

# PRODUCT DATA

## Array Microphone — Type 4935



Array Microphone Type 4935 is a 7 mm ( $\sim 1/4''$ ) prepolarized microphone with built in DeltaTron® preamplifier and transducer identification. The preamplifier terminates in an SMB coaxial socket.

When used for simultaneous measurement of a large number of signals, for example, for the measurement of STSF, the microphones can be clipped into a strong yet light grid network to form a complete array.

Supports IEEE-P1451.4 "A Smart Transducer Interface for Sensors and Actuators".

**4935**

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## Uses and Features

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### USES

- Simultaneous recording of time signals in medium to large microphone arrays, for example, simulated pass-by measurements
- Spatial Transformation of Sound Fields (STSF) measurements using Type 7688
- Non-stationary STSF measurements using Type 7712

### FEATURES

- 7 mm ( $\sim 1/4"$ ) prepolarized microphone with built-in DeltaTron preamplifier
- Phase matching:  $\pm 3$  degrees, 100 to 3000 Hz,  $\pm 5$  degrees, 3000 to 5000 Hz
- Pressure-field response (re. 250 Hz): 100 to 3000 Hz:  $\pm 1$  dB and 3 kHz to 5 kHz:  $\pm 2$  dB
- Wide dynamic range, typically 30 dB to 140 dB
- Nominal sensitivity 5.6 mV/Pa
- Microphone housing clips into Microphone Array Systems WA 0806, WA 0807 and WA 0808
- Easy calibration with Pistonphone Type 4228 and Multitube Adaptor
- Detachable cable with SMB coaxial plug
- Lightweight and efficient cabling system
- DeltaTron powered. Compatible with ICP<sup>®</sup>, ISOTRON<sup>®</sup>, PIEZOTRON<sup>®</sup>, CCLD, etc.
- Supports IEEE-P1451.4 "A Smart Transducer Interface for Sensors and Actuators"

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## Array Microphone Type 4935

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*Fig. 1 Typical application of Array Microphone Type 4935. The noise pattern for a car fan unit is being analyzed using a microphone array and the Spatial Transformation of Sound Fields technique (STSF system Type 7688)*



Array Microphone Type 4935 is for use in systems requiring a large number of microphones, for example, for STSF measurements, especially non-stationary STSF measurements, as they often require large arrays to cover the entire measurement object.

The microphones have excellent phase matching over wide ranges of temperature and humidity. The microphone is prepolarized, which enables a 2 wire system (DeltaTron) to be used. The system has excellent immunity from EM radiation.

DeltaTron powering also means that low-cost, flexible cabling can be used. A rugged protection grid provides an integrated heat shield.

The microphone is front-vented for pressure equalization.

Type 4935 is an economical solution that provides good phase matching and amplitude linearity over the frequency range relevant to array applications.

### **Acoustic Arrays**

When used for STSF measurements or other acoustic measurements requiring a large number of measurement points, it may be convenient to arrange the microphones in an array. This is possible using Microphone Array Systems WA0806/7/8 (see separate Product Data). The microphone housing clips directly into the grid positions.

### **Calibration**

The microphones can be calibrated using any one of Brüel & Kjær's Calibrators (see Ordering Information). For an easy function check, we recommend, however, Pistonphone Type 4228, together with a 6-microphone adaptor (Brüel & Kjær order number WA0728). This adaptor allows 6 microphones to be connected to the pistonphone at the same time, while they are still positioned in the array. Alternatively Sound Level Calibrator Type 4231 with  $\frac{1}{4}$ " Adaptor DP0775 can be used.

### **Cables**

The types of cable available for use with Array Microphone Type 4935 are:

- a single-channel, coaxial cable terminated with SMB plugs
- a single-channel coaxial cable, SMB to BNC
- a 6-channel cable terminated with a 37-pole D-connector for connection to a 6-channel input module Type 3030 used in Intelligent Data Acquisition System Type 3561

The 6-channel cables are numbered for easy identification.

### **IEEE – P1451.4 “A Smart Transducer Interface for Sensors and Actuators”**

The IEEE – P1451 Working Group has been working on a uniform approach for connecting sensors and actuators to communication networks, control systems and measurement systems. IEEE – P1451.4 proposes a mixed-mode smart transducer communication protocol based on existing analogue connections. It also specifies Transducer Electronic Data Sheet (TEDS) formats for interfacing analogue transducers with additional, smart features to legacy systems. The proposed interface is designed to be compatible with other P1451 network-capable transducer interfaces.

