

Design guidelines

February 2020

Revision 3.2

| LANmark-6A
Cabling System

This document is intended to provide general guidance on LAN cabling infrastructure design & installation good practices and for compliance to NCS warranty application requirements. It is not meant to serve as the only reference for installation requirements or be a substitute for applicable training requirements.

For further advice or support regarding installation queries please contact your local Nexans Cabling Solutions representative.

For more information on products please contact your local Nexans Cabling Solutions Sales office or visit:

www.nexans.com/LANsystems

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1. Introduction

The following installation requirements cover the minimum and maximum length configurations for installing a Nexans LANmark-6A structured cabling system using LANmark-6A cable and connectivity.

The LANmark-6A cabling system has been designed not only to meet but exceed the demanding requirements of Augmented Cat 6 and Class EA Standards. The performance headroom of LANmark-6A, which is above the minimum requirements of the International Standards, can be used to build shorter links and channels than those recommended by the Standards.

Both the Standards recommendations and the Nexans specific length restrictions are described in the following chapters.

Please ensure that you have selected the appropriate connector version for the chosen cable solution. NCS offers 2 connector versions depending on the wire thickness within the cable.

For **AWG22 to AWG24 wire sizes**, connectors for solid wire **N420.66A** shall be used.

For **AWG26 wire sizes** (both in case of stranded or solid wire) and for **all cables with stranded wire** used in patch cords or CC/CP cords, connectors for stranded wire **N420.67A** shall be used.

2. General Guidelines and Standards Compliance

All installation designs must follow industry best practice and demonstrate compliance with the relevant parts of ISO/IEC 11801-(1 to 6):2017/COR1:2018, EN 50173-(1 to 6):2018 or ANSI/TIA-568.2-D standards and shall be tested to either ANSI/TIA-568.2-D or ISO/IEC 11801-(1 to 6):2017/COR1:2018. Furthermore, the General Installation Guidelines from Nexans and especially all detailed product installation instructions must be followed.

General Guidelines are available under http://www.nexans.co.uk/eservice/UK-en_GB/fileLibrary/Download_540209803/UK/files/General%20Installation%20guide%202014_V2.0%20DWI_LR.pdf

Product Installation Sheets are in most cases included with the product. Please check the following link for up-to-date installation rules for the product you plan to install:

<https://www.nexans.co.uk/eservice/Library.nx?topicSelected=13045&parentScope=13044#directory>

In order to apply for installation Warranty Certification as offered by Nexans Cabling Solutions (NCS), verification testing of the installation has to be undertaken in accordance with the 'Field Test Procedure of LANmark-6A Cabling System' or the 'Application Note LANmark-6A MPTL testing' document.

<https://www.nexans.co.uk/eservice/Library.nx?topicSelected=13043&CZ=UK&parentScope=13043#directory>

To pass testing for the Nexans warranty all Permanent Links and/or Channels in an installation shall pass in accordance with NCS set-up requirements.

It should be agreed with the client before starting the contract how to deal with marginal pass results, as they may not be aware that a marginal result may be because of the accuracy and tolerances of the tester.

Nexans will consider a *PASS as acceptable within the warranty when specific conditions apply – see table below.

However, a *FAIL or FAIL shall be investigated as it is not acceptable.

Warranty Module	Channel Limits
LANmark-6A	No *PASS accepted
LANmark-6A MPTL	Not Supported

Permanent Link Limits
*PASS acceptable if length > 5m and < 15m
Only PASS test results accepted

3. Length Considerations for Design and Installation

3.1 Length specifications in ISO/IEC Standards

The following length requirements for twisted pair cabling are defined within ISO/IEC 11801, EN 50173 and TIA 568 documents:

Table 1 - Minimum and Maximum Lengths as per Standards

Segment	Minimum length in m	Maximum length in m
FD - CP	15	85
CP – TO	5	-
FD – TO (no CP)	15	90
Work area cord ^a	2	5
Patch cord	2	-
Equipment cord ^b	2	5
All cords	-	10
^a If there is no CP, the minimum length of the work area cord is 1m.		
^b If there is no cross-connect, the minimum length of the equipment cord is 1m.		

Whereas the maximum length is given as a normative requirement, minimum length is informative and is given to indicate which length limitations were taken into account when the component and link limits for electrical performance have been selected. It is recognized that short links with a high number of connection points at close proximity do generate more internal crosstalk and reflections. Therefore, it is likely that below these minimum length configurations, headroom above the Standard's performance requirements cannot necessarily be achieved. Star pass results at short lengths are therefore likely, if not normal, according to the Standards.

