help desk

DMX gremlins | By Wayne Howell

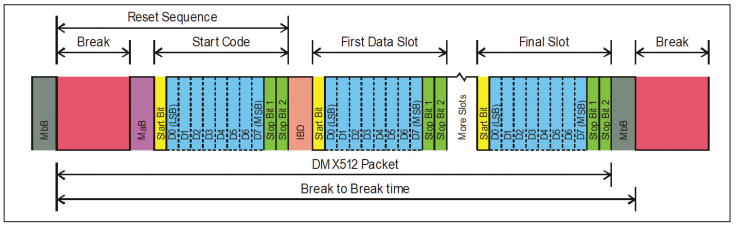
"So, three parts to the Reset Sequence - what could go wrong? This is actually where most of the flicker problems live . . ."

In the course of reviewing the catalogue of Help Desk columns, I was surprised to note that this is number 30. I also noted that the number of Help Desk tickets related to DMX512, compatibility and flickering had not diminished during those two and a half years . . .

So, I've decided that over the course of the next few columns I will look at DMX512, Remote Device Management (RDM) and related issues in some detail. The starting point is to understand how DMX512 is structured on the wire . . .

DMX512 PACKET

The DMX512 packet is a continuously repeating sequence that comprises of a Reset Sequence followed by up to 512 bytes of data (as shown in the figure below). The fact that the DMX512 packet repeats continuously is the reason why it is called a 'streaming protocol' - if an error occurs in one packet, it will likely be corrected by the one that follows it.



REFRESH RATE

This is the frequency at which DMX512 packets are sent. Usually expressed in Hertz (Hz), which means the number of packets sent per second, the maximum refresh rate for a full-size DMX512 packet (containing 512 channels) is around 44Hz. Sometimes the refresh rate is quoted in milliseconds (mS), but this is actually the time between two consecutive Reset Sequences. The two descriptions are simply converted, as one is the reciprocal of the other, e.g. 44Hz refresh rate equates to approximately 23mS period.

Most lighting products contain a microprocessor chip. These come in a wide range of sizes, costs and processing powers. Consider a product designed to receive DMX512 and drive LEDs: the microprocessor will be busy receiving DMX512, operating a user interface and generating pulse width modulation or similar to drive the LEDs. If a product designer chooses a microprocessor with too little processing power, something would have to give, and this often leads to products that operate fine with a medium refresh rate, but flicker badly with full-speed DMX512. Thankfully, most Ethernet gateways and many DMX512 splitters offer functions that can slow down the DMX512 in order to help such products operate correctly.

RESET SEQUENCE

The Reset Sequence is used to describe the three parts that show the start of the DMX512 packet. It comprises the Break, Mark After Break and the Start Code.

The Break is an 'intended error' that the receiver can easily detect. It's a low pulse that lasts for at least 92μS (microseconds). The Mark after Break (MaB) is just the short delay between the Break and the Start Code. The word 'mark' simply means a logic high level. The Mark lasts for at least 12μS. The Start Code is a number in the range 0 to 255 which defines the meaning of the DMX512 packet.

So, three parts to the Reset Sequence - what could go wrong? This is actually where most of the flicker problems live. Some consoles and gateways insist on using the minimum allowed Break and MaB times. Moreover, earlier versions of DMX512 allowed smaller values for these parameters; DMX512 receivers with slower microprocessors can potentially miss the entire Reset Sequence, which will definitely cause flicker. To put it into perspective, the MaB time of 12μS is likely to correspond to 24 to 48 single instructions for a simple microprocessor.

The Start Code is the single biggest cause of flicker - but that is not its fault. The Start Code value of zero tells us that the packet contains standard level data that should be used to control the lights. Other values are used for numerous purposes, such as manufacturer specific communication and, of course, RDM. The DMX512 standard requires that all receivers check this Start Code and if the data is not of the required type, to throw it away - something that numerous 'cheap' products neglect. But more on this next month . . .

SLOTS AND INTER-SLOTS

After the Reset Sequence, there follows up to 512 bytes of data. As mentioned, the meaning of this data is defined by the Start Code: if the Start Code is zero, then these are 512 lighting level channels, which DMX512 refers to as Data Slots. However, for most purposes the terms Channel 1 and Slot 1 are interchangeable. The figure shows the construction of a Slot, comprising a Start-Bit, 8 Data-Bits and 2 Stop-Bits. Each Bit is 4μS long, so an entire Slot is 11 bits or 44μS long. The Start-Bit and Stop-Bits are there to allow the receiver to decode the data.

DMX512 does not require there to be a gap between Slots, so the last Stop-Bit on one Slot can butt up to the Start-Bit of the next Slot. If there is a gap, it is (not surprisingly) called the Inter-Slot Gap or Inter-Slot Delay.

Some DMX512 receiver products cannot reliably receive DMX512 Packets without an Inter-Slot Gap. Products with this particular failing tend to exhibit flicker on higher channels.

SUMMARY

In January, I'll be looking at RDM and how badly-designed products misbehave when confronted with this incredibly useful tool.

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