



Z-MAX™ 6A
PLANNING & INSTALLATION
GUIDE

Edition 2.3

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1. INTRODUCTION

The purpose of this guide is to provide both designers and installers with the necessary information to properly plan and install a Siemon Z-MAX Category 6A/Class E_A cabling system. Siemon's Z-MAX 6A system is specified to 500MHz and provides support of 10 Gb/s applications up to 100m (328 ft.) distances. This document serves as a comprehensive source for all associated elements of the cabling system planning and installation. It is strongly recommended to review all information contained in this document prior to design or installation of a Z-MAX 6A system to ensure all requirements are met.

2. PRODUCTS

The Z-MAX 6A cabling system is an end-to-end cabling system which has been qualified to exceed all industry standard parameters when comprised of Z-MAX 6A products in conjunction with Siemon's Category 6A 4-pair copper cables. The system, and associated components, is available in both shielded and unshielded versions.

Z-MAX 6A PRODUCTS

- Z-MAX 6A Work Area Outlets
- Z-PLUG
- Z-MAX Patch Panels
- Z-MAX 6A Panel Outlets
- Z-MAX 6A Modular Cords
- Z-MAX 6A Trunks
- Termination Tools
- Siemon Category 6A Copper Cable

2.1. Z-MAX 6A Work Area Outlets

The Z-MAX 6A work area outlets are available in shielded and unshielded, hybrid (flat/angled), keystone, and side entry versions. The outlet body (hybrid and keystone versions) is identical for both types, and thus they share a common termination practice, but each features a unique mounting bezel for its' associated mounting type (see Figure 1).

The hybrid Z-MAX 6A work area outlets are capable of being mounted in both flat and angled orientation in MAX series mounting faceplates and associated products.

⚠ The Z-MAX keystone version outlets have been designed for use with the industry standard keystone openings. This outlet is intended for use in Siemon keystone specific panels, plates and many other industry standard compliant keystone openings. These outlets are ideal for use with 3rd party keystone work area products such as local market faceplates, floor boxes, poke-thru's, etc. where Siemon standard mounting solutions do not exist. Fit with any 3rd party keystone mounting products should always be qualified ahead of time to ensure compatibility.

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- ✎ The keystone version of the Z-MAX outlets does not offer an icon pocket like the hybrid version of the Z-MAX outlets.

The side entry Z-MAX 45 outlet was developed specifically for installations requiring a flat mount orientation in a shallow depth application such as two compartment raceway channels with limited clearance back boxes (see Section 3.5 and Figure 10 for specific Z-MAX 45 clearance requirement). These Z-MAX 45 outlets share the same outlet mounting functionality as the standard hybrid and keystone Z-MAX outlets noted above. While the outlet mounting functionality remains the same, the depth reduction requires a unique rear design and termination practice. The Z-MAX 45 allows the installer the option of terminating the cable sideways in either a 45-degree top right cable exit or bottom left cable exit. The 45 degree exit also allows side-stacking of multiple outlets for minimal cable interference. The downside is the termination time required is approximately 50% longer than the regular Z-MAX due to the extended procedure with the smaller lacing cap, the drain wire wrap, the rear cover installation and the tie wrap not required with the conventional Z-MAX. Also note that the Z-MAX 45 is not capable of being installed/removed from the front side of a faceplate, this must be accomplished from the rear of the plate.

- ✎ *The Z-MAX 45 outlet is not compatible with the TERA-MAX patch panels.*
- ✎ *The Z-MAX 45 hybrid outlet is not recommended for angle mounting. Use regular Z-MAX hybrid for angle mount applications and obtain similar rear clearance (see 3.5 for outlet depth requirements).*
- ✎ *Not all MAX mounting faceplates and associated products are compatible with Z-MAX. Table 1 identifies any compatibility issues associated with the Z-MAX hybrid outlets and MAX mounting products.*

Minor Compatibility Issues		
Product	Z-MAX Limitations	Solution
CTE-MXA-(XX)-(XX)	Must flip outlet upside down	N/A
T50-(XX)	Must attach metal mounting frame after inserting outlet	N/A
MX-E4F-(XX)	Minor interference at outlet bezel corners and faceplate	N/A
MX-A-01	Mounting in angled orientation requires higher insertion force	N/A
MX-UMA-(XX) and CT-UMA-(XX)	Z-MAX 45 hybrid is only recommended for flat mount applications and cannot mount in the angle orientation with these plates	Standard Z-MAX hybrid
Incompatible Accessories		
Product	Z-MAX Limitations	Solution
MX-45-(XX)-(XX)	Does not work in angled orientation	MX-45-(XX)-(XX)L
MX-D(X)-(XX)	Does not work in angled orientation	MX-D(X)Z-(XX)
MX-FY-02	Too hard to insert in angled condition	MX-FYZ-02
MX-SM(X)-(XX)	Included bezel is incompatible with standard Z-MAX unless multimedia bezel is used). Will work with flat mount Z-MAX*	MX-SMZ(X)-(XX) or Z6A-(X)F(XX)

MX-JIS-X-XX-D	Incompatible with standard ZMAX (requires flat mount Z-MAX)	Z6A-45-SF(XX)
MX-E4A-(XX)	Incompatible (angles cancel resulting in a flat orientation)	None
MX-E2A-(XX)	Incompatible (angles cancel resulting in a flat orientation)	None
MX-TFP-S-06-(XX)	Incompatible (angle of outlet is too shallow)	None

Table 1: Z-MAX Compatibility with MAX Mounting Products

⚠ Due to alien crosstalk (AXT) requirements, Z-MAX 6A UTP outlets shall not be side-stacked in standard MAX modular faceplates and must utilize 10G MAX faceplates for full PS ANEXT and PS AACR-F warranty margins. The use of standard MAX faceplates (excluding the 1-port version) will eliminate our additional guaranteed margins published for PS ANEXT and PS AACR-F in the Z-MAX 6A UTP channel warranty.

2.2. Z-MAX Panel Outlets (and work area outlet comparison)

Z-MAX panel outlets share the same outlet body as the Z-MAX work area outlets – simply without a latching feature/colored mounting bezel, and thus share the same termination practice, but are specifically intended for use with Z-MAX patch panels only. They are included with Z-MAX patch panel kits but are also available separately if required.

⚠ Z-MAX panel outlets are not compatible with any MAX series faceplates or adapters.



Figure 1: Z-MAX Outlet Comparison

2.3. Z-PLUG

The Z-PLUG (see Figure 2) enables direct field termination of horizontal cabling at the device end with a modular plug – replacing the Telecommunications Outlet (TO) or Service Outlet (SO) and associated Work Area (WA) cord. The Z-PLUG provides reliable Category 6A/Class E_A performance and accommodates a wide variety of cable constructions. Use of the Z-PLUG does not have any impact on warranty performance but will require a unique testing regime (see MPTL testing described in Section 5.2).



Figure 2: Z-PLUG

2.4. Z-MAX Patch Panels

The patch panels use Z-MAX panel outlets which share the exact same termination process as the Z-MAX work area outlets. However, they do not include the applicable hybrid or keystone mounting bezel. The result is a patch panel solution which allows for outlet termination external to the panel where there is inherently more space to work.



Figure 3: Z-MAX Patch Panel

⚠ Only Z-MAX panel outlets are compatible with Z-MAX patch panels – hybrid or keystone outlets are not compatible.

Similarly, the cable tie-down locations on rear side of patch panel allow installation and securing of the cable ties after they have been pre-attached to the cables. This allows the cable ties to be applied loosely around the cable prior to the congested area behind the panel and subsequently slid down the cable and secured as a final step.

The Z-MAX patch panels are offered in flat and angled styles as well as versions with or without integrated rear managers. All versions are also available in both empty and kitted options. Empty versions are intended for use with Z-MAX panel outlet trunks. Kitted versions include the applicable number of Z-MAX panel outlets and represent the option that should be ordered unless Z-MAX trunks are being used.

Labeling is provided via a high visibility 6-port icon/label holder which is easily secured above the panel ports via three (3) snap-in latches. The holder accepts Z-MAX icons or 6-port label strips included with the panels. The label strips are provided as a single, perforated strip numbered 1-24 on one side (see Figure 4) and blank on the other side. (Note that for 48-port panels, there is one strip numbered 1-24 and another numbered 25-48).

1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24

Figure 4: Z-MAX Panel Labels (24-Port)

For alternate, laser printable labeling, Siemon has a Microsoft Excel template available on the Siemon website (<http://www.siemon.com/us/download/labels.asp>) that can be customized, printed and cutout. Additionally, with icon/label holders in place, there is approximately 12.5mm (0.50 in.) of blank panel space above the icon/label holders that was intentionally left open for use with industry labeling software and machines.

