Application Note

Guidelines for Consolidation Points

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NS-AN25-0007

Date:
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Product Line:
Copper Cabling Systems

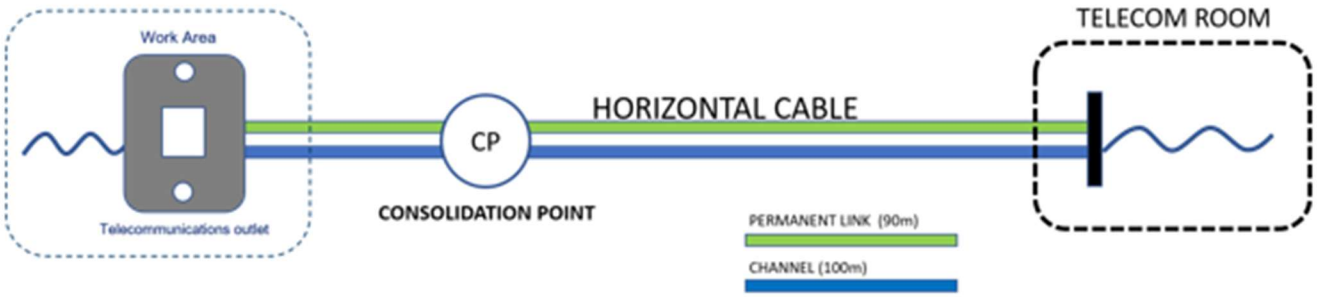
Part Numbers Affected:
Various Copper Products

Introduction

The consolidation point (CP) is an optional additional connection, allowed within the horizontal cabling of a structured cabling installation. The CP is defined in the ANSI/TIA-568.0 standard, as shown in the figure below.

This application note will explore the definition of a consolidation point and the rules which must be observed when standards-compliant CPs are deployed and implemented, using a variety of Leviton products.

Although a consolidation point may be used with fiber optic cabling, this application note will deal primarily with category-rated four-pair twisted-pair cabling. The document will also touch on some misconceptions about consolidation point design and usage, and explain why certain products are not useful as components of a consolidation point design.



The consolidation point is an optional additional connection, allowed within the horizontal cabling of a structured cabling installation.

> **Note:** There is a **Definition of Useful Terms** section at the end of the document for any possibly unfamiliar terms or acronyms in this application note. We have highlighted the first use of these in this document for easy identification.

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Usage of a Consolidation Point

The most common usage of a CP is in work areas where there is open office furniture (e.g., cubicles). Horizontal cabling runs from the TR to the CP, then from the CP to the work area outlet. When the open office furniture is reconfigured, it is only necessary to re-cable from the CP down to the work area outlets.

The frequent reconfiguration of cubicle furniture is known as “churn.” Without a CP, when churn occurs, it is usually necessary to fully re-cable the affected portion of the office (i.e., replace the entire length of the horizontal cabling, from the TR to the work area).

Another common usage of a CP in structured cabling installations occurs when it is necessary (or desirable) to change cable types somewhere in the middle of a horizontal cabling link. Examples of this might be: changing from a plenum-rated cable to a wet-location rated cable for conduit-in-slab-on-grade applications, or changing from a full-size Category 6A cable to a smaller-diameter zone cable for easier cable routing through the open office furniture pathways.

Rules for Consolidation Point Usage

- Each Cabling Subsystem 1 link containing a CP connector shall also contain a MUTOA or EO. The link must terminate at a wallplate (or similar device). It may not go directly to equipment.
- Device connections for work areas shall not be made directly to the CP connector (i.e., no patch cord connections directly from the CP to electronics in the work area).
    - For device connections in coverage areas (i.e., WAPs, cameras, network clocks) a field terminated plug may be used to serve the electronics.
- Cross-connections shall not be used at a CP (i.e., no patch cords may be employed within a CP). The connection at the CP must be an interconnection.
- No more than one CP connector shall be used within the same Cabling Subsystem 1 cable run.
- A transition point and a CP connector shall not be used in the same Cabling Subsystem 1 link.
- The cables and connections used at a CP shall meet the requirements of ANSI/TIA-568.2.
- Copper cabling shall be installed in accordance with ANSI/TIA-568.0, Section 6 (Cabling Installation Requirements).

