



# ADDISON OMS CABLING SYSTEM

## Matrix 5E Copper Cabling Solutions

Matrix 5E offers both unshielded and shielded system, in full compliant with EIA/TIA 568-B.2 and ISO 11801 D channel, providing significant margin in both return loss and NEXT, in support of many different networking requirements, including 1000Base-T, Broadband video, 3D video and other multimedia applications.

### ☆ Matrix 5E Unshielded System

Part No.	Description
AD-PP-24-C5E-A/B	Cat 5e 24 Port Unshielded Patch Panel
AD-KM-C5E-A/B-XX	Cat 5e Unshielded Data Jack
AD-BC-CAT5EUTP4PCM24	Cat 5e UTP 4 Pairs PVC Cable
AD-CAT5EUTP4PM001CM26A-XX	Cat 5e 1m UTP Power Sum PVC Patch Cord
AD-CAT5EUTP4PM003CM26A-XX	Cat 5e 3m UTP Power Sum PVC Patch Cord
AD-CAT5EUTP4PM005CM26A-XX	Cat 5e 5m UTP Power Sum PVC Patch Cord



### ☆ Matrix 5E Shielded System

Part No.	Description
AD-PP-24-C5ES-A/B	Matrix 5e 24 Port Shielded Patch Panel
AD-KM-C5ES-A/B-XX	Matrix 5e Shielded Data Jack
AD-BC-CAT5EFTP4PCM24	Cat 5e FTP 4 Pairs PVC Cable
AD-CAT5EFTP4PM001CM26A-XX	Cat 5e 1m FTP Power Sum PVC Patch cord
AD-CAT5EFTP4PM003CM26A-XX	Cat 5e 3m FTP Power Sum PVC Patch cord
AD-CAT5EFTP4PM005CM26A-XX	Cat 5e 5m FTP Power Sum PVC Patch cord



### ☆ Worst Values and Typical Values for Matrix 5E Channel (1-100Mhz)

	Worst Margin	Typical Margin
INSERTION LOSS	5%	10%
NEXT	3 dB	8.5dB
PSNEXT	5.5dB	9.5dB
ELFEXT	4.5dB	10.5dB
PSELFEXT	5.5dB	11.5dB
RL	1.0dB	5.5dB

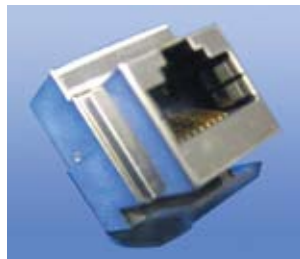
Matrix 5E is a high performance cabling system. With the use of impedance matching components, the data error rates of the channels are highly reduced, thus increasing the transmission performance and efficiency to a great extent. Matrix 5E components work in full harmony with the cables, significantly increasing the margin for both permanent link and channel testing, thus highly reducing the interference during the data transmission.

Matrix 5E far exceeds the requirement TIA/EIA and ISO 11801, providing extra channel margin to ensure sure pass in any handheld tester during the field site testing. The typical NEXT value of Matrix 5E is around 8 dB whereas the worst value exceeds 3 dB.

Matrix 5E provides extended working frequency up to 350 MHz. Through the special design in the twist distance in the cable pairs, the cables can be tested up to 350 MHz which provides the best support for the current and future multimedia applications. Matrix 5E cables fulfill the testing procedures as governed by ASTM6 D4566, complying with Power Sum requirement, which is very critical for reducing signal distortion as this is the total sum of the crosstalk from each of the other pairs in the cable and this will more accurately reveal the actual crosstalk performance of the cables.

In 2002, Addison launched out enhanced Shielded system, which effectively provides superior EMI/RFI capability for the cabling system. External interference source usually has very adverse effect on the system performance and to reduce these interference, Matrix 5E enhanced shielded system adopts either the individually shielded or individually shielded plus overall shielded cable. These cables are highly recommended for environments with great interference sources which may significantly affects the attenuation, NEXT and also ELFEXT performance.

Matrix 5E can offer different jacket types such as PVC, LSOH, LSFROH, CMR, CMP for meeting different fire performance requirements.