Array Microphone Type 4935 incorporates a TEDS, the contents of which are shown in Fig. 2 using a TEDS editor.

Fig. 2 Example of a Transducer Electronic Data Sheet editor used to show the data contents of Array Microphone Type 4935

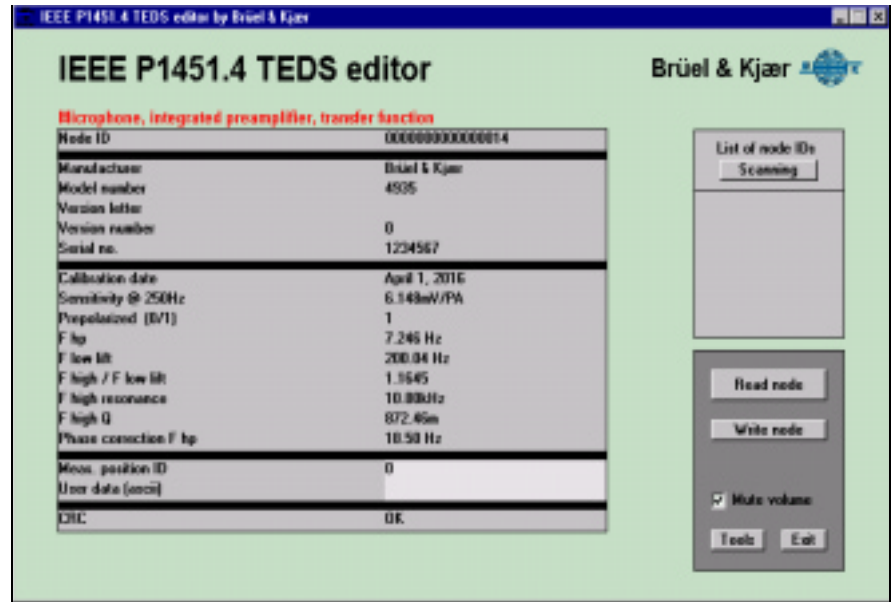
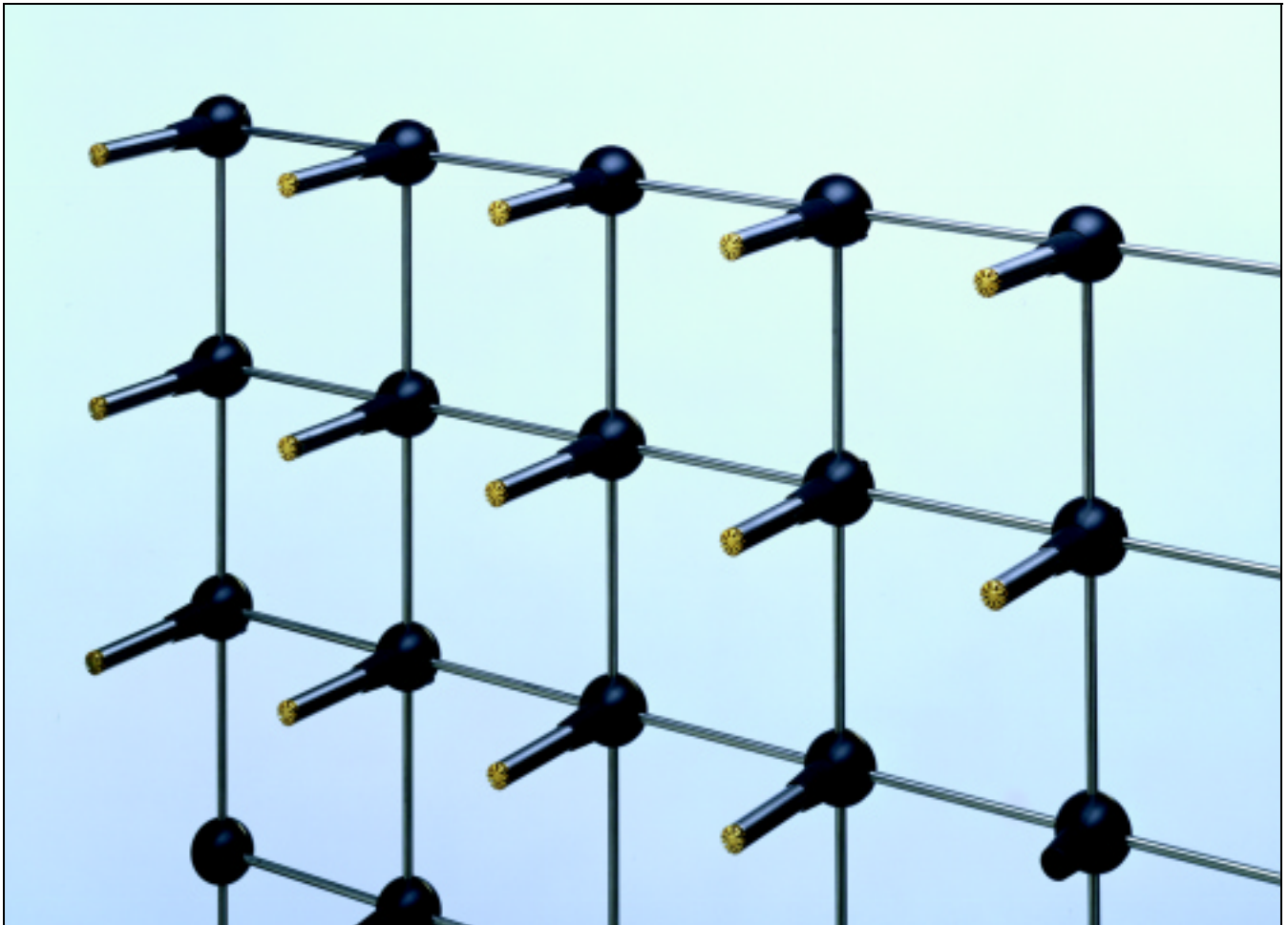


