogram) using iPad functionality.

Download the app to demo the system

To use Sonoscout NVH Recorder, you need a LAN-XI front end and Sonoscout License BZ-5950-L. However, you can run the Sonoscout app in Virtual Front End mode. This allows you to try the recording functionality without a licence or a LAN-XI module connected.

Hardware

Fig. 2
A typical Sonoscout Hardware Kit in its case. The case has space for additional accessories

Kits

Standard hardware kits are available to help you build a Sonoscout NVH Recorder system to suit your needs. All hardware kits include the battery module, a wireless frame and all the necessary cabling delivered in a case.

Note: Hardware kits do not include Sonoscout License BZ-5950-L or a Sonoscout control unit (iPad).

CAN Bus/AES3 support

CAN Bus LAN-XI Module Type 3058 is specifically designed for automotive testing applications. It features two CAN bus channels and eight input channels, four of which can be configured as two balanced input channels for digital signals according to AES3.

See BP 2566 for more information about Type 3058.

Binaural microphones

Sonoscout supports Binaural Microphone Types 4101-B and 4965-B. Correction curves are provided with the microphones and can be used with other software, such as the Desktop NVH Simulator from VI-grade.

LAN-XI module support

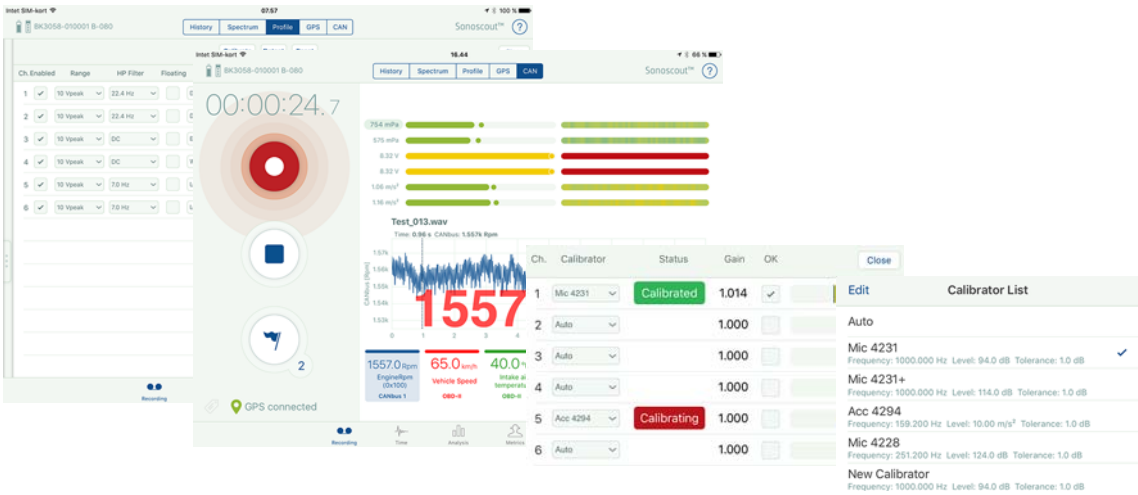
Fully Supported					Partially Supported			Not Supported	
3050	3052	3053	3058	3676	3056*	3160†	3677†	3057	3161

* High-speed tacho mode and auxiliary input channels are not supported
† Output channels are not supported

Recording

- Setup of front end
- Tacho and CAN channel support with correction for missing pulses
- Remote control of BK Connect Time Data Recorder
- Auto-calibration
- Data recording (with pre-triggering and auto-stop options)
- GPS recording
- Peak and level meters
- Markers to identify specific events or sections
- Available Virtual Front End mode (demo mode)
- Recording of **all** CAN data for later post-processing