# Matrix 6 1G Copper Cabling Solutions

Matrix 6 provides both unshielded and shielded system, in full compliant with EIA/TIA568-B.2 and ISO 11801 E channel, providing significant margin for both return loss and NEXT. This provides strong support for different applications such as 1000 Base-T, broadband video, 3D video, 10GBase-T and other multimedia applications.

## ☆ Matrix 6 Unshielded System

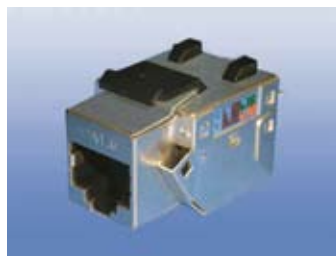
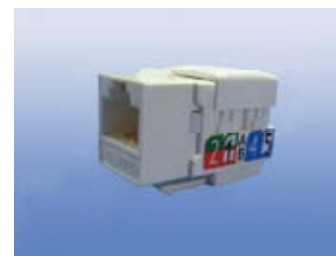
Part No.	Description
AD-PP-24-C6-A/B	Cat 6 24 Port Unshielded Patch Panel
AD-KM-C6-A/B-XX	Cat 6 Unshielded Data Jack
AD-BC-CAT6UTP4PCM23	Cat 6 UTP 4 Pairs PVC Cable
AD-CAT6UTP4PM001CM26A-XX	Cat 6 1m UTP Extended Frequency PVC Patch Cord
AD-CAT6UTP4PM003CM26A-XX	Cat 6 3m UTP Extended Frequency PVC Patch Cord
AD-CAT6UTP4PM005CM26A-XX	Cat 6 5m UTP Extended Frequency PVC Patch Cord

## ☆ Matrix 6 Shielded System

Part No.	Description
AD-PP-24-C6S-A/B	Cat 6 24 Port Shielded Patch Panel
AD-KM-C6S-A/B-XX	Cat 6 Shielded Data Jack
AD-BC-CAT6STP4PCM23	Cat 6 STP 4 Pairs PVC Cable
AD-BC-CAT6SFTP4PCM23	Cat 6 SFTP 4 Pair PVC Cable
AD-CAT6FTP4PM001CM26A-XX	Cat 6 1m FTP Extended Frequency PVC Patch Cord
AD-CAT6FTP4PM003CM26A-XX	Cat 6 3 m FTP Extended Frequency PVC Patch Cord
AD-CAT6FTP4PM005CM26A-XX	Cat 6 5 m FTP Extended Frequency PVC Patch Cord

## ☆ Worst Values and Typical Values for Matrix 6 Channel (1-250Mhz)

	Worst Margin	Typical Margin
INSERTION LOSS	5%	6%
NEXT	6dB	8dB
PSNEXT	7dB	9dB
ELFEXT	6dB	8dB
PSELFEXT	7dB	9dB
RL	4dB	5dB



Matrix 6 system provides a 4 connector channel solution, using impedance matching data jacks to work in harmony with patch panels, significantly increasing the margin for both the channel and permanent link testing. The centered design of the products has optimized the product to the greatest extent.

Matrix 6 far exceeds the requirement TIA/EIA and ISO 11801, providing extra margin to ensure sure pass in any handheld tester during the field site testing. The typical NEXT headroom of Matrix 6 is around 8 dB whereas the worst headroom value exceeds 6 dB.

Matrix 6 system can work under 500 MHz extended frequency in support of the future 10G applications. Every components in Matrix 6 system features special patented design in order to guarantee significant margin for offering an adequate buffer margin in any harsh installation environment. Patch cord is a very important component in a channel. Addison launches out the extended frequency patch cord in compliant to the EIA/TIA component requirement, providing significant margin in NEXT in a channel testing.

Matrix 6 can offer different jacket types such as PVC, LSOH, LSFROH, CMR, CMP for meeting different fire performance requirements.



