Extended Display Identification (EDID) 
A Primer

What is an EDID?

Extended Display Identification Data (EDIDs) are data structures that reside in a display device—commonly referred to as “sinks” in HDMI and DisplayPort standards documents—such as an HDTV or a computer monitor. They are intended to be read by a “source” device (e.g. set top boxes, DVD players, PC graphic cards) in order to simplify user operation and to ensure that the user’s viewing experience is optimal, or as good as it can be based on the capabilities of the rendering sink device, i.e. audio system and/or video display (sink).

EDIDs were created by Video Electronics Standards Association (VESA) to support “plug and play” on PCs when VGA monitors supported multiple video resolutions. They were then incorporated into consumer electronic devices by the Consumer Electronics Association (CEA). The VESA EDID standard has been updated to support digital PC monitors and HDTVs using DVI, HDMI, and more recently DisplayPort. Both VESA and CEA are involved in setting standards for EDIDs.

The current version used in consumer electronic gear for the HDMI interface is Enhanced EDID (E-EDID) 1.3 which is based on CEA-861E and incorporated into the HDMI 1.4 specification. The EDID 1.3 specification was released in 2000. The current version used for PCs with the DisplayPort interface is EDID 1.4, released in March 2007.

EDID – A Critical Piece of the Audio Visual Experience

We take for granted the automation that EDIDs provide. One way to get a sense of the importance of EDIDs is to imagine what a user would have to do if EDIDs did not exist. In modern home theatre environments, the absence of EDIDs in a sink device such as an HDTV, Audio/Video receiver or video processor, would mean that the user would need to review the specifications of these device(s) and learn their capabilities. The user would then have to set the audio and video formats of the source device to ensure that its audio and video output did not exceed the capabilities of the audio system or display. If the specifications were not available or were not intelligible, the user would have to employ trial and error methods to discover the optimal settings.

For PCs, the absence of an EDID in the monitor would mean that the graphics card would have a default resolution. If the resolution needed to be changed, it would have to be set manually. Although not widely supported currently, the DisplayPort standard includes support for audio. When audio is supported on DisplayPort-equipped monitors, without an EDID, the audio would have to be set manually in a manner similar to that described above for home theatre systems.
What Information Does an EDID Contain?

EDIDs provide a variety of information describing the capabilities of a display device or audio system. The data is arranged in 128 byte blocks. The VESA standard requires just a single block for VGA, DVI and DisplayPort. However, DisplayPort EDIDs will be enhanced to support an option for an extension block in order to define additional capabilities not covered in Block 0. The CEA requires both the initial VESA block (Block 0) and one or more extension blocks; therefore HDMI display devices have both the VESA block and the CEA extension block.

EDIDs are stored in an EPROM of an audio or video rendering device. Because of the limited storage space, EDID data is stored in a very compact manner using bit or byte oriented storage. In some cases the values are truncated or abbreviated to conserve space.

The following is a list of information describing a display’s capabilities in the base EDID block.

- Header – 8 bytes of fixed data.
- Vendor and product identification.
- EDID version – the current version for HDMI 1.4 is EDID 1.3. The current DP version is EDID 1.4.
- Basic display parameters – video input definition, screen size and gamma.
- Color characteristics – chromaticity and white point.
- Established timings – computer display timings recognized by VESA
- Standard timings – VESA timings based on Discrete Monitor Timing or Generalized Timing Formula. CE devices must support 640 by 480. Most of these timings are not supported by consumer electronics devices.
- Detailed timing descriptors - The VESA E-EDID Standard requires that the first detailed timing descriptor be the "preferred" video format and subsequent detailed timing descriptors listed in order of decreasing preference.

Consumer electronic equipment with HDMI interfaces, require both the VESA block and at least one extension block. The extension block defines the more important audio and video capabilities for HDTVs or audio systems. The following is a list of some of the key data utilized in E-EDID for the HDMI interface in the CEA extension block.

- General video information – such as video type (RGB, YCbCr) and sampling (4:4:4, 4:2:2).
- Video data block – a list of video timings supported (480p, 720p, 1080p).
- Audio data block – a list of audio formats supported (LPCM, compressed).
- Speaker allocation – used when the HDTV supports multi-channel compressed and uncompressed audio.
- Vendor specific data block – provides HDMI-specific data for deep color, 3D, CEC and lipsync.
- Detailed timing descriptors – provides detailed timing descriptors for backward compatibility.
EDID Operation

The EDID of a sink is read by a source device in response to a connection event—called a hot plug—downstream at the display. The EDID is transmitted over the Display Data Channel (DDC) for CE products using VGA, DVI and HDMI, or over the auxiliary channel for monitors with DisplayPort interfaces. In the simple case with a source directly connected to a display device, the EDID is read when the hot plug lead is asserted. The following is a depiction of this operation.

**Typical EDID operation – source device (STB) and sink device (HDTV)**

In cases where there is a repeater device between the source device and the sink device—common in home theatres—the EDID is read when a hot plug pulse is transmitted by the audio system in response to a connection event downstream at the sink. A repeater will forward the EDID directly to the source device, or in the case of an audio system, will substitute its audio block for the audio block of the sink and then forward the reconfigured EDID to the source.