Fig. 3
Recording – typical views



Time data viewing and editing

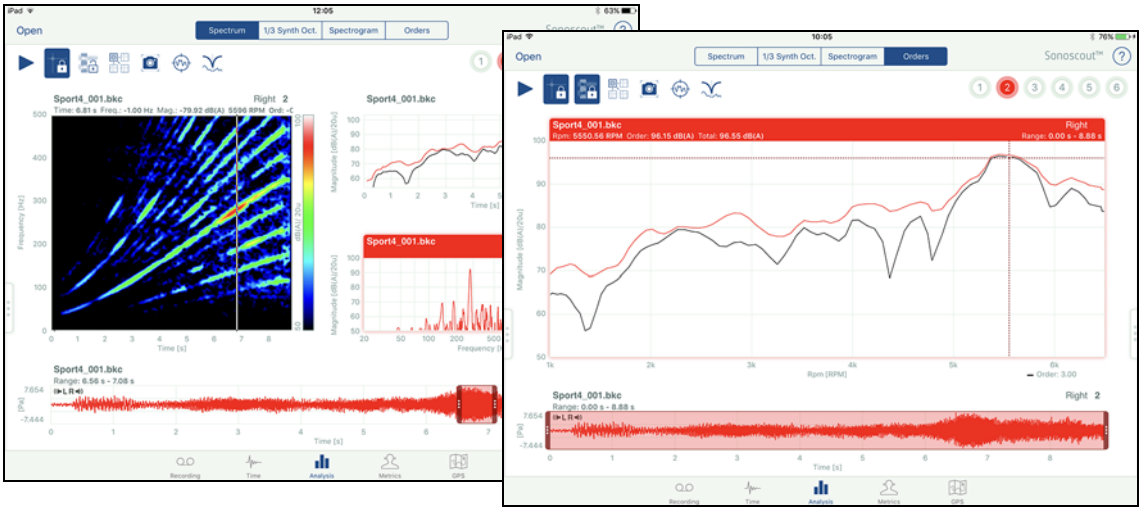
- Display recorded time files
- Transfer LAN-XI Notar™ stand-alone recorder files from SD card
- Convert time files to different formats
- Display tacho signals as profiles including smoothing and correction for missing pulses
- Display CAN signals as profiles
- Display all channels as a strip chart
- Edit time file: trim to a range

Fig. 4
Time data review – typical views

Analysis

- Analysis using:
  - Autospectrum or PSD
  - 1/3-octave (synthesized from FFT)
  - Spectrogram
  - Order analysis (order plus overall level)
- Average over selected range or instantaneous spectra
- View spectra while listening – real-time 2D spectrum is displayed, synchronized to the play cursor
- Create, import and display target curves
- Use RPM Finder to generate an rpm profile from a single channel
- Simple filtering

