Extended Distance Guide

End-to-End cabling systems from design to testing

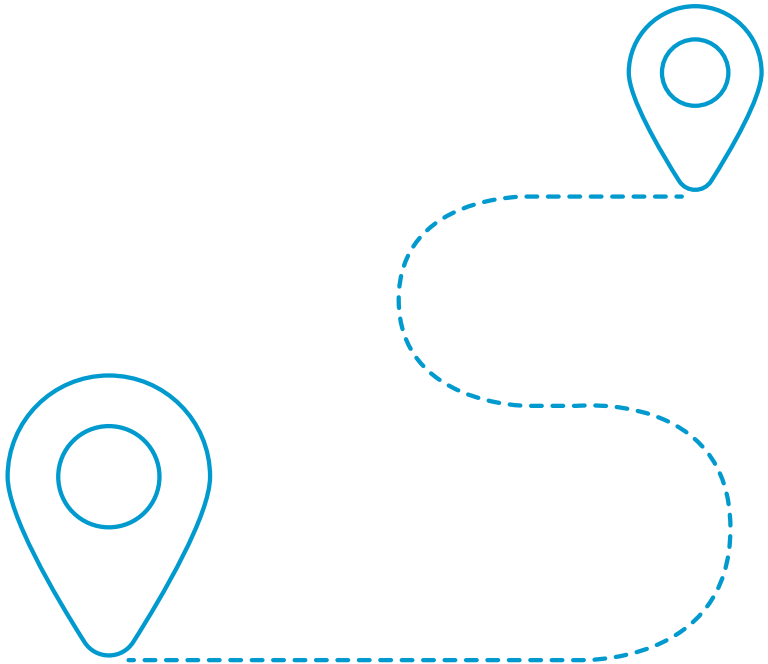
ATLAS-X1™ SST
PARADIGM™

Contents

Introduction to Extended Distances

The ISO/IEC and TIA standards bodies have long established common design principles for copper structured cabling systems. One of the core principles is that the maximum horizontal cabling channel can be no longer than 100 meters. Defining the maximum channel length has enabled active equipment manufacturers to design transmission equipment based on a known worst-case performance scenario. This in turn ensures predictable electrical performance of transmission media, allowing interoperability and interchangeability of standards compliant components within the channel.

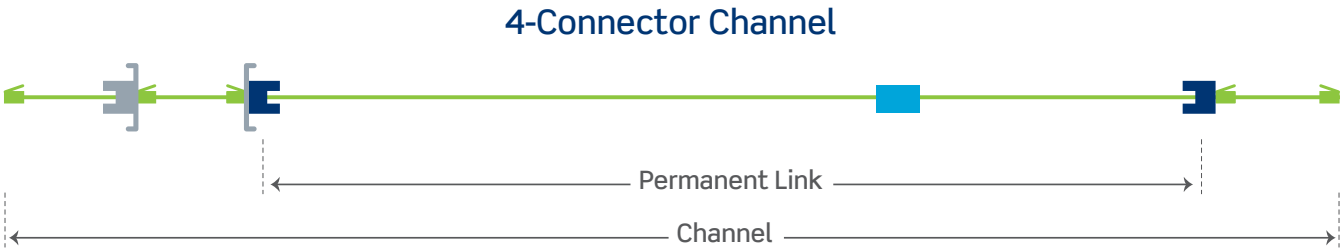
Organizations are increasingly deploying IoT devices such as occupancy sensors, smart thermostats, and air quality monitors, often located over 100 meters from the telecommunications room (TR). Additionally, IP security cameras and Wi-Fi access points are frequently installed in distant outdoor areas without AC power. The expansion and standardization of these IoT systems, with their unique power and data requirements, are pushing the limits of typical copper structured cabling systems. Overextending cable reach can result in high error rates and poor performance, while building additional TRs is often impractical due to time, effort, and cost. Therefore, organizations are seeking ways to extend cabling systems beyond 100 meters without compromising performance and quality.



Cabling Standards

- ANSI/TIA 568.1
- ISO/IEC 11801
- EN 50173-1

TIA and ISO structured cabling standards specify a 90 m maximum Permanent Link (PL) and 100 m maximum channel length with up to 4-connectors including patch cords, up to a total of 10 m. Channels going beyond these limits are what we refer to as extended distance channels. When installing channels of 100 m or less, the installation practices outlined in ANSI/ TIA-568.2, ANSI/TIA-569, or ISO 11801, and the BICSI TDMM Manual must be followed.

