



Reference Guide

DiGidot Reference Guide

This DiGidot Reference Guide has been created to help end users understand the practical limitations of different cable types when using a SPI based protocol. In LED control systems, cable type and length directly affects signal integrity and thus stability. Choosing the correct wiring method and minimizing distances is essential to prevent data errors resulting in flickering or in general unstable behavior. This guide details three types of cables that can be used in DiGidot installations. These include two single core cables, dual core cables and network cables.

In the past DiGidot stated a single value for the maximum distance between the controller and the first LED IC when using a standard SPI data connection. This type of signal is unbalanced, meaning it uses a single data wire referenced to the ground of the power supply. While this method is simple and adequate for short distances, unbalanced signals are more sensitive to electrical noise and interference. For that reason, cable lengths should always be kept as short as possible to guarantee a stable SPI signal.

It is possible to transmit data over longer distances by using two signal wires from the controller. This creates a balanced signal, which can distinguish between noise and the signal itself. A balanced transmission allows the receiving device to compensate interference that will occur along the cable. This improves reliability compared to single wire SPI connections.

While a balanced signal is technically superior to unbalanced, it uses more hardware to function. Optimising your setup can result in a perfectly operating solution without the need for additional hardware. As a general rule, cable lengths should always be kept as short as possible. For longer distances, particularly above 20 meters, the use of PxLNet is strongly recommended.

Field results may vary depending on the installation environment. Cables routed alongside power lines, motors, switching power supplies or other sources of electromagnetic interference will perform worse. Cable quality also has a major influence on performance, a poor quality cable can reduce the achievable maximum distance by 30 percent or more.

Seeking the limits for unbalanced data transfer is at your own risk!

The values given is the maximum cable length before the signal became too distorted. These cables are lab tested and the results are reproducible. The following tests are done without using any physical controllers or LED ICs. This method is chosen to keep all tests as scientific as possible. The distances specified are based on voltage drop and deformation of the signal.

The measurements for voltage drop and deformation of the signal are done by using an oscilloscope and a function generator. We've simulated the WS2812 LED IC and used it's tolerances as a guide for whether it properly registers a value or not. Any test that did not maintain to stay above or below its respective threshold for the specified duration was considered as a fail. A low read would be below 1.5VDC and a high read above 3.5VDC. Percentage uptime for transmitted 0 values: 30.43%. Percentage uptime for 1 values: 53.85%.

Function generator used: Rigol DG2052

Oscilloscope used: Rigol MSO5074

Single core wires laid loose on the ground, not twisted pairs

mm ² (AWG)\ Frequency	250 kHz	500 kHz	800 kHz	1.6 MHz	Ref Cable
0.25 (24)	8 m	8 m	8 m	3 m	Lapp LiY
0.5 (20)	10 m	10 m	6 m	2 m	Lapp H07V-K
0.75 (18)	6 m	6 m	6 m	4 m	Lapp H07V-K
1 (17)	10 m	10 m	10 m	4 m	Lapp H07V-K
1.5 (16)	10 m	10 m	10 m	10 m	Lapp H07V-K
2.5 (14)	14 m	14 m	10 m	4 m	Lapp H07V-K
4 (12)	16 m	12 m	8 m	4 m	Lapp H07V-K
6 (10)	15 m	15 m	8 m	4 m	Lapp H07V-K

Network cables on a spool

mm ² (AWG)\ Frequency	250 kHz	500 kHz	800 kHz	1.6 MHz	Ref Cable
F/UTP	150 m	100 m	50 m	50 m	CAT 5E (solid)
U/UTP	250 m	250 m	150 m	100 m	CAT 5E (stranded)
S/FTP	150 m	100 m	50 m	50 m	CAT 6 (stranded)

Two core cables on a spool

mm ² (AWG)\ Frequency	250 kHz	500 kHz	800 kHz	1.6 MHz	Ref Cable
0.14 (26)	100 m	50 m	50 m	50 m	Spagledti 70121
0.35 (22)	32.5m ¹	32.5m ¹	32.5m ¹	32.5m ¹	Tasker TSK1038
0.5 (20)	100 m ¹	100 m ¹	100 m ¹	100 m ¹	Spagledti 70102
0.75 (18)	126 m ¹	126m ¹	126 m ¹	126 m ¹	Lapp Ölflex Robust 210
1 (17)	100 m ¹	100 m ¹	100 m ¹	100 m ¹	Spagledti 70121
1.5 (16)	100 m ¹	100 m ¹	100 m ¹	100 m ¹	Eucaflec H07RN-F
2.5 (14)	100 m ¹	100 m ¹	100 m ¹	100 m ¹	Spagledti 70114

1 Longer cables have not yet been tested

The clear giveaway from these results is that twisted- and dual/multi-core cables perform the best. Untwisted or single core cables perform the worst and should be avoided.



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