- ⚡ *Due to alien crosstalk (AXT) limitations associated with ultra-high-density patching, the use of 48-port, 1U Z-MAX 6A U/UTP patch panels will eliminate the additional worse case guaranteed published margins for PS ANEXT and PS AACR-F for the Z-MAX 6A U/UTP channel warranty.*
- ⚡ *For shielded applications, the Z-MAX hybrid outlets (in the flat orientation) can also be used in conjunction with TERA-MAX panels. The TERA-MAX solution may also be more suitable for customers who prefer one style outlet for both the patch panels and work area and/or prefer specific color-coded ports at the panel since the hybrid outlets, unlike the Z-MAX panel outlets, come with the colored bezels.*

2.5. Z-MAX Modular Cords

Z-MAX modular cords are available in both stranded and solid versions to support a wide range of applications. Stranded cords are double-ended and are intended for use in either the cross-connect or work area. Solid cords are available in single or double-ended versions with CMR, CMP or LSOH (CPR rated) jackets and are intended for use in either equipment cord or consolidation point applications.

- ⚡ *Stranded cords may also be used for equipment cords, but the termination practices for stranded shielded (S/FTP) cable are more complex and the cables would have to be ordered double the intended length and cut in half. While using stranded cables for equipment cord, derating factor shall be considered for maximum channel length.*
- ⚡ *For single-ended assemblies, or double-ended assemblies intended to be cut in half, the wiring scheme (T568A or T568B) must be specified to match the termination used on the opposite end.*
- ⚡ *Equipment, work area, and cross-connect cord lengths shall be $\geq 2.0m$ (~7 ft.). The use of shorter lengths cords will void the additional worse case guaranteed margins for the Z-MAX 6A U/UTP channel warranty and may result in category 6A/class E_A standards compliant performance with little or no margin.*

⚡ Category 6A BladePatch cords can be used with Z-MAX systems but will void all additional worst case guaranteed margins for the Z-MAX 6A /U/UTP channel warranty and may result in category 6A/class E_A standards compliant performance with little or no margin.

SkinnyPatch 6A shielded and unshielded cords feature a smaller diameter cable to reduce bundle and pathway fill for space savings as well as providing improved airflow, accessibility and cable management in high density applications.

⚡ Due to the 28AWG construction of SkinnyPatch 6A cords, their total combined length per channel is limited to 8m (26 ft) for a maximum channel length of 98m (321 ft)

⚡ SkinnyPatch 6A cords can be used in a Z-MAX cabling system but will void all additional worst case guaranteed margins for the Z-MAX 6A U/UTP channel warranty and may result in category 6A/class E_A standards compliant performance with little or no margin.

⚡ To address heat dissipation when using bundled SkinnyPatch cords for remote powering applications, Siemon recommends the following maximum bundle sizes:

Application	Unshielded	Shielded
Type 1 PoE (15.4 W)	96	96
Type 2 PoE (30 W)	96	96
Type 3 PoE (60 W)	48	48
Type 4 PoE (90 W)	24	24
POH (100 W)	24	24
<i>Note: Siemon Category 6A shielded 28 AWG SkinnyPatch cords have an ampacity of 0.5 A per conductor in bundle sizes up to 24 cables, at an ambient temperature of 45 °C</i>		

Table 2: Maximum SkinnyPatch Bundle Sizes

2.6. Z-MAX Trunks

Z-MAX trunks provide high-performance Category 6A/Class E_A performance in a quickly implemented, efficient and cost-effective alternative to individual field-terminated components. They can be ordered in outlet-to-outlet configurations for installation between patch panels or outlet-to-plug configurations for installation between a patch panel and active equipment (equipment cords) or consolidation point applications.

⚡ Outlet types for Z-MAX trunk cables must be specified: Z-MAX panel outlets are only for use with Z-MAX patch panels, Z-MAX hybrid outlets are for use in work area faceplates and zone box / consolidation points. The Z-MAX shielded hybrid outlets can also be used in the TERA-MAX shielded panel as explained at the end of section 2.4 above.

Trunks are available in lengths of 3 – 90m (9 – 295 ft.) which represent the minimum and maximum lengths that can be supported by the Z-MAX systems for solid trunking assemblies. For tips on proper installation of trunk cables, refer to Siemon’s Trunking Cable Installation Guide.

2.7. Termination Tools

While very similar in nature and appearance, unique tools are required for termination of Z-MAX outlets, Z-MAX 45 outlets and Z-PLUGs (see Figure 4). All tools feature unique colors to identify them and attachment points for securing to lanyards or keychains. They are included in standard packs of 50 outlets/plugs. Associated termination videos demonstrating operation of these user-friendly tools are available at www.siemon.com.

The easy-to-use and ergonomically designed Z-TOOL (p/n: Z-TOOL) is required for termination of Z-MAX outlets. In addition to being included in each standard pack of 50 Z-MAX outlets, the Z-TOOL is also included with each Z-MAX patch panel kit. The Z-TOOL also features an additional feature which closes and locks the hinged cable retention/grounding clip. It can be used as a standard hand tool or can be mounted to a rack for ready access during panel terminations.

The Z-MAX 45 termination tool (p/n Z-TOOL-45) is used to terminate Z-MAX 45 outlets. Linear lacing channels and the tool’s color-coded guide ensure correct conductor placement and offers a best in-class termination time and repeatable performance. In addition to Z-MAX 45 outlet termination, the tool is also used to hold the lacing module during conductor lacing and can be used to remove the lacing module for re-termination.



Z-TOOL
Z-MAX Outlet Tool



Z-TOOL-45
Z-MAX-45 Outlet Tool



Z-TOOL-ZP
Z-PLUG Tool

Figure 5:

Like the Z-TOOLS, the Z-PLUG termination tool (p/n Z-TOOL-ZP) enables best in class termination time and performance in an ergonomically friendly and intuitive design. In addition to Z-PLUG termination, the tool can also be used to close and lock the hinged cable retention/grounding clip as well as facilitate re-termination via latch defeating features in the handle.

2.8. Category 6A Copper Cables

Siemon’s high performance category 6A shielded and unshielded cables are available in CMR, CMP and LSOH (CPR compliant) as well as Indoor/Outdoor (I/O) and Outside Plant (OSP)

constructions. Siemon also offers a category 6A cable for unshielded applications constructed with a discontinuous or non-conductive shield barrier. This cable features enhanced category 6A performance using a smaller cable diameter while providing improved heat dissipation and reduced alien crosstalk. Only Siemon category 6A cables can be used in warranted Z-MAX 6A systems.

Shielded Z-MAX outlets are ideally suited for use with F/UTP constructions, however Siemon's 600MHz F/FTP, 1000MHz S/FTP and 1200MHz S/FTP cables may also be used in conjunction with shielded Z-MAX outlets. Reference the following additional termination notes for proper cable preparation with larger diameter cables.

- ✎ *Termination of some larger diameter 22/23 AWG S/FTP cables with shielded Z-MAX outlets, Z-MAX 45 outlets and Z-PLUGs may require the use of pliers to ensure cable and conductors are fully seated into the termination module.*
- ✎ *Termination of large diameter OSP cables with Z-MAX outlets, Z-MAX 45 outlets and Z-PLUGs requires a slightly modified termination practice – supplemental cable preparation instructions can be found at www.siemon.com.*

3. PATHWAY PLANNING

While there are standard planning practices that continue to apply such as pathway fill, maintenance of minimum cable bend radius and proper cable handling there are also many planning aspects specific to Z-MAX 6A installations that must be considered. Following are guidelines to assist with both standard planning practices as well as those specific to Z-MAX 6A.

3.1. Category 6A Cable Diameters

One of the key elements of consideration for Z-MAX 6A planning is the horizontal cable diameters. In lieu of using a shielded solution, the primary method for reducing the effects of alien crosstalk along the length of a channel is to create greater separation between cables. As opposed to cabling mitigation techniques such as manual separation of cables, the best method is achieved by design. Increasing space within the overall cable ensures that adjacent cables are properly separated to reduce the effects of alien crosstalk. This increased cable diameter is present on both horizontal unshielded cables and unshielded modular cords.

This change requires that special attention be given to pathway spaces including cable trays, conduit systems, cable managers, etc. Typical diameters for Siemon's category 6A cables are as shown in Table 2.

- ✎ *Cable diameters are subject to change. The most current product specifications should always be referenced prior to performing any pathway spacing calculations. The current product specification sheets can be found in the Siemon E-catalog: https://ww2.siemon.com/e-catalog/ECAT_Index_page.aspx?category_id=cable.*

Cable Type	Nominal Cable O.D. mm (in.)
U/UTP Patch Cable (traditional)	7.4 (0.29)
U/UTP Patch Cable (SkinnyPatch)	5.3 (0.21)
U/UTP Horizontal Cable (traditional UTP)	8.4-8.9 (0.31-0.33)
U/UTP Horizontal Cable (GT & LT versions)	6.6-7.0 (0.26-0.275)
OSP (UTP) Cable	9.0 (0.355)
OSP single jacket (F/UTP) Cable	8.2 (0.32)
F/UTP Patch Cable	6.4 (0.25)
F/UTP Patch Cable (SkinnyPatch)	5.5 (0.22)
F/UTP Horizontal Cable	6.8-7.0 (0.27-0.28)
S/FTP Horizontal Cable (Int'l)	7.5 (0.30)

Table 3: Category 6A Cable Diameters

3.2. Pathway Sizing

When determining pathway sizing, it is important to note that there is a difference between calculated fill and actual fill. Calculated fill assumes all space is used (i.e. – no space between adjacent cables) and cables are routed perfectly parallel. In reality, there is always space between cables (as they are essentially round) and cable lay is typically random along the pathway. For example, a calculated fill ratio of 50% for a cable tray can be expected to physically fill 100% of the entire cable tray due to spaces between cables and random placement.

