

# Music Engine Player

Technical specification for AV integrators ·  
configuration: Raspberry Pi 4, built-in 3.5 mm  
analogue output

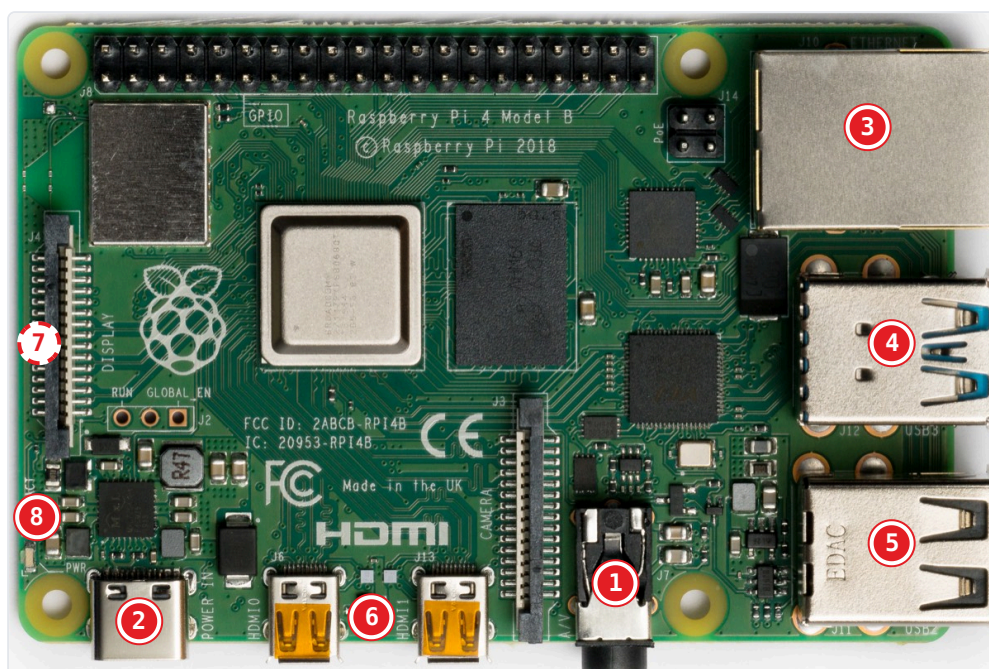
Document ME-DS-01  
Revision 1.3 · 9 Sep 2026

Contact [info@music-engine.hu](mailto:info@music-engine.hu)

|                                                              |                                                             |                                                                   |                                                         |
|--------------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------------|---------------------------------------------------------|
| <b>HARDWARE</b><br>Raspberry Pi 4 B, ≥<br>2 GB, fanless case | <b>POWER</b><br>USB-C 5.1 V / 3 A ·<br>3–5 W typical        | <b>NETWORK</b><br>Gigabit Ethernet or<br>Wi-Fi · outbound<br>only | <b>BOOT TO MUSIC</b><br>≈ 60 s, resumes<br>last channel |
| <b>AUDIO OUTPUT</b><br>3.5 mm jack ·<br>unbalanced stereo    | <b>MAX LEVEL</b><br>≈ 0.4 V RMS (≈ -8<br>dBV) at full scale | <b>FORMAT</b><br>44.1 kHz · 16-bit ·<br>stereo · MP3<br>streams   | <b>STREAM LOSS</b><br>local backup music<br>after 30 s  |

## 1 · BOARD AND CONNECTORS

Top view of the Raspberry Pi 4 Model B as fitted in the player (shown without its case).  
The numbers are used throughout this sheet.



| NO. | CONNECTOR                    | ROLE IN THIS INSTALLATION                                                      | DETAILS   |
|-----|------------------------------|--------------------------------------------------------------------------------|-----------|
| 1   | 3.5 mm AV jack (J7)          | Audio output to the PA input. The only audio connection in this configuration. | Section 2 |
| 2   | USB-C power input (PWR IN)   | 5.1 V / 3 A supply.                                                            | Section 5 |
| 3   | Gigabit Ethernet (RJ45, J10) | Network, preferred over Wi-Fi.                                                 | Section 4 |

| NO. | CONNECTOR                           | ROLE IN THIS INSTALLATION                                                    | DETAILS   |
|-----|-------------------------------------|------------------------------------------------------------------------------|-----------|
| 4   | USB 3.0 × 2 (blue, J12)             | Not used in this configuration.                                              | —         |
| 5   | USB 2.0 × 2 (black, J11)            | Not used.                                                                    | —         |
| 6   | micro-HDMI × 2 (J6, J13)            | Not used; the player runs without a display.                                 | —         |
| 7   | microSD slot (underside, left edge) | System and local backup music. Dashed marker: on the underside of the board. | Section 5 |
| 8   | Status LEDs (PWR red, ACT green)    | Red steady = powered; green flickers with disk activity.                     | Section 6 |

Photo: Laserlicht, Wikimedia Commons, CC BY-SA 4.0 ([creativecommons.org/licenses/by-sa/4.0](https://creativecommons.org/licenses/by-sa/4.0)). Callouts added.