3.2 Length specifications for LANmark-6A

LANmark-6A products exceed the minimum requirements of the ISO/IEC Standards for components, so LANmark-6A can provide more link and channel design flexibility and still meet the Standard's performance requirements

The following minimum and maximum length specifications apply when LANmark-6A products are used.

Table 2 – Length Specifications Overview

Segment	Minimum length in m	Maximum length in m	Minimum length in m	Maximum length in m
	Standard Patch cords		Slimflex Patch cords	
2 Connector Channels				
FD – TO (or Panel – Panel)	5	90	5	80*
Work area cord	0.3	5	0.5	5
Patch cord	0.3	5	0.5	5
3 and more Connector Channels				
FD – CP	5	83.5°	5	73.5**
CP – TO	3	-	3	-
Work area cord	0.5	5	0.5	5
Patch cord	0.5	-	0.5	5
Equipment cord	0.5	5	0.5	5
All cords	-	10	-	10
Modular Plug Terminated Link				
FD – Modular Plug	5	90	5	90
Patch cord	0.3	5	0.5	5
°calculation based on use of 5m equipment and work area cords and 3m consolidation cord (Channel without cross connect) * Horizontal cable length can be 90m if Slimflex cordage is reduced to 6m total length ** Horizontal cable length can be 83.5m if Slimflex cordage is reduced to 6m total length				

These specifications are valid only if all components within the channel are NCS LANmark-6A products. Especially if Cross Connects and/or Consolidation Points are used, LANmark-6A patch cords series (excluding Slimflex cords) must be used to build the CC and CP links.

3.3 Stranded Cable Length Compensation

Certain channel configurations need more than a total of 10m cords. As the attenuation of flexible stranded cable is higher than solid horizontal cable, the maximum length of the permanent link must be reduced when the total length of flexible cable exceeds 10m. The maximum link length is normally 90m of solid horizontal cable. For every 1m of additional flexible cable (above the 10m already calculated for patch cords) used between the Consolidation Point and the Telecommunications Outlet, the horizontal cable length must be reduced by 1.5 m (see table).

The following table shows the length calculation formulas taking into consideration the length of each portion of the channel:

Table 3 - Horizontal link length equations

Model	Fig.	Class EA channels (including use of Slimflex cords)
Interconnect - TO	12a	$l_h = 104 - l_a \times X$
Cross connect - TO	12b	$l_h = 103 - l_a \times X$
Interconnect-CP-TO	12c	$l_h = 103 - l_a \times X - l_c \times \gamma$
Cross connect-CP-TO	12d	$l_h = 102 - l_a \times X - l_c \times \gamma$

l_h - the maximum length of the fixed horizontal cable (m)
 l_a - combined length of patch cords/jumpers, equipment and work area cords (m)
 l_c - the length of the CP cable and/or CC equipment cord (m)
 X - the ratio of cord cable insertion loss (dB/m) to fixed horizontal cable insertion loss (dB/m):
 for LANmark-6A use **1.5** and for LANmark-6A Slimflex use **2.5**
 γ - the ratio of CP cable insertion loss (dB/m) to fixed horizontal cable insertion loss (dB/m):
 for LANmark-6A use **1.5**

NOTE:
 For operating temperatures above 20°C, l_h should be reduced by
 0.2% per °C for screened cables
 0.4% per °C (20°C to 40°C) and 0.6% per °C (>40°C to 60°C) for unscreened cables

Please note: In the tables shown in the next paragraphs the variables used in the formulas above have been substituted by the following letters.