Fig. 3 Several types of microphone arrays are available. Integral Connection Array WA0806 shown in Fig. 1 has a fixed microphone spacing and cabling is reduced to a minimum with a fixed LEMO connector for each microphone. In contrast Flexible Connection Array WA0807 shown below requires a separate microphone cable for each microphone, but provides greater flexibility with respect to microphone spacing



# Compliance with Standards

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| <b>CE</b>           | CE-mark indicates compliance with: EMC Directive and Low Voltage Directive.                                                                                                                                                                                                                                                                            |
| <b>Safety</b>       | EN 61010–1 and IEC 1010–1: Safety requirements for electrical equipment for measurement, control and laboratory use.                                                                                                                                                                                                                                   |
| <b>EMC Emission</b> | EN 50081–1: Generic emission standard. Part 1: Residential, commercial and light industry.<br>EN 50081–2: Generic emission standard. Part 2: Industrial environment.<br>CISPR 22: Radio disturbance characteristics of information technology equipment. Class B Limits.<br>FCC Rules, Part 15: Complies with the limits for a Class B digital device. |
| <b>EMC Immunity</b> | EN 50082–1: Generic immunity standard. Part 1: Residential, commercial and light industry.<br>EN 50082–2: Generic immunity standard. Part 2: Industrial environment.<br><b>Note 1:</b> The above is guaranteed using accessories listed in this Product Data sheet only.                                                                               |
| <b>Temperature</b>  | IEC 68–2–1 & IEC 68–2–2: Environmental Testing. Cold and Dry Heat.<br>Operating Temperature: –10 to +55°C (+14 to +131°F)<br>Storage Temperature: –25 to +70°C (–13 to +158°F)                                                                                                                                                                         |
| <b>Mechanical</b>   | Non-operating:<br>IEC 68–2–6: Vibration: 0.3 mm, 20 m/s <sup>2</sup> , 10–500 Hz<br>IEC 68–2–27: Shock: 1000 m/s <sup>2</sup><br>IEC 68–2–29: Bump: 1000 bumps at 250 m/s <sup>2</sup>                                                                                                                                                                 |
| <b>Enclosure</b>    | IEC 529: Protection provided by enclosures: IP 20                                                                                                                                                                                                                                                                                                      |