Fig. 5
Analysis task – typical views



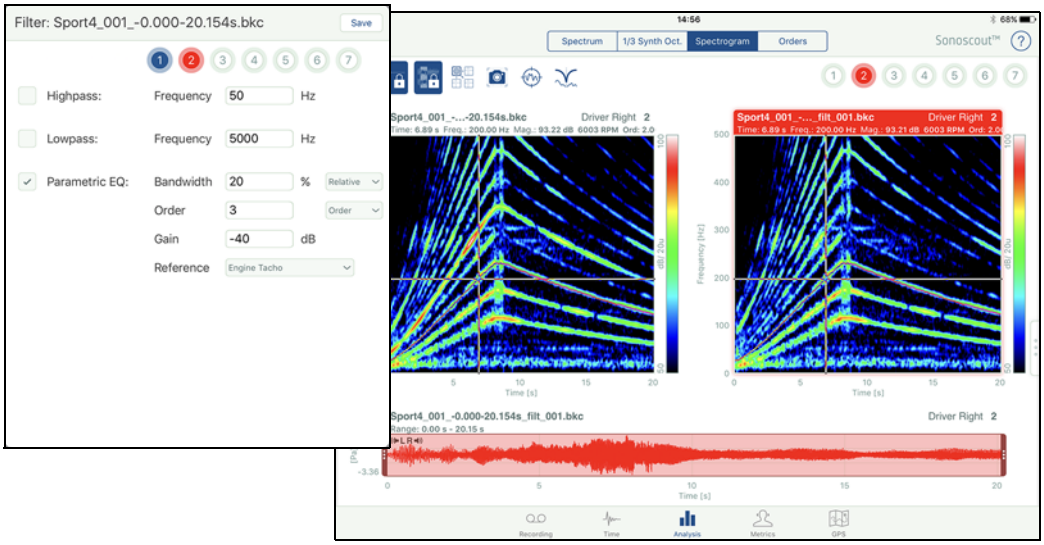
RPM finder

This feature allows you to calculate an rpm profile from any signal channel. You identify an order by touching it at several points on the spectrogram display, and the algorithm uses this as a starting point for the rpm calculation. You can check the estimated profile using the spectrogram before appending it to the file as an rpm profile or tacho channel (with or without GPS speed embedding).

Filtering

Apply any combination of low-pass, high-pass and notch (fixed frequency or rpm-tracked) filter to any channel. In Fig. 6, an engine order-tracked filter is applied to a third engine order. A two-display layout is used to compare and listen to the filtered and unfiltered sounds – notice the large reduction in the third order.

Fig. 6
Filtering



Sound quality metrics

Metrics as a critical band spectrum:

- Average loudness
- Average sharpness

Metrics as a function of time, rpm, or speed:

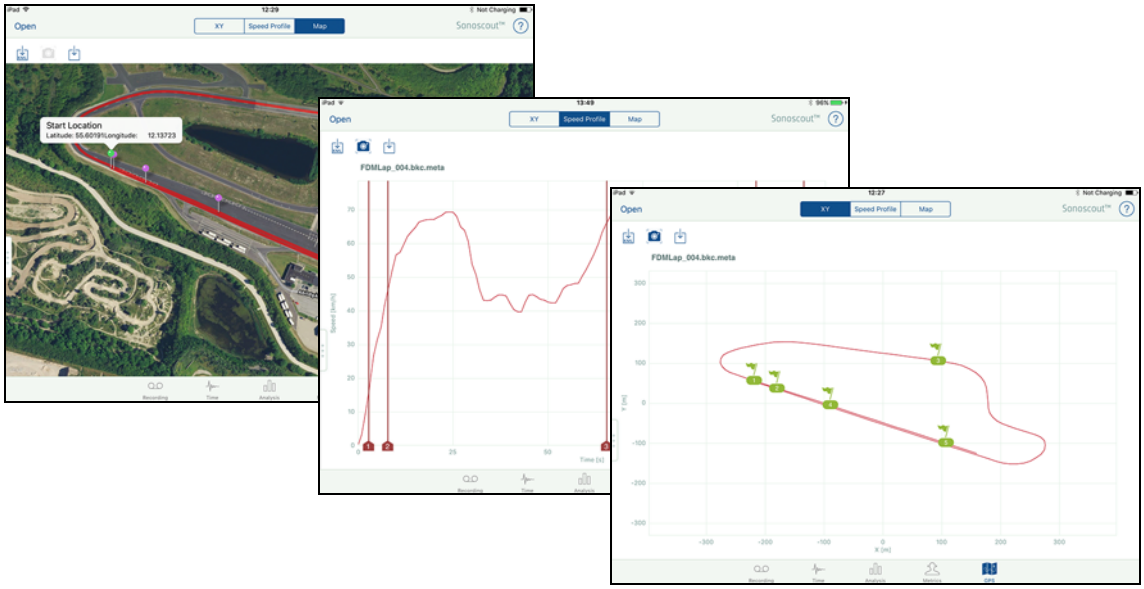
- Average loudness
- Average sharpness
- Overall level
- Overall level in a frequency band
- Articulation index

GPS options

The GPS task has the following options:

- Display the X-Y coordinates of the currently opened file
- Display the speed profile
- Convert the GPS speed to a speed profile channel and add to the time file
- Display a hybrid map with the start and end positions marked (if you have Internet connection)
- Export file as a keyhole markup language file (KML) file

Fig. 7
GPS – typical views



Target curves

Create, import and display target curves that can then be applied in any 2D display in the Analysis, Metrics or GPS tasks. Display the target as a single curve, or as two curves offset by a +/– user-defined value, see Fig. 8.

