

INSTALLATION GUIDE

LCS³ PoE INFRASTRUCTURE



THE GLOBAL SPECIALIST
IN ELECTRICAL AND DIGITAL BUILDING INFRASTRUCTURES



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PREAMBLE

THE INTERNATIONAL INSTALLATION STANDARD ISO/IEC 14763-2 IMPOSES CONSIDERATION OF POE FOR ANY NEW INSTALLATION

- It defines three Categories:

Category	i_c - average	i_c	Controls required during	
			Attachment of remote powering	Planning of subsequent cabling installation
RP1	≤ 212 mA	≤ 500 mA	Yes	Yes
RP2	> 212 mA < 500 mA	≤ 500 mA	Yes	Yes
RP3	≤ 212 mA	≤ 500 mA	No	Yes

Table 1: International installation standard ISO/IEC 14763-2

THE INFRASTRUCTURE MUST BE OF TYPE RP3 TO COMPLY TO RESIDENTIAL, COMMERCIAL AND INDUSTRIAL ENVIRONMENTS

“For installation of cabling in accordance with ISO/IEC 11801-2, ISO/IEC 11801-3, ISO/IEC 11801-4 and ISO/IEC 11801-6, the planning, installation and administration requirements of Category RP3 shall be applied.”

This means that it allows the maximum PoE (Type 4 90w) on 100% of the links without overheating and without disrupting the Ethernet signal.

In order to achieve the RP3 category, multiple heat calculations must be made considering the environment temperature, types of cables, type of cable management, the number of cables per bundles, shape of the bundles and separation of the bundles. This is then used to calculate the maximum achievable distance of the channels at the estimated cable temperature.

Legrand has made this guide for simplified installation conditions by making some assumptions. Following this guide provides guaranteed distances and compliance to RP3 Category.

As a reminder, all PoE assumption and calculations must be documented (This PoE guide if used as the reference document) and kept in the technical specifications for reference in future additions to the cabling.

DEFINITIONS

CORD DEFINITIONS

■ Equipment cord

A cord used between a patch panel and an active equipment.

■ Patch Cord

A cord used between two patch panels.

■ Work Area cord

A cord used between an outlet and an end-device.

■ TR cord(s)

Cords in the Telecom Room. This can be a patch cord, an equipment cord, or both.

■ Area cabling cord

Cords, either dual ended or single ended, of distance up to 20m part of the LCS³ offer for the use of the area cabling box. In LCS³ catalogs, the Area Cabling Cord are clearly identified for this use. These can be stranded or solid 24 to 26 AWG.

■ Consolidation Point cord (or CP cord)

Area cabling cord used as the permanent link section between the consolidation point and the outlet.

SHIELDED / UNSHIELDED DEFINITIONS

■ Unshielded

solutions using U/UTP cables.

■ Shielded

solutions using SF/FTP, S/FTP, F/FTP, F/UTP or U/FTP cables.

IEEE POE STANDARDS

TABLE OF POE EQUIPMENT PERFORMANCE

PoE Power Over Ethernet Simplify technical sheet	802.3bt							
	Type 3					Type 4		
	802.3at				PoE ⁺ Third Party certified		PoE ⁺ Third Party certified	
	802.3af PoE ⁺ Third Party certified		Type 1					
Classe of (Power Sourcing Equipment - PSE)	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8
Max Power at PSE	4 W	7 W	15.4 W	30 W	45 W	60 W	75 W	90 W
Minimum Power at PoE Device	3.84 W	6.49 W	13 W	25.5 W	40 W	51 W	62 W	71.3 W
Number of pairs used	over 2 pairs		over 2 or 4 pairs		over 4 pairs			

Table 2: PoE Equipment Performance

THE LEGRAND POE GUIDELINES

Under specified conditions, LCS³ cabling systems Class E (Cat.6) and Class EA (Cat.6_A) will comply to the RP3 requirements of the ISO/IEC 14763-2 (as well as EN 50174-2) and therefore ensure both Ethernet and PoE on 100% of the links installed. Class D (Cat.5) is excluded from the PoE guidelines as it is not recognized for commercial building cabling in ISO 11801-2.