**Typical EDID operation with an audio system (AVR)**
Verifying EDID Implementation

The audio/video ecosystem related to EDID is not complete without considering validation of an EDID implementation. Given the importance of EDIDs in simplifying and optimizing the user experience, it is critical to get an EDID implementation correct. There are various types of tests necessary—and required—to ensure proper operation. The following illustrations depict the setup for testing EDID in sink devices and repeater-type devices as well as testing a source device’s handling of EDIDs.

Setup for testing sink with test equipment emulating a source device

Setup for testing a source device with test equipment emulating a display device

Setup for testing repeater device - test equipment emulates both source & sink
**Functional testing**

The most basic type of testing conducted in a development lab environment is functional testing. Functional testing involves simulating a properly operating device with test equipment. The test equipment interoperates with the sink device whose EDID is being verified. Conversely, when developing a source device, functional testing is used to verify that a source responds properly to a known-good EDID that is emulated by the test equipment. In most cases, a developer will want to test their source device against a variety of known-good EDIDs—old and new—to verify proper operation.

Testing the EDID of a repeater device is more challenging and requires test equipment that can emulate both a know-good source and a known-good sink device.

**Fault testing**

Developers should also conduct fault testing on their EDID-equipped devices. Fault testing is a more rigorous type of testing. In fault testing, the test equipment is configured to simulate a series of anomalous behaviors to verify that a device operates as desired in sub-optimal conditions. Fault testing is important to ensure interoperability.

For testing source devices, test equipment emulates a rendering device and is provisioned with a flawed EDID. A variety of anomalies can be introduced to ensure that a source device responds in an appropriate manner. In order to emulate a flawed EDID or a series of them, it is essential to have an EDID Editor utility in the test equipment. With an EDID Editor utility, developers can quickly construct a variety of modifications to existing EDIDs to verify that a source responds in the proper way.

![EDID Editor utility](image)
EDID fault testing of a sink device or input side of an audio system, involves requesting EDID data in a way that is not typical. For example, although permissible, reading the EDID one byte at a time, may result in an undesirable response from the display.

Developers of repeater devices, such as an audio or video processor, may want to mix functional testing and fault testing. For example, a developer could use test equipment to emulate a known-bad EDID on the sink device and emulate a known-good source device.

Compliance testing

Since improper EDIDs can cause significant interoperability problems, an HDMI device has to pass compliance testing in an Authorized Test Center (ATC) in order to use the HDMI logo. A similar compliance test for DisplayPort devices is currently under development and is expected to be required soon for DisplayPort logo use. Compliance test specifications are created after the release of a specification. Their purpose is to define the series of tests necessary to ensure that a device operates correctly in accordance with the specification.

Compliance testing of an EDID begins by defining the intended capabilities of the sink device. The capabilities are entered or imported into a compliance test application residing on a piece of test equipment. The test can then be executed. The pass/fail results for each distinct test in the entire series of an EDID compliance test are shown in a report. Care must be taken to ensure that a failure is genuine and not the result of an improper configuration when declaring the capabilities of the sink device.

Sample portion of DisplayPort EDID compliance test report
Since submitting and having to resubmit a commercial product for testing is expensive and time consuming, the best approach is for developers to procure test equipment for their lab to conduct pre-compliance testing. In many cases developers can obtain the same equipment used in the ATCs for their own lab. This significantly reduces the chance of failure in the ATCs at least to the extent of the range of tests the test equipment can perform. In the case of EDID compliance testing, the approved test tool for HDMI is commercially available from Quantum Data. A VESA-approved EDID compliance test tool for DisplayPort is anticipated to be commercially available soon from Quantum Data as well once the compliance test specification is finalized.

Interoperability testing

Although the goal of compliance testing is to ensure that devices interoperate, it is often not sufficient in and of itself because of the diversity of equipment and suppliers. Therefore additional interoperability testing is often needed. One such area where interoperability testing has a high value is in ensuring backward compatibility.

In order to support backward compatibility with existing source devices, new EDIDs must include all fields and blocks that past versions of EDIDs have had. The data in the CEA extension blocks have length fields so that older sources can skip newer, unsupported, data blocks. Backward compatibility can be verified with the sink device under development but it is often more convenient to use test equipment because it enables developers to more quickly update EDIDs in the emulated sink for testing.

In developing new source devices, engineers may want to verify that it interoperates with the EDIDs of older sink devices, having test equipment that can emulate a variety of older EDIDs is essential.

During all types of testing in the lab—functional, fault, compliance and especially interoperability—the EDID transactions can be monitored. This can help identify the root cause of some EDID-related interoperability problems, particularly those related to timing and responses to hot plug events. The following is a sample of EDID transaction logging.
Sample portion of DisplayPort EDID compliance test report

EDIDs are comprised of complex data sets that are critical in simplifying and optimizing the user experience in both PC and consumer electronic environments. Ensuring that EDIDs are implemented correctly is a key part of the development process. Quantum Data is a recognized authority on the verification of EDID implementations. Their test equipment and associated test applications are used in the authorized test centers and by developers all over the world.

About Quantum Data

Headquartered in Elgin, Illinois, Quantum Data, Inc. invents test instruments that help manufacturers bring next-generation video, audio, and control products to market – faster and without interoperability problems. Quantum Data provides a variety of solutions for testing EDIDs for source, repeater and display devices. These EDID test solutions are the approved EDID test solutions for use in the Authorized Test Centers for both HDMI and DisplayPort. For more information about Quantum Data please visit: www.quantumdata.com – or call 847-888-0450.