For cable tray systems, maximum capacity shall not exceed a calculated fill ratio of 50% or a maximum of 150mm (6 in.) inside depth. Maintaining a maximum depth serves to minimize the effects of “cable set” by reducing cable bundle size and weight to avoid changing the geometric shape of the cables. To allow room for future expansion, and to facilitate additions and removal of cables, a lesser fill is recommended.

To calculate the necessary cable tray size for a specific cable type, the following procedures can be followed:

$$\text{Area of Cable} = \pi r^2 = 3.14 \times (\text{cable O.D.}/2)^2$$

$$\text{Area of Cable Tray} = \text{width} \times \text{depth}$$

$$\text{Capacity (Calculated)} = (\text{Area of Cable Tray} \times 50\%*) / \text{Area of Cable}$$

*Initial design fill ratio for cable tray = 50% (perimeter & furniture pathways = 60%)

Using these calculations for common cable tray sizes, Table 3 illustrates the cable tray fill requirements for both the UTP and F/UTP solid cables:

Cable Tray Size	Cable O.D.
-----------------	------------

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[W x D] mm (in.)	7.0mm (0.275 in.)	7.4mm (0.29 in.)	8.4mm (0.33 in.)	8.9mm (0.35 in.)
152 x 101 (6 x 4)	202	181	140	124
304 x 101 (12 x 4)	404	363	280	249
457 x 101 (18 x 4)	606	545	420	374
610 x 101 (24 x 4)	808	726	561	498
152 x 152 (6 x 6)	303	272	210	187
304 x 152 (12 x 6)	606	545	420	374
457 x 152 (18 x 6)	909	817	631	561
610 x 152 (24 x 6)	1212	1090	841	748

Notes:

- The side rail outside depths (height) can be as much as 32 mm (1-1/4 in) more than the inside loading depth for ladder, ventilated trough, and solid bottom cable trays.
- For site specific calculations, see the Siemon Installation Calculators (Cable Tray Fill worksheet) available on the Siemon Partner Support Center website: (www.siemon.com/ally/).

Table 4: Calculated Cable Tray Capacity

An illustration of the differences in cable tray capacity is shown in Figure 6. This illustrates the pathway sizing advantage when using a smaller diameter cable.

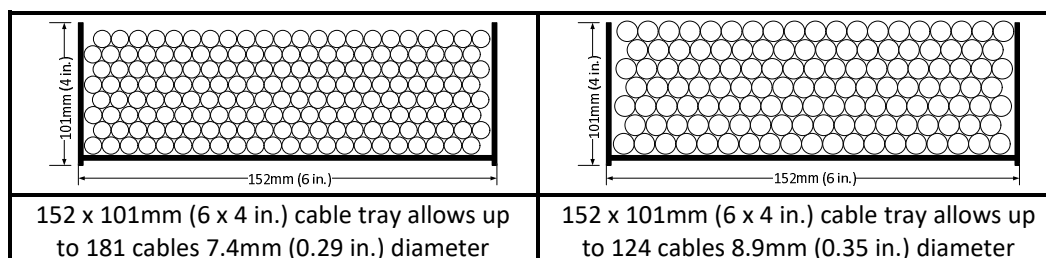


Figure 6: Example of Cable Tray Fill

Another commonly used pathway is conduit. When calculating fill capacity for conduit, there are many factors, such as conduit bends, that require consideration and evaluation to specific site requirements. Table 4 illustrates the necessary conduit sizing for both the UTP and F/UTP horizontal cables based upon the conditions noted:

Conduit Trade Size (metric designator)	Max number of cables based upon allowable fill			
	Cable O.D.			
	7.0mm (0.27 in.)	7.4mm (0.29 in.)	8.4mm (0.33 in.)	8.9mm (0.35 in.)
3/4 (21)	3	2	2	2
1 (27)	4	4	3	2
1-1/4 (35)	7	6	5	4
1-1/2 (41)	10	9	7	6
2 (53)	16	14	11	10
2-1/2 (63)	29	25	19	17
3 (78)	43	38	29	26
3-1/2 (91)	56	49	38	34

Conduit Trade Size (metric designator)	Max number of cables based upon allowable fill			
	Cable O.D.			
	7.0mm (0.27 in.)	7.4mm (0.29 in.)	8.4mm (0.33 in.)	8.9mm (0.35 in.)
4 (100)	72	63	48	43

Notes:

- The table above provides guidelines on cable capacity for conduit based on two 90° bends and a maximum length of 30 m (100 ft).
- The table above is based on 40% initial calculated fill and a de-rating factor of 15% for each of two 90° bends: 100% -15%-15% = 70%; 40% x 70% = 28%. For site specific calculations, see the Siemon Installation Calculators (Conduit Fill worksheet) located on the Siemon Partner Support Center website (www.siemon.com/ally/).
- Conduit fill will vary depending on the quantity of cables being pulled at any one time.
- The number of cables that can be installed in a conduit can be limited by the allowed maximum pulling tension of the cables.

Table 5: Conduit Sizing for Horizontal Cables

Siemon’s RouteIT vertical and horizontal cable managers are specifically designed to readily manage the challenges proposed by today’s high volume, high density cabling systems. Available in multiple sizes, these versatile cable managers provide a system solution for ready routing and protection of both horizontal cables and patch cords. Tables 6 & 7 illustrate the capacity for many of the most common types for Siemon cable management offerings. For a complete list of all Siemon vertical and horizontal managers capacities please reference the product installation link under the support tab at www.siemon.com.

	Cable OD mm (in.)				
	0.21 (5.33)	0.27 (6.86)	0.29 (7.37)	0.31 (7.87)	0.33 (8.38)
HCM(E)-4-1U	18	16	14	12	11
HCM(E)-4-2U	62	54	47	41	36
HCM(E)-4-4U	148	129	112	98	86
HCM(E)-6-1U	27	23	20	17	15
HCM(E)-6-2U	92	80	69	60	53
HCM(E)-6-4U	222	193	168	147	129
RWM-1	17	15	13	12	10
S110-RWM-01	20	17	15	13	11
S110-RWM2-01	53	46	39	34	30
WM-143-5	17	15	13	11	10
WM-144-5	36	31	27	23	21
WM-145-5	62	54	47	41	36

Note: Manager cable capacities reflect a calculated fill rate of 40% which is intended to reflect 100% fill during actual use to de-ratings associated with cable entry/exit

Table 6: Horizontal Cable Management Capacity

	Cable OD mm (in.)				
	0.21 (5.33)	0.27 (6.86)	0.29 (7.37)	0.31 (7.87)	0.33 (8.38)
RS (Channel)	113	98	85	74	66

	Cable OD mm (in.)				
	0.21 (5.33)	0.27 (6.86)	0.29 (7.37)	0.31 (7.87)	0.33 (8.38)
RS3 (Channel)	174	151	131	114	101
RS-CNL	282	245	212	186	164
VCM-6	408	355	308	269	238
VCM-10	704	612	530	464	409
VCM-12	851	740	641	561	495
VP-VPC6-1-(XX)	256	223	194	169	149
V8A-VPC4-1-(XX)	114	99	85	75	66
V8A-VPC6-1-(XX)	167	145	126	110	97
V8A-VPC145-1-(XX)	68	59	51	44	39
VPCA-6 (Front)	182	158	137	120	106
VPCA-6 (Rear)	282	245	212	186	164
VPCA-12 (Front)	390	339	294	257	227
VPCA-12 (Rear)	565	491	425	372	328
Notes: Manager cable capacities reflect a calculated fill rate of 40% which is intended to reflect 100% fill during actual use to de-ratings associated with cable entry/exit. If using for slack storage, above capacities should be further reduced by 50% to accommodate individual cables being routed twice within a manager					

Table 7: Racks & Vertical Cable Management Capacity

3.3. Pathway Sharing

Strategies to minimize alien crosstalk can significantly impact Category 6A U/UTP product design and installation considerations. As part of our ongoing analysis of Category 6A/Class E_A cabling performance and focused study of alien crosstalk, Siemon R&D Labs has evaluated the effects of bundling Category 6A U/UTP cables with other lower performing categories of U/UTP cables (5e & 6).