SINGLE ARCHITECTURE PER SITE

For administration reasons, a single site may only have one type of PoE architecture within the following list:

■ VERSION 1:

No cross-connect allowed, with equipment cord maximum 5m (Standard compliant cord lengths)

■ VERSION 2:

No cross-connect allowed, with equipment cord maximum 2m (Optimized distance)

■ VERSION 3:

Cross-connect allowed, with TR cords maximum 5m (Standard compliant cord lengths)

SIMPLIFIED PERFORMANCE CALCULATION

In order to simplify the calculations and to be certain that the infrastructure complies to RP3 requirements, Legrand defines simple rules in terms of environment temperature, types of bundles, architecture and distances. The table below is a summary of the simple rules. More complete information is found in the rest of the document.

Temperature	OFFICE SPACE with PVC trunking or other closed containment		28° C Max		
	CABLE MANAGEMENT SPACES, including technical room, IT cabinets, plenum		30° C Max		
Bundle	Bundle contain maximum 24 cables or 12 zone cords				
	Bundle limits per type of containment are respected				
Distance	Maximum distances compliant to the architecture are verified during testing	VERSION 1 No cross-connect Optimizing cord lengths	PL	Work area Cord	Equipment Cord
			Shielded	85 m	5 m
		Unshielded	80 m	5 m	5 m
		VERSION 2 No cross-connect Optimizing Max links distances	PL	Work area Cord	Equipment Cord
			Shielded	90 m	5 m
		Unshielded	85 m	5 m	2 m
		VERSION 3 With cross-connect Standard compliant cord lengths	PL	Work area Cord	TR cords
			Shielded	84 m	5 m
Unshielded	79 m	5 m	5 m		
Others	Specific zone cabling distances are respected				
Specific outdoor conditions are respected					
Specific PoE Identification is respected					

Table 3: Simplified performance calculation

DISTANCES WITHOUT CROSS-CONNECT

When the conditions of this guideline are ensured, the following distances are ensured on LCS³ cabling.

■ **Diagram of a 2-connector channel (without cross-connect)**

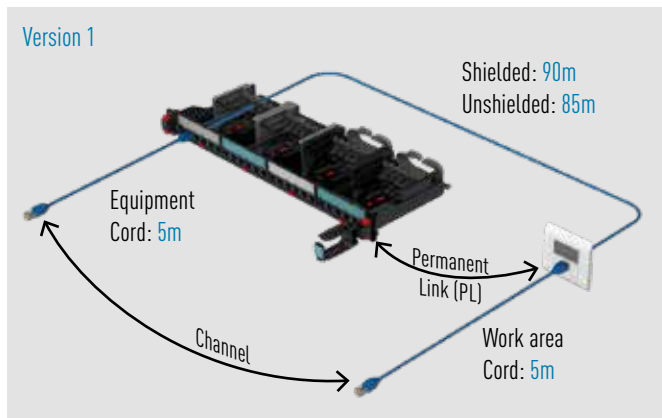


Figure 1: 2-connectors channel (without cross-connect), version 1

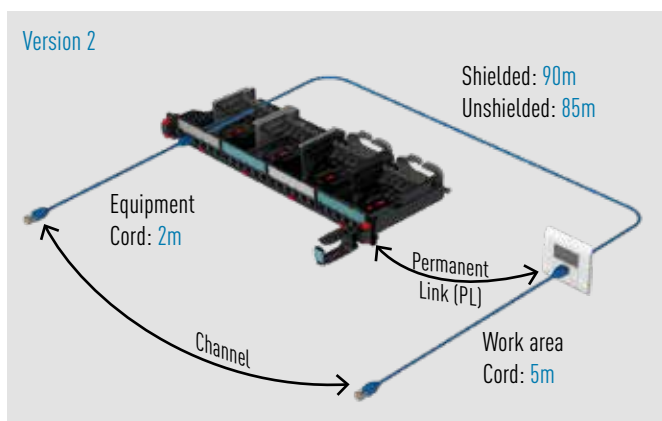


Figure 2: 2-connectors channel (without cross-connect), version 2

VERSION 1 – STANDARD COMPLIANT CORD LENGTH

The objective is to maintain the 5m limit on the cords, resulting in a shorter Permanent Link.