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- For balanced twisted-pair cabling, in order to reduce the effect of multiple connections in close proximity on near-end cross-talk (NEXT) loss and return loss (RL), the CP should be located at least 15 m (~50 ft) from the distributor (the distributor is the HC, which is normally within the TR or in a TE).
- The location of the consolidation point should be developed in accordance with the security plan of the building.
- Consolidation points should be provided with appropriate security, such as key-locking, tool-removable covers, or other suitable means to discourage unauthorized access.
- Furniture intended to house consolidation points shall include sufficient space to accommodate cable strain relief, terminations, and anticipated horizontal cable slack storage.
- The use of suspended ceiling space or access floor space for consolidation points may be acceptable, provided that the space is accessible without moving building fixtures, equipment, or heavy furniture, and without disturbing building occupants.
- In all cases, the use of consolidation points in plenum spaces used for environmental air shall conform to applicable building codes (i.e., in a plenum space, the components which make up the CP must either be plenum-rated, or housed within a plenum-rated enclosure).

Creating a Consolidation Point

The ANSI/TIA-568 standard does not call out any specific product to be used as a consolidation point. While requirements are specified for consolidation points, the specific hardware to be used is left up to the installer's design. The choice of what parts will be used is heavily influenced by the specific application.

To house a large CP intended to be installed in the ceiling grid, one might utilize a plenum-rated zone enclosure, such as the Z1000-PC2. A more-modest CP might incorporate a patch panel or a 110 block, mounted inside any appropriate junction box or enclosure. A stand-alone zone box, such as the 49225-24E could be used to house up to 24 CP jack connections, and the zone box is stackable, for larger CP requirements. Examples of these parts are shown in the figure below.

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49225-24E
24-Port Zone Box

4S089-4WP
4-Port Surface Mount Box

5WMED-4C
Medium Wall-mount
Enclosure

Z1000-PC2
2'x2' Passive Ceiling Zone Enclosure

SBCPI-S
VXC Coupler

All of these solutions are plenum rated.

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Another product which might be used as a consolidation point would be Leviton's E2XHD-series mini panel (part number E2XMB-S12). The E2XHD System uses cassettes to hold six QUICKPORT™ jacks and the E2XMB mini panel will hold up to two of these cassettes. E2XMB mini panels are stackable, for larger CP configurations. The E2XMB-S12 has a grounding stud, for easy bonding to the telecommunications grounding system. The 6-port jack cassettes (empty) are part number E2XHD-BRK. When mounted in a plenum airspace, these units would need to be installed inside of a plenum-rated junction box.

The E2XMB-S12 mini panel shown with the E2XHD-BRK 6-port jack cassette.

Choices for Consolidation Point Connections

- **Jack/Plug Interconnection**

The connection within the CP must be an interconnection (not a cross-connection). A common choice is one jack/plug connection for each horizontal link. The section of horizontal cable coming from the TR could be terminated, either on a 110-style patch panel, or onto a QUICKPORT jack. The jack would then snap into a QUICKPORT patch panel or a zone box. If shielded cabling is being installed, the connector choice would be a shielded ATLAS-X1™ jack.

> **Note:** In a plenum ceiling or plenum raised floor space, a 110-style patch panel would need to be mounted in a plenum-rated enclosure. The zone enclosue (the Z1000 unit shown above) is plenum rated and provides internal rails for patch panel mounting.

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Other plenum-rated solutions used in jack/plug interconnections (and the mounting arrangements for such interconnections) include: the 24-port zone box, QUICKPORT™ UTP patch panels and QUICKPORT shielded patch panels (when used within the Z1000 enclosure), plenum rated OPT-X™ SDX wall-mount enclosures, and plenum rated surface mount boxes, EXTREME™ jacks, ATLAS-X1™ jacks, and the 6APLG tool-free plug. Also, plenum-rated jack-to-plug cable assemblies can be factory manufactured, using plenum-rated cable. These parts are shown in the figures below.

QUICKPORT EXTREME jacks. Category 6 (part number 61110-xx6) and Category 6A (part number 6110G-xx6).

QUICKPORT ATLAS-X1 shielded and unshielded jacks. Category 6A jacks (part numbers 6ASJK-xx6 and 6AUJK-xx6) shown. ATLAS-X1 jacks are also available in Category 6 (part numbers 61SJK-xx6 and 61UJK-xx6).