## Matrix 6A 10G Copper Cabling Solutions

Since the approval of 10G 802.6ae standard for fiber optic cable, in 2002, a working committee for 10GBASE T was set for studying the feasibility of running 10Gbps over 100m drive distance. This is a horizontal cabling system advocated by T1568-B and ISO/IEC 11801 for Cat 6E class or better system in support of future gigabit applications.

In 2006, Addison launched out Matrix6A cabling system. Matrix 6A is a system design based on Cat 6E class, in compliant with IEEE 802.3an standard. Matrix 6A 10G system can run 100 meters for 10GBase-T. According to IEEE 802.3, the “between channel” crosstalk (which is called AXTalk) requirement is very important in the signal to noise ratio. In general, for a channel length of 55m or less, Cat 6 cable may well meet the transmission requirements to support 10GBASE-T. But for a drive distance from 55m to 100m, an augmented cabling system is required for delivering 10 Gigabit performance. Matrix 6A is a system designed for delivering better AXTalk performance than Cat 6 or Class E for support of 10GBASET traffic. Matrix 6A system can work under 500 MHz extended frequency. Every component in Matrix 6A 10G features special design in order to guarantee significant margin for offering a comfortable buffer in any harsh installation environment.

### ☆ Matrix 6A 10G Unshielded System

Part No.	Description
AD-PP-24-C6A-A/B	Cat 6A 10G 24 Port Unshielded Patch Panel
AD-KM-C6A-A/B-XX	Cat 6A 10G Unshielded Data Jack
AD-BC-CAT6AUTP4PCM23	Cat 6A 10G UTP 4 Pair PVC Cable
AD-CAT6AUTP4PM001CM26A-XX	Cat 6A 10G 1m UTP Extended Frequency PVC Patch Cord
AD-CAT6AUTP4PM003CM26A-XX	Cat 6A 10G 3m UTP Extended Frequency PVC Patch Cord
AD-CAT6AUTP4PM005CM26A-XX	Cat 6A 10G 5m UTP Extended Frequency PVC Patch Cord



### ☆ MATRIX 6A 10G Shielded System

Part No.	Description
AD-PP-24-C6AS-A/B	Cat 6A 10G 24 Port Shielded Patch Panel
AD-KM-C6AS-A/B-XX	Cat6A 10G Shielded Data Jack
AD-BC-CAT6ASTP4PCM23	Cat 6A 10G STP 4 Pair PVC Cable
AD-BC-CAT6ASFTP4PCM23	Cat 6A 10G SFTP 4 Pair PVC Cable
AD-CAT6ASTP4PM001CM26A-XX	Cat 6A 10G 1m STP Extended Frequency PVC Patch Cord
AD-CAT6ASTP4PM003CM26A-XX	Cat 6A 10G 3m STP Extended Frequency PVC Patch Cord
AD-CAT6ASTP4PM005CM26A-XX	Cat 6A 10G 5m STP Extended Frequency PVC Patch Cord



### ☆ Worst Values and Typical Values for Matrix 6A 10G Unshielded Channel (1-500Mhz)


	Worst Margin	Typical Margin
INSERTION LOSS	7%	8%
NEXT	2dB	6dB
PSNEXT	2dB	6dB
ELFEXT	3dB	6dB
PSELFEXT	3dB	7dB
RL	2dB	4dB



### ☆ Worst Values and Typical Values for Matrix 6A 10G Shielded Channel (1-500Mhz)

	Worst Margin	Typical Margin
INSERTION LOSS	7%	8%
NEXT	7dB	9dB
PSNEXT	8dB	10dB
ELFEXT	8dB	10dB
PSELFEXT	9dB	11dB
RL	4dB	5.5dB





Crosstalk measures signal coupling from one wire pair to another within a twisted pair cabling link. It is measured by NEXT and FEXT. The crosstalk between wire pairs in different bundles is negligible in 1000BASE-T application. However, for 10Gb/s Ethernet, due to higher frequencies, the crosstalk coupling, which is called AXTalk, now occurs between wire pairs in different cabling links routed in proximity to each other. AXTalk becomes the most significant disturbance or noise source for the 10GbE applications.