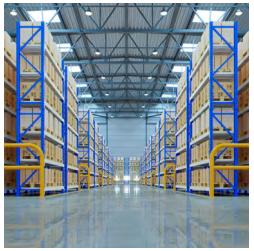


Common Applications

There are a few scenarios where the 100 m limitation can become problematic or become expensive to comply with. In these scenarios, it is desirable to implement stable, high-performance channels that extend beyond the 100 m limit.

Such scenarios include:

Outdoor or campus locations



Large spaces

- Warehouses
- Distribution Centers
- Sports Facilities

Industrial facilities

"That one...."

- Camera
- Access Control Station
- Wireless Access Point

Operational Technology / Intelligent Building Controls

Successful extension of channels beyond 100 m is achievable with the right structured cabling products and thoughtful implementation.

Key Considerations

When going beyond the 100 m standard, key points to consider include:

- Make certain the products specified have been throughly tested by the manufacturer and are backed by a warranty to achieve the expected performance.
- Ensuring that the specified extended distances apply for all of your required channel topologies, not just plug to plug.
- Ensuring that the extended distance performance that you require is specified over a real-world operating temperature range and not just at room temperature.
- Can your extended distance system meet category rated industry standards for 100 m channels as well as support extended distance applications in real world environments? One system for different applications.

The Leviton ATLAS-X1™ SST MILLENNIUM™ and PARADIGM™ systems have been designed to assure the highest level of performance and reliability in these extended distance scenarios.

Real World Performance Verification

For more than 30 years, Leviton has offered high-quality network connectivity that's built to last and backed by an industry-leading warranty. We are able to stand behind our products because of rigorous internal testing that ensures our products and systems meet – and often exceed – performance standards from IEEE, TIA, and ISO. This happens inside Leviton's System Verification Lab (SVL), which plays an important role in ensuring cabling systems quality and performance and verifying adherence to standards.

Systems are tested in "worst case" scenarios, so customers know their system will perform as expected in data center and enterprise environments. Testing is performed in Leviton US and UK facilities, using state-of-the-art testers and advanced custom equipment designed in-house. The SVL is made up of engineers and technicians who perform electrical, mechanical, materials, environmental, and quality testing. These experts have decades of experience, and many are active members in standards organizations like IEEE, TIA, and ISO – the groups that define next generation fiber optic and copper networks.

Leviton's SVL invested thousands of hours putting ATLAS-X1™ SST MILLENNIUM™ and PARADIGM™ systems through their paces with rigorous testing, including both thermal cycling and bit error rate testing. As a result of this extensive testing, customers can rely on Leviton to support their mission critical applications in real-world conditions. Our extensive knowledge and experience in this area allows us to offer the best extended distance performance in the industry for category-rated twisted-pair systems. And all of it is backed by our Application Assurance Warranty.

The SVL emblem signifies that verification was performed by Leviton expert engineers and technicians who follow a rigorous testing process. This ensures cabling systems adhere to quality and performance standards in real-world network environments across the globe.

Installation of the ATLAS-X1™ SST System

Extended Application and PoE Distances

PLENUM, RISER, OUTDOOR, CPR	IEEE 802.3 PoE				
	Data Only	Type 1 (15.4 W)	Type 2 (30 W)	Type 3 (60 W)	Type 4 (100 W)
10BASE-T	200 m (656 ft)		140 m (459 ft)		
100BASE-TX	155 m (509 ft)				
1000BASE-T					
2.5GBASE-T	140 m (459 ft)				
5GBASE-T	110 m (361 ft)				
10GBASE-T	100 m (328 ft)				

Table 1

When planning extended distance links, the Ethernet speed and PoE level must be considered. Most security cameras and IoT devices require 10 or 100 Mbps data rates, but their PoE levels vary considerably depending on options such as heater, blowers, PTZ, etc... Most WAPs should have at least 1 Gbps data rates and 30 W of PoE or less. Future device upgrades should be considered so that the structured cabling will support multiple generations of active equipment. The ATLAS-X1 SST system includes both indoor and outdoor rated cables that can be combined in any combination to create the necessary topology. Indoor rated cables are available in flame ratings that can be installed anywhere in the world. This allows for links to travel through diverse environments on individual sites, and be specified globally for locations anywhere.