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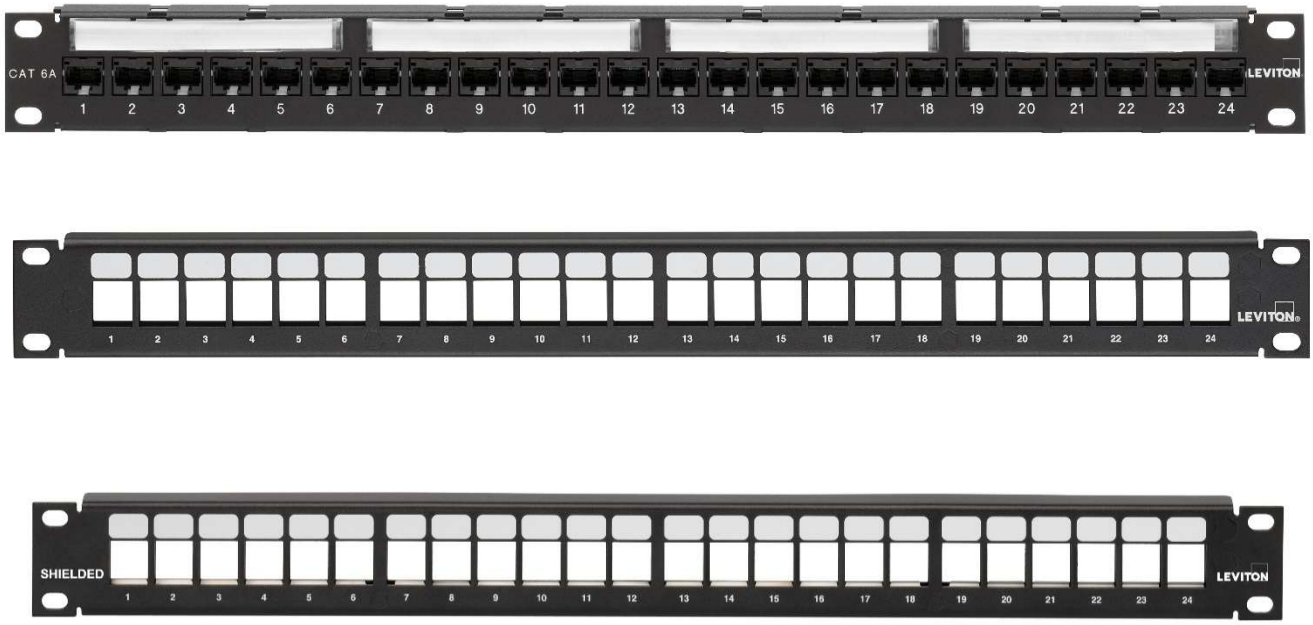

Leviton Patch Panels – Top: 110-style panel, Middle: QUICKPORT™ panel, Bottom: Shielded panel – many versions available (all may be used in the Z1000 zone enclosure).

If a jack/plug interconnection is chosen for the CP, then the other horizontal cable section needs to be a cable assembly with a jack on one end and a plug on the other end. These can be factory-made or field-assembled. If field-assembled, the 6APLG-S6A tool-free plug is recommended. This plenum-rated plug may be used for shielded or unshielded cabling and may be used with either Category 6 or Category 6A cabling.

6APLG-S6A Tool-free Plug

Factory-made Jack-to-Plug Cable Assembly

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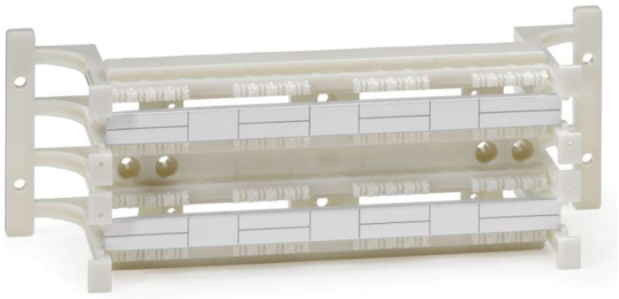
- **110 Block Interconnection**

A 110 punchdown block is another choice for CP connections. For Category 6A UTP installations, the 41D6A-1F4 block is recommended. For Category 6 UTP installations, the 41AB6-1F4 block may be used, as seen below. These blocks are kitted with the appropriate number of C4 connectors and include labeling components as well.



Category 6A 110 Block
41D6A-1F4 terminates up to 16 Category 6A links.

Category 6 110 Block
41AB6-1F4 terminates up to 24 Category 6 links.