Fig. 8
Target curves can also be used as tolerance bands – the dark grey curve is set to +2.5 dB, the light grey to –2.5 dB. The Δ cursor (highlighted) indicates the difference between the upper target and the measured spectrum

Overlaid displays

This feature allows you to overlay up to four channels from one file, or the same channel from four different files. Each display has a different line style and a colour that matches the colour of the legend box, for easy recognition, see Fig. 9.

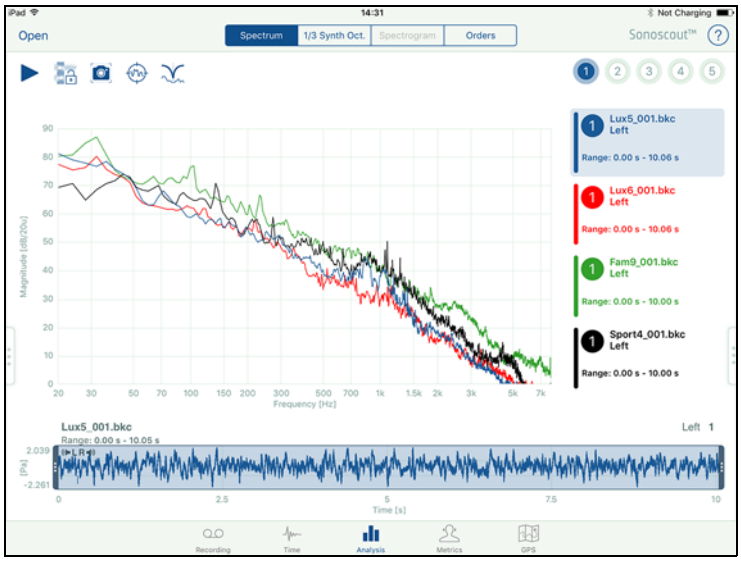


Fig. 9
Overlaid displays

When you click on a channel display, the associated time history is shown below the graph, and if you tap the play button the (sound) file will play in your headphones.

Sonoscout CANdidate

Sonoscout CANdidate feature allows you to audit the CAN bus data. For example, if you have CAN data in your measurement, but do not have a DBC file to translate/decrypt the data on the CAN bus, then CANdidate can help you.

Basic parameters like rpm, speed and throttle position are decrypted from the DBC file that CANdidate generates via an easy-to-use wizard.

Requirements

Sonoscout Control Unit: Apple iPad running iOS 10, or later. Please see the compatibility table below for supported devices:

DEVICE	PROCESSOR	LIMITATIONS
iPad 4th Gen	1.4 GHz dual-core	Reduced performance
iPad Mini 2 or 3	1.3 GHz dual-core	Reduced performance
iPad Air	1.4 GHz dual-core	Reduced performance
iPad Air 2	1.5 GHz tri-core	None
iPad Pro 9.7″	2.3 GHz dual-core	None
iPad Pro 10.5″	2.3 GHz dual-core	None
iPad Pro 12.9″	2.3 GHz dual-core	None

Software download

Free download from the App Store with Virtual Front End demo

Hardware specifications

BRÜEL & KJÆR HARDWARE

The specifications, compliance with standards and service options can be found in the following product data:

- BP 2215: LAN-XI Data Acquisition Hardware
- BP 2586: LAN-XI Light Type 3676-B-040
- BP 2475: Binaural Recording Headphones Type 4965-B
- BP 1311: Sound Calibrator Type 4231
- BP 2101: Calibration Exciter Type 4294
- BP 1436: Sound Quality Head and Torso Simulator Type 4100/-D
- BP 2566: LAN-XI CAN Bus Module 25.6 kHz Type 3058

IPAD

For specifications of iPads and their operating systems, please refer to the relevant product support pages on http://www.apple.com/