Application Assurance Terms and Conditions:

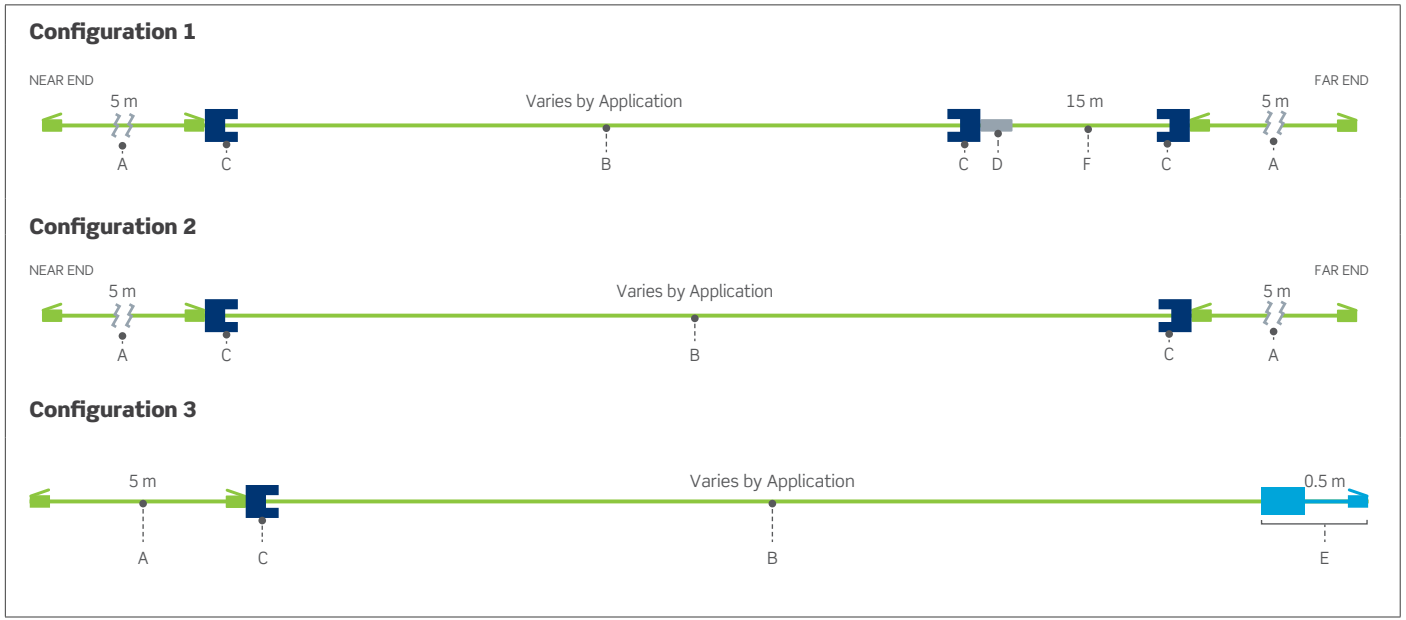
- All active equipment must comply with IEEE 802.3 standards throughout duration of operation and be configured to allow link segments that significantly exceed 100 meters to operate.
- All cable and components must be installed in accordance with industry best practices and Leviton's Certified Integrator must perform the installation that will be submitted for warranty.
- Temperature of cabling throughout all segments does not exceed 60 degrees Celsius.
- Channels that exceed 100 meters become application specific and must be operated in full duplex mode.
- Supplies the passive cabling system performance required for stated IEEE application speeds and PoE power delivery when tested to Leviton specific custom limits (Network equipment excluded).
- Leviton's special 25-year application assurance warranty will cover extended distance as per configurations outlined in the MILLENNIUM™ ATLAS-X1 SST System Data Sheet. Leviton application assurance terms and conditions apply.
- Twisted-pair Ethernet applications at link segments longer than 100 meters in length are not standards compliant and therefore there is no guaranteed interoperability or functionality with other components or equipment even if they are standards compliant.

Notes:

1. Extended distances listed in Table 1 are backed by Leviton's 25-year Applications Assurance Warranty when tested to Leviton specified test limits.
2. As active equipment ages, extended distance reach may be reduced.
3. By default, some switches may disable ports if the link is detected to be significantly longer than 100 meters.
4. Extended distance performance requires Leviton modular patch panels and ATLAS-X1™ unshielded 6A jacks only and does not apply to channels with punch-down panels. Actual application performance will vary depending on the switch manufacturer, part number, software, firmware and configuration.
5. The use of 28 AWG patch cords in a modular plug terminated link (MPTL) or channel will void the extended distance application assurance warranty.
6. Any moves, adds, or changes to the channel will require re-testing for warranty coverage to apply.
7. Contact Leviton Application Engineering (US: contractorprograms@leviton.com or EMEA: appeng.eu@leviton.com) to acquire specific test limits and testing procedure.