AXTalk will be measured as Alien NEXT (ANEXT) between wire pairs, as well as Alien FEXT (AFEXT). Since the combined impact of many wire pairs in the bundle upon the victim wire pair must be assessed, Power Sum Alien NEXT (PSANEXT) and Power Sum Alien FEXT (PSAFEXT) must be computed for the victim wire pair. AXTalk Margin Calculation (ACMC) is a combined PSANEXT and PSANEXT average margin.

AXTalk has to be considered only between links that run in the same cable bundle. Therefore, the smaller the bundle size, the less significant is the AXTalk. The best bundle size is 12 links, with maximum links not exceeding 24. ANEXT is generated in the first 20m of the bundle as it is highly affected by the connectivity hardware such as patch panel, patch cord and wire management.

It is not practical or necessary to test all of your links for Alien Crosstalk compliance. The TIA does not specify a sample plan. However, the IEC has defined a sampling plan of 1% or 5 links whichever is the greatest. For 10GBASE-T or TSB-155 testing, the longest links in the installation will be selected as the disturbed cables as these will almost always be the worst performing links in terms of PS AXtalk. For Augmented Category 6 or Class Ea testing, the longest links and shortest links in the installation will be selected to be the disturbed cables as these will almost always be the worst performing links in terms of PS ANEXT and PS AACR-F.

ADDISON adopts Fluke DTX 1800 Cable Analyser to perform the field certification. The tester supports two different 10GBASE-T standard, namely TSB-155 and TIA/EIA-568-B.2-10. TSB-155 only formulates guidelines and is not a standard. According to TSB, for any installed Cat 6 links, Alien Crosstalk (AXTALK), the crosstalk between wire pairs in adjacent cables, should be certified to pass the specified test parameters over the bandwidth required to support 10GBASE-T (1 through 500 MHz). General expectations are that AXTALK for Cat 6 UTP cables less than 55 meters in length will meet the requirements for 10GBASE-T.

And TIA defines a new cabling type that is called Augmented Category 6 (Cat 6A) and Augmented Class E (EA). The new “Augmented” cabling types define a higher level of performance for the cabling performance as well as for the Alien Crosstalk characteristics of a cabling system. The Augmented cabling types are being designed to support 10GBASE-T over a full 100 m horizontal channel.

The field certification process for 10Gig includes two phases: The first phase certifies the transmission capacity of each individual link. The test limits are identical to the limits for Cat 6 (Class E) up to 250MHz, but the testing frequency range is extended to 500MHz to support much higher data rates of 10G/bs Ethernet technology. The second phase encompasses certification of the cabling links for compliance with the Alien Crosstalk performance requirements. Alien Crosstalk certification for 10GBASE-T should include testing of some links in a bundle to verify compliance with AXTALK test parameters such as PSANEXT and PSAACR-F.

The setup of Alien NEXT measurement between two links is shown in figure 1. The Main DTX-1800 unit is plugged into the disturbed cabling link (the victim link) and the Remote unit is plugged into a disturber link. The two test units measure the Alien Near End Crosstalk between all the wire pairs of the two cabling links. The alien Crosstalk communication module must be installed in each tester unit and that these two modules must be connected with a patch cord. Also the two cables in the test procedure must be terminated with the special Link Terminators. The Main tester is connected to DTX AxTalk Analyser which controls the tests and automatically upload the alien crosstalk measurement results between all the wire pairs of the two measured links and calculate the Power sum alien crosstalk test parameters for the victim link. All the possible NEXT between two cabling links counts 16 combinations.

Figure 2 shows the connections of the testers to measure the pair to pair Alien FEXT between cables in a bundle. The two tester units are now connected at different ends of the bundle. A spare cabling link can be used to provide the synchronization path between the main and remote tester units. The open ends of the links involved in the test must be terminated by the same type of plug as used for Alien NEXT testing. The DTX test kit always verify that each link is properly terminated before conducting the AXTalk tests.