Power spectrum analysis results have identified that, in a worst-case configuration, bundling of Category 6A U/UTP cables with other category U/UTP cables is only a potential concern when the bundle contains both Category 6A and lower-category U/UTP cables specifically transmitting 10GBASE-T signals. There is no concern if lower category cables are used to support non-10GBASE-T applications (e.g. 1000BASE-T, 100BASE-TX, 10BASE-T, ATM, DSL, baseband video, RS 485, analog or digital telephony) and are in the same bundle as category 6A UTP cables used to support 10GBASE-T and all other applications.

For this reason, mixing, in the form of either bundling or conduit sharing, of Category 6A U/UTP cables with other categories of U/UTP cables is allowed as long as the lower-category unshielded cables are not expected or required to support a 10GBASE-T application. When Category 6A U/UTP and other categories of U/UTP cables are transmitting 10GBASE-T signals, pathways such as cable trays may be shared, but the different category cables must be bundled and/or routed independently. Bundling and separation requirements do not apply when six or fewer copper balanced twisted-pair cables (independent of category) are sharing the same pathway.

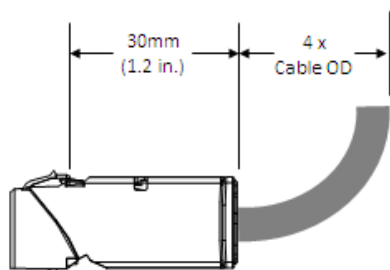
The same bundling and separation requirements do not apply to shielded cables or category 6A U/UTP cables constructed with any type of foil crosstalk barrier. These cable designs may be bundled or share pathways with all other categories of cables without concern of crosstalk interference.

3.4. Horizontal Cable Bend Radius

In addition to overall pathway sizing, proper care must be taken to ensure the minimum bend radius for both U/UTP and shielded cable types. The minimum bend radius, under no load conditions, for 4-pair unshielded (U/UTP), foiled (F/UTP) and fully shielded (S/FTP) twisted pair cable shall not be less than four times the cable diameter unless otherwise noted on the associated product specification sheet.

3.5. Outlet Depth Requirements

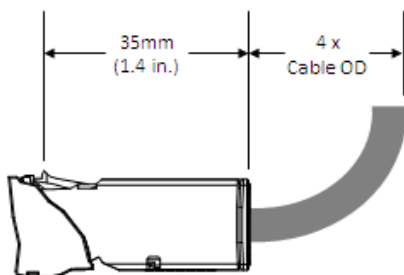
When planning for work area mounting, it is important to ensure there is adequate clearance for depth requirements associated with the outlet and cable. Use of the keystone Z-MAX outlet or flat mounting of the hybrid Z-MAX outlet represents the worst-case depth requirements as shown below in Figures 7 and 8, respectively. Note that depths listed are from the outlet latch position. The overall depth from the wall face will vary between faceplate types.



Cable OD mm (in.)	Overall Depth* mm (in.)
6.35 (0.25)	55.40 (2.20)
6.86 (0.27)	57.44 (2.28)
7.37 (0.29)	59.48 (2.36)
7.87 (0.31)	61.48 (2.44)
8.38 (0.33)	63.52 (2.52)
8.89 (0.35)	65.56 (2.60)

* Depth from latching area. Depth from face of outlet is 8mm (0.3 in.) greater. Distance from wall face to latching area will also vary between faceplate types.

Figure 7: Keystone Z-MAX Depth Requirements

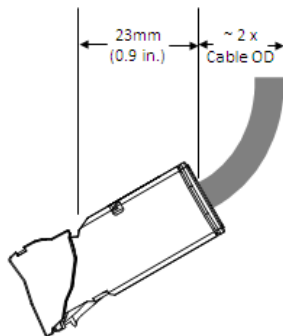


Cable OD mm (in.)	Overall Depth mm (in.)
6.35 (0.25)	60.40 (2.40)
6.86 (0.27)	62.44 (2.48)
7.37 (0.29)	64.48 (2.56)
7.87 (0.31)	66.48 (2.64)
8.38 (0.33)	68.52 (2.72)
8.89 (0.35)	70.56 (2.80)

Figure 8: Hybrid Z-MAX Flat Mounting Depth Requirements

The versatility of the hybrid Z-MAX outlet also allows it to be mounted in an angled orientation which reduces the overall depth requirements by approximately 42% over flat mounting as

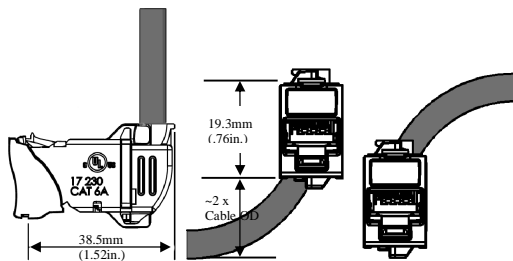
shown in Figure 8. This is ideal for applications where cables enter from the top of the outlet box.



Cable OD mm (in.)	Overall Depth mm (in.)
6.35 (0.25)	35.7 (1.40)
6.86 (0.27)	36.7 (1.44)
7.37 (0.29)	37.7 (1.48)
7.87 (0.31)	38.7 (1.52)
8.38 (0.33)	39.8 (1.56)
8.89 (0.35)	40.8 (1.60)

Figure 9: Hybrid Z-MAX Angled Mounting Depth Requirements

The rear clearance of the side entry Z-MAX 45 outlet (see Figure 9) is virtually identical to the angled mount rear clearance as shown in Figure 8 above. However, the Z-MAX 45 may be the only option for a shallow flat mount orientation.



Cable OD mm (in.)	Overall Height [cable bend + outlet opening] mm (in.)
6.35 (0.25 in.)	25.65 (1.01)
6.86 (0.27 in.)	26.16 (1.03)
7.37 (0.29 in.)	26.67 (1.05)
7.87 (0.31 in.)	27.17 (1.07)
8.38 (0.33 in.)	27.68 (1.09)
8.89 (0.35 in.)	28.19 (1.11)

Figure 10: Z-MAX 45 Depth/Height Requirements

The best way to address depth requirements is at the planning stages to ensure the appropriate products are used. The simplest option is to simply incorporate an outlet box that accommodates the necessary bend radius requirements or a front extension plate. An example of an outlet box with additional depth specifically designed for telecommunications use is shown below in Figure 11.

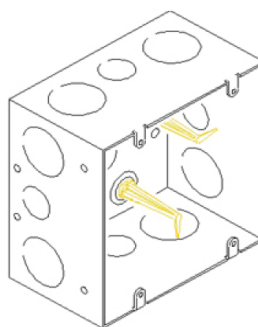


Figure 11: 5 Square® Telecommunications Box provides 73mm (2.875 in.) of Depth

If the use of an outlet box that ensures bend radius requirements are met is not feasible, there are additional product options available to further reduce outlet depth requirements. The most straightforward is the introduction of Siemon's Stand-Off Rings to extend the faceplates forward from the face of the wall. Siemon's Stand-Off Rings are available in depths of 12.5mm (0.50 in.) and 25mm (1.00 in.) in both single and double gang versions. They are compatible with both MAX and CT series faceplates.

Siemon also offers TERA-MAX adapters for CT faceplates that can be used to further improve rear clearances. These adapters are angled and available in two (2) versions for vertical orientations with top entry (CTE-MXA / 1- or 2-port / Figure 12) and horizontal orientations with side entry (CTE-HZA / 2-port / Figure 13). They are compatible with all CT series faceplates and adapters (i.e. – CT Modular Furniture Adapters) and provide a 21% depth reduction vs. standard angled outlet mounting and 54% vs. standard flat outlet mounting.

