

132 White Oak Road,  
New Holland, PA 17557  
Telephone: 800-237-5835  
Email: [Industrial.support@nexans.com](mailto:Industrial.support@nexans.com)



### **Stranded Conductor Length De-rating Reference**

Cables manufactured using stranded conductors are desirable for applications requiring increased flexibility. Patch cords and cables for industrial environments are examples of these cables. The change in conductor size and design for flexibility typically results in greater attenuation of signal. To ensure performance, these flexible products are usually designed and specified for de-rated, or reduced, maximum lengths. If a cable product has a de-rated length, it is this length that is expected to pass the 100 m cable performance test. For example, cables utilizing 24 AWG stranded conductor might only be rated for a length of 83 m; this means that when the cable is tested in an 83 m length, it will pass the specifications that assume a cable length of 100 m. At lengths above 83 m, it will not pass the insertion loss specification. Berk-Tek reports the maximum de-rated cable length on the bulk cable datasheet (for example 83m). The purpose of this application note is to associate this de-rated cable length to various connectivity applications per the TIA standards.

Category cables must have connectors added to be used. Installers usually build channels out of cable, female connectors, and patch cords. The channel is the whole cabling system between the endpoint devices (e.g. computers and network switches). A permanent link is a section of cable with female RJ45 connectors on both ends. Jacks and patch panels are attached to cable to create permanent links in buildings to allow access to the network from wall outlets. Permanent link maximum length is recommended to be 90 m for solid conductors. Male RJ45 connectors (plugs) on both ends of the length de-rated flexible cable create a patch cord. Patch cords are short flexible cords used to connect the permanent link to the endpoint devices. The maximum recommended length of patch cordage (total on both sides) in a channel is 10 m. Combining the permanent link and the patch cords, a typical channel will have a maximum length of 100 m.

A channel built from length de-rated stranded cables would be composed of a reduced length permanent link and up to 10 m of patch cords. The permanent link should be 90% of the de-rated cable length. Figure 1 shows an example of a length de-rated cable and the channel that would be built from it. Table 1 provides a reference for the link length recommended for commonly available conductor cables.

## 83 m Flexible Cable

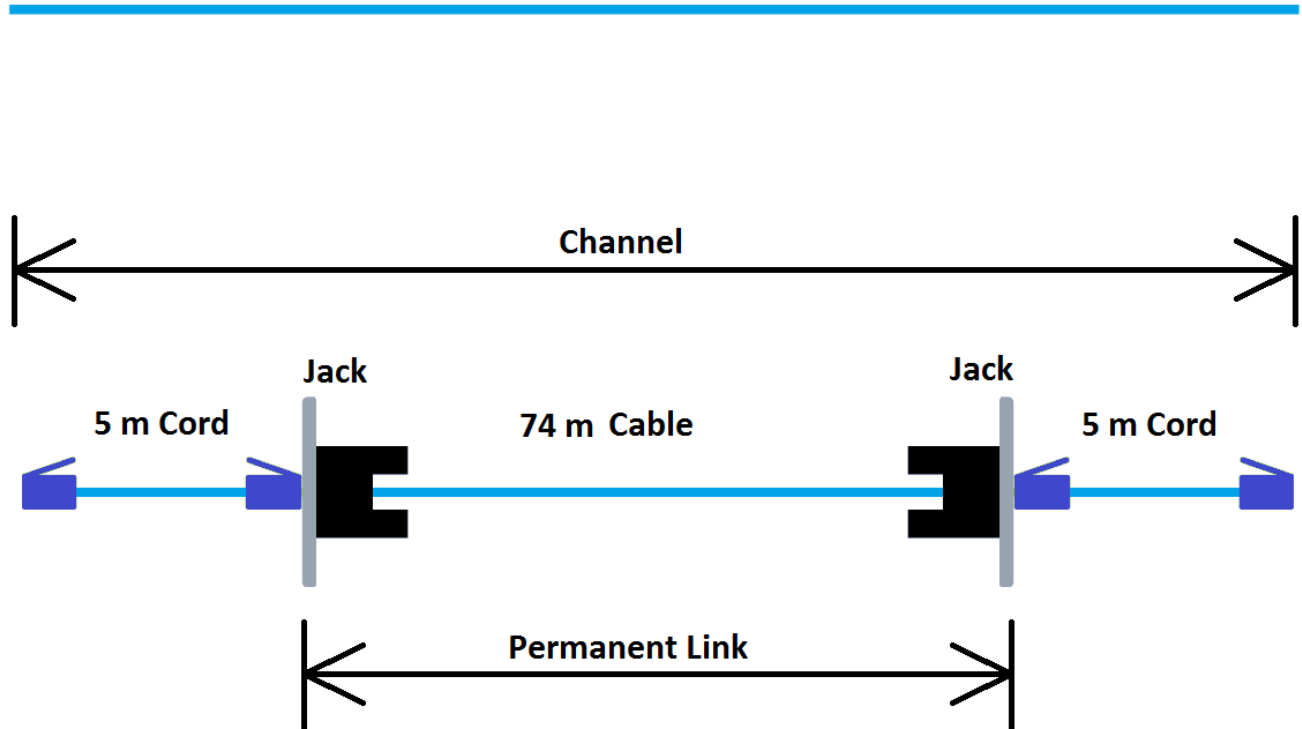


Figure 1: Example Flexible Cable Maximum Length and Channel

Table 1: Length Recommendations

Conductor Type	Cable Length	Permanent Link Length (90% of Cable Length)	Total Patch Cord Length	Channel Length (link + patch cords)
24 AWG Solid	100 m	90 m	10 m	100 m
24 AWG Stranded	83 m	74 m	10 m	84 m
26 AWG Stranded	66 m	59 m	10 m	69 m
28 AWG Solid	51 m	45 m	10 m	55 m

Typical channels can have up to 4 connectors in the form of plug/jack connections or consolidation points. See Figure 2 for an example solution with components.