	PL	Work area Cord	Equipment Cord
Shielded	85 m	5 m	5 m
Unshielded	80 m	5 m	5 m

Table 4: Standard compliant cord length distance

VERSION 2 – OPTIMIZED DISTANCE

The objective is to obtain the maximum Permanent Link distance, resulting in the use of shorter cords.

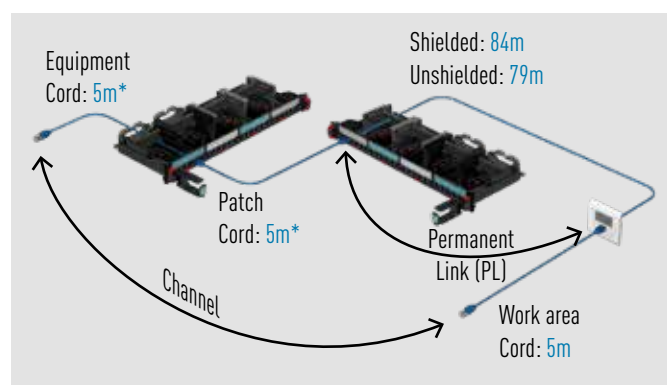
	PL	Work area Cord	Equipment Cord
Shielded	90 m	5 m	2 m
Unshielded	85 m	5 m	2 m

Table 5: Optimized distance

DISTANCES WITH CROSS-CONNECT

When the conditions of this guideline are ensured, the following distances are ensured on LCS³ cabling.

■ **Diagram of a 3-connector channel (with cross-connect)**



* 5m for combined patch and equipment cord. Not for each.

Figure 3: 3-connector channel (with cross-connect)

VERSION 3 – STANDARD COMPLIANT CORD LENGTH WITH CROSS-CONNECT

A cross connect rather than interconnect may be used with LCS³ solutions under PoE. Below is the diagram of the cross-connect.

In this configuration, the maximum distances are as follows:

	PL	Work area Cord	TR Cords (Equipment Cord + Patch Cord)
Shielded	84 m	5 m	5 m
Unshielded	79 m	5 m	5 m

Table 6: Standard compliant cord length with cross-connect distance

OPTIMIZED DISTANCE WITH CROSS-CONNECT

A solution with cross-connect and optimized cable length is impractical and is not proposed.

CONDITIONS

ENVIRONMENT

The temperature of the environment is assumed as follows:

- Maximum 28 °C in workspace where closed containment such as PVC trunking is used.
- Maximum 30°C in all other cable management spaces, including technical room, IT cabinets, false ceiling (plenum).

CORDS

The cords cannot be bundled together (see photo)

They must remain loose allowing the heat to evacuate. Care must be taken to allow sufficient patch cord management.

Note: High density cords with AWG28 are excluded.



CABLES

Conditions for the permanent or semi-permanent cabling are as follows:

- The cables can be in bundles of maximum **24 cables**.
- Area cabling cords can be in bundles of maximum **12 cables**.
- The bundles of cables **do not require any separation thanks to our Legrand simplification** of the installation conditions.
- Below, a table of maximum number of bundles allowed per type of cable tray, organized in **1 layer**:

SINGLE LAYER



Single layer	Open (E/F)*	Non-Perforated tray (C)*	Closed Tray (B)*
Cat.6 UTP	6	2	1
Cat.6 shielded	6	4	1
Cat.6 _A UTP	10	5	1
Cat.6 _A shielded	10	6	1

* According to IEC 60364-5-52

Table 7: Number of bundles allowed per type of cable tray (1 layer)