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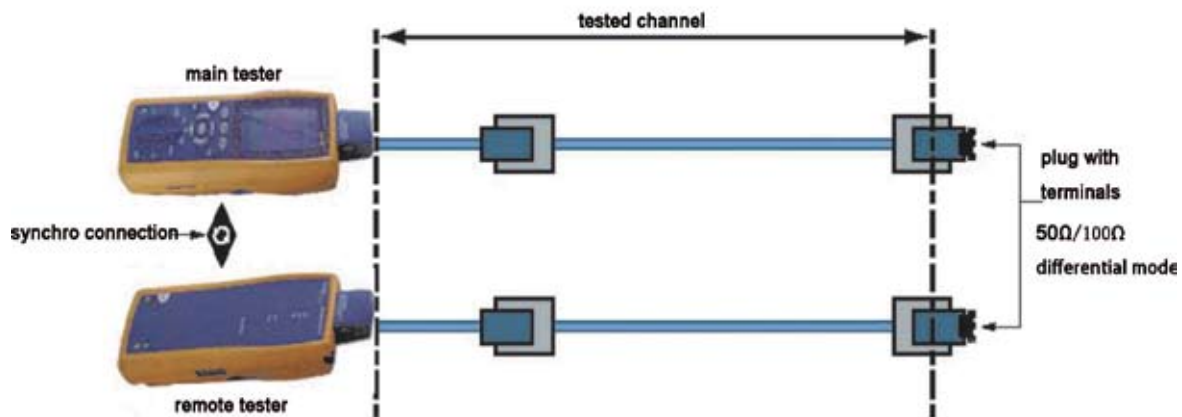


Fig1 - Pair to pair Alien NEXT measurements. The main and remote units are set side by side at one end of the cabling bundle under test. These units are plugged into different cables. The Alien Crosstalk Communication Modules plugged into the main and smart remote units are connected with a patch cord to provide the measurement synchronization that allows the testers to perform all of the pair to pair Alien NEXT measurements.

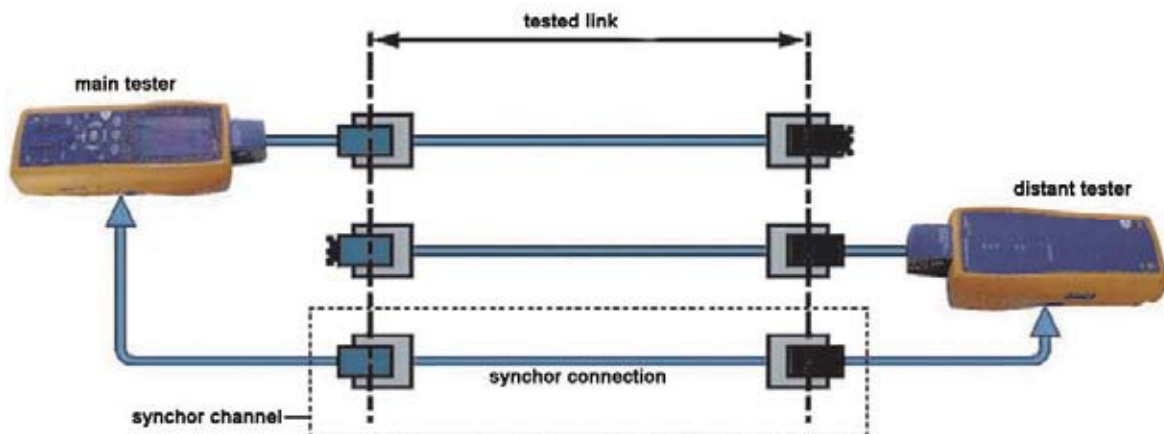


Fig2 - Pair to pair Alien FEXT measurements. The main and remote units are plugged into different cabling links at opposite ends of bundle under test. A spare channel in this bundle connects the synchronization modules plugged into each of the testers to allow the testers to perform all of the pair to pair FEXT measurements between the wire pairs of two selected cabling links.

AXTalk is the biggest challenge for 10G application. In particular, AXTalk is the most significant disturbance in unshielded system. For Matrix 6A unshielded system, Addison redesign the cable structure by increasing the jacket thickness, changing the twisting distance, and using a bigger separator in order to reduce the interference between different pairs, thus eliminating the ANEXT to a significant extent.