2 · AUDIO OUTPUT

| PARAMETER         | VALUE                           | NOTES                                                                                 |
|-------------------|---------------------------------|---------------------------------------------------------------------------------------|
| Connector         | 1 3.5 mm TRRS, 4-pole           | Raspberry Pi AV jack. A standard 3-pole TRS stereo plug fits and works.               |
| Signal type       | unbalanced, AC-coupled          | Single-ended line output. Not a headphone or speaker driver.                          |
| Maximum output    | ≈ 0.4 V RMS ≈ -8 dBV ≈ -5.8 dBu | Digital full scale, hardware level 100 %. Typical value; measured figures on request. |
| Nominal programme | ≈ 60 mV RMS ≈ -24 dBV           | Music runs at about -16 LUFS, roughly 16 dB below full scale.                         |
| Hardware level    | 50–100 %, set remotely          | Fleet default 90 % (≈ -6.6 dB). We set 100 % for PA installations.                    |
| Load              | ≥ 10 kΩ line inputs             | Any mixer, amplifier or DSP line input.                                               |
| Converter         | PWM-derived, ≈ 60–70 dB S/N     | Adequate for background music.                                                        |
| Channels          | stereo, mono-compatible         | Summing L+R for a mono PA is fine; spoken spots are centred.                          |



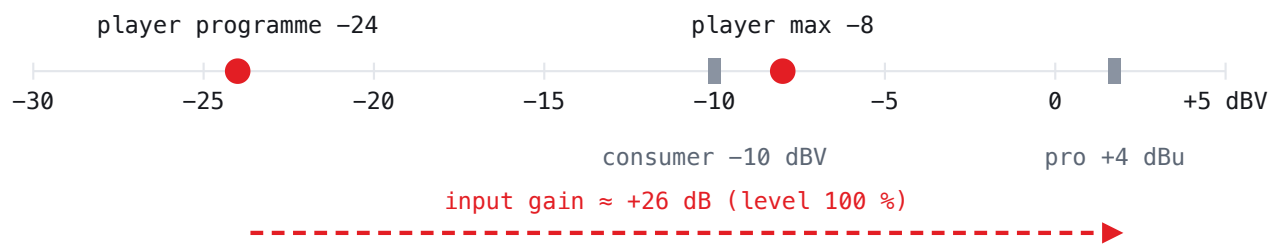
T = left    R1 = right    R2 = ground  
S = composite video, unused  
(a 3-pole plug grounds it, harmless)

Pinout of the player's 3.5 mm jack (connector 1 ). Wire it as a normal stereo line output.

Gain structure

The player is a consumer-level source. To reach a nominal +4 dBu on a professional input, the input stage must add about **+26 dB** at hardware level 100 % (about +32 dB at the 90 %

fleet default). Use a line input with a gain trim, a mic/line combo input switched to line, or an active DI / line-level converter with gain. Do not plan on the player making up level: the software volume tops out at unity (0 dB) and 100 % is the hardware maximum.



Where the player sits on the level ladder, and the gain the PA input has to supply.

Cabling

Shielded cable, unbalanced run ≤ 3 m to the input. For longer runs or a remote rack, convert to balanced at the player with a DI box or line-level converter. The USB-C supply is floating, so hum normally originates on the PA side; a ground-loop isolator at the input resolves it. Use 3.5 mm TRS to 2 × 6.3 mm TS or 2 × RCA breakout cables.

3 · LOUDNESS AND DYNAMICS

| ITEM                   | VALUE                              | NOTES                                                                                                        |
|------------------------|------------------------------------|--------------------------------------------------------------------------------------------------------------|
| Music channels         | ≈ -15 to -17 LUFS integrated       | Normalised at the source. Peaks below -1 dBTP.                                                               |
| Spoken spots (jingles) | -14 LUFS · -1.5 dBTP ceiling       | EBU R128 two-pass normalisation on the player; per-spot trim ±10 dB from the portal; max 45 s.               |
| Music during a spot    | bed at ≈ -16.5 dB (15 % amplitude) | Music ducks under the spot and returns afterwards. Full-length songs played by staff mute the music instead. |
| Software volume        | 0–100, 100 = unity                 | Never above 0 dB gain. Set from the portal, by schedule per daypart, or by staff from a phone.               |
| Channel change         | ≈ 1 s crossfade                    | Gapless on outputs with the mixing layer; otherwise a sub-second soft switch.                                |
| Silence detection      | probe every 60 s, -50 dB threshold | A silent source triggers failover and an alert; the player never plays dead air knowingly.                   |