DIMENSIONS

	FRONT-END COMBINATION	SONOSCOUT CASE (INCL. SYSTEM COMPONENTS)
Length:	248 mm (9.76″)	50 cm (19.69″)
Width:	53 mm (2.09″)	42.5 cm (16.73″)
Height:	131 mm (5.16″)	17 cm (6.69″)
Weight:	2.03 kg (4.48 lb)	5.81 kg (12.81 lb)

Recording

FREQUENCY RANGE

Maximum channel count and frequency range is dependent on the tablet and LAN-XI module. For any dual-core tablet, the maximum frequency range is 102.4 kHz per channel (LAN-XI module dependent)

MODES

- Streaming to tablet: Max. length determined by storage space on tablet
- SD recording mode

REAL-TIME DISPLAYS

Channel monitor (time or FFT), channel peak level meter, channel peak level history, elapsed recording time, tachometer (time or profile), CAN profile, large digital readout of rpm, speed or CAN signal

TRIGGERING

Start: Manual (with or without pre-triggering)
Stop: Manual or auto-stop after predefined time interval

EVENT MARKER

Markers can be added during recording. Each marker has a unique number

Calibration

Automatic: Auto-detection and calibration of all TEDS transducers on all Brüel & Kjær sound and vibration calibrators
Manual: For user-defined calibrators and non-TEDS transducers

Data storage

METADATA

Editable user-definable information fields stored in the header of .bkc files and available for use in BK Connect analysis software

NATIVE CALIBRATED FILE FORMATS

.bkc, .wav (24-bit), .ASQ-WAV, .hdf, .pti. Profile (rpm, speed, CAN) of 1, 2, or all channels. Zoom using multitouch or using editable settings. Range selection for replay or trimming

Playback

Select any 1 or 2 channels for listening. All sounds resampled to 44.1 kHz. Auto-crossfading during switching and at end of files to avoid clicks

FILES

Copy LAN-XI Notar recorded files from the SD card to the tablet.
Download files from the tablet to a PC using a Web browser

Analysis

CALCULATIONS

FFT Lines: 400, 800, 1600, 3200, 6400, 12800, 25600
Frequency Range (Hz): 1600, 3200, 6400, 12800, 25600, 51200, 102400 (depending on LAN-XI module)
Band Types: Narrow-band, 1/3-octave (FFT)
Frequency Span (Hz): 200, 400, 800 (decimation using resampling and filtering)
Overlap %: 0, 25, 50, 66.67, 75
Averaging: Linear with Hanning window
Acoustic Weighting: Linear, A, B, C, D

DISPLAYS

Graph Types: Autospectrum (rms), PSD, 1/3-octave (FFT synthesis), spectrogram, order cut
Axes:

X-AXIS SCALE	Y-AXIS SCALE	Z-AXIS SCALE
Linear	Linear	Linear
Logarithmic	Logarithmic	Logarithmic
CPB	dB	

Layout: 1, 2, 3 or 4 display windows. Any graph type can be displayed in each window. Different files can be displayed in different windows
Cursors:

- **2D:** Time; level
- **3D:** Time; level; rpm; speed; order number

Linked cursors can be synchronized in different windows

Metrics

CALCULATIONS

Overall: Overall level (sound) in dB, Linear, A, B, C, D; overall level (vibration) in dB re 1, or in units
Sound Quality: Display average values or plot as function of time, rpm or speed

- Loudness (ISO 532B), sharpness, articulation index from CPB calculation
- Display average values or plot as critical band spectra

GPS

RECORDING

GPS coordinates from mobile device's built-in GPS unit. Update rate determined by the mobile device
Note: The device must be cellular-enabled

Displays

- X-Y plot of coordinates
- Speed profile and satellite map showing starting point for the recording
- Speed display

Note: Speed profile can be appended to the time history file as an additional channel

Ordering information

Sonoscout software

Sonoscout software is not included in the hardware kits, please order separately.