- Below is a table of maximum number of bundles allowed per type of cable tray, organized in 2 layers:

DUAL LAYER



Dual layer	Open (E/F)*	Non-Perforated tray (C)*
Cat.6 UTP	4	Not allowed
Cat.6 shielded	4	Not allowed
Cat.6 _A UTP	6	4
Cat.6 _A shielded	8	4

* According to IEC 60364-5-52

Table 8: Number of bundles allowed per type of cable tray (2 layers)

■ **Example:**

A non-perforated tray can carry 4 bundles of Cat.6_A shielded cabling, each bundle having max 24 cables or max 12 area cabling cords.

- 3 layers of bundles is not possible for PoE compliant installations defined in Legrand PoE guide.
- To allow a higher number of bundles than shown above, then a minimum separation of 20mm must be ensured between the bundle groups for one layer configuration, and 50mm for dual layer configuration.
- Non-bundled cables should be considered as multiple bundles. Up to 7 stacked cables is single bundle height, up to 14 stacked cables is dual bundle. (half for area cabling cords)



WALL PENETRATIONS

Fire rated wall penetrations generally combine multiple bundles together.

There is no limit on bundle size if these cables are together for no more than 1m distance for wall penetrations.

WORKSPACE - CABLES IN CLOSED CONTAINMENT

- **Cables Cat.6:**
maximum 24 cables in all containments.
- **Cables Cat.6_A:**
maximum 36 cables in all containments.
- **Area cabling cords Cat.6 or Cat.6_A:**
maximum 12 cords in all containments.



Note: Use of multiple compartments does not increase the cable capacity as it does not lower the heat.

AREA CABLING BOX - DISTANCES

The Legrand area cabling box and associated cords can be used in 2 configurations: Consolidation point and MUTOA*. The area cabling cords, used either as CP cable or as user cord, have higher attenuation than cable, and therefore have different conditions: Only for CP use: if the CP cord is made of the same solid conductor cable as the CP link, and terminated with a field installable plug, then the distance below do not apply. (See chapter FIELD TERMINATED PLUG).

VERSION 1 - AREA CABLING BOX WITHOUT CROSS-CONNECT AND STANDARD COMPLIANT CORD LENGTHS

This option is not proposed for use of area cabling options for ease of administration reasons.

VERSION 2 - AREA CABLING BOX WITHOUT CROSS-CONNECT AND OPTIMIZED DISTANCE

If the objective is to optimize the channel length, then the distance limits below can be used.

- **The conditions are:**
 - Only interconnect is allowed
 - The equipment cord is maximum 2m

■ The two options are:

- Use of the area cabling cord in a channel with a Consolidation Point:
- Use of the area cabling cord in a channel with a MUTOA (Multi-User Telecommunications Outlet Assembly)