$$l_h = H$$

$$l_a = F1 \ \& \ F2$$

$$l_c = C1 \ \& \ C2$$

F1 = Equipment cord or CC patch cord
 F2 = Work area cord

C1 = Service presentation/crossconnect
 C2 = Consolidation point cable

4. Detailed Channel Design Guidelines for LANmark-6A

4.1 2 Connector Channel Design Guidelines

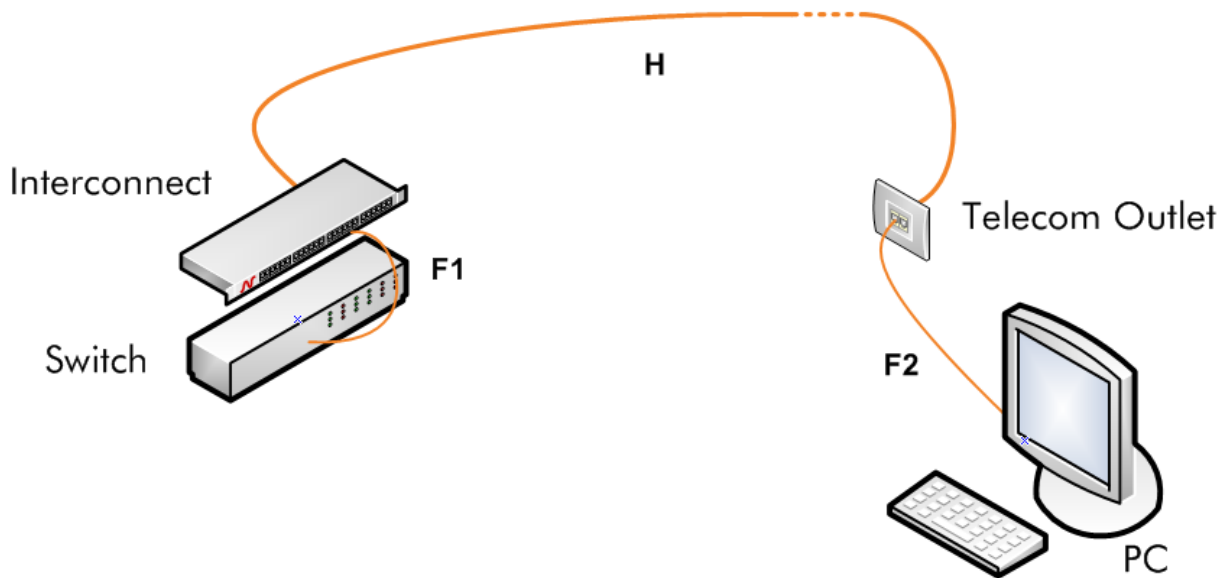


Figure 12a

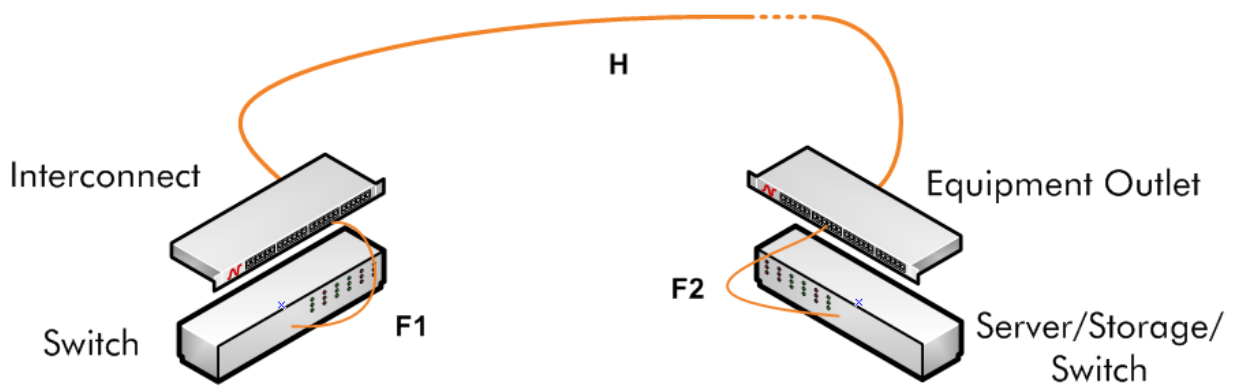
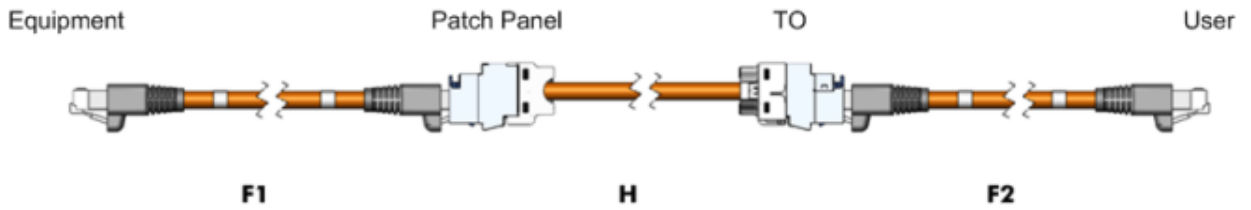


Figure 12a-bis (Datacentre or Backbone)

Table 4 - 2 Connector Channel Length Specifications

	Description	Minimum length in m	Maximum length in m	Minimum length in m using Slimflex	Maximum length in m using Slimflex
		$H = 104 - (F1+F2) * 1.5$		$H = 104 - (F1+F2) * 2.5$	
H	Horizontal Permanent Link	5	90	5	80*
F1 & F2	Patch cord	0.3	5	0.5	5
H+F1+F2	Total channel length	$5 + 0.3 + 0.3$ = 5.6m	$90 + 5 + 5$ = 100m	$5 + 0.5 + 0.5$ = 6m	$90 + 3 + 3$ =96m
* 5 m cords used in calculation, Horizontal cable can be 90m if Slimflex cordage is reduced to 6m total length					



