Importance of high-quality / fully wired HDMI cables

Contents

It is highly recommended that a fully wired, all 19 pins in use, HDMI cable is used. If any of the wires are missing or not connected, some functionality may be absent, and resilience to EMI interface may be reduced.

Document info

Version	date	author	Comments
0.1	4-Apr-25	David M	Initial draft

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All the pin numbers referenced in the App note are for the full-size HDMI connector; see Table 1 at the top of page 6.

1. 19-Wire HDMI Cables (Standard)

✅ Recommended for full HDMI compatibility.

- A **fully wired HDMI cable** contains all **19 pins** connected.
- Supports **all HDMI features**, including:
  - **Video & Audio** (TMDS data channels)
  - **EDID & DDC communication** (Pins 15 & 16)
  - **Hot Plug Detect** (HPD) for device recognition (Pin 19)
  - **CEC** for remote control between devices (Pin 13)
  - **Ethernet & Audio Return Channel** (HEAC) if supported (Pins 14 & 17)

2. 13-Wire HDMI Cables (Limited Functionality)

⚠ May cause issues with device recognition, EDID, or CEC-based control.

- Some **cheaper** or **older HDMI cables** only have **13 wires** connected.
- These may **lack certain features**, such as:
  - **CEC** (Consumer Electronics Control) (Pin 13 missing)
  - **Ethernet & Audio Return Channel** (HEAC) (Pin 14 missing)
  - **Hot Plug Detect** (HPD) (Pin 19 missing in some cases)
  - **DDC (EDID communication)** issues if Pins 15 or 16 are missing or not properly connected.
- These features require a dedicate ground wire (pin 17). IF this Ground wire is not present these features may not function.

3. The missing Wires

3.1. SCL & SDA Pins on an HDMI Cable – What Are They Used For?

On an HDMI cable, the **SCL** and **SDA** pins are part of the **Display Data Channel** (DDC), which is used for **EDID** (Extended Display Identification Data) communication between the source (e.g., PC, game console) and the display (e.g., TV, monitor, projector).

Pin Functions:

- **Pin 15 - SCL** (Serial Clock Line)
  - Provides the clock signal to synchronize data transmission.
- **Pin 16 - SDA** (Serial Data Line)
  - Transmits EDID information from the display to the source device.

3.2. What Do These Pins Do?

- **EDID** Communication:
  - The source device (e.g., a PC, gaming console) queries the display using **SCL** & **SDA** to read the EDID data.
  - EDID contains information about the display's **supported resolutions, refresh rates, colour depth**, and **audio capabilities**.
  - Based on this, the source configures the optimal display settings.

- **HDCP** Authentication (if used):
  - HDMI also uses **SCL** & **SDA** for **HDCP** (High-bandwidth Digital Content Protection) authentication.
  - If HDCP encryption is required (e.g., for Blu-ray or streaming services), the source verifies the display's HDCP status before sending protected content.

4. What Happens If SCL or SDA Are Not Working?

- **No display** or **incorrect resolution** (since the source cannot read EDID).
- **Handshaking issues**, **flickering**, or **no signal** when using HDCP-protected content.
- **Fallback to low resolution** (e.g., 640×480) or default settings.

5. Conclusion:

- **SCL** (Pin 15), **SDA** (Pin 16) and ground (pin 17) are essential for HDMI communication.
  - If EDID-related issues occur, check these pins and the +5V power (Pin 18), which powers the EDID circuit in the display.

Examples

In these examples the Treedix HDMI Cable Tester is used. Information and purchasing details can be found on the manufacture's website and Amazon

https://treedix.com/products/treedix-usb-cable-tester-board-usb-cable-checker-data-wire-with-acrylic-case-charging-test-data-line-type-c-micro-type-a-type-b

https://www.amazon.co.uk/Treedix-Cable-Tester-Data-Board/dp/B0C4YNMVFL?th=1

Shown in Figure 2 is a cable where all the wires are connected.