Installation of the ATLAS-X1™ SST System

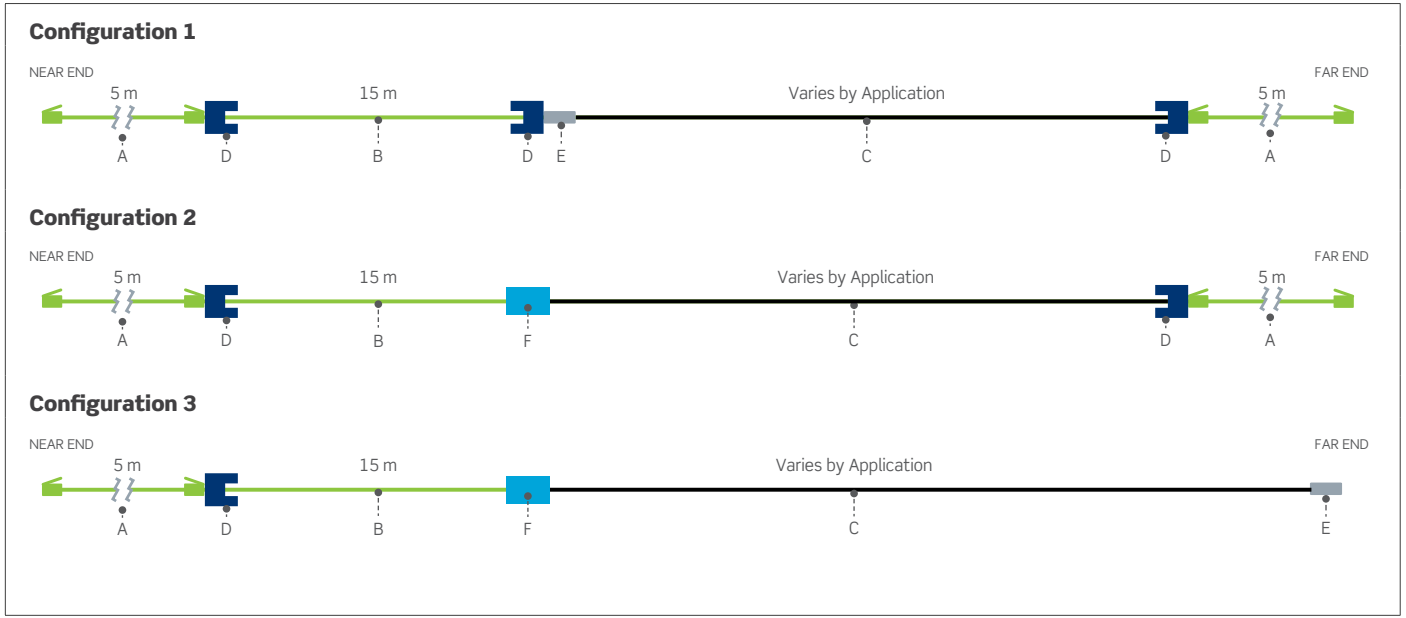
Indoor Configurations



A: Region-Appropriate Cat 6A Cord (6AS10 or AC6PCF)
B: Indoor-rated SST Cable
C: ATLAS-X1™ 6AUJK Cat 6A Jack
D: 6A Universal Tool-Free Plug
E: VXC Assembly
F: IndoorSST Cable or Cat 6A LSZH CP Cord

Installation of the ATLAS-X1™ SST System

Outdoor Configurations*



Indoor cable
Outdoor cable

A: Region-Appropriate Cat 6A Cord (6AS10 or AC6PCF)
B: Indoor-rated SST Cable
C: SST Outdoor Cable
D: ATLAS-X1™ 6AUJK Cat 6A Jack
E: 6A Universal Tool-Free Plug
F: VXC Coupler or Consolidation Point

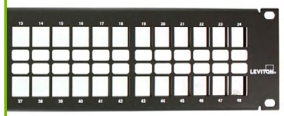
* VXC, Consolidation Point, Jack, patch cords and plugs must be housed and protected from the outside environment.