4.2 3 Connector Channel using a Cross Connect

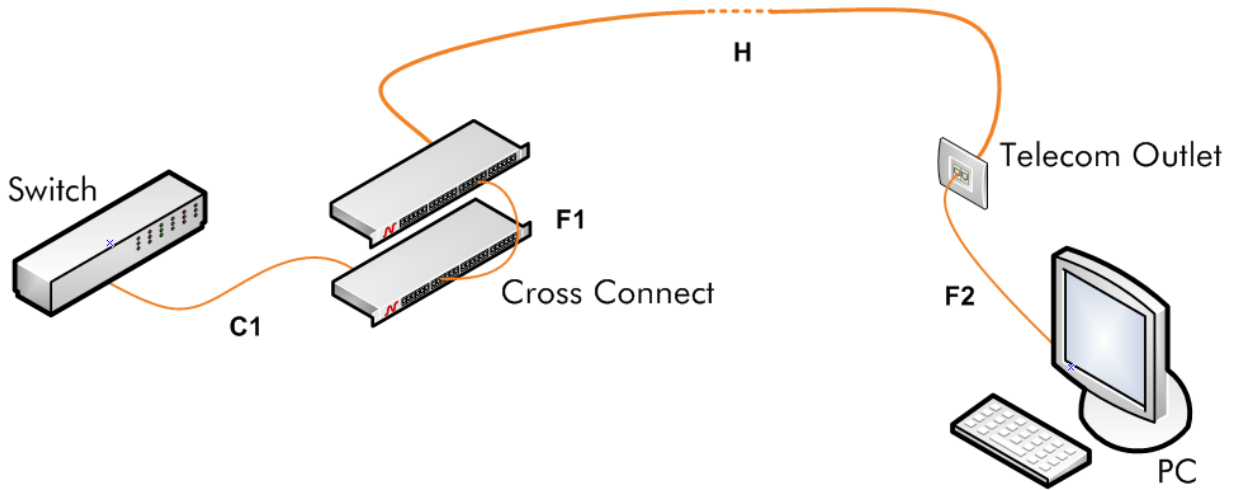


Figure 12b

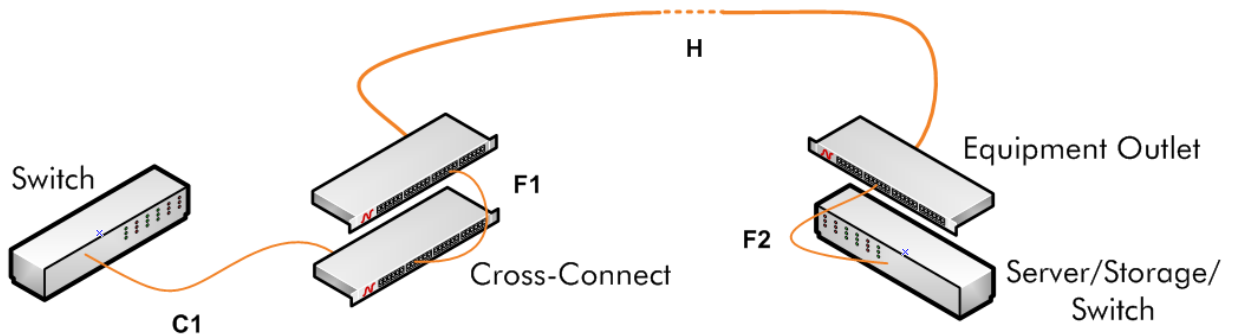


Figure 12b-bis (Datacentre or Backbone)

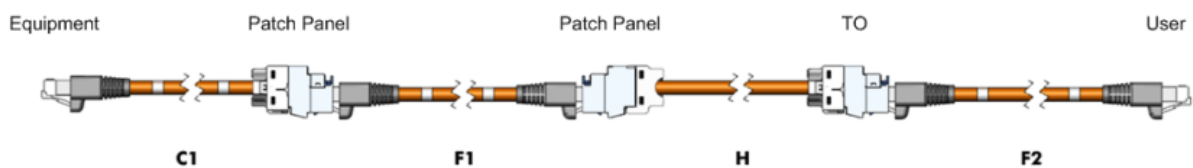
Table 5 - 3 Connector Channel Length Specifications