Matrix 6A shielded system adopts F/UTP, U/FTP or S/FTP cables for improving the attenuation, NEXT and AXTalk performance, to support 10G transmission over 100m channel length. Compared with the MATRIX 6A unshielded system, MATRIX 6A shielded system can achieve an improved shannon capacity of around 35Gbps, better ANEXT by around 20dB and reduced EMI interference. In gigabit Ethernet, at least Shannon capacity of 15.9 Gbps is required for the transmission ability. Shannon capacity is basically the ability to carry data current which goes down as noise increases. Alien crosstalk is this type of noise. In Matrix 6A unshielded system, around 17-20 Gbps can be achieved for Shannon capacity and the margin is not too high. Thus, it is recommended to adopt shielded system with better Shannon capacity in support of gigabit application.

## Matrixlight 10G Optic Fiber Cabling Solutions

With the falling cost of the Ethernet equipment, 10GBase-T has become the prevailing trend in the system design. Basically, the data transmission rate for horizontal cabling and backbone bears a ratio of 1:10 to avoid any traffic congestion. Currently, Cat 6 is widely used for the horizontal cabling, which provides 1000Mbps to the desk. To ensure smooth network traffic, 10G fiber optic cable should be used in backbone.

Optic fiber cables become the best choice because of the compact size, high transmission capacity and bandwidth. Optic transmitter is mainly of two categories: One is LED using multimode fiber as the transmission media and the other is laser using single mode fiber cable as the transmission media. Single mode cable can certainly fulfill the 10G Ethernet requirement but the cost of laser equipment is extremely high. Traditional multimode fiber cable can support 10G application over a short distance of around 50m and may not be adequate for supporting the backbone traffic. To support 10G Ethernet application, VCSEL (Vertical cavity surface emitting lasers) was then developed. VCSEL combines the strong characteristics of laser including response time, narrow transmission bandwidth and the special strength of LED such as high coupling efficiency and low equipment cost. Special 50/125 $\mu$ m fiber cable is designed to work in harmony with VCSEL equipment at 850nm wavelength for supporting 10Gbps over 300m drive distance and 1000Mbps over 900m drive distance. Relatively speaking, the cost of optimized 50/125 $\mu$ m fiber cable is slightly higher than traditional fiber cable. In June 2002, IEEE approved the new standard for 10G Ethernet. In September 2002, the ISO/IEC 11801 also standardized a new categorization for the multimode fiber cables. Under the new categorization, multimode fiber cables are classified under OM1, OM2 and OM3 category. OM1 refers to the traditional 62.5 $\mu$ m fiber cables. OM2 refers to the traditional 50 $\mu$ m fiber cables and OM3 refers to the optimized 50 $\mu$ m fiber cables. The bandwidth of traditional 62.5 $\mu$ m is only 200MHz under 850 nm wavelength and 500MHz under 1300nm wavelength. This bandwidth is far inadequate for supporting 10G Ethernet application. However, with the invention of OM3 fiber cable, 10G Ethernet application can now be fully supported with OM3 fiber cable which can offer 2000MHz bandwidth at 850nm wavelength.

☆ Below are the bandwidth and the maximum transmission distance of different fiber cables for 10G Ethernet application

Fiber Type	Bandwidth 850nm MHz*km	Bandwidth 1300nmMHz*km	1Gbps Transmission Distance		10Gbps Transmission Distance		Fiber Class
			@850nm	@1300nm	@850nm	@1300nm	
Multimode			@850nm	@1300nm	@850nm	@1300nm	
Traditional 62.5/125 $\mu$ m	200	500	200m	550m	33m	300m	OM1
Traditional 50/125 $\mu$ m 802.3z	500	500	550m	550m	82m	300m	OM2
Traditional 50/125 $\mu$ m ADDISON	500	800	550m	950m	82m	450m	OM2
50/125 $\mu$ m-100	600	1200	750m	2000m	100m	650m	OM2+
0/125 $\mu$ m-150	700	500	750m	550m	150m	300m	OM2+
50/125 $\mu$ m-300	1500	500	1000m	550m	300m	300m	OM3
50/125 $\mu$ m-550	3500	500	1000m	550m	550m	550m	OM3+