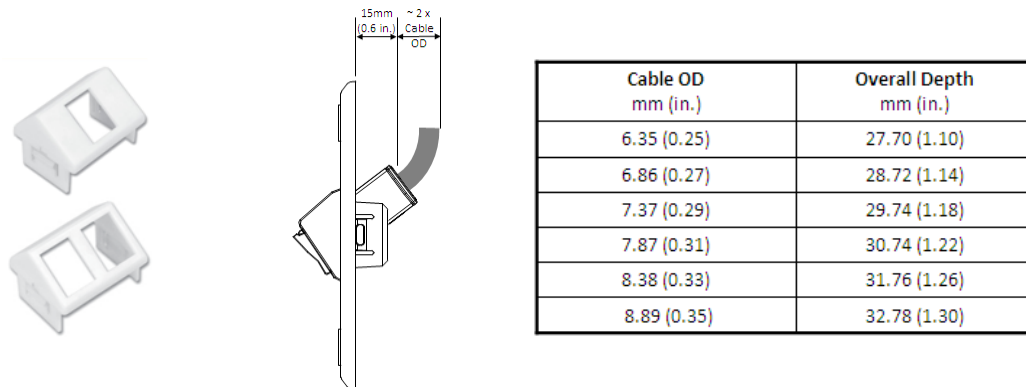


Figure 12: CTE-MXA Adapter

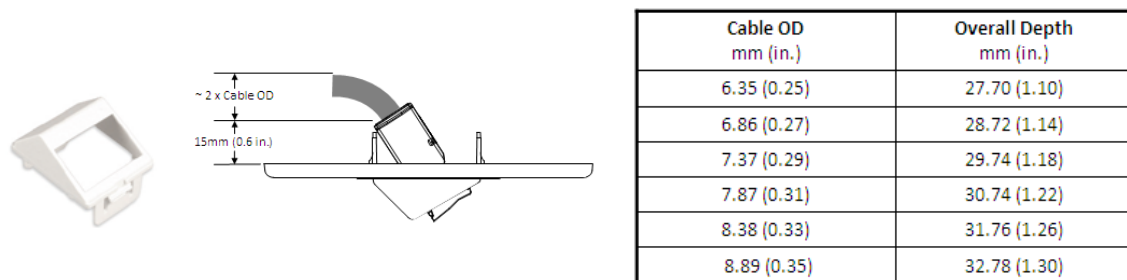


Figure 13: CTE-HZA Adapter

For modular furniture environments requiring snap-in adapters, Siemon's traditional modular furniture adapters provide 10mm (0.40 in.) of depth and the universal furniture adapters provide 17.8mm (0.7 in.) of depth for the CT series and 25.4mm (1.0 in.) of depth for the MAX series. The CT versions can be used with the CTE-MXA or CTE-HZA adapters. Alternately, 3rd party modular furniture extenders are available that can provide up to 19mm (0.75 in.) of additional depth. The extender snaps into the modular furniture opening and the modular furniture adapter snaps into extender.

Note that some of these solutions can be combined to provide a cumulative solution. For example, the combination of the CTE-MXA or CTE-HZA adapters mounted into CT faceplates in conjunction with the 25mm (1.0 in.) Stand-Off Rings can reduce overall depth requirement to less than 8mm (0.30 in.). TERA-MAX adapters are not designed for use with the Z-MAX 45 outlets.

3.6. Outlet depth comparisons

The following depth comparisons examples are shown with clearance requirements based on a 7.3 mm (0.29") cable and a 4 X Cable diameter bend radius using Siemon modular furniture series adapter plates and North American MAX and Keystone series wall plates. Additional rear clearance may be gained with other faceplate depth variations or by using faceplate stand-off rings such as part#: CT(X)-RING-(XXX)-(XX).

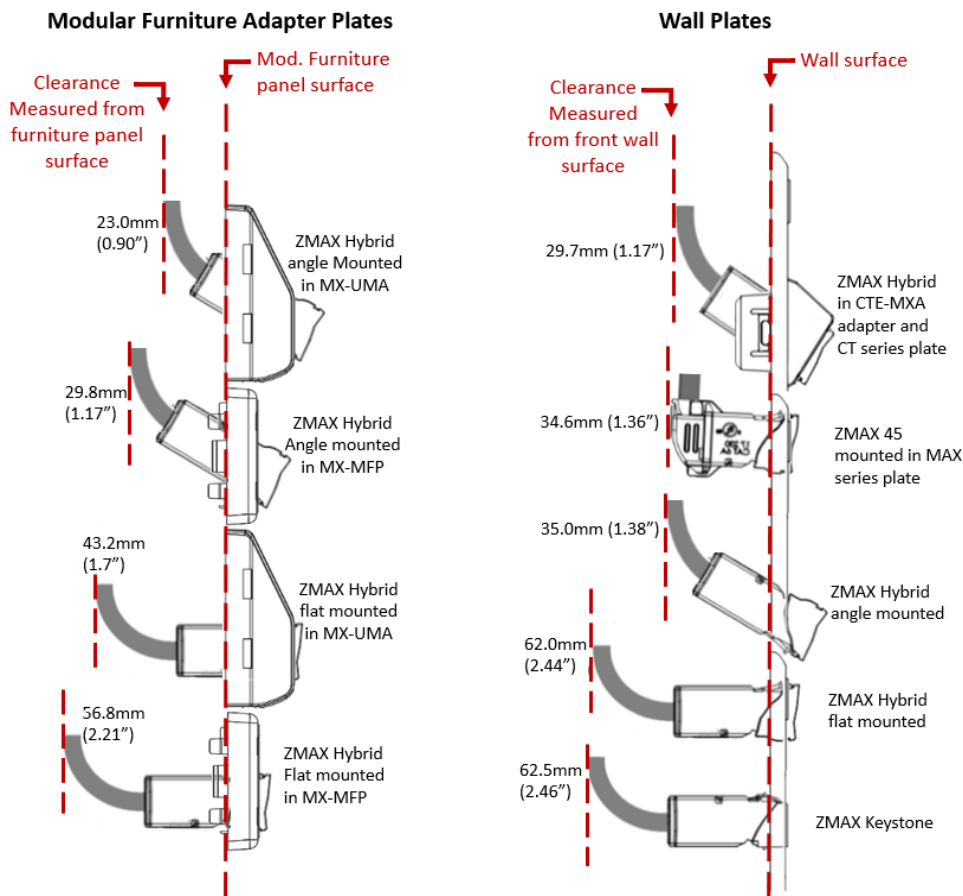


Figure 14: ZMAX Outlet Mounting Depth Comparison

3.7. Patch Cord Bend Radius

TIA-568.0-D specifies the minimum inside bend radius for 4-pair patch cords as 4 x the cord cable diameter. The below table provides guidance based upon current stranded patch cord diameters and should be followed unless otherwise specified on the associated product specification sheet.

Cord	Required Bend Radius
Z-MAX 6A UTP	29.5mm (1.2 in.)
Z-MAX 6A UTP SkinnyPatch	21.3mm (0.84 in.)
Z-MAX 6A Shielded	25.4mm (1.0 in.)
Z-MAX 6A Shielded SkinnyPatch	22.0mm (0.9 in.)

Table 8: Stranded Patch Cord Bend Radius Requirements

4. SYSTEM DESIGN

Customer requirements often dictate the configuration of the cabling system to be installed. The decision between an interconnect and cross-connect may be determined by physical space or budget requirements while the introduction of a consolidation point may be based upon the move-add-change rate. As a result, multiple possible configurations that may be implemented. The following sections identify the unique requirements associated with each configuration.

For all Z-MAX 6A installations, regardless of the model installed, the following length requirements apply in order to obtain full warranty margins:

- Maximum horizontal cable length is 90m (295 ft.)
- Minimum horizontal cable length is 15m (50 ft.)
- Maximum total stranded cord length (including work area, equipment and cross-connect cords, if applicable) is 10m (33 ft.) for 24/26 AWG and 8m (26 ft.) for 28 AWG cord. Refer to Table 8 for additional details and exceptions.
- Minimum stranded cord length is 2m (~7 ft.)

Violation of any of these length requirements will void all margins for the Z-MAX 6A channel warranty and may result in Category 6A/Class E_A standards compliant performance with little or no margin.

Additionally, for each cabling configuration (2-, 3- or 4-connector) there are configuration specific details as shown in table below. Also included in the configurations is the optional Modular Plug Terminated Link (MPTL). This is an alternate model that is recommended in cases where there are no potential plans for moving the end device and security and aesthetics is preferred over flexibility.

	Z-MAX 6A Full Margin Warranty (Min/Max)	Z-MAX 6A Category 6A/Class E _A Compliant Warranty (Min)	Z-MAX 6A Short Link Category 6A/Class E _A Compliant Warranty (Min)
2-Connector			
Equipment Cord	2m / 5m	1m	2m
Horizontal Cable	15m / 90m	15m	3m
Work Area Cord	2m / 5m*	1m	2m
3-Connector w/Consolidation Point			
Equipment Cord	2m / 5m	1m	N/A
Horizontal Cable	15m / 85m	15m	N/A
Consolidation Point Cable	5m / 75m	5m	N/A
Work Area Cord	2m / 5m*	1m	N/A
3-Connector w/Cross-connect			
Equipment Cord	2m / up to 5m	1m	3m
Cross-connect Cable	2m / up to 5m	1m	2m
Horizontal Cable	15m / 90m	15m	3m
Work Area Cord	2m / up to 5m*	1m	2m
4-Connector w/Consolidation Point & Cross-connect			
Equipment Cord	2m / up to 5m	2m	N/A
Cross-connect Cable	2m / up to 5m	2m	N/A
Horizontal Cable	15m / 85m	15m	N/A
Consolidation Point Cable	5m / 75m	5m	N/A
Work Area Cord	2m / up to 5m*	2m	N/A
Note: Maximum combined length of cords per channel not to exceed: 10 meters (cords 26 AWG or larger, i.e. Z-MAX® series) 8 meters (cords 28 AWG, i.e. SkinnyPatch series) * For site specific calculations, see the Siemon Installation Calculator (Open Office Work Area Cord) located on the Siemon Ally Website for exceptions to maximum lengths in open office cabling designs.			

Table 9: Channel Configuration Length Requirements

The following sections highlight the various products eligible for use in Z-MAX systems. While not specifically listed, Z-MAX 6A trunks are also available and may be substituted where applicable.

