HDMI 1.4 System Troubleshooting Guide

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HDMI troubleshooting guide

HDMI advantages

- Highest image and sound quality
  - The only transmission method for 1080p and higher video
  - Lossless multi channel audio
- One wire for all (video, audio, control, power)
- Build-in smart
  - Self image resolution optimizing via communication
  - Lip-sync via communication
  - System control via communication

HDMI disadvantages

- Distance limitation (Cliff Effect)
- Compatibility issues
- Harder to troubleshoot
- Unpredictable and unforgiving

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Major HDMI electronics problems

- Bandwidth related problems
  - No picture or sound
  - Random bad pixels
- Communication related problems
  - No picture or sound
  - Wrong picture or sound format
  - Flashing color background
  - Copy protection error
  - Ethernet error
- +5 V Power related problems
- Ground loop related problems

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Bandwidth related problems

- The data rate of a 1080p, 60 Hz, 24-bit color is about 4 Gbps
  - 48-bit Deep Color, 120 Hz, 4k, 3D each doubles it
- When data rate doubles, the max cable length reduce to half
- Electronics has a hard cutoff max data rate; if the signal is over it, it won't pass no matter what
- The quick way to troubleshoot this kind of the problem is to reduce the data rate to see if the image comes back
  - Turn off Deep Color or change to 1080i, etc
- The solution is to change to new electronic devices or to add the Luxi HDMI Extender (see left)

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HDMI cable max data rate

Length (m) / Brand	1.0	2.0	3.0	4.5	6.0	7.5	9.0	12.0	15.0	20.0	25.0	30.0	35.0
A	93	47	32	32	23	19	16	12	9	7	6	5	4
B	32	26	18	18	13	11	9	7	5	4			
C	21	15	10	10	8	6	5	4					
D	12	6	4	5	4								

Color coding:	2	1080i, Satellite/cable STBs, DVD players	12	Not in use yet
	4	1080p, Blu-ray players, PS3, Xbox 360	16	Not in use yet
	6	1080p 36-bit deep color	32	Not in use yet
	8	4k x 2k, 3D, 1080p 48-bit deep color		

Note: All numbers are nominal transfer data rate in Gbps

Here are more signal formats:

HDMI 1.2	**720p/1080i**	24 Hz	60 Hz	120 Hz
	24-bit	0.8	**2**	4
HDMI 1.3	**1080p**	24 Hz	60 Hz	120 Hz
	24-bit	1.6	**4**	8
	36-bit	2.4	6	12
	48-bit	3.2	8	16
HDMI 1.4	**4k x 2k**	30 Hz	60 Hz	120 Hz
	24-bit	**8**	16	32
	3D 1080p	24 Hz	60 Hz	120 Hz
	24-bit	3.2	**8**	16

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Communication related problems

- This is the most difficult problem to troubleshoot
- It has the many many different symptoms
  - Because the single wire is responsible for all handshaking and copyright communications
- It’s very difficult to understand the problem
- It’s related to all the HDMI components in the system, not just one
- It’s also a result of a HDMI specification flaw
  - It will happen to certain systems no matter how well each component is designed and built

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One-way data transmission using one wire

- The transmitter pulls the data line either to high (+5 V or logical “1”) or low (0 V or logical “0”); both stages are stable
- Example: wired IR

Two-way data transmission using two wires

- Two wires, one for transmitting (Tx) and one for receiving (Rx)
- True duplex and highly reliable
- Example: RS-232

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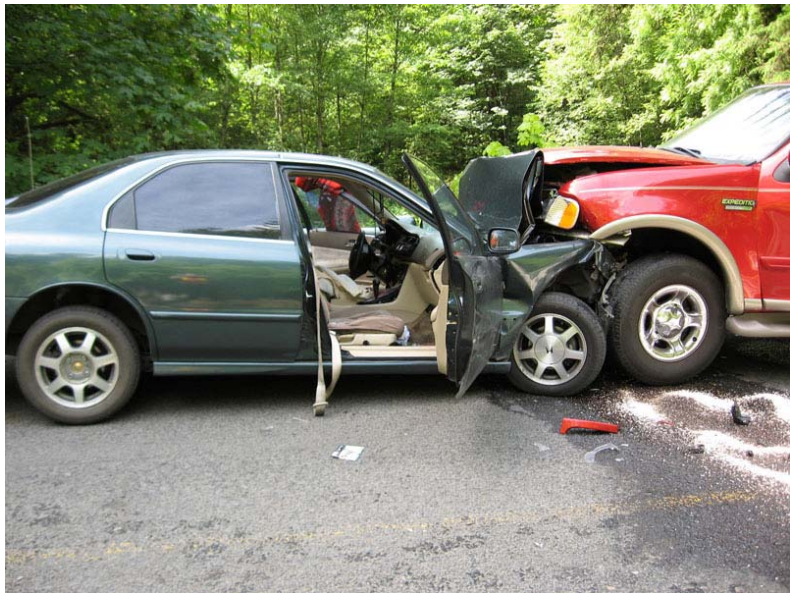
HDMI uses one wire for two-way communication!