BZ-5950-L-N01* **Sonoscout Licence (node-locked),** with LAN-XI channel streaming

Includes the following:

- UL-1018: 16 Gb memory card (SD, miniSD, microSD)

* Requires Annual Software Support Agreement for Sonoscout App M1S-5950-L-N01

Sonoscout hardware kits

Note: Hardware kits are delivered in Sonoscout Case KE-4333. Sonoscout Control Unit (iPad Pro) and Sonoscout License are ordered separately from hardware kits.

SONOSCOUT KIT*	ORDER NUMBER	INCLUDED LAN-XI HARDWARE			CABLING
		INPUT MODULE	BATTERY MODULE	WIRELESS FRAME	
Basic	**Type 3663-000**		Type 2831-A Includes: • ZG-0469: Mains Charger • ZH-0686: Adapter (single module to battery power)	Type 3660-A-200	• AO-0546: Car Charger
Basic (Japan)	**Type 3663-J-000**			Type 3660-A-201	• AO-0546: Car Charger • AN-0076: Mains Cable, Japan
4 Channel	**Type 3663-A-040**	Type 3050-A-040 4-ch. Input Module 51.2 kHz (Mic, CCLD, V)		Type 3660-A-200	• AO-0546: Car Charger
4 Channel (Japan)	**Type 3663-J-040**			Type 3660-A-201	• AO-0546: Car Charger • AN-0076: Mains Cable, Japan
6 Channel	**Type 3663-A-060**	Type 3050-A-060 6-ch. Input Module 51.2 kHz (Mic, CCLD, V)		Type 3660-A-200	• AO-0546: Car Charger
6 Channel (Japan)	**Type 3663-J-060**			Type 3660-A-201	• AO-0546: Car Charger • AN-0076: Mains Cable, Japan
8 Channel CAN Bus/AES3	**Type 3663-B-080**	Type 3058-B-080 8-ch. Input plus 2-ch. CAN Bus Module 25.6 kHz (CCLD, V)		Type 3660-A-200	• AO-0546: Car Charger
8 Channel (Japan) CAN Bus/AES3	**Type 3663-J-080**			Type 3660-A-201	• AO-0546: Car Charger • AN-0076: Mains Cable, Japan
12 Channel	**Type 3663-B-120**	Type 3053-B-120 12-ch. Input Module 25.6 kHz (CCLD, V)		Type 3660-A-200	• AO-0546: Car Charger
12 Channel (Japan)	**Type 3663-J-120**			Type 3660-A-201	• AO-0546: Car Charger • AN-0076: Mains Cable, Japan

Service

M1S-5950-L-N01 Annual Software Support Agreement for Sonoscout App – required with BZ-5950-L-N01

Service products for LAN-XI hardware also available, see BP 2215

Accessories

OPTIONAL BRÜEL & KJÆR ACCESSORIES

Type 3660-A-200	LAN-XI 1-module Wireless LAN Frame
Type 4231	Sound Calibrator
Type 4294	Calibration Exciter
Type 4100-D	Sound Quality HATS
Type 4965-B	Binaural Microphone with TEDS and Headphones
UA-0692	Universal Headrest Microphone holder, for ½″ and ¼″ microphones
UL-1029-A	Sonoscout Control Unit (iPad Pro)
UL-1052	2-ch. OBD-II-to-analogue Converter (speed/rpm)
ZH-0700	4-ch. CAN-to-analogue Converter, incl. CAN Bus Cable AO-0760-D-005 (25-pin sub-D (M) to 4-way SMB (M), 0.5 m (1.7'), 70 °C (158 °F)) and 4 × Adapter JP-0076 ((SMB (M) to BNC (M), 50 Ω))

Many sensors are available, see bksv.com/transducers

RECOMMENDED THIRD-PARTY ACCESSORIES

Available from RAM® Mounts (www.rammount.com)

- RAM-B-166-C-202: Suction Mount for attaching iPad
- RAM-HOL-AP8U: Cradle for iPad (part of RAM-B-166-C-202)

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