ATLAS-X1™ SST System Components by Region

ATLAS-X1™ Jack

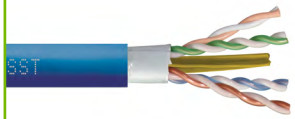
Global

QUICKPORT™ Modular Patch Panel



Global

SST Cable



Global

Cat 6A Standard CMR Patch Cords

North America

Cat 6A Standard LSZH Patch Cords

Europe, Middle East, APAC and Latin America

Cat 6A LSZH CP Cords

Europe, Middle East, APAC

VXC Coupler

Global

Consolidation Point

Global

Cat 6A Tool-Free Plug

Global

Installation of the PARADIGM™ System

Extended Application and PoE Distances

Max Supported Distances	PARADIGM with Stadion Cable				
	Data Only (m)	Type 1 (15.4 W)	Type 2 (30 W)	Type 3 (60 W)	Type 4 (100 W)
10BASE-T	275 m (902 ft)		200 m (656 ft)		
100BASE-TX	200 m (656 ft)				
1000BASE-T					
2.5GBASE-T	165 m (541 ft)				

Table 2

Application Assurance Terms and Conditions:

- All active equipment must comply with IEEE 802.3 standards throughout duration of operation and be configured to allow link segments that significantly exceed 100 meters to operate.
- All cable and components must be installed in accordance with industry best practices and Leviton's Certified Integrator must perform the installation that will be submitted for warranty.
- Temperature of cabling throughout all segments must not exceed 60 degrees Celsius.
- Channels that exceed 100 meters become application specific and must be operated in full duplex mode.
- The extended length channels will support IEEE 802.3 application speeds and PoE power delivery when passing Leviton specific custom limits (network equipment excluded).
- Leviton's special 25-year application assurance warranty will cover extended distance as per configurations outlined in the PARADIGM™ System Data Sheet or this application guide. Leviton application assurance terms and conditions apply.
- Twisted-pair Ethernet applications at link segments longer than 100 meters in length are not standards compliant and therefore there is no guaranteed interoperability or functionality with other components or equipment even if they are standards compliant.

Device installations, such as outdoor security cameras, located far from the telecommunications room and exposed to environmental stressors place unique demands on distance and reliability. PARADIGM™ is a next generation copper networking solution engineered to deliver reliable Ethernet connectivity beyond the traditional 100 meter limit in outdoor, campus, and perimeter environments where distance, power, and reliability must be addressed together.

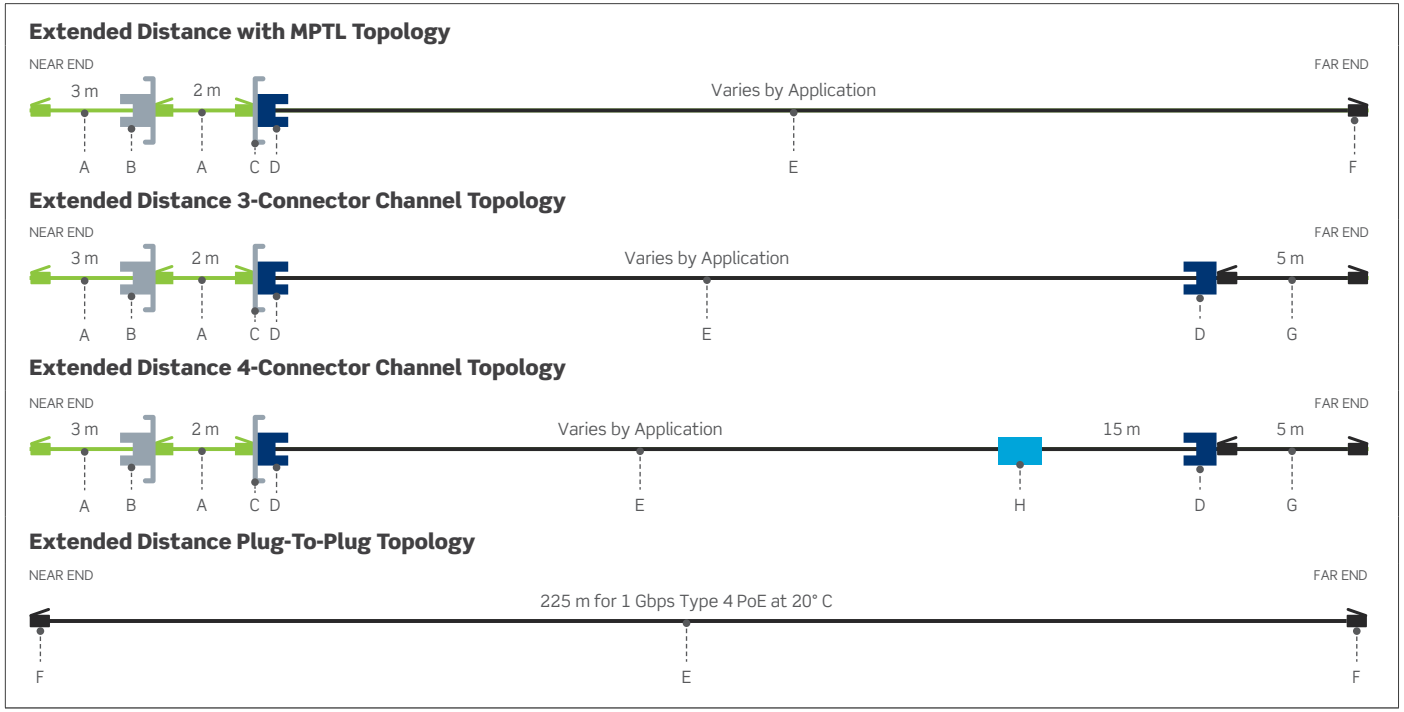
PARADIGM supports extended distance deployments commonly found in these applications, enabling reliable Ethernet and PoE delivery for data rates up to 2.5 G and power levels up to 100 W in real world operating conditions. In addition to multi connector channel configurations, PARADIGM validation includes a plug to plug link configuration for specific application scenarios, with defined performance limits established through system level testing.