- Just like using one lane for two way traffic on a highway, collision happens



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Communication related problems

- Similarly, using one wire for two way communication, collision happens and communication breaks down

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Communication related problems

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Communication related problems

- This one wire for two-way communication protocol is called I^2C (read as eye square see)
- I^2C stands for Inter Integrated Circuit, developed by Philips to enable two-way communication between IC chips on the same circuit board
- Later Apple used I^2C in their MAC computer to connect LCD monitor to the main unit; it became the DVI standard
- HDMI inherited the I^2C from DVI for backwards compatibility

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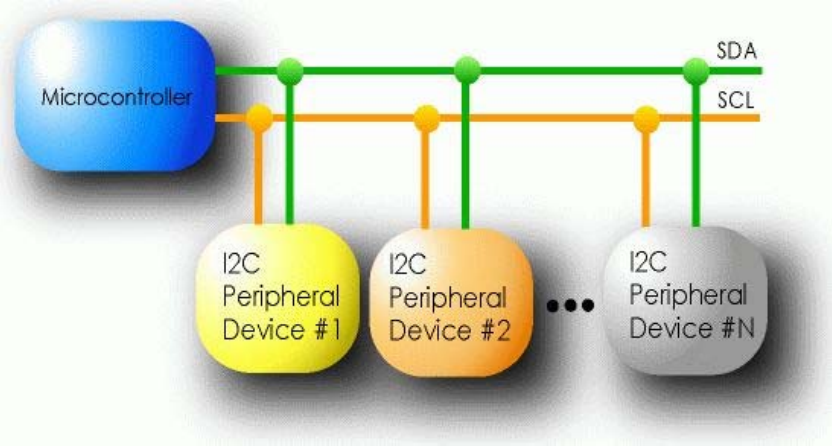
Communication related problems

- In addition to the high and low stages like in the one-way communication, I²C also enables a 3rd stage called floating; in this stage the wire is neither pulled high or low
- Multiple devices share the same wire; the device pulls the wire to high or low would become the master; the rest of the devices become the slaves
- When the master finishes talking, it releases the wire to floating so other device can become new master



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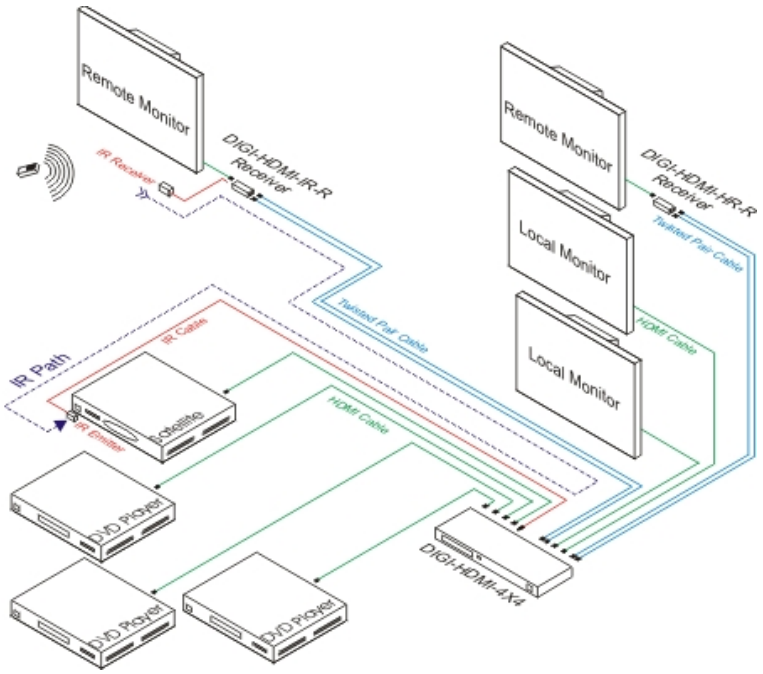

Communication related problems

- This I^2C protocol works well within a circuit board, and between MAC monitor and computer because the distance of ICs are very close and all components are designed by the same manufacturer
- When we use it in an HDMI system in which the cables are long and many devices are made by different manufacturer, problems happen