## Specifications 4935

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| <p><b>Guaranteed Specifications*</b></p> <p><b>SENSITIVITY:</b><br/>– 45 dB re 1V/Pa ±3 dB, 5.6 mV/Pa, (re 250 Hz)</p> <p><b>FREQUENCY RESPONSE:</b><br/><b>Pressure-field response (re 250 Hz):</b><br/>±1 dB, 100 Hz to 3 kHz<br/>±2 dB, 3 kHz to 5 kHz</p> <p><b>INHERENT NOISE:</b><br/>&lt;35 dB SPL (A-weighted)</p> <p><b>UPPER LIMIT OF DYNAMIC RANGE:</b><br/>140 dB (A-weighted, THD &lt;3%)</p> <p><b>PHASE MATCH:</b><br/>100 to 3000 Hz: ±3°<br/>3000 to 5000 Hz: ±5°<br/>relative to a factory reference</p> <p><b>*Note:</b> Guaranteed specifications are measured at 23°C (73.4°F). All uncertainty values are specified at 2σ (i.e., expanded uncertainty using a coverage factor of 2). Measured with 3 mA current generator with an open loop voltage of 28 V.</p> <p><b>General Specifications†</b></p> <p><b>INHERENT NOISE (A-weighted):</b><br/>30 dB (–10 to +40°C, 14 to 104°F)<br/>35 dB (–10 to +55°C, 14 to 131°F)<br/>15 dB in 1/3-octave at 1 kHz</p> <p><b>FREE-FIELD FREQUENCY RESPONSE:</b><br/><b>0° incidence free-field response (re 250 Hz):</b><br/>+5, –2 dB, 5 kHz to 20 kHz</p> | <p><b>OUTPUT IMPEDANCE:</b><br/>70 Ω</p> <p><b>OUTPUT SOCKET:</b><br/>SMB coaxial socket</p> <p><b>POLARIZATION VOLTAGE:</b><br/>Prepolarized</p> <p><b>MAX. LOAD:</b><br/>5 kHz, 140 dB: 30 nF corresponding to 300 m cable</p> <p><b>Environmental</b></p> <p><b>INFLUENCE OF TEMPERATURE AND HUMIDITY:</b><br/>Maximum relative deviations for an array of microphones Type 4935 at 10 to 40°C, 30 to 90% RH and from 100 Hz to 5 kHz<br/><b>Phase:</b> &lt;1°<br/><b>Amplitude:</b> &lt;0.3 dB</p> <p><b>MAGNETIC FIELD SENSITIVITY</b><br/>40 dB SPL for 80 A/m, 50 Hz field</p> <p><b>VIBRATION SENSITIVITY (20 to 1000 Hz)</b><br/>Approx. 50 dB equivalent SPL for 1 m/s<sup>2</sup> axial acceleration</p> <p><b>Dimensions and Weight</b></p> <p><b>Diameter:</b> 7 mm (–1/4")<br/><b>Length:</b> 65 mm (2.6")<br/><b>Weight:</b> 10 g (0.35 oz.)</p> <p><b>†Note:</b> General specifications are typical values for reference use</p> |
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# Ordering Information

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| <b>Type 4935 Array Microphone</b><br>Microphone Type 4935 is supplied in a rugged box. When ordering, up to six microphones are supplied in the same box                                                                                                                                                                                                                                                                                                 |  | <b>WL 1291:</b> Conversion cable for AO 0562 to 6 × BNC sockets<br><b>WA 0804:</b> Patch connector, 6 SMB cables into a common LEMO connector                                                                                                                                                           |
| <b>Optional Accessories</b><br><br><b>Individual traceable calibration chart BC 0259</b><br><br><b>Cables for use with Intelligent Data Acquisition System Type 3561:</b>                                                                                                                                                                                                                                                                                |  | <b>Array:</b><br><b>WA 0806:</b> Integral Connection Array<br><b>WA 0807:</b> Flexible Connection Array<br><b>WA 0808:</b> Vertical In-line Array<br><br><b>KE 0378:</b> Suitcase for up to 48 Microphones Type 4935                                                                                    |
| <b>AO 0562:</b> 6-channel PUR Cable from Lemo to 37-pole D-connector 10 m or specify length <i>x</i> in metres when ordering<br><b>AO 0563:</b> Single channel cable terminated with SMB plug. Specify length <i>x</i> in metres when ordering<br><b>AO 0564:</b> Reference cable 10 m or <i>x</i> m (specify <i>x</i> in metres when ordering), single SMB to BNC<br><b>WL 1271:</b> Reference cable to IDA split cable 0.5 m (6 × BNC plug to 37 pole) |  | <b>Calibration:</b><br><b>Type 4228:</b> Pistonphone<br><b>Type 4231:</b> Sound Level Calibrator<br><b>DP 0775:</b> 1/4" Adaptor for Type 4231<br><b>WA 0728:</b> 6-microphone Adaptor for Pistonphone Type 4228<br><b>Type 4226:</b> Multifunction Acoustic Calibrator (includes 1/4" Adaptor DP 0775) |

*For use in arrays, up to 48 microphones  
Type 4935 can be contained in the  
handy suitcase KE 0378*



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Brüel & Kjær reserves the right to change specifications and accessories without notice