By combining intentional channel design with verification against defined test limits, PARADIGM provides a structured, warrantied path to extended Ethernet connectivity without compromising installation integrity or long term reliability.

Notes:

1. Extended distances listed in Table 2 and table 3 are backed by Leviton's 25-year Applications Assurance Warranty when verified to Leviton specified test limits.
2. As active equipment ages, extended distance reach may be reduced.
3. By default, some network devices may disable ports if the link is detected to be significantly longer than 100 meters.
4. Maximum channel lengths in Table 2 assume 10 m of patch cord for permanent links and 5 m of patch cord for MPTL configurations.
5. Any moves, adds, or changes to the channel will require re-testing for warranty coverage to apply. Contact Leviton Application Engineering (US: contractorprograms@leviton.com or EMEA: appeng.eu@leviton.com) to acquire specific test limits and testing procedure.
6. For surge protection recommendations, please see App Note NS-AN26-0002, found on the Stadion product pages and the PARADIGM landing page

PARADIGM™ Systems with Stadion Cable

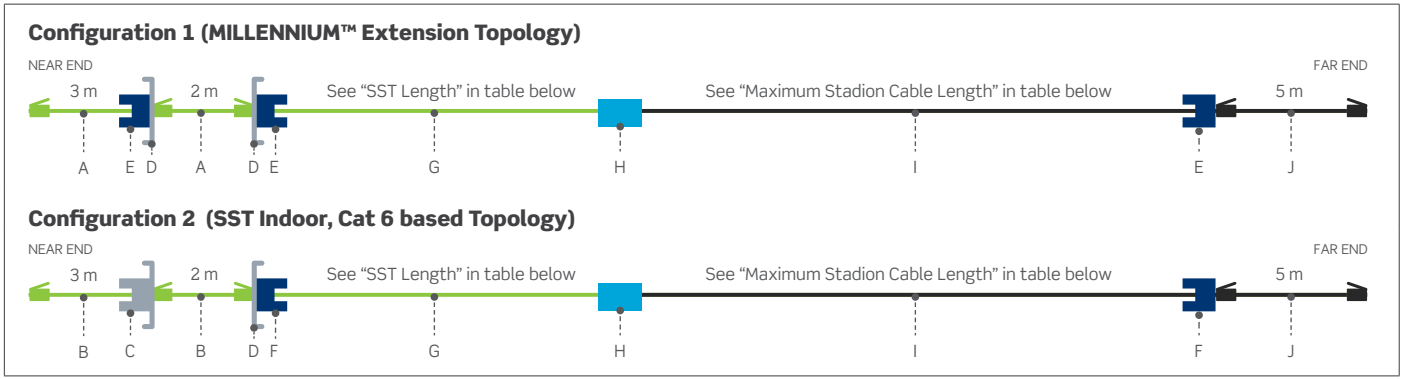


* VXC, Jack, indoor patch cords, and plugs must be housed and protected from the outside environment.