	Description	Minimum Length in m	Maximum Length in m	Min. length in m using Slimflex for F1 & F2	Max. length in m using Slimflex for F1 & F2
		H = $103 - (F1 + F2 + C1) * 1.5$		H = $103 - (F1 + F2) * 2.5 - C1 * 1.5$	
H	Horizontal Permanent Link	5	83.5°	5	73.5**
C1	Service Presentation - Cross Connect	3	20*	3	20*
F1 & F2	Patch cord	0.5	5	0.5	5
Examples		Using short and long CC	Using short and long CC	Using slimflex Patch cords with short and long CC	Using slimflex Patch cords with short and long CC
H+C1+F1+F2	Length for 3 Connector Channel with Short CC	$5+3+0.5+0.5$ = 9m	$83.5+3+5+5$ = 96.5m	$5+3+0.5+0.5$ = 9m	$83.5+3+3+3$ = 92.5m
H+C1+F1+F2	Length for 3 Connector Channel with Long CC	$5+20*+0.5+0.5$ = 26m	$58+20*+5+5$ = 88m	$5+20*+0.5+0.5$ = 26m	$58+20*+3+3$ = 84m

° Calculation based on 5 m F1&F2 cords to maintain maximum flexibility on choice of patch cord length for user and patch area

* Informative maximum length

** 5 m cords used in calculation, Horizontal cable can be 83.5m if Slimflex cordage is reduced to 6m total length



4.3 3 Connector Channel using a Consolidation Point

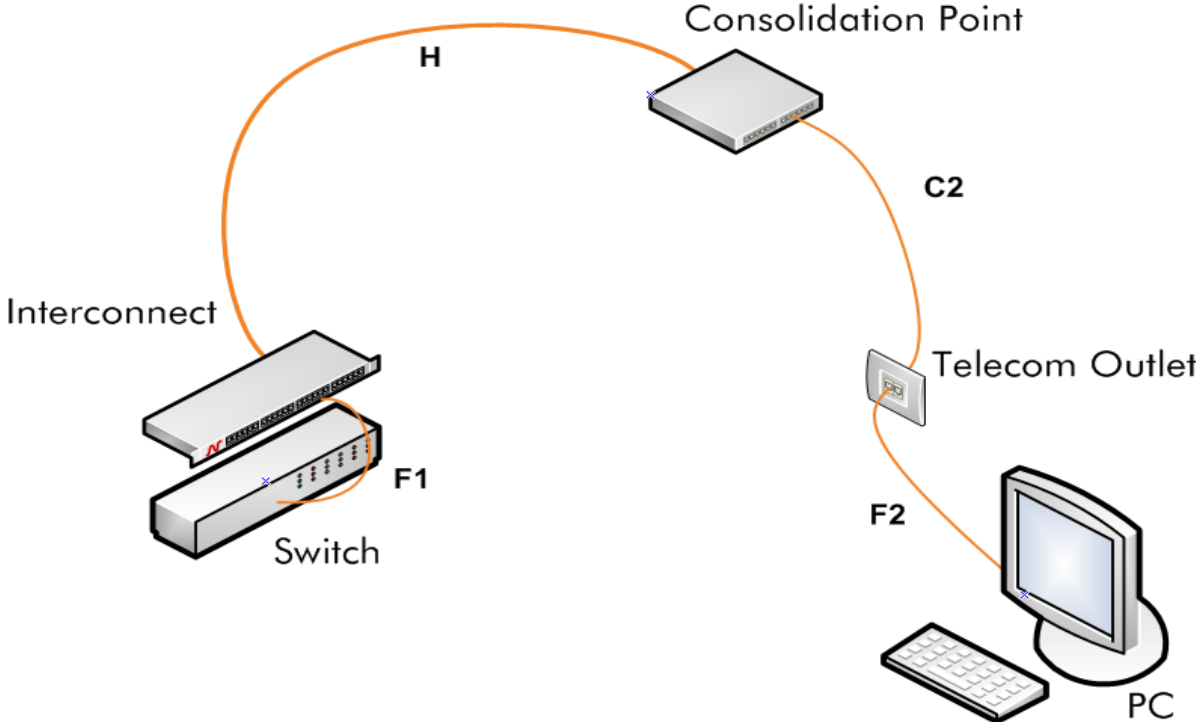