4 · NETWORK REQUIREMENTS

| ITEM       | REQUIREMENT                                                | NOTES                                                                            |
|------------|------------------------------------------------------------|----------------------------------------------------------------------------------|
| Connection | 3 RJ45 10/100/1000 (preferred) or Wi-Fi 802.11ac 2.4/5 GHz | WPA2/WPA3-Personal. Wired on the technical network is strongly recommended.      |
| Addressing | DHCP, IPv4                                                 | Static reservation optional. No inbound ports, no port forwarding, NAT-friendly. |

| ITEM             | REQUIREMENT                                             | NOTES                                                                                                                                |
|------------------|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| Egress, required | TCP 443 (HTTPS) · TCP 8000 (HTTP) · UDP 123 (NTP) · DNS | 443 to the Music Engine service and music catalog; 8000 to the stream servers (e.g. staging.mymusicengine.com). No TLS interception. |
| Egress, optional | UDP 41641 or TCP 443                                    | Remote-support VPN (Tailscale), outbound only; can be disabled on request.                                                           |
| Bandwidth        | ≈ 128–192 kbit/s per player, continuous                 | ≈ 60–90 MB per hour; ≈ 1.5–2 GB per day. A one-time download of backup music of up to a few GB after commissioning.                  |
| Not supported    | captive portals, guest Wi-Fi with splash pages          | The player detects and reports an unusable backup connection.                                                                        |
| Zones            | one player per audio zone                               | Each player is managed individually; schedules and content are shared from the portal.                                               |

## 5 · POWER AND ENVIRONMENT

| ITEM         | VALUE                                           | NOTES                                                                                             |
|--------------|-------------------------------------------------|---------------------------------------------------------------------------------------------------|
| Power supply | <b>2</b> USB-C, 5.1 V / 3 A (15 W), Schuko plug | Official Raspberry Pi supply included. Typical draw 3–5 W.                                        |
| Mains        | 230 V, one outlet per player                    | Put it on the PA's UPS circuit if uninterrupted music matters; power cuts are otherwise harmless. |
| Dimensions   | ≈ 95 × 65 × 30 mm in case · ≈ 100 g             | Board 85 × 56 mm. Shelf, DIN-rail clip or hook-and-loop in the rack, near the mixer.              |
| Ambient      | 0–40 °C, free air                               | Passive cooling. Avoid sealed, unventilated cabinets and direct sun.                              |
| Storage      | <b>7</b> microSD, high-endurance, 32–64 GB      | Holds the system and the local backup music.                                                      |
| Watchdog     | hardware, 14 s                                  | Reboots automatically if the system ever freezes.                                                 |

## 6 · RELIABILITY AND OPERATION

### When the stream is unavailable

After 30 s without a usable stream the player switches to its local backup music (shuffled, stored on the card) with a crossfade, and returns to the live channel 30 s after it is back. Spoken spots are cached locally and keep playing. A silent source counts as unavailable.

## Self-healing

The player monitors itself (process, signal level, temperature, supply voltage, network). Faults escalate from a player restart to a reboot before anyone is alerted; our operations team and, optionally, the venue receive alerts by e-mail.

## Updates and support

Software updates are delivered over the air without a site visit and without interrupting playback beyond a short restart. Remote diagnostics cover logs, network state, audio signal level and hardware health.

## Content

Music channels are licensed recordings. Spoken spots are either uploaded MP3s or created in the portal with a synthetic voice from the venue's own text. Weekday/time schedules, per-zone volume and staff phone control are included.

## 7 · INSTALLATION CHECKLIST

---

1. **Input.** One line-level input per zone with  $\geq +26$  dB of gain trim, or an active DI / line-level converter in front of it.
2. **Cable.** ❶ 3.5 mm TRS to 2 × 6.3 mm TS (or 2 × RCA), shielded,  $\leq 3$  m unbalanced; longer runs balanced via the converter.
3. **Power.** ❷ One 230 V outlet for the USB-C supply, preferably UPS-backed with the PA.
4. **Network.** ❸ One RJ45 drop on a network with unrestricted outbound HTTPS and port 8000 (or Wi-Fi credentials as a fallback).
5. **Space.** Roughly 100 × 70 × 35 mm, ventilated, within cable reach of the input.
6. **Commissioning.** We set the hardware level to 100 % and start a reference channel; you trim the input gain to nominal, check mono compatibility and hum, and we trigger a 30-second failover test so the switch to backup music is heard once.
7. **Hand-over.** Zone names, opening-hours schedule and the initial spot list go into the portal before go-live.

---

Music Engine · [info@music-engine.hu](mailto:info@music-engine.hu)

ME-DS-01 rev 1.3 · 2026-09-09 · values marked  $\approx$  are typical; measured figures on request