Note: In plenum ceiling or plenum raised floor spaces, a 110 punchdown block would need to be housed within a plenum-rated enclosure. A plywood backboard within the enclosure would provide a suitable surface for mounting the punchdown block. The Z1000-PC2 enclosure may also be used for this application with panel mounting brackets removed.

- **Cable Coupler Interconnection**

Another product that could be used for CP connections is Leviton's VXC Coupler (part number SBCPI-00S). This product is a cable-to-cable coupler and is plenum rated, so it may be used in a plenum ceiling space to create a consolidation point for a single link. Where a larger number of links are involved, multiple VXC Couplers may be housed in a plenum-rated junction box if desired. The VXC Coupler is rated for both UTP and shielded cabling infrastructures. A picture of the VXC Coupler may be found on the following page.

The VXC Coupler (SBCPI-00S) shown with its two wire managers and two zip ties (used for cable strain relief).

Cable Length Considerations

While ANSI/TIA-568 has a required minimum of 15 m (50 ft) from the TR to the CP, the standard does not specify the minimum length of the second horizontal cable segment, running from the CP to the WAO. It should be apparent that the same kind of NEXT issues may occur with a short cable segment. If the served WAs are close to the CP, link performance may be improved by increasing the length of the CP to WAO cable segment and properly storing the cable slack. If storage of cable slack above ceiling tiles or below a raised floor is unavailable or undesirable, another solution for storage may be to store a large slack coil within the modular furniture panels.

Keep in mind, to be standards compliant, the total length of the installed horizontal cabling may not exceed 90 meters (295 feet).

Installation and Testing Considerations when Consolidation Points are Used

The first horizontal cable segment (which runs from the TR to the CP) can be considered to be permanent cabling. The second horizontal cable section (which runs from the CP to the work area outlet) may see multiple adds, moves, and changes during the life of the cabling system.

When cabling a building with low-density work areas (or work areas that will not be active until some future date) it may make sense to install the first horizontal cable segments to support the potential full capacity of the WAs served, and install the second horizontal cable segments only to the WAOs which will initially be used. Additional plug/jack cable assemblies may be added as needed to support growth over time.

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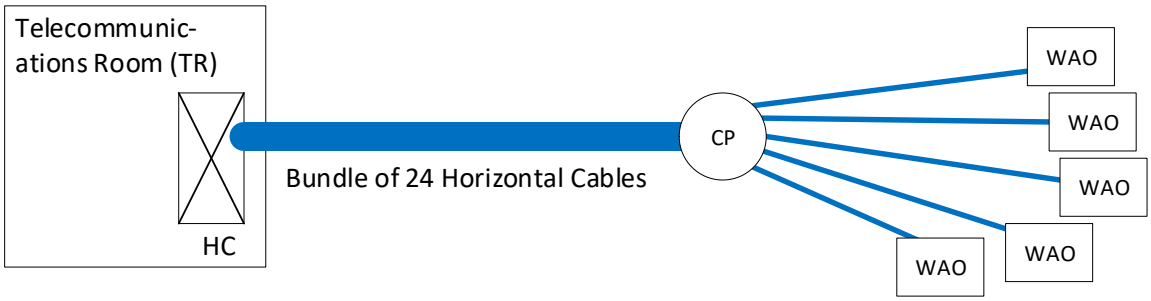
- **Testing Jack/Plug Interconnections**

Choosing a jack/plug connection for the CP will enable easier testing of the incomplete links. The first horizontal cable segment originates with a jack (or patch panel port) in the TR and terminates in another jack (or patch panel port) at the CP. Where no second horizontal cable segment is installed, a permanent link test may be performed on just the first cable segment.

The second horizontal cable segment will be a plug-to-jack cable assembly. The plug will be plugged into the jack in the CP, and the jack will be installed into a wallplate or surface-mount box in the WA. Where the second horizontal cable segment is installed, the appropriate test would be an end-to-end permanent link test (i.e., from the jack in the TR to the jack in the WAO).



- **Testing the Consolidation Point – CP equipped with Jack/Plug Interconnections.**
    - The five links in the diagram above are fully installed from the HC to the WAOs.
        - These would be tested (permanent link) from HC to WAO.
    - The other 19 links terminate on a jack within the CP and are reserved for future use.
        - These 19 links would be tested (permanent link) from HC to CP.