The cable shown in Figure 4 has no ground / shield for the data and its clock. These ground wires are used to reduce cross talk and enhance EMU radiation resistance. More importantly the cable also does not have the **CEC** wire.

In the example shown in Figure 1 and Figure 3 the data and clock screen wires and CECG are missing. The **CECG** is the ground for the **DDC** / **EDID** function (**SCL** and **SDA**), **ARC** (Audio Return Channel) and **HEC** (bidirectional data communication link). These last two functions are also called **HEAC**. Without a dedicated ground wire these circuits may not function as expected.

Figure 1 : Micro HDMI cable - not all grounds are not connected

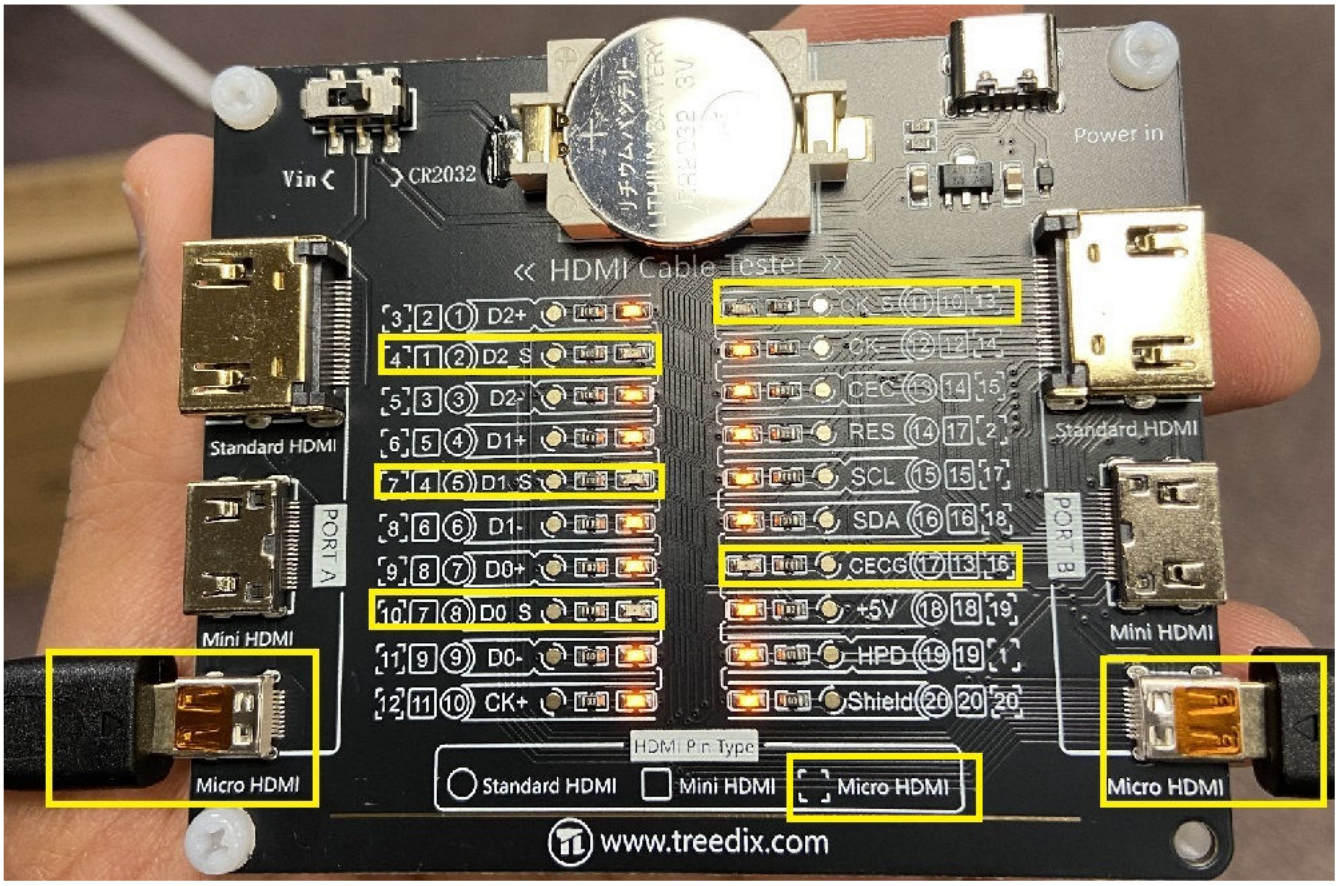

Figure 2 : Micro to standard HDMI cable – all wires used

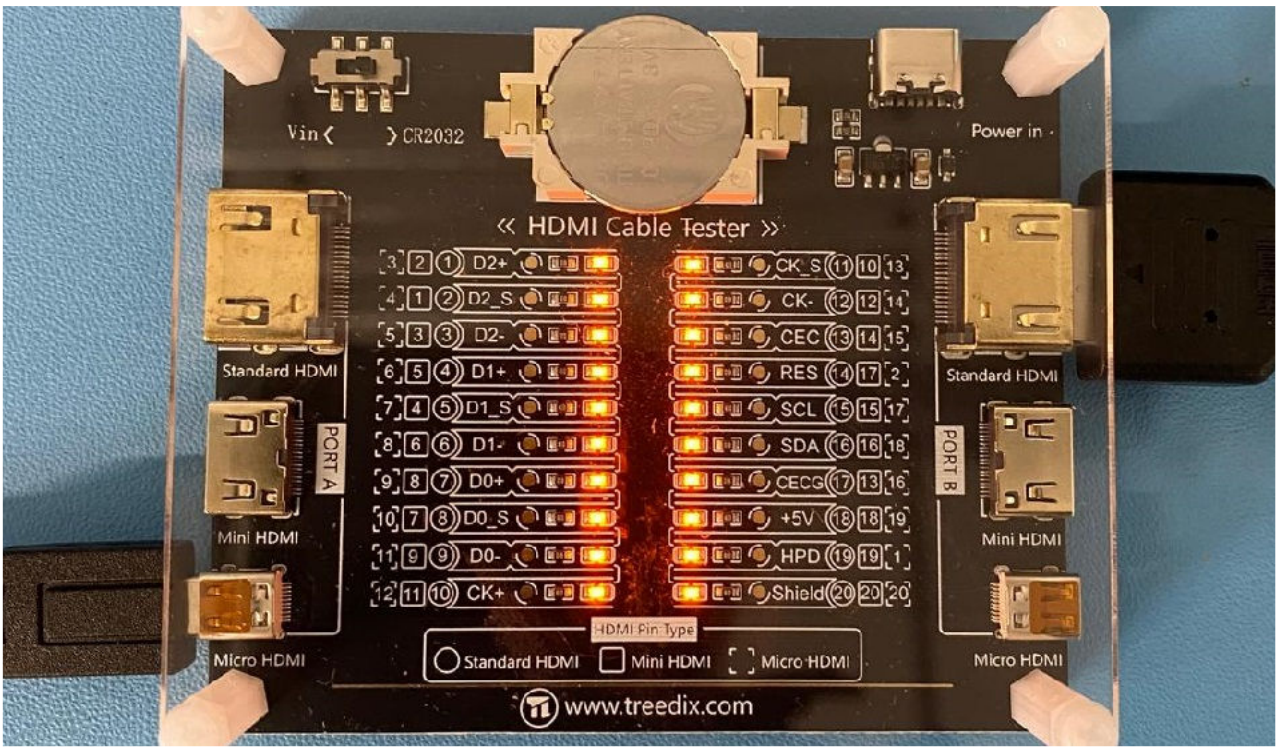

Figure 3 : Mini to standard HDMI cable – not all grounds are not connected

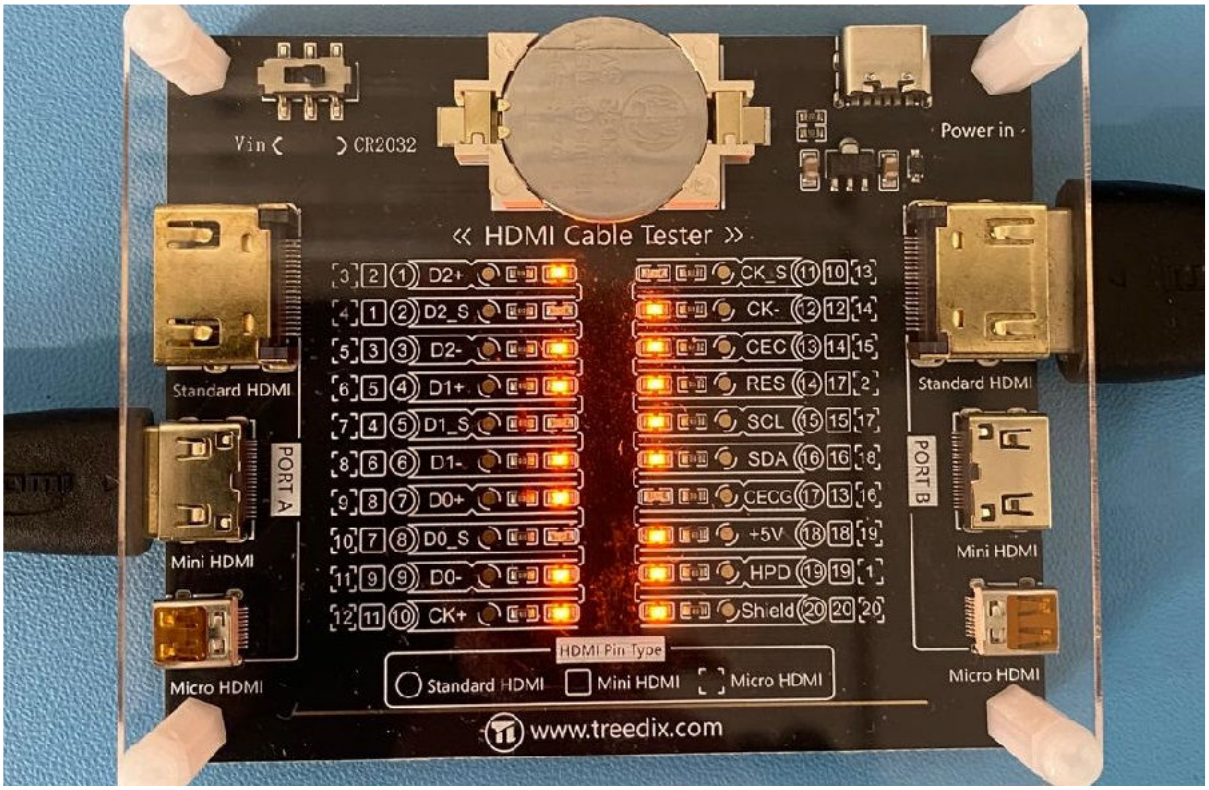