Indoor cable
Outdoor cable

A: Region-Appropriate Cat 6 Cord (6D460 or C6CPCU)
B: 110-Style Patch Panel
C: QUICKPORT™ Patch Panel
D: ATLAS-X1™ 61UJK Cat 6 Jack
E: Stadion Cable
F: Uiversal Tool-Free Plug
G: SST Outdoor or RDT I/O Patch Cord
H: VXC Coupler

PARADIGM™ Systems with Both SST and Stadion Cable



Indoor cable
Outdoor cable

A: Region-Appropriate Cat 6A Cord (6AS10 or AC6PCF)
B: Region-Appropriate Cat 6 Cord (6D460 or C6CPCU)
C: 110-Style Patch Panel
D: QUICKPORT™ Patch Panel
E: ATLAS-X1™ 6AUJK Cat 6A Jack
F: ATLAS-X1™ 61UJK Cat 6 Jack
G: Indoor-rated SST Cable
H: VXC Coupler
I: Stadion Cable
J: SST Outdoor or RDT I/O Patch Cord

* VXC, Jack, indoor patch cords, and plugs must be housed and protected from the outside environment.

SST Length	Maximum Stadion Cable Length			
	10BASE-T Type 1 PoE	10BASE-T Type 2-4 PoE	100/1000BASE-T Type 1-4 PoE	2.5BASE-T Type 1-4 PoE
15 m (49 ft)	244 m (800 ft)	167 m (548 ft)	167 m (548 ft)	137 m (449 ft)
30 m (98 ft)	223 m (732 ft)	144 m (472 ft)	144 m (472 ft)	119 m (390 ft)
45 (147 ft)	202 m (663 ft)	121 m (397 ft)	121 m (397 ft)	101 m (331 ft)
60 m (196 ft)	181 m (594 ft)	98 m(321 ft)	98 m (321 ft)	83 m (272 ft)
75 m (249 ft)	160 m (525 ft)	75 m (246 ft)	75 m (246 ft)	65 m (213 ft)
90 m (295 ft)	139 m (456 ft)	52 m (171 ft)	52 m (171 ft)	47 m (154 ft)

Table 3

PARADIGM™ System Components by Region

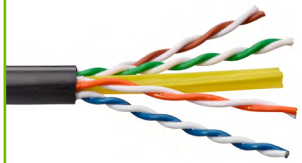
ATLAS-X1™ Jack

Global

QUICKPORT™ Modular Patch Panel

Global

Stadion Cable



Global

Cat 6 Standard CM Patch Cord

United States, Canada, and LATAM

Cat 6 Standard LSZH Patch Cord

Europe, Middle East, APAC and Latin America

VXC Coupler

Global

RDT Indoor/Outdoor Patch Cord*

United States, Canada, and LATAM

SST Outdoor Patch Cord*

Europe, Middle East, APAC

Field Term Plug

Global

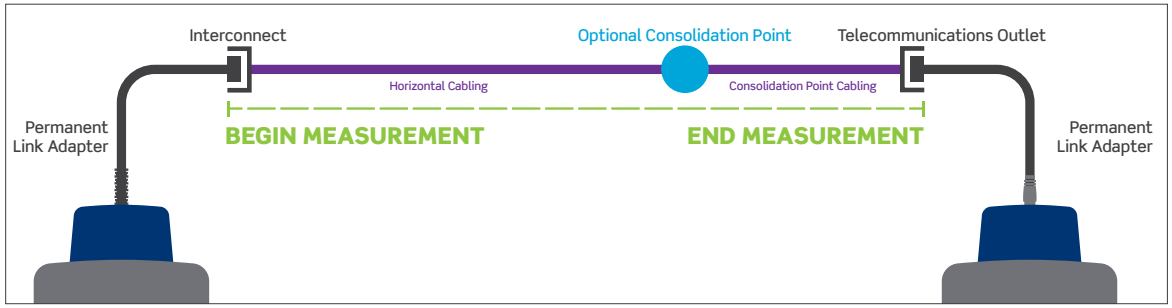
* For RDT I/O Patch Cords and SST Outdoor Patch Cords contact Tech Services at appeng@leviton.com for product specific Data sheets

Testing and Warranty

Field testing and certification is essential to verify that the installation meets the necessary electrical requirements to support applicable IEEE 802.3 standards intended for use.

