Active Optical Cables (AOCs), The Rising Star in Transceiver Markets

White paper

Introduction

As data rates rise and datacentre clusters grow in size, copper cabling technology is getting stretched to its limits. Active optical cable (AOC) assemblies were invented to replace copper technology in datacentres and high-performance computing (HPC) applications in virtue of its stability and flexibility. In the era of the optical network, AOC cable captures a major chunk of high-speed optical inter-connectivity market on a global level.

Bandwidth usage is soaring, driven by the proliferation of Internet-connected devices. At this time, active optical cable (AOC cable) has emerged. Besides, the market of AOCs keeps growing and has a broad prospect.

Active optical cable (AOC) is a high-performance communication cable used for short-range multi-lane communication and interconnected applications. This white paper gives more information regarding the Active Optical Cables and the need to use them.

What are Active Optical Cables (AOCs)?

Active Optical Cable is the type of optical cable or technology which uses the electrical inputs similar to the traditional copper lines. However, Active Optical Cable uses the optical fibre in between the connectors.

AOC uses electrical-to-optical conversion on the cable ends to improve speed and distance performance of the cable without sacrificing compatibility with standard electrical interfaces.

An Active Optical Cable transforms the data signal into a laser light, which is communicated over an optical fibre. The conversion of electronic data is done by an optical transceiver connector. This allows for the fibre to disconnect from the transceiver. At the transceiver's end, Active Optical Cables bond the fibre connection, which in turn creates a cable assembly similar to a DAC cable.

Structure of Active Optical Cable

Active Optical Cable mainly consists of two parts- the fibre optic connector and fibre cable. The connection between fibre cable and connectors is not separable. If the connector or cable needs to be changed, they should be removed together. The electrical and optical signal conversion can be achieved right through each end of optical fibre.
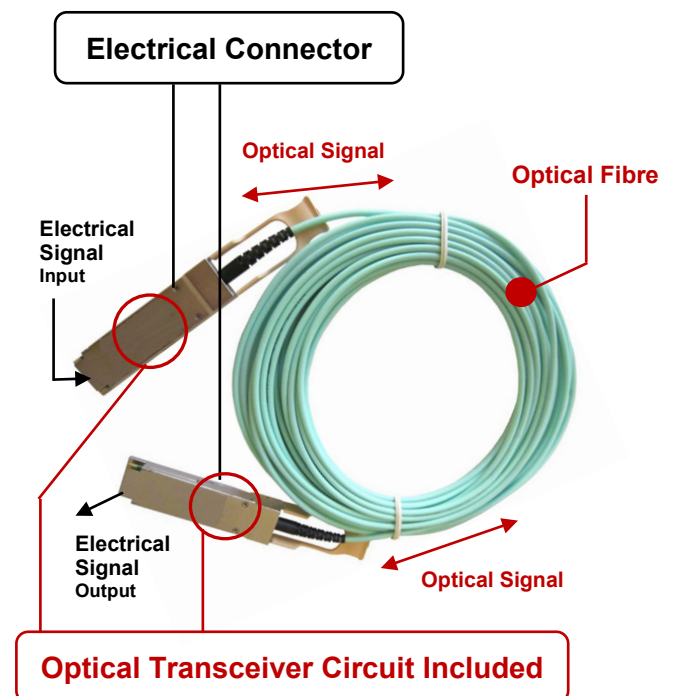
Structure of Active Optical Cable

Active optical cable as a system is made up of two optical transceivers and a jumper. The transmission

rate of this system is higher, and reliability is better than the system that composed of relatively separate components.

Advantages of AOC

However, people may wonder the reasons why choosing active optical cable over direct attach copper cable. Here are some advantages of using active optical cable:

- **Lighter weight:** Lowest weight for high port count architectures. The weight of active optical cable is lighter than copper cable due to the optical fibre material. It is possible for AOC cable to achieve a simpler cable management with a lower weight.

- **Immune to EMI:** Electromagnetic interference immunity is another benefit of active optical fibre. EMI is a disturbance generated by an external source that affects an electrical circuit by electromagnetic induction, electrostatic coupling or conduction. Since the optical fibre is a kind of dielectric which is unable to conduct electric current, active optical cable will not be affected by the electromagnetic energy.

- **Improved performance:** Active Optical Cables (AOC) accelerate storage, data, and high-performance computing connectivity.

- **Lower power consumption:** Low power consumption enabling a greener datacentre

- **Higher bandwidth**: Active optical cable has a higher bandwidth because its signal transmits through optical fibre as optical signal which transmits faster than electrical signal in copper cable.

- **Higher Efficiency:** Low interconnection loss, Lower Bit Error Rate (BER) and Low-cost solution for datacentres and high-performance computers

- **Reduced bulkiness:** Small bend radius for easy installment

- **Thinner and longer reach:** Although both cables are used for short range data communication, active optical cable is able to provide a longer reach than direct attach copper cable among devices.