4.1. 2-Connector Unshielded Channel or MPTL

A 2-connector model is comprised of a connector at each end of the link and does not include a consolidation point or cross-connect.

ID	FUNCTION	DESCRIPTION	PART NUMBER
1	a. Equipment Cord b. Work Area Cord	Z-MAX 6A U/UTP Patch Cord	ZM6A-(XX)-(XX) or SP6A-(XX)-(XX)(X)
2	Patch Panel	Z-MAX 6A UTP Patch Panel	Z6A-PNL(X)-24(X) or Z6A-P(X)-24
3	Horizontal Cabling	Category 6A U/UTP Cable	9C6(X)4-A5-(XX)AR1A or 9U6(X)4-A5-(XX)-R1A (US) or 9C6(X)4-A5 (Int'l)
4	Work Area Outlet	Z-MAX 6A UTP Outlet	Z6A-(X)(XX)
5	End Device Modular Plug	Z-PLUG 6A Modular Plug	ZP1-6AS-01S

Table 10: Eligible Products for 2-Connector UTP Channel or MPTL

4.2. 3-Connector Unshielded Channel w/Consolidation Point (CP)

A 3-connector model with consolidation point is comprised of a connector at each end of the link as well as a consolidation point connection within the link.

ID	Function	Description	Part Number(s)
1	a. Equipment Cord b. Work Area Cord	Z-MAX 6A UTP Patch Cord	ZM6A-(XX)-(XX) or SP6A-(XX)-(XX)(X)
2	a. Patch Panel (TR) b. Patch Panel (CP)	Z-MAX 6A UTP Patch Panel	Z6A-PNL(X)-24(X) or Z6A-P(X)-24
3	Horizontal Cabling	Category 6A UTP Cable	9C6(X)4-A5-(XX)AR1A or 9U6(X)4-A5-(XX)-R1A (US) or 9C6(X)4-A5 (Int'l)
5	Work Area Outlet	Z-MAX 6A UTP Outlet	Z6A-(X)(XX)
6	Field Terminated Modular Plug for CP or end device	Z-PLUG 6A Modular Plug	ZP1-6AS-01S

Note: Alternate product for the CP: Z-MAX category 6A outlets in a zone box may be used in place of ZMAX panel at the CP

Table 11: Eligible Products for 3-Connector UTP Channel or MPTL w/CP

4.3. 3-Connector Unshielded Channel w/Cross-connect

A 3-connector model with cross-connect comprised of a connector at each end of the link with a cross-connect at one end.

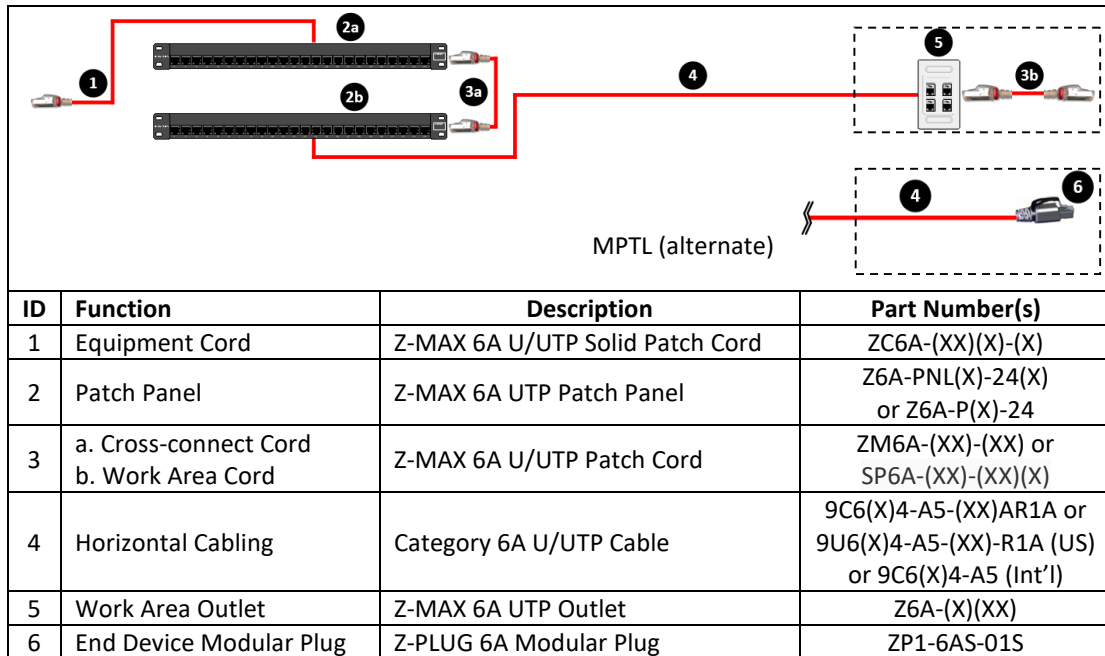
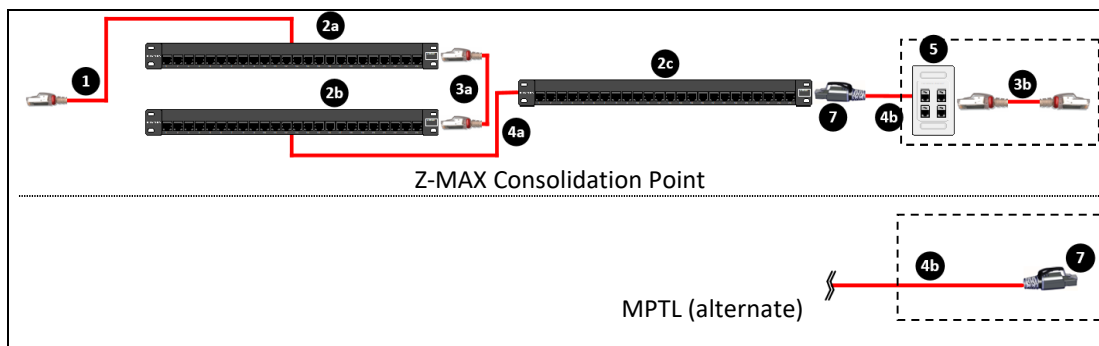


Table 12: Eligible Products for 3-Connector UTP Channel or MPTL w/Cross-connect

4.4. 4-Connector Unshielded Channel

A 4-connector model is comprised of a connector at each end of the link as well as a consolidation point connection within the link with a cross-connect at one end.



ID	Function	Description	Part Number(s)
1	Equipment Cord	Z-MAX 6A U/UTP Solid Patch Cord	ZC6A-(XX)(X)-(X)
2	a. b. Patch Panels (TR) c. Patch Panel (CP)	Z-MAX 6A UTP Patch Panel	Z6A-PNL(X)-24(X) or Z6A-P(X)-24
3	a. Cross-connect Cord b. Work Area Cord	Z-MAX 6A U/UTP Patch Cord	ZM6A-(XX)-(XX) or SP6A-(XX)-(XX)(X)
4	Horizontal Cabling	Category 6A U/UTP Cable	9C6(X)4-A5-(XX)AR1A or 9U6(X)4-A5-(XX)-R1A (US) or 9C6(X)4-A5 (Int'l)
6	Work Area Outlet	Z-MAX 6A UTP Outlet	Z6A-(X)(XX)
7	Field Terminated Modular Plug for CP or end device	Z-PLUG 6A Modular Plug	ZP1-6AS-01S

Notes:
1. Alternate product for the CP: Z-MAX category 6A outlets in a zone box may be used in place of ZMAX panel at the CP

Table 13: Eligible Products for 4-Connector UTP Channel or MPTL

4.5. 2-Connector Shielded Channel

A 2-connector model is comprised of a connector at each end of the link and does not include a consolidation point or cross-connect.

ID	FUNCTION	DESCRIPTION	PART NUMBER
1	a. Equipment Cord b. Work Area Cord	Z-MAX 6A Shielded Patch Cord	ZM6A-S(XX)-(XX) or SP6A-S(XX)M-(XX)(X)
2	Patch Panel	Z-MAX 6A Shielded Patch Panel	Z6AS-PNL(A)-24(K) or Z6AS-P(X)-24
3	Horizontal Cabling	Category 6A Shielded Cable	9A6(X)4-A5-(XX)-R1A (US) or 9A6(X)4-A5 (Int'l)
4	Work Area Outlet	Z-MAX 6A Shielded Outlet	Z6A-S(X)(XX) or Z6A-45-S(XXX)
5	End Device Modular Plug	Z-PLUG 6A Modular Plug	ZP1-6AS-01S

Note: In addition to Category 6A shielded cables, other cable constructions may also be compliant and compatible for use in conjunction with shielded Z-MAX outlets. See section 2.8 Category 6A copper cables for more information

Table 14: Eligible Products for 2-Connector Shielded Channel or MPTL

4.6. 3-Connector Shielded Channel w/Consolidation Point (CP)

A 3-connector model with consolidation point is comprised of a connector at each end of the link as well as a consolidation point connection within the link.

