

# High-performance in-vehicle computing platform with acoustics for public transport

## ebblo Assist Acoustic Box

The ebblo Assist Acoustic Box sets a new benchmark for modern in-vehicle IT. Far more than a peripheral device, it is a fully certified, robust and high-performance computing platform developed specifically for the demanding conditions of public transport. Whether deployed in buses or trams, the Acoustic Box delivers reliable computing power exactly where it is needed.

### Robustness meets intelligence

Designed for the harsh realities of road and rail operation, the Acoustic Box complies with the most stringent industry standards. It is certified to EN 50155 for railway applications and UN ECE R10 for automotive use. Its compact, rugged enclosure protects sensitive electronics against vibration, temperature fluctuations and electromagnetic interference. Thanks to its extended operating temperature range of -25 °C to +70 °C, it is ideally suited for installation in non-air-conditioned environments.



### Plug-and-play installation

Time is money – especially when retrofitting vehicle fleets. The Acoustic Box has therefore been consistently optimised for fast and simple installation. It integrates seamlessly into standardised 19" racks (12 TE) or can be flexibly mounted inside the vehicle using brackets. All connectors are designed for mobile use (M12 Ethernet), ensuring secure and durable connections. Once connected, the device automatically integrates into the vehicle network via DHCP and standardised protocols – true plug-and-play functionality.

### The ebblo Assist Acoustic Box as the voice of the vehicle

Within the ebblo Assist ecosystem, the Acoustic Box fulfils a vital social function: it becomes the voice of the vehicle and implements the two-sense principle. In doing so, it enables barrier-free and independent use of public transport for blind and visually impaired passengers.

### Talking vehicle

Traditionally, information about routes and destinations has often been available only visually via exterior displays. The Acoustic Box fundamentally changes this by generating clear, intelligible voice announcements exactly where passengers need them – for example at the vehicle entrance area. Announcements such as “Route 5 to Central Station, departure in 2 minutes” provide visually impaired passengers with the orientation and confidence required for independent mobility. The Acoustic Box thus translates inclusion into practical technology.

### Intelligent audio management

Technically, the Acoustic Box acts as an intelligent gate-keeper within the vehicle’s audio signal path. During normal operation, it transparently loops through the existing vehicle audio signal (e.g. driver microphone, control centre) (LF input to LF output), leaving the original system completely unaffected. As soon as an announcement is required – whether an automated route announcement or targeted information from the backend – the Acoustic Box actively takes control. It fades out the original signal, injects the announcement and immediately releases the audio path again afterwards. Priority between the on-board computer and the Acoustic Box is configurable. This smart switching allows the Acoustic Box to be integrated into existing PA systems even when no additional audio inputs are available.



## Open, universal computing platform for the future

The Acoustic Box was not designed as a single-purpose device. Beneath the surface lies an architecture deliberately built for openness and versatility. It can be deployed as a powerful general-purpose compute unit, providing transport operators with a standardised platform for a wide range of digitalisation tasks.

### Performance for third-party applications

Equipped with a high-performance octa-core CPU, an integrated neural processing unit (NPU) and generously dimensioned memory, the Acoustic Box offers substantial performance reserves. These resources are not limited to ebblo Assist and can also be used for third-party applications, such as:

- **Edge AI and Analytics:** The computing power can be used for AI models, e.g. for optical passenger counting.
- **Ticket validation:** The box can act as a local server for ticket validators.
- **Predictive maintenance:** Detection of anomalies through vibration analysis (e.g. bearing damage or track quality) using externally connected sensors.

### Linux-based and integration-friendly (Standalone option)

The Acoustic Box is also available as a pure hardware platform – without the ebblo Assist application. It is based on a hardened Linux operating system that includes middleware. This not only guarantees stability and security, but also offers developers a high degree of flexibility. Thanks to its open API architecture, the hardware is fully decoupled from application logic.

Integrators can access all of the Box’s functions (playing audio or text-to-speech, monitoring inputs, switching outputs, operating the watchdog) via standardised JSON messages (MQTT) without having to develop proprietary drivers. This makes integrating the Box as a smart component into existing IT environments easier than ever before.

### Future-proof connectivity

With Fast Ethernet, USB interfaces and digital I/Os, the Acoustic Box is fully equipped for all common use cases – preparing vehicles for the connected mobility of tomorrow.

## Technical specifications

### Computing core

- CPU: Octa-core high-performance processor (2× Cortex-A78, 6× Cortex-A55) – Performance for neural text-to-speech engines
- AI accelerator: Integrated NPU for high-performance edge AI
- Memory: 8 GB RAM, 32 GB flash storage
- Security: Integrated Trusted Platform Module (TPM) for hardware-based security and identity management

### Communication and interfaces

- Control: JSON over MQTT – Full, transparent control of all hardware functions via the network
- Ethernet: 4-port 10/100 Mbit switch (M12-coded), including 2× PoE (IEEE 802.3af)
- Audio:
  - Smart audio loop: Looping of the external audio signal (input to output)
  - 1× PA audio path for integration into the vehicle's sound system
  - 2× direct speaker outputs (25 W combined) for connecting local speakers (e.g. external speakers in the door area)
- I/O: Universal digital inputs and outputs (potential-free and galvanically isolated)
- USB (service): 1× USB 3.0 Type A, 1× USB 2.0 Micro

### Power supply

- Input voltage: 24 V DC (16.8 V to 32 V DC)
- Peripheral devices: 2× Power over Ethernet (PoE)

### Reliability and maintenance functions

- Hardware watchdog: hardware reset in case of software malfunction
- Visualisation: three application-controlled RGB LEDs

### Housing and installation

- Format: Compact industrial housing, compatible with 3U subracks
- Mounting: Flexible installation in standing or horizontal orientation, or in a 19" rack; front-wiring adapter available for confined spaces
- Dimensions: 61 mm (12U) × 128.4 mm × 196.5 mm
- Protection rating: IP54 (front with connected cables), IP20 (housing body)

### Certifications and standards

- Railway: Full compliance with EN 50155 (Chapter 13.3) and EN 45545-2 (fire protection)
- Automotive: UN ECE R10 type approval (E-mark)
- EMC: CE conformity (2014/30/EU)
- Climate: Operating temperature range –25 °C to +70 °C (**Class T3**), for non-air-conditioned installation sites



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