Figure 4 : HDMI cable – some grounds and CEC are not connected

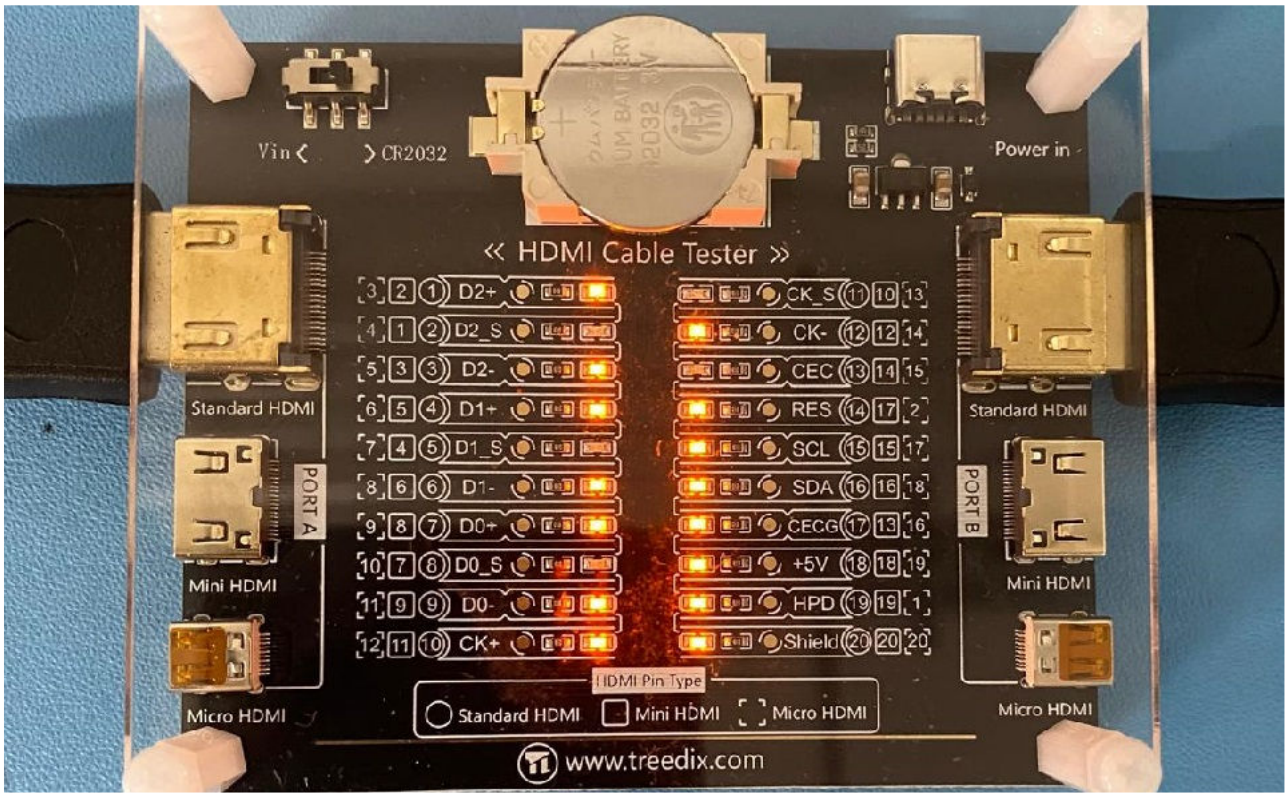

Table 1 - HDMI pinout

Pins			
Standard	**Mini**	**Micro**	**Function**
Pin 1	2	3	TMDS data2+
Pin 2	1	4	TMDS data2 shield
Pin 3	3	5	TMDS data2−
Pin 4	5	6	TMDS data1+
Pin 5	4	7	TMDS data1 shield
Pin 6	6	8	TMDS data1−
Pin 7	8	9	TMDS data0+
Pin 8	7	10	TMDS data0 shield
Pin 9	9	11	TMDS data0−
Pin 10	11	12	TMDS clock+
Pin 11	10	13	TMDS clock shield
Pin 12	12	14	TMDS clock−
Pin 13	14	15	Consumer Electronics Control (CEC)
Pin 14	17	2	Reserved (HDMI 1.0–1.3a) Utility/HEAC+ (HDMI 1.4+, optional, HDMI Ethernet Channel (HEC), and Audio Return Channel (ARC))
Pin 15	15	17	SCL (I2C serial clock for DDC)
Pin 16	16	18	SDA (I2C serial data for DDC)
Pin 17	13	16	Ground (for DDC, CEC, ARC, and HEC)
Pin 18	18	19	+5 V (up to 50 mA)
Pin 19	19	1	Hot plug detect (all versions) - HEAC− (HDMI 1.4+, optional, HDMI Ethernet Channel, and Audio Return Channel)

Figure 5 : Back of Treedix Tester showing pinout