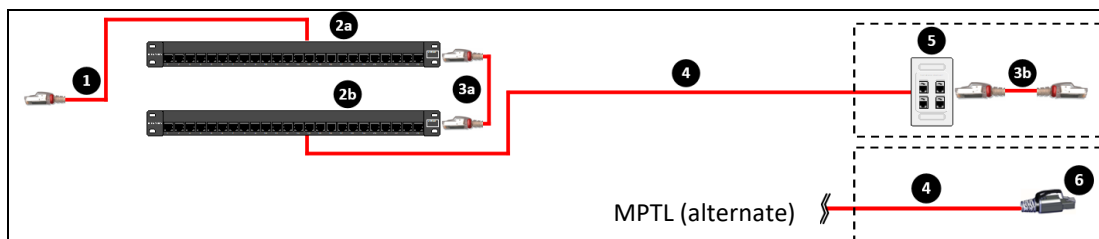
ID	Function	Description	Part Number(s)
1	a. Equipment Cord b. Work Area Cord	Z-MAX 6A Shielded Patch Cord	ZM6A-S(XX)-(XX) or SP6A-S(XX)M-(XX)(X)
2	a. Patch Panel (TR) b. Patch Panel (CP)	Z-MAX 6A Shielded Patch Panel	Z6AS-PNL(A)-24(K) or Z6AS-P(X)-24
3	Horizontal Cabling	Category 6A shielded Cable	9A6(X)4-A5-(XX)-R1A (US) or 9A6(X)4-A5 (Int'l)
4	Work Area Outlet	Z-MAX 6A Shielded Outlet	Z6A-S(X)(XX) or

			Z6A-45-S(XXX)
5	Field Terminated Modular Plug for CP or end device	Z-PLUG 6A Modular Plug	ZP1-6AS-01S
Notes: 1. Field terminated TERA outlets and plugs must be used at the CP in conjunction with a TERA-MAX patch panel 2. In addition to Category 6A F/UTP cables, other cable constructions may also be compliant and compatible for, use in conjunction with shielded Z-MAX outlets. See section 2.8 Category 6A copper cables for more information. 3. Alternate product for the CP: Z-MAX category 6A shielded outlets in a zone enclosure may be used in place of a ZMAX patch panel at the CP.			

Table 15: Eligible Products for 3-Connector Shielded Channel or MPTL w/CP

4.7. 3-Connector Shielded Channel w/Cross-connect

A 3-connector model with cross-connect comprised of a connector at each end of the link with a cross-connect at one end.



ID	Function	Description	Part Number(s)
1	Equipment Cord	Z-MAX 6A Shielded Solid Patch Cord	ZC6A-S(XX)(X)-(X) or SP6A-S(XX)M-(XX)(X)
2	Patch Panel	Z-MAX 6A Shielded Patch Panel	Z6AS-PNL(A)-24(K) or Z6AS-P(X)-24
3	Cross-connect Cord	Z-MAX 6A Shielded Patch Cord	ZM6A-S(XX)-(XX)
4	Horizontal Cabling	Category 6A F/UTP Cable	9A6(X)4-A5-(XX)-R1A (US) or 9A6(X)4-A5 (Int'l)
5	Work Area Outlet	Z-MAX 6A Shielded Outlet	Z6A-S(X)(XX) or Z6A-45-S(XXX)
6	End Device Modular Plug	Z-PLUG 6A Modular Plug	ZP1-6AS-01S

Note: In addition to Category 6A F/UTP cables, other cable constructions may also be compliant and compatible for use in conjunction with shielded Z-MAX outlets. See section 2.8 Category 6A copper cables for more information.

Table 16: Eligible Products for 3-Connector Shielded Channel or MPTL w/Cross-connect

4.8. 4-Connector Shielded Channel

A 4-connector model is comprised of a connector at each end of the link as well as a consolidation point connection within the link with a cross-connect at one end.

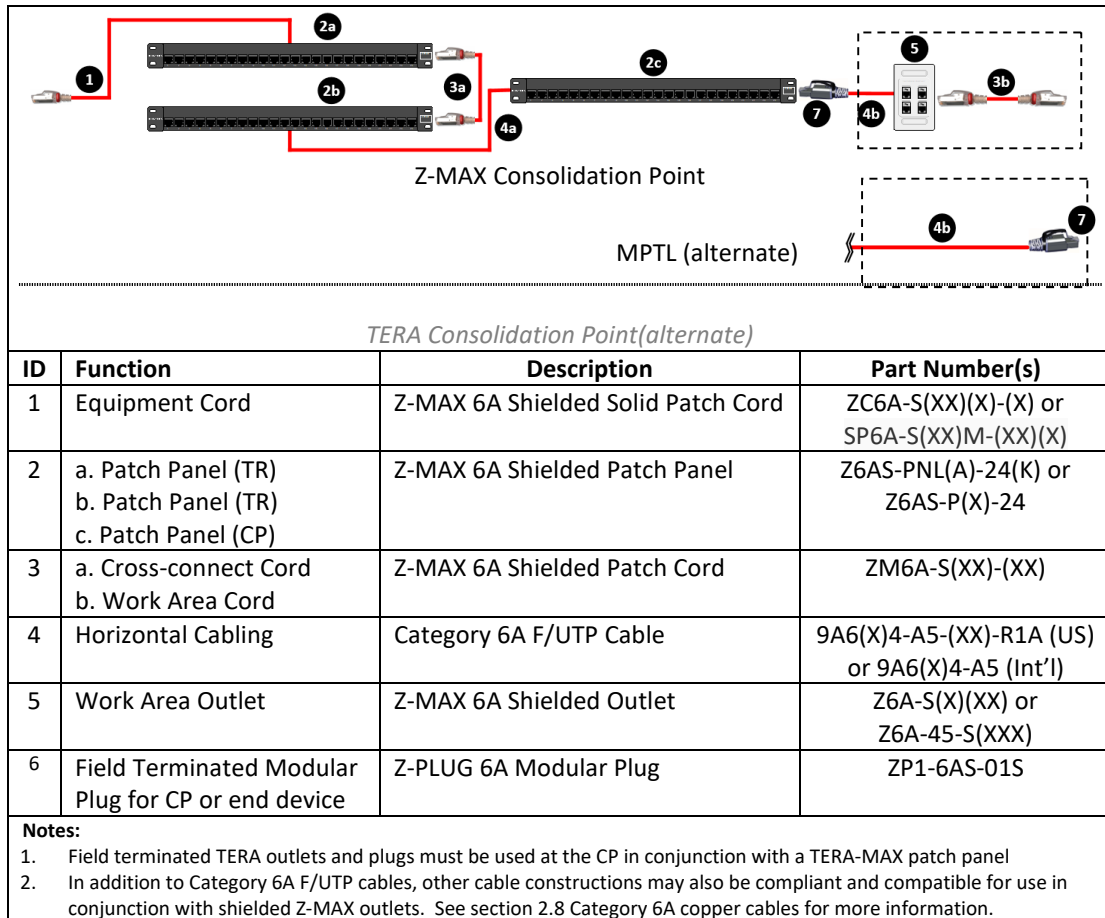


Table 17: Eligible Products for 4-Connector Shielded Channel

5. TESTING

Siemon requires 100% transmission testing of installed cabling links/channels. For the Z-MAX 6A system, an approved field tester capable of performing frequency testing to 500MHz for augmented category 6 requirements. The list of required field test parameters are as follows:

- Wire Map (plus shield continuity – for shielded applications)
- Length
- Insertion Loss
- NEXT
- PS NEXT
- ELFEXT

- PS ELFEXT
- Return Loss
- Propagation Delay
- Delay Skew

Alien crosstalk compliance is attained via product design and compliant installation and is not a required field test. While field test methods of alien crosstalk are available, it is generally agreed that it may not be entirely practical due to the conditions required for the testing. The parameters for field tests associated with alien crosstalk include: ANEXT, AFEXT, PSANEXT and PSAFEXT.

The current listing of approved field testers, adapters and applicable tests is shown in the below table. Refer to the Siemon Partner Support Center website for the latest updated list.

https://www.siemon.com/ally/warranty/field_testing/

Tester	Firmware Version ¹	Permanent Link Adapter	Channel Adapter	MPTL Adapter
Fluke Networks: DSX-5000 DSX-5000 DSX-8000	Latest version required	DSX-PLA004S	DSX-CHA004S	Available as an accessory item from each test manufacturer: Request Category rated (5e, 6, 6A) Patch Cord Channel Adapter
		DSX-PLA004S	DSX-CHA004S	
		DSX-PLA804S	DSX-CHA804S	
AEM: TestPro 100		TP-AD-6APL	TP-AD-6ACH	
Ideal Networks: LanTEK III-500MHz LanTEK III-1000MHz		R161051	R161053	
Softing: WireXpert 500 WireXpert 4500	WX-AD-6ALKIT2	WX-AD-6ACH2		
VIAMI: Certifier10G™ Certifier40G™	NGC-4500-6ALKIT2	NGC-4500-6ACH2		

¹ Latest versions of firmware should be used unless otherwise noted

Table 18: Field Testing Requirements for Z-MAX 6A Systems

5.1. Calibration

All field testers used must be within factory calibration timeframes and also must be re-calibrated prior to each use based upon the manufacturer's requirements. In addition, all adapters used must be in good condition and be approved for use based upon the requirements listed under section 5.