Its Applications

Active optical cable has been applied to different fields. The followings are the most typical applications for AOC cable:

- InfiniBand transmission

- Datacentre networks

- High-performance computing clusters

- Data communication, backplane and proprietary density applications

- Fibre Channel compatible interconnect

- 40GBE and 10GBE interconnects

- 10G, 40G telecom connections

- Hubs, switches, routers, high-speed servers

- Storage area network (SAN)

- Ethernet 10G, 40G

Active Optical Cables

Datatronix Active Optical Cables (AOCs) achieve high data rates over long reaches, using a fraction of the power of other brands while providing streamlined installation for high-performance computing and storage applications.

Datatronix's SFP+ and QSFP+ Active Optical Cables (AOC) portfolio offers a wide range of active cables with various options in terms of lengths and cables. It is the perfect solution to link switches over short distance.

➢ **10G SFP+ Active Optical Cables**

SFP+ to SFP+ 10GB Active Optical Cable is a cutting edge active optical cable particularly for use between SFP+ ports. It is lighter and more adaptable than copper SFP+ coordinate join cables (DACs). It features hot-pluggable SFP+ link finishes and supports 10.3125 Gb/s bit rate with RoHS-6 consistent. They are electrically compliant with SFF-8431.

➢ **25G SFP28+ Active Optical Cables**

SFP28 to SFP28 25G Active Optical Cable assemblies are high performance, cost effective I/O solutions for 25G Ethernet and 25G Fibre Channel applications. It features hot-pluggable SFP+ link finishes and supports 25.78125 Gb/s bit rate with RoHS-6 consistent. They are electrically compliant with SFF-8431.


10G/25G SFP+ AOC

➢ **40G QSFP+ Active Optical Cables**

40G QSFP+ Active Optical Cable assemblies are high performance, cost effective, long reach interconnect I/O solutions for 40G Ethernet 40G Fibre Channel applications. It is an assembly of 4 full-duplex lanes, where each lane is capable of transmitting data at rates up to 10Gb/s, providing an aggregated rate of 40Gb/s. They are electrically compliant with SFF-8436.

➢ **100G QSFP28 Active Optical Cables**

100G QSFP28 Active Optical Cable

assemblies are high performance, cost effective I/O solutions for 100G Ethernet and 100G Fibre Channel applications. They are designed expressed for high speed, high density and low power consumption for today's datacentre networking applications. They offer 4 independent data transmission channels and 4 data receiving channels via the multimode fibres. An aggregate data rate of 100 Gbps can be achieved by this product. The QSFP28 Active Optical Cable is one kind of parallel transceiver which provides increased port density and total system cost savings.
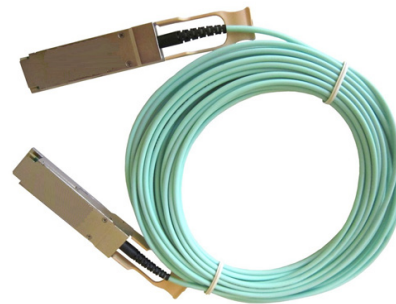
40G/100G QSFP+ AOC

➢ **40G QSFP+ to 4 x 10G SFP+ Breakout Active Optical Cables**

The Four-Channel, Pluggable, Parallel, Fibre-Optic QSFP+ Active Optical Cable (AOC) to 4× SFP+ Active Optical Cable break-out solution is intended for 40G to 4×10G applications. This AOC is a high-performance cable for short-range multi-lane data communication and interconnect applications. It integrates four data lanes in each direction with 40 Gbps aggregate bandwidth. Each lane can operate at 10.3125 Gbps. These cables also support 4 x 10G InfiniBand QDR applications. Datatronix QSFP+ to 4x 10G SFP+ AOC cable is a 40GBase QSFP+ hybrid optical cable. A side is a QSFP+ optical connector, B side is 4 SFP+ optical connectors. It's an application for link with QSFP+ port on 40Gb/s rate switch or host and feed up to 4 upstream 10Gb/s switch or host. They are electrically compliant with SFF-8436 & SFF-8431.

➢ 100G QSFP28 to 4 x 25 SFP28 Active Optical Cables

The Four-Channel, Pluggable, Parallel, Fibre-Optic 100G QSFP28 Active Optical Cable (AOC) to 4×25G SFP28 Active Optical Cable break-out solution is intended for 100G to 4×25G applications. This AOC is a high-performance cable for short-range multi-lane data communication and interconnect applications. Datatronix 100G QSFP28 to 4x 25G SFP28 Active Optical Cable is designed for use in breakout to 4x 25G Ethernet links up to 100m on Multi-Mode Fibre (MMF). Based on vertically integrated VCSEL array technology and designed with QSFP28/SFP28 MSA-compliant high-density connectors, the 100G QSFP28 to 4x 25G SFP28 AOC assemblies are compact, lightweight, and low power. They are electrically compliant with SFF-8436 & SFF-8431.

40G/100G QSFP+ BREAKOUT AOC

All the Datatronix AOCs have low power scattering and have a rigid force tab for enhanced high-density installments. They are fully tested for compatibility with intended equipment.

Conclusion

Active Optical Cable is one of the most recommended fibre cables by the professional technicians. This is due to its unique feature of using both the fibre optical and electrical signals. Today, many homes are installing Active Optical Cable for its high performance.

Datatronix Active Optical Cables (AOC) assure investment in