Leviton recommends using a test instrument that is capable of accepting custom test limits to perform the required verification test.

The required test set up is as illustrated below:



Installations are tested using Leviton's established permanent link and custom limits.

Please contact Leviton technical support at contractorprograms@leviton.com (North America, LATAM) or appeng.eu@leviton.com (EMEA, APAC) to request the Fluke or Softing custom limits for extended distance testing.

continued ›

Testing and Warranty

OBTAINING AN LEVITON CERTIFIED PROGRAM (LCP) APPLICATION ASSURANCE WARRANTY ON AN EXTENDED DISTANCE PERMANENT LINK (PL) CONFIGURATION

- Applies to MILLENNIUM™ and PARADIGM™ system links or channels greater than 100 meters as identified in the Leviton system data sheets (SDS). Only products and configurations listed in SDS and this application guide will be allowed.
- Leviton's Certified Integrator must perform the installation that is being submitted for warranty.
- LCP Integrator logs in to the Leviton warranty portal and completes the warranty application.
- Include a note in the submission that results include extended distance links.
- LCP Integrator uploads a Bill of Material and compliant test results.
- Separate standards compliant (100 m or shorter channel / 90 m or shorter permanent link) from extended distance test results. Consider placing these in a separate project file or folder when submitting.
- Test all extended distance installations to the applicable LCP provided extended distance custom test limit. Test in a Permanent Link or MPTL configuration. Channel testing will require prior approval.
- Confirm PoE type needed before selection of test limit.
- Upon completion of the warranty application the project is reviewed and processed.
- Upon approval, a 25-Year Application Assurance Warranty certificate will be issued on the approved extended distance links.

Additional Recommendations and Best Practices

This guide is intended to provide basic guidelines for the installation of Leviton and BERK-TEK™ copper cabling products. The use of this guide is not a substitute for installation training through the Leviton Certified Program (LCP). Installation practices outlined in the latest revision of ANSI/TIA 568.2, ANSI/TIA-569, ISO 11801, and the BICSI TDMM Manual must be followed.

MAXIMUM CABLE LENGTHS

Per the MILLENNIUM™ and PARADIGM™ system data sheet Extended Application and PoE Distances table.

CABLE SLACK

Providing additional cable slack at both ends is recommended to accommodate potential rework.

- Telecommunications closet: 3 meter (10 feet)
- Telecommunications outlet: 30 cm (12 inches) for twisted pair cables

MAXIMUM CABLE PULL FORCE

UTP Cables: 110 N (25 lbf)

MODULAR PLUG TERMINATION LINK (MPTL)

Follow Leviton MPTL installation and testing guidelines when installing links with a Jack to Plug configuration.

HANDLING OF CABLE

Reel/Reel Boxes/Reelex Boxes must be stored and handled in an upright position to reduce the chance of twisting and kinking the cable.

CABLE BEND RADIUS

No less than 4 times the cable diameter

CABLE MANAGEMENT AND PULLING PRACTICES

Eliminate cable stress:

- Control tension in suspended cable runs by limiting spans between supports to 1.5 m (5 ft.) or less, per ANSI/TIA-569's requirements.
- Avoid tightly cinched cable bundles.
- Avoid kinking during installation and dressing the cable.
- Avoid changing the geometry of the cable.
- Follow manufacturers' recommendations for loading cable trays and j- hooks.
- The use of tie wraps should be avoided.
- Avoid EMI/RFI sources.
- When pulling cable, apply pulling force evenly to all conductors in the cable.
- Avoid exceeding the minimum bend radius of the cable.

CONNECTOR TERMINATION

Follow Leviton's guidelines for termination of Leviton's connectors and patch panels.

LEVITON®

Leviton Network Solutions designs and builds tomorrow's networks, today. Our global systems are engineered to exacting standards and are available worldwide with our extensive distribution network. Leviton Network Solutions delivers value by providing speedy service, scalable solutions, assured performance, and an agile collaborative process. Leviton was established in 1906 and continues to invest in and grow our business. Together, let's build what's next for your network.

Network Solutions products are **available worldwide** in **over 100 countries**. Visit us online at leviton.com/ns to learn more.

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