In typical Industrial applications such as PLC interconnection with Switches, Smart devices, Integrated Sensors and Computers, an End-to-End link with no patch cords is commonly used. An End-to-End link can be constructed out of a length of cable with plugs attached on the ends. Figure 3 shows an example of an End-to-End link made of a flexible cable. Figure 4 shows a patch cord for reference. A patch cord and a flexible End-to-End link are very similar except for length and parameter requirements.

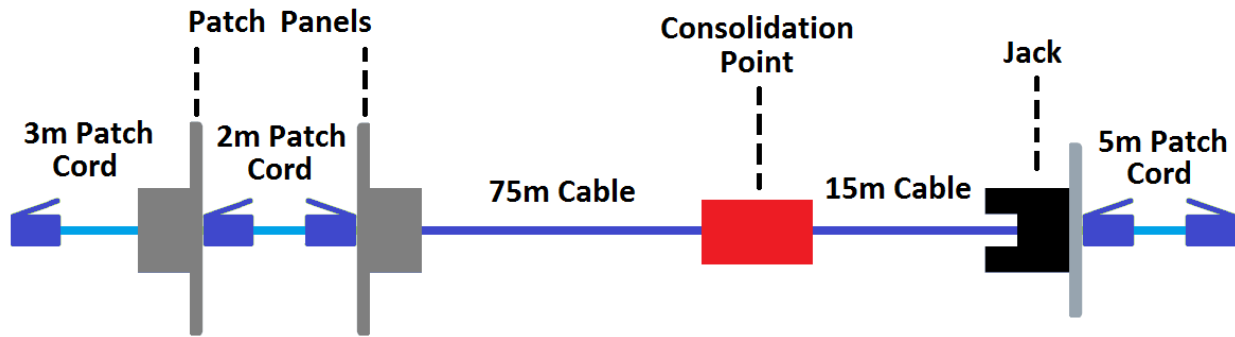


Figure 2: Four-Connector 100 m Channel Example

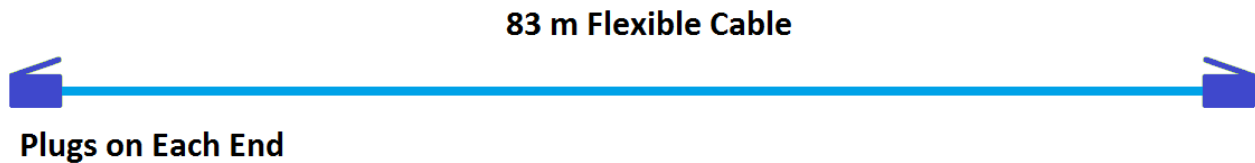


Figure 3: End-to-End Link Example

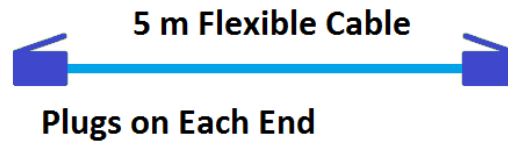


Figure 4: Patch Cord Example

Different systems have different performance requirements. Handheld test equipment can be used to qualify the installed systems to their requirements. Channels and links have many more requirements than cordage. To help clarify, Table 2 shows the parameters that are required for each solution.

**Table 2: Typical Parameters to be Measured (Category 6)**

Solution	Parameters
Patch Cord	RL, NEXT, DCR
End-to-End Link and Channel	IL, RL, NEXT, PS NEXT, ACRF, PSACRF, Z, delay, delay skew, DCR, DCR Unbalance, Mutual Capacitance, Capacitance Unbalance

Along with conductor sizes, elevated temperatures can increase the loss of cables and further de-rate the maximum length allowed for a cabling system. Table 3 provides guidance for using length de-rated cables at environments with expected elevated temperatures.

**Table 3: Maximum Permanent Link Length for Channels at Elevated Temperature**

<b>Temp (°C)</b>	<b>Unscreened Solid 24 AWG (m)</b>	<b>Screened Solid 24 AWG (m)</b>	<b>Unscreened Stranded 24 AWG (m)</b>	<b>Screened Stranded 24 AWG (m)</b>	<b>Unscreened Stranded 26 AWG (m)</b>	<b>Screened Stranded 26 AWG (m)</b>	<b>Unscreened Solid 28 AWG (m)</b>	<b>Screened Solid 28 AWG (m)</b>
20	90	90	74.7	74.7	59.4	59.4	45.9	45.9
25	88.3	89.1	73.3	74.0	58.3	58.8	45.0	45.4
30	86.6	88.2	71.9	73.2	57.2	58.2	44.2	45.0
35	85.0	87.4	70.5	72.5	56.1	57.7	43.3	44.6
40	83.4	86.5	69.3	71.8	55.1	57.1	42.6	44.1
45	81.0	85.7	67.3	71.1	53.5	56.6	41.3	43.7
50	78.8	84.9	65.4	70.5	52.0	56.0	40.2	43.3
55	76.6	84.1	63.6	69.8	50.6	55.5	39.1	42.9
60	74.6	83.3	61.9	69.2	49.2	55.0	38.0	42.5

For more information, contact [industrial.support@nexans.com](mailto:industrial.support@nexans.com) for technical support.