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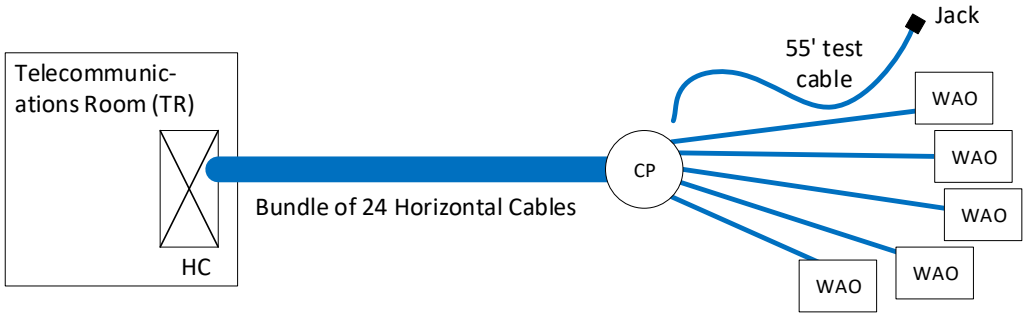
- **Testing 110 Punchdown Block Interconnections**

When a 110 punchdown block is used, installed cable performance testing requires a bit more work.



- **Testing – CP equipped with 110 Punchdown Block Interconnections**.

  The five links in the diagram above are fully installed from the HC to the WAOs.
  - These would be tested (permanent link) from HC to WAO.

  Note: When customer contract calls out installation of horizontal cable to the CP only, a special test method from the TR to the 110-block may be necessary. (When the links are later completed, an end-to-end permanent link test must be performed to prove functionality and to have the affected links added to any project warranty coverage).

- The other 19 links terminate to a 110 block at the CP and are reserved for future use.
  - Create a test cable of at least 16.5 meters (~55 feet) with a jack on one end (the test cable should be the same type of cable and jack as the installation).
  - Punch this cable down onto the top of an available C4 connector in the CP.
  - Test as permanent link from the HC to the jack at the end of the test cable.
  - Remove test cable, re-terminate onto the next available C4 connector, and run another PL test.
  - Repeat until all 19 links are tested.

  Note: The test cable length called out here allows for multiple re-terminations, while keeping the cable segment at least 50 feet long. When the test cable becomes shorter than 50 feet, discard it and build another test cable.

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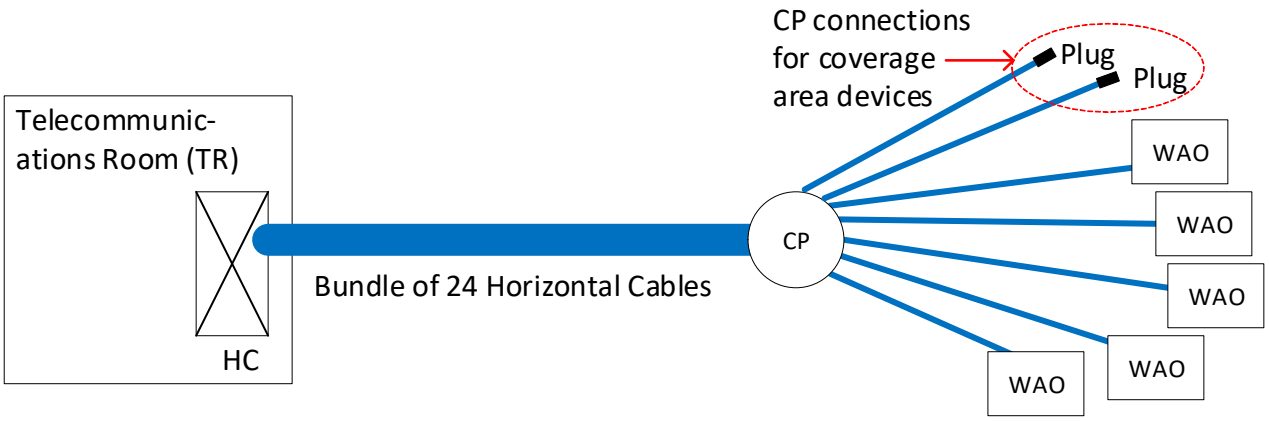
- **Testing for Consolidation Point Coverage Area Links**



When horizontal cables from the CP are terminated in plugs (for coverage area devices such as WAPs, cameras, network clocks, etc.) the proper testing for these links is MPTL.

> **Note:** Coverage area devices may (optionally) be wired with a jack (and the electronics connected via an appropriate patch cord). If a jack is used at the coverage area end of the link, then the proper test would be a permanent link test.