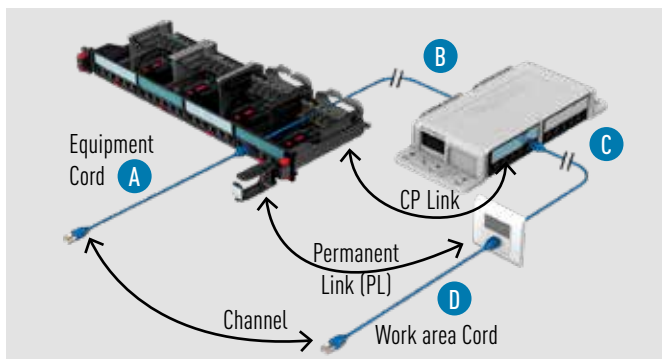


Figure 6: Area cabling cord in a channel with a CP

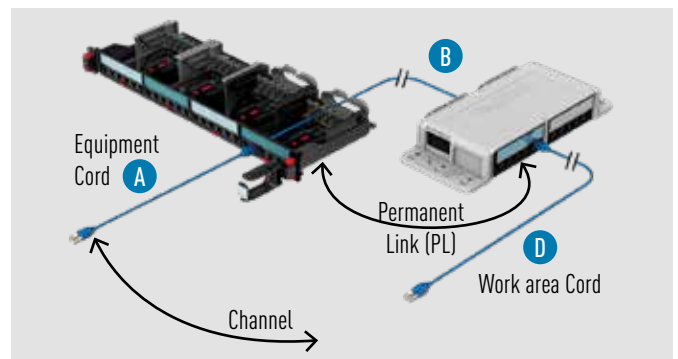


Figure 5: Area cabling cord in a channel with a MUTOA*

	CP Cord (C)	CP Link (B)	Equipment Cord (A)	Work Area Cord (D)	Total Channel
Shielded Systems	8 m	75 m	2 m	5 m	90 m
	15 m	64 m	2 m	5 m	86 m
	20 m	57 m	2 m	5 m	84 m
Unshielded Systems	8 m	70 m	2 m	5 m	85 m
	15 m	60 m	2 m	5 m	82 m
	20 m	52 m	2 m	5 m	79 m

Table 9: Standard compliant cord lengths

	Work Area Cord (D)	PL (B)	Equipment Cord (A)	Total Channel
Shielded Systems	8 m	83 m	2 m	93 m
	15 m	73 m	2 m	90 m
	20 m	65 m	2 m	87 m
Unshielded Systems	8 m	79 m	2 m	89 m
	15 m	69 m	2 m	86 m
	20 m	61 m	2 m	83 m

Table 10: Optimized distance

VERSION 3 - AREA CABLING BOX WITH CROSS-CONNECT AND STANDARD COMPLIANT CORD LENGTH

To allow all standard compliant configurations, then the distance limits show below should be followed. Both cross connect and interconnect are allowed.

- Use of the area cabling cord in a channel with a Consolidation Point:

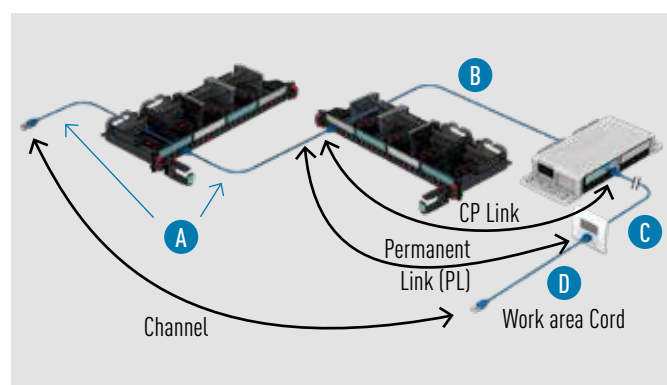


Figure 7: Area cabling cord in a channel with a CP

- Use of the area cabling cord in a channel with a MUTOA*

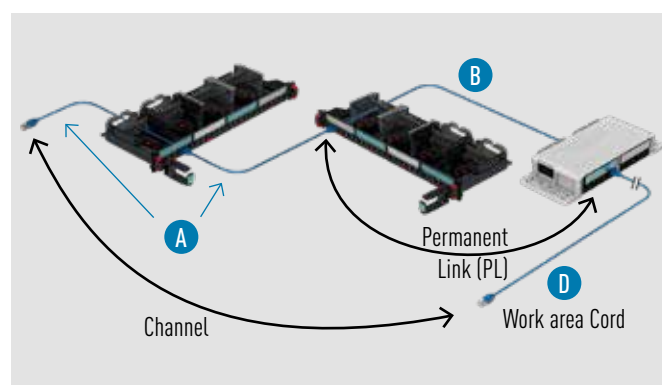


Figure 8: Area cabling cord in a channel with a MUTOA*

	CP Cord (C)	CP Link (B)	TR Cords (A)	Work Area Cord (D)	Total Channel
Shielded Systems	8 m	69 m	5 m	5 m	87 m
	15 m	59 m	5 m	5 m	84 m
	20 m	51 m	5 m	5 m	81 m
Unshielded Systems	8 m	65 m	5 m	5 m	83 m
	15 m	54 m	5 m	5 m	79 m
	20 m	47 m	5 m	5 m	77 m