Figure 12c

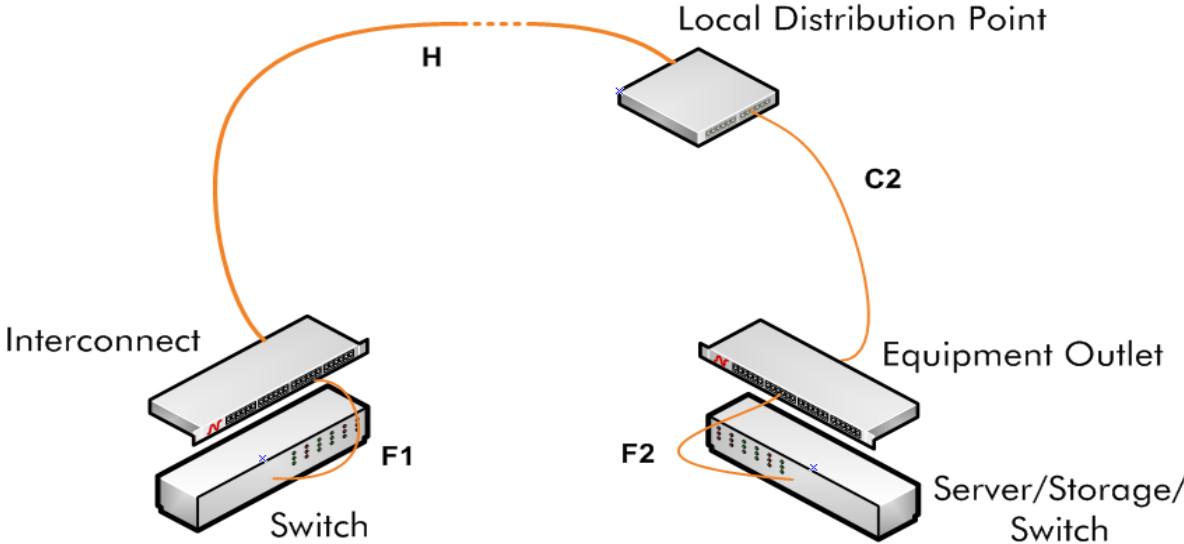


Figure 12c-bis (Datacentre)

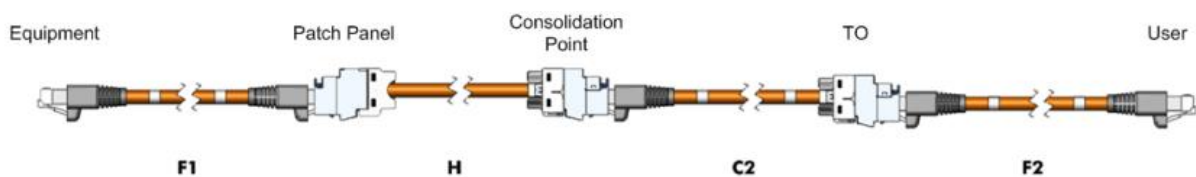
Table 6 - 3 Connector Channel Length Specifications

	Description	Minimum Length in m	Maximum Length in m	Min. length in m using Slimflex for F1 & F2	Max. length in m using Slimflex for F1 & F2
		H = $103 - (F1 + F2 + C2) * 1.5$		H = $103 - (F1 + F2) * 2.5 - C2 * 1.5$	
H	Horizontal Permanent Link	5	83.5°	5	73.5**
C2	Consolidation Point cable	3	20*	3	20*
F1 & F2	Patch cord	0.5	5	0.5	5
Examples		Using short and long CP	Using short and long CP	Using slimflex Patch cords with short and long CP	Using slimflex Patch cords with short and long CP
H+C2+F1+F2	Length for 3 Connector Channel with Short CP	$5+3+0.5+0.5 = \mathbf{9m}$	$83.5+3+5+5 = \mathbf{96.5m}$	$5+3+0.5+0.5 = \mathbf{9m}$	$83.5+3+3+3 = \mathbf{92.5m}$
H+C2+F1+F2	Length for 3 Connector Channel with Long CP	$5+20*+0.5+0.5 = \mathbf{26m}$	$58+20*+5+5 = \mathbf{88m}$	$5+20*+0.5+0.5 = \mathbf{26m}$	$58+20*+3+3 = \mathbf{84m}$

° Calculation based on 5 m F1&F2 cords to maintain maximum flexibility on choice of patch cord length for user and patch area