For reconfiguration, due to furniture "churn", or for "adds", due to growth, any new or replaced segments of Horizontal Cable should be tested via the end-to-end (HC to WAO) permanent link test, or the end-to-end (HC to coverage area plug) MPTL test, as described in the various test scenarios above.

- **Testing VXC Coupler Interconnections**

When using the VXC Coupler for a CP interconnection, if the second horizontal cable segment terminates in a jack, the proper test is a permanent link test. If the second horizontal cable segment terminates with a plug, then the proper test would be an MPTL test.

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Bonding and Grounding

Whenever a metallic enclosure is used to house a CP, that enclosure is considered to be part of the telecommunications cabling infrastructure, and as such it must be properly bonded to the PBB, or to an SBB in the telecommunications grounding system.

In general, if the CP is within 30 meters (~100 feet) cabling distance from a TR SBB, a #6 AWG TEBC may be run from the SBB in the TR to the CP, for bonding. Bonding connections must be accomplished with appropriate listed parts, installed per the manufacturer's recommendations.

Distances over 100 feet will require a larger TEBC. Please refer to bonding and grounding standards and, in all cases, check with the AHJ for any required local bonding/grounding practices.

Shielded Cabling Systems

Where shielded cabling is being installed, the recommended choice for the CP and CP connections would be shielded ATLAS-X1™ Jacks, mounted in a QUICKPORT™ patch panel.

Please note that a patch panel in the CP does not need to be a shielded panel. Shield bonding is maintained at the CP jack/plug interconnection and system grounding occurs at the shielded panel in the TR, as can be seen in the diagram below. Note that the CP patch panel sheet metal still needs to be bonded to the telecommunications grounding system.

If the CP is installed in the plenum ceiling space, the Z1000-PC2 zone enclosure would be an appropriate unit to house the CP. The 6APLG-S6A tool-free plug would be used at the CP interconnection.

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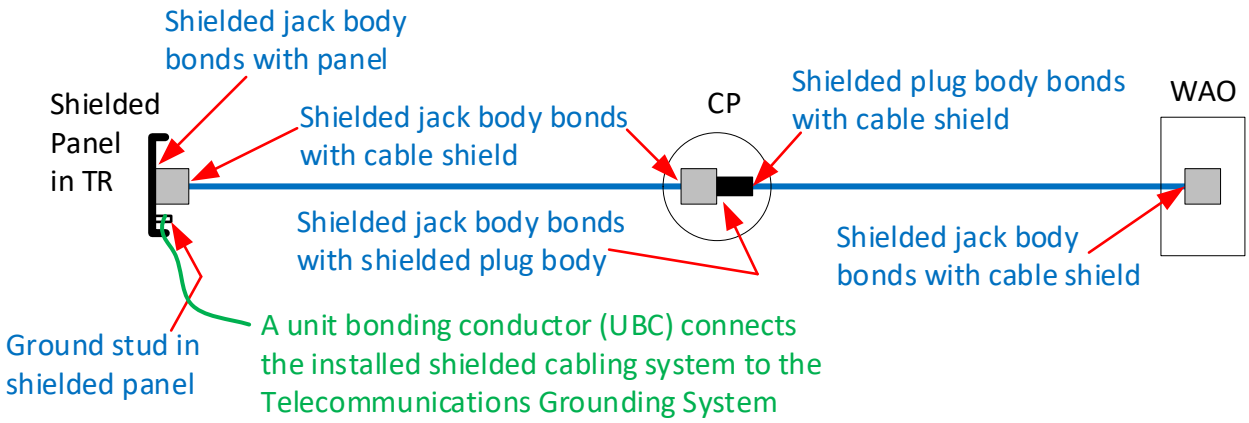

Notes in blue explain the bonding path for a typical shielded cabling system including a CP. The note in green explains how and where the shielded system is bonded to ground.

Grounding of the installed shielded links is accomplished by running an independent UBC from each TR shielded QUICKPORT™ patch panel to a properly installed telecommunications grounding system. The UBC should be a minimum #12 AWG conductor (best practice is a #6 AWG conductor).

What Parts are not Suitable Choices for Consolidation Points?