☆ Below are the attenuation and chromatic dispersion values for different fiber types

		Traditional Single Mode Fiber	Zero Water Peak Fiber	Non Zero Dispersion Shifted Fiber	
				Long Haul	Metro Area
Nominal Attenuation Values (dB/km)	1310nm	0.33	0.34	N/A	0.35
	1383nm	0.40	0.31	0.32	0.32
	1550nm	0.19	0.19	0.20	0.20
	1625nm	0.21	0.21	0.21	0.21
Nominal Chromatic Dispersion Values (dB/km)	1310nm	0	0	N/A	-11.5
	1550nm	16.5	16.5	4.5	4.5
	1625nm	23	23	10.5	8.5

☆ Below are the transmission speed of different light sources

	LED	VCSEL	DFB/FP Laser Diodes
Cost	Low	Moderate	High
Application	Multimode fiber	Multimode fiber	Single mode fiber
Maximum Speed Supported	1Gbps	12.5Gbps	40Gbps
Active Transmission Speed	622Mbps	10Gbps	40Gbps



# ADDISON OMS CABLING SYSTEM

In view of emerging 10Gbps Ethernet requirement, Addison put forward 10Gbps fiber solution, MATRIXLIGHT system. MATRIXLIGHT is a 10Gbps fiber system offering OM3 50/125 fiber cables and single mode fiber cables in full compliant with IEC 60793-2 and TIA 492AAAC DMD. Working with VCSEL, the OM3 fiber cable can support 10Gbps with transmission speed over 300m, complying to ISO/IEC11801-2nd standard. Addison OM3 fiber cable can support low cost 10Gbps serial transmission technology. In 10Gbps Base-SR, there are two operating bandwidths. One is the 1500/500 MHz/km and the other is 2000MHz/km, both supporting 850nm light source, and generally support backbone and fiber to the desk solution. Addison OM3 fiber cables works in full harmony with the fiber patch panels and components in order to support the existing network topology and can be deployed in either the backbone or horizontal cabling. Lastly, Addison single mode cable features a very low attenuation of 0.7dB/km, which significantly increases the transmission distance from 5 Km supported by 1Gbps to 40 Km supported by 10Gbps.

Traditional multimode fiber cannot be deployed in long distance transmission. Following the wide installation base for Cat 6 systems, it is expected that 10Gbps fiber cable will be widely used in the backbone cabling. Before 1000Mbps Ethernet come into play, selection of fiber types is very straight forward. With a drive distance of 2,000m and transmission speed of OC-12 (622Mb/s), 62.5/125 $\mu$ m multimode fiber cable is adequate for any applications. Beyond this distance and speed, single mode fiber cable will be deployed. With the development of OM3 multimode fiber in the industry, the transmission distance can be greatly increased under the 850nm wavelength. With the use of OM3 fiber cables and VCSEL, the OM3 fiber solution becomes the best cost effective cabling solutions. When transmission distance exceed 1,000m, single mode cable is still the only solution right now, the transmission distance of single mode cable can reach 5000m at 1310nm wavelength for 1000Mbps speed rate and 10000m for 10Gbps rate. When transmission distance is less than 1,000m, OM3 50 $\mu$ m multimode fibers can be considered for 1,000Mbps application but for 10Gbps application, single mode cable has to be used. When transmission distance is less than 300m, OM3 multimode cable can be used in both the 1000Mbps and 10Gbps application.

Addison has upgraded the multimode fiber from OM1 to OM3 and even OM3+ which can provide support of 10Mbps transmission over 550m and also 1000Mbps over 1100m. Further, Addison has also launched out single mode Zero Water Peak fiber cables to support full bandwidth transmission. Addison 10Gbase-SR OM3 fiber cable features low cost and high efficiency, thus ensuring the highest return in the system investment and becomes the most preferred fiber to the desk solution in the industry.