* Informative maximum length

** 5 m cords used in calculation, Horizontal cable can be 83.5m if Slimflex cordage is reduced to 6m total length



4.4 4 Connector Channel using a Cross Connect and Consolidation Point

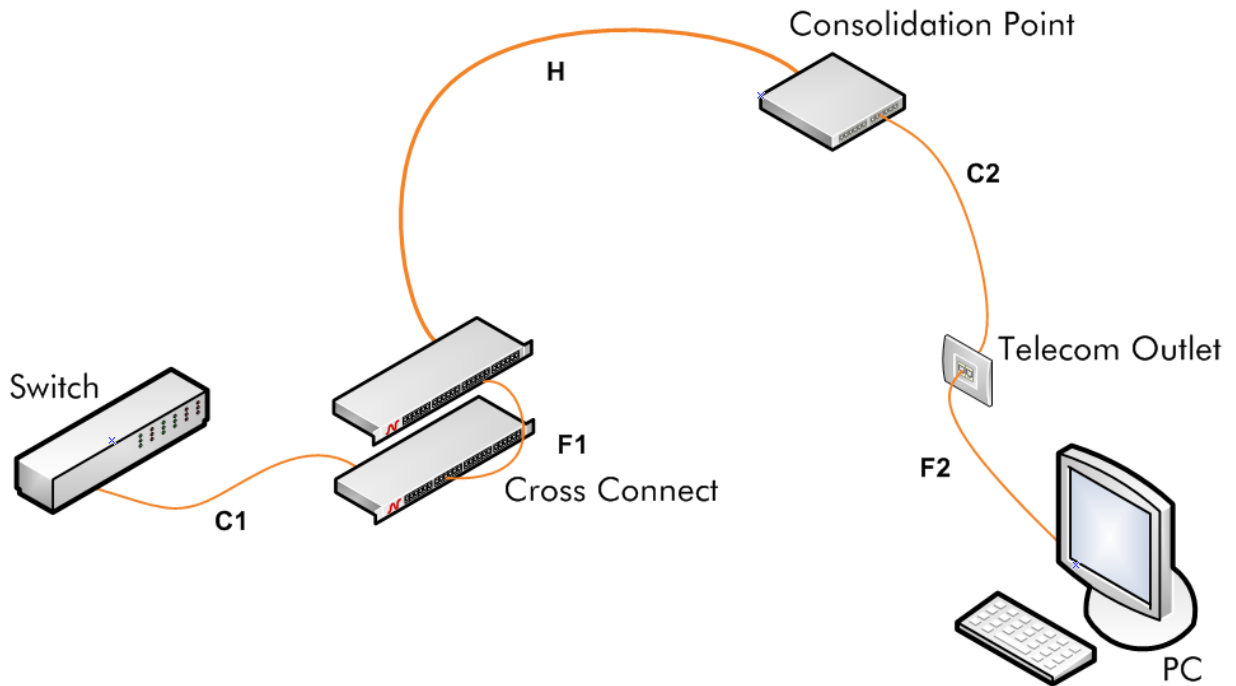


Figure 12d

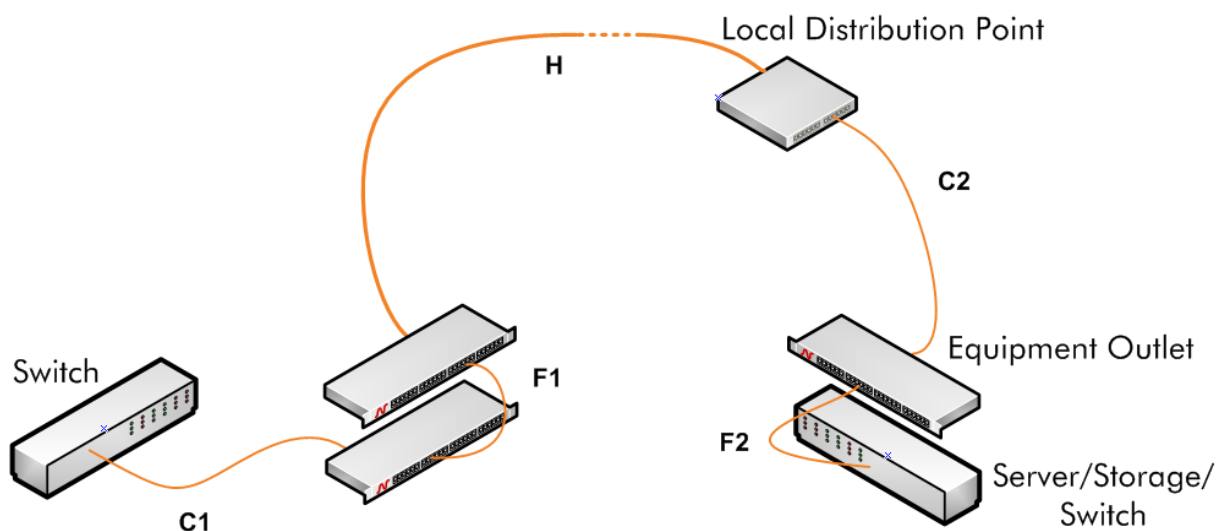
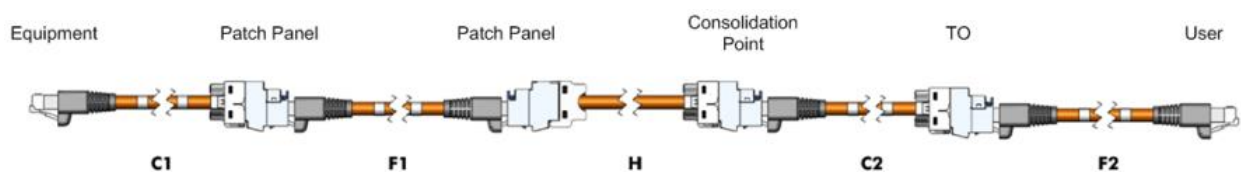