Patch cords may not be used in a consolidation point. If a TE contains patch panels and patch cords, it is **not** a consolidation point. It is most likely a horizontal cross-connect, where the incoming cabling is Cabling Subsystem 2 backbone cabling, and the outgoing cabling is Cabling Subsystem 1 horizontal cabling. The problem with a patch cord in a CP is that it adds another connection to the link and increases noise on the link.

Category 6 or Category 6A couplers are not defined by the ANSI/TIA-568 standard as structured cabling devices. These are plug-to-plug couplers (not a cable coupler like the VXC). A plug-to-plug coupler puts two (inherently noisy) plug/jack connections right next to each other. They would be a poor choice for connecting the two horizontal cable segments in a CP.

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Definition of Useful Terms

- **AHJ** – Authority having jurisdiction, who covers local building codes that must be followed
- **C4 Connector** – A type of IDC connector used with 110 punchdown blocks
- **Cabling Subsystem 1** – The horizontal cabling, running from the horizontal cross-connect to an EO or MUTOA.
- **Cabling Subsystem 2** – The allowed second level of backbone cabling, running from the intermediate cross-connect to the horizontal cross-connect.
- **Cabling Subsystem 3** – Backbone cabling, running from the main cross-connect to the iIntermediate cross-connect, or (when no IC exists) from the main cross-connect to the horizontal cross-connect.
- **Consolidation Point (CP)** – An assembly of consolidation point connectors.
- **Consolidation Point Connector** – An optional fixed connector within cabling subsystem 1 (the horizontal cabling) serving work areas.
- **Cross-connect** – A facility enabling the termination of cable elements and their interconnection or cross-connection.
- **Cross-connection** – A connection scheme between cabling runs, subsystems, and equipment using patch cords or jumpers that attach to connecting hardware on each end.
- **EO** – Equipment outlet; alternately, TO (telecommunications outlet) or WAO (work area outlet).
- **Horizontal Cross-connect (HC)** – The cross-connect identified as Distributor A in the ANSI/TIA-568 standard. It connects backbone cabling (cabling subsystem 2 or cabling subsystem 3) to the horizontal cabling (cabling subsystem 1).
- **IDC** – Insulation displacement connection
- **Interconnection** – A connection scheme that employs connecting hardware for the direct connection of a cable to another cable without a patch cord or jumper.
    - An interconnection is one connection. Compare to a cross-connection, which uses a patch cord or jumper. The use of a patch cord encompasses two connections.
    - Examples of an interconnection would be a 110 block, a single plug/jack connection, or a cable-to-cable coupler, such as the VXC Coupler.
- **Intermediate Cross-connect (IC)** – The cross-connect identified as Distributor B in the ANSI/TIA-568 standard. It connects first level backbone cabling (cabling subsytem 3) and second level backbone cabling (cabling subsystem 2) – where two levels of backbone cabling are employed.
- **Link** – A transmission path between two points, not including equipment and cords.

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- **Main Cross-connect (MC)** – The cross-connect identified as Distributor C in the ANSI/TIA-568 standard. It connects outside services to the backbone cabling (cabling subsystem 3).
- **MPTL** – Modular plug terminated link. The MPTL originates with a jack in the TR and terminates on a plug in the coverage area. (Compare with permanent link).
- **MUTOA** – Multi-user telecommunications outet assembly; a work area outlet which serves multiple users.
- **PBB** – Primary bonding busbar (a component in the telecommunications grounding system).
- **Permanent Link (PL)** – The installed cabling, typically from the TR to the WAO. The permanent link terminates on a jack at each end of the cabling.
- **SBB** – Secondary bonding busbar (a component in the telecommunications grounding system).
- **TE** – Telecommunications enclosure.
- **TEBC** – Telecommunications equipment bonding conductor (a component in the telecommunications grounding system).
- **TO** – Telecommunications outlet; alternately, EO (equipment outlet) or WAO (work area outlet).
- **TR** – Telecommunications room.
- **Transition Point** – A connection between round cable and flat undercarpet cable in cabling subsystem 1.
- **UBC** – Unit Bonding Conductor. The UBC runs from the TR shielded patch panel of a properly installed shielded cabling system, to a properly installed telecommunications grounding system, accomplishing the proper grounding of the cabling system. An independent UBC shall be run for each TR shielded patch panel in the installation.
- **UTP** – Unshielded twisted pair, also known as U/UTP
- **WAO** – Work area outlet; alternately, EO (equipment outlet) or TO (telecommunications outlet).
- **Work Area (WA)** – The space where occupants interact with telecommunications terminal equipment.

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