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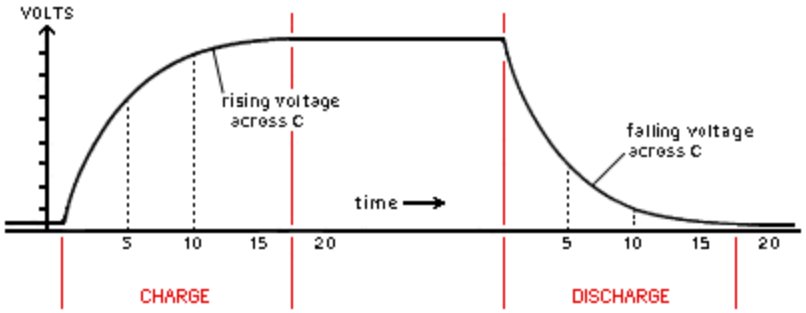
Communication related problems

- When one device starts talking, it pulls the wire high or low; but it takes some micro seconds to charge the capacitance in the cables and the devices on the line; so there's a chance that other device is checking the wire and determined it's free and starts talking at the same time; this is collision!



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Communication related problems

- In many cases, it's not the individual device to blame for the collision; rather it's the HDMI spec flaw
- The collision depends on the combination of all the components in a system; It will happen, but we can not predict to which system
- It's like throwing a dart onto a board; the collision only happens when the dart hits the bull's eye

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Communication related problems

- This problem is very hard to troubleshooting
- Quantum Data have just introduced the HT-180 handheld tester for this very purpose
- It connects to a system and check the communication with every device in the system, gives detailed report to pinpoint which device during which communication failed
- The report can be emailed or printed

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Communication related problems

- This bull's eye analogy also gives us the solution for the problem: if collision happened, then it could be fixed by moving the bull's eye any where to avoid the dart
- This can be changing the Blu-ray player or receiver to a different model, or even using different HDMI cables
- If no change is allowed to a system, you can still add the Luxi HDMI Communicator (left), to alter the bull's eye

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Ethernet related problems

- HDMI 1.4 spec added Ethernet capability
- In an ideal situation, system should be backwards compatible
- But some companies' HDMI 1.3 cables connect the two pins for Ethernet with straight wires; this would fool the system thinking it's a HDMI 1.4 cable thus attempts Ethernet communication.
- When this happens, manually disable the HDMI build in Ethernet; use extra Cat5 cables to connect Ethernet instead

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+5 V power related problems

- HDMI source supplies a small +5 V power thru the HDMI cable to power the communication circuit in the display so they can talk even when the display is turned off
- Many products take advantage of this to save an external power, like HDMI Extender, active HDMI cable, etc
- If these devices draw more current than the source can supply, the +5 V collapses
- Check the power indicator on the active device without an external power; if dim or off, add an external power to it

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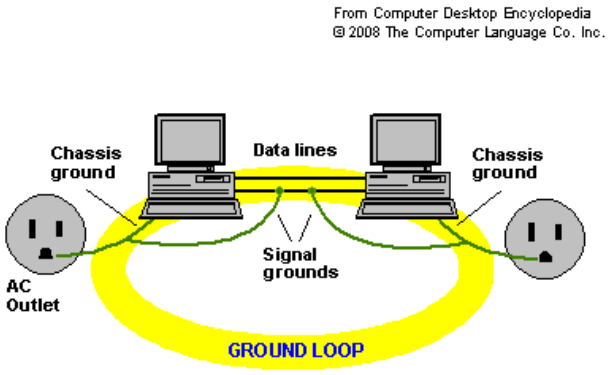

AC ground loop related problems

- The devices in the source rack may plug in a AC outlet with different circuit from the one the display plugs in
- Thus the ground potential (or voltage) between the far apart AC outlets may not be 0 V it should be
- When the signal cables are connected, the ground potential could interrupt the signal or could even burn the devices
- Luxi HDMI over Cat products have ground isolator build-in
- For other products, use an isolation transformer when needed

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Troubleshooting procedure summary

- First to check if all the power LEDs lit; if any of them not lit or dim, add or replace external power supplies
- Lower the source resolution to 1080i or even 480p; if the image shows up on TV, you know it's a bandwidth related problem
- Use the Luxi HDMI Extender to fix the cable bandwidth (length) related problem
- Lower the source resolution to 1080i or even 480p; if the image still does not show up on TV, you know it's a communication related problem
- Use the Luxi HDMI Communicator to fix the communication problem
- Use multi-meter to measure AC voltage between outlet grounds to identify ground loop problem
- If all failed, email us at xlu@luxielectronics.com for help.

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Thank you!

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