Table 11: Standard compliant cord length (Consolidation Point)

	CP Cord (D)	PL (B)	TR Cords (A)	Total Channel
Shielded Systems	8 m	78 m	5 m	91 m
	15 m	67 m	5 m	87 m
	20 m	60 m	5 m	85 m
Unshielded Systems	8 m	74 m	5 m	87 m
	15 m	63 m	5 m	83 m
	20 m	56 m	5 m	81 m

Table 12: Compliant cord length (Multi-User Telecommunications Outlet Assembly)

*MUTOA (Multi-User Telecommunications Outlet Assembly)

ALTERNATIVE CONFIGURATIONS

For any installation not compatible with this guideline, the conditions of ISO/IEC 14763-2 or EN 50174-2 should be met and Legrand Technical Support can be contacted for assistance.

SPECIAL CASES

INSTALLATION OF CABLES OUTDOOR

For use of cable in outdoor environment, the conditions are as follows:

- Cable must be rated for outdoor use.
- Outdoor temperature is maximum 45°C.
- No direct sunlight on the cable.
- Bundles of maximum 6 cables, outdoor and indoor.
- Work area cord is maximum 2m.

FIELD TERMINATED PLUG

- The use of a field terminated plug on a cable at the end of a link, also called MPTL, does not affect the distances of permanent link and channel even though the work area cord is absent from the channel.

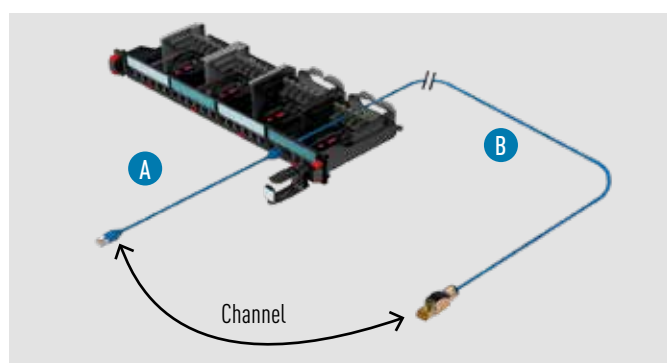


Figure 14: Diagram of CP without cross-connect, in Versions 1 and 2

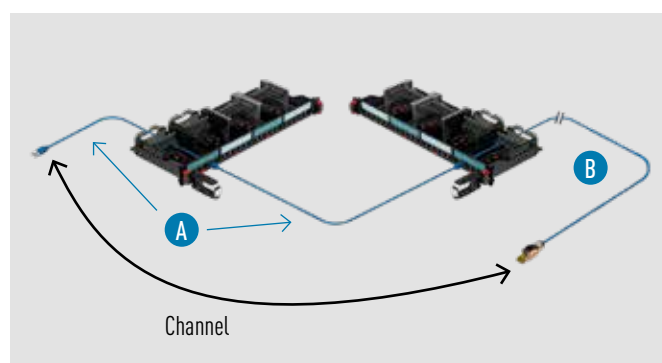


Figure 15: Diagram of CP with cross-connect, in Version 3

		MPTL (B)	Equipment cord (A)
Version 1 No cross Connect Optimizing cord lengths	Shielded	85 m	5 m
	Unshielded	80 m	5 m
Version 2 No cross Connect Optimizing distances	Shielded	90 m	2 m
	Unshielded	85 m	2 m
Version 3 With Cross Connect Standard compliant cord lengths	Shielded	84 m	5 m
	Unshielded	79 m	5 m

Table 13: Modular Plug Terminated Link (MPTL)

- The use of a field terminated plug to create CP Cord between the Zone Cabling box and the outlet is possible if the cable is the same as the cable for the CP link. In this case, the distances showed in the tables for the Consolidation Point do not apply. Instead the distance in the table below apply:

		CP Link (B) + CP Cord (C) combined	Work Area Cord (D)	Equipment cord (A)
Version 1	Shielded	84 m	5 m	5 m
	Unshielded	79 m	5 m	5 m
		CP Link (B) + CP Cord (C) combined	Work Area Cord (D)	Equipment cord (A)
Version 2	Shielded	89 m	5 m	2 m
	Unshielded	84 m	5 m	2 m
		CP Link (B) + CP Cord (C) combined	Work Area Cord (D)	Equipment cord + Patch Cord (A)
Version 3	Shielded	83 m	5 m	5 m
	Unshielded	78 m	5 m	5 m

Table 14: Distances of CP links using field terminated plugs

CABLE EXTENDER

- The cable extender can be used as a splice between indoor and outdoor cables or as a single port CP. See table 15 below for applicable distances.



Figure 13: Cable extender

		Indoor (B) + outdoor (C) cables combined	Work Area Cord (D)	Equipment cord (A)
Version 1	Shielded	84 m	5 m	5 m
	Unshielded	79 m	5 m	5 m
Version 2	Shielded	89 m	5 m	2 m
	Unshielded	84 m	5 m	2 m
Version 3	Shielded	83 m	5 m	5 m
	Unshielded	78 m	5 m	5 m

Table 15: Cable extender distances

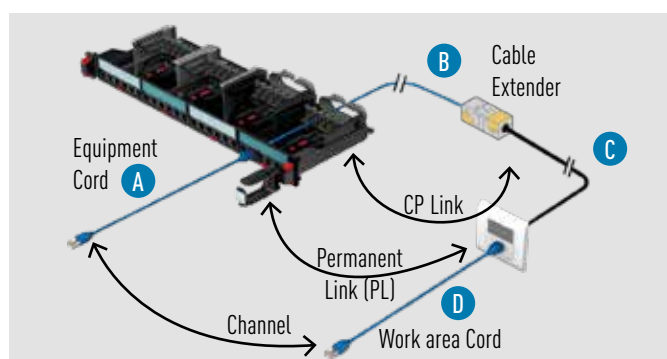


Figure 14: Diagram of CP without cross-connect, in Versions 1 and 2

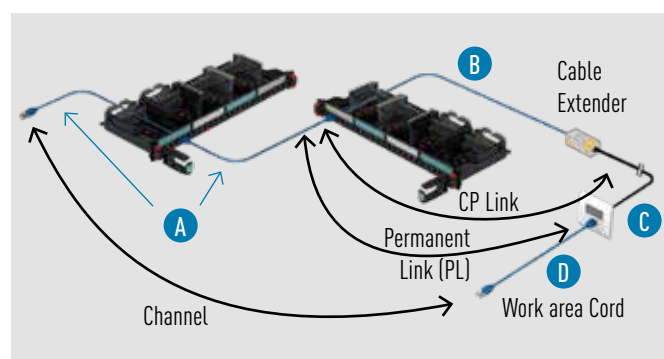


Figure 15: Diagram of CP with cross-connect, in Version 3

IDENTIFICATION & DOCUMENTATION

PoE limits must be clearly identified for administration purposes. The following items must be labeled and documented in the technical report:

- Patching area, if cords are limited to 2m: labels and documentation with maximum cord length allowed.
- Consolidation points: labels and documentation with maximum CP cord length allowed.
- MUTOAs: labels and documentation with maximum user cord length allowed.

MOVES, ADD AND CHANGES

Any future change on the infrastructure, as defined in ISO/IEC 14763-2, must consider the initial conditions defined to ensure that the Category RP3 is maintained. The process is the following:

- Definition of the needs of the moves, adds and changes,
- Consideration of the current conditions for category RP3
- Evaluation of consequences the changes to these conditions
- Assurance that the complete installation will still comply to category RP3.

If any doubt exists on the compliance after installation, Legrand customer service can be contacted.



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