5.2. Test Configurations

Siemon allows the use of either Permanent Link or Channel testing, at the discretion of the installer. Each configuration is illustrated below for reference:

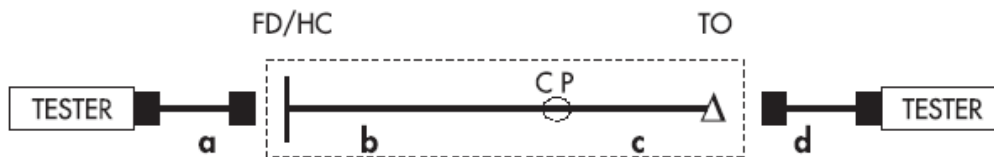


Figure 15: Permanent Link Testing

where:

$b + c \leq 90$ m (295 ft.)

a & d = permanent link adapters

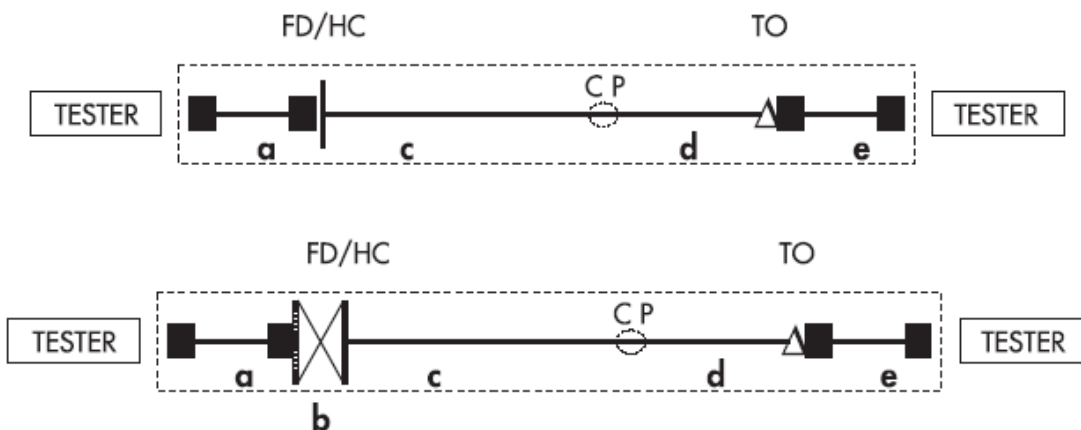
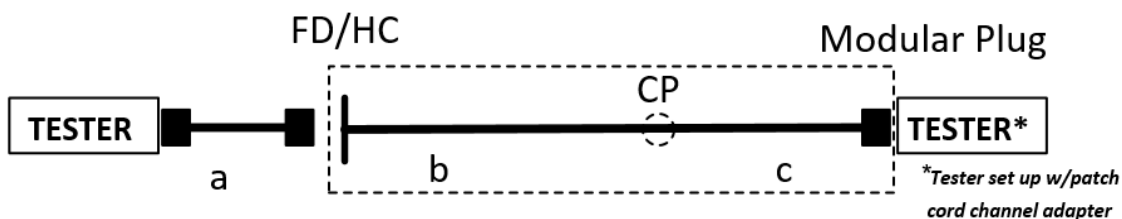


Figure 16: Channel Testing

where:

$c + d \leq 90$ m (295 ft.)

$a + b + c + d + e \leq 100$ m (328 ft.)



*Tester set up w/patch cord channel adapter

Figure 17: MPTL Testing

where:

a = permanent link adapters

b + c ≤ 90 m (295 ft.)

MPTL side is tested with category 6A approved patch cord channel adapter

5.3. Test Results

Siemon requires the use of PASS results for warranty. Test results that contain an asterisk are within the accuracy range of the field tester. Any results resulting with an asterisk require corrective actions. If experiencing marginal results on links that have had corrective action performed, contact a Siemon Technical Services Group representative for resolution.

5.4. Troubleshooting

General

Potential Root Cause	Recommended Corrective Action
Low battery	Replace battery or recharge unit
Test instrument out of calibration	Re-calibrate
Worn test adapter(s)	Check with manufacturer on maximum number of tests recommended and replace if required

Wire Map

Potential Root Cause	Recommended Corrective Action
Two pairs have been swapped when terminating	Identify and re-terminate
Wires connected to wrong pins at the connector	Identify and re-terminate
Cable not terminated	Terminate
Stress at connection, cable routed to wrong location, damaged connector, etc.	Re-install cable - (cable break location can be determined by TDR function of tester)

Length

Potential Root Cause	Recommended Corrective Action
Installed cable over 90 meters	Re-route cable
NVP not set correctly	Set NVP correctly and re-test
Excessive temperatures	Re-route cabling away from heat source

Insertion Loss

Potential Root Cause	Recommended Corrective Action
Poor connections	Re-terminate and re-test
Impedance mismatch - cable and connectors not matched	Replace connector or cable and re-test
Excessive length	Re-route cable if possible and re-terminate
Construction of the cable and its components	Replace cable

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NEXT (PS NEXT) / ELFEXT (PSELFEXT)

Note: NEXT time domain fault analysis on tester can be used to assist in identifying source or location

Potential Root Cause	Recommended Corrective Action
Split pairs	Check wire map; identify and re-terminate
Poor termination	Re-terminate and re-test
Excessive untwist of pairs at termination	Re-terminate and re-test
Cable ties too tight	Remove cable ties and re-test (may require replacement of cables)
Cable bundles too large	Re-bundle and re-test (may require replacement of cables)
Cable pulling tension exceeded at install	Replace cables
Old or coiled patch cords	Replace and/or uncoil patch cords
Worn test adapter(s)	Check with manufacturer on maximum number of tests recommended and replace if required
Bend radius of cable exceeded	Re-route cables and re-test (may require replacement of cables)

Propagation Delay / Delay Skew

Potential Root Cause	Recommended Corrective Action
Damaged cable	Replace cable

Return Loss

Note: Return Loss time domain fault analysis on tester can be used to assist in identifying source or location

Potential Root Cause	Recommended Corrective Action
Excessive untwist of pairs at termination or kinks due to excessive cable stored poorly	Re-terminate and re-test
Cable ties too tight	Remove cable ties and re-test (may require replacement of cables)
Cable bundles too large	Re-bundle and re-test (may require replacement of cables)
Cable pulling tension exceeded at install	Replace cables
Worn test adapter(s)	Check with manufacturer on maximum number of tests recommended and replace if required
Mismatch in cabling components (particularly category 6) or test equipment	Change components and/or check tester adaptors (personality modules)
Wrong autotest setting selected	Correctly set tester and re-test
Bend radius of cable exceeded (often at point of termination)	Re-route cable and re-test (may require replacement of cable)

If you have any questions regarding the content of this document or other related issues, please contact the Siemon Technical Services Group in Watertown CT at 1-800-365-2285 or your

regional international Siemon sales office. For a complete listing of Siemon offices, please visit www.siemon.com.

Z-MAX 6A PLANNING & INSTALLATION GUIDE

Version	Revisions	Date
1.0	1. Initial Release	
2.0	<ol style="list-style-type: none"> 2. Incorporated Z-PLUG, Z-MAX 45 and SkinnyPatch 6A 3. Incorporated the additional termination tools associated with Z-PLUG and Z-MAX 45 4. Update Table 8 - Channel Configuration Length Requirements 5. Updated cabling configuration tables (added MPTL & deleted TERA at consolidation points) 6. Specify de-rated length for 28 AWG SkinnyPatch cords 7. Added max bundle recommendations for 28 AWG cords 8. Added paragraph referencing the discontinuous or shield barrier style for the GT & TL style cables 9. Update Table 17 with latest approved field testers & links including MPTL adapter requirements 10. Provide general links or instructions where to find capacity tables that already exist on web site. 11. Added several clarifications and text corrections throughout. 	2020- 04-30
2.1	Add flat mount recommendation and compatibility for Z-MAX 45 hybrid outlet in Universal Modular Adapter plates	2022-05-10
2.2	Remove all S210 references (discontinued product)	2022-10-18
2.3	<ol style="list-style-type: none"> 1. Additional clearance info and depth comparison figure added. 2. Removed note about the keystone version of the Z-MAX outlets fitting (non-flush) into CTE-MXA adapters which is no longer valid on revised version CTE-MXA's. 3. Clarified paragraph about keystone version outlet and related compatibility. 4. Corrected conduit fill & cable tray tables to match the Siemon calculator 	2023-09-05