Figure 12d-bis (Datacentre)

Table 7 - 4 Connector Channel Length Specifications

	Description	Minimum Length in m	Maximum Length in m	Min. length in m using Slimflex for F1 & F2	Max. length in m using Slimflex for F1 & F2
		$H = 102 - (F1 + F2 + C1 + C2) * 1.5$		$H = 102 - (F1 + F2) * 2.5 - (C1 + C2) * 1.5$	
H	Horizontal Permanent Link	5	78°	5	68**
C1	Service Presentation - Cross Connect	3	20*	3	20*
C2	Consolidation Point cable	3	20*	3	20*
F1 & F2	Patch cord	0.5	5	0.5	5
Examples		Using short and long CC and CP	Using short and long CC and CP	Using Slimflex Patch cords with short and long CC and CP	Using Slimflex Patch cords with short and long CC and CP
H+C1+C2+F1+F2	Length for 3 Connector Channel with Short CC	$5+3+3+0.5+0.5 = 12\text{m}$	$78+3+3+5+5 = 94\text{m}$	$5+3+3+0.5+0.5 = 12\text{m}$	$78+3+3+3+3 = 87\text{m}$
H+C1+C2+F1+F2	Length for 3 Connector Channel with Long CC	$5+20^*+20^*+0.5+0.5 = 46\text{m}$	$27+20^*+20^*+5+5 = 77\text{m}$	$5+20^*+20^*+0.5+0.5 = 46\text{m}$	$27+20^*+20^*+3+3 = 73\text{m}$
° Calculation based on 5 m F1&F2 cords to maintain maximum flexibility on choice of patch cord length for user and patch area * Informative maximum length ** Horizontal cable can be 78m if Slimflex cordage is reduced to 6m total length					



4.5 Modular Plug Terminated Link

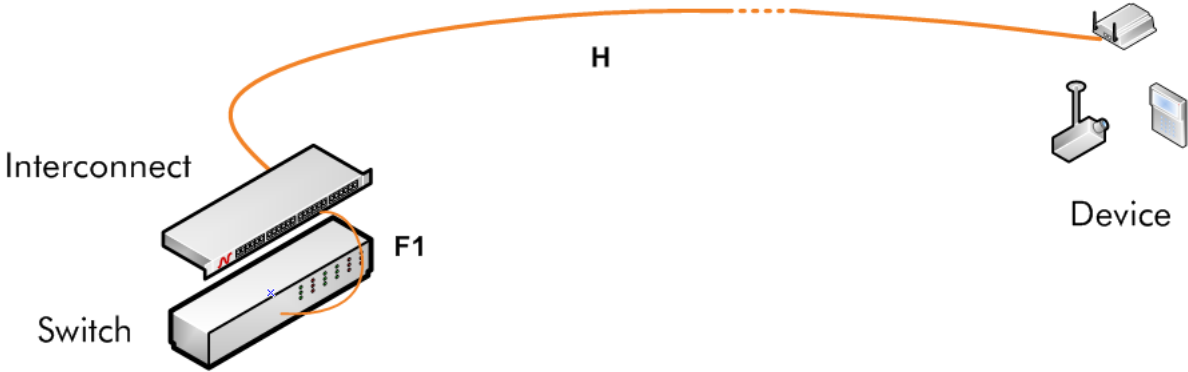
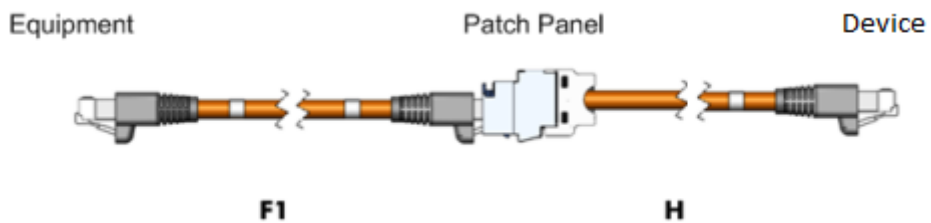


Figure 13

Table 8 - 1 Connector Channel Length Specifications

	Description	Minimum length in m	Maximum length in m	Minimum length in m using Slimflex	Maximum length in m using Slimflex
H	Horizontal Permanent Link	5	90	5	90
F1	Patch cord	0.3	5	0.5	5
H+F1	Total channel length	5 + 0.3 = 5.3m	90 + 5 = 95m	5 + 0.5 = 5.5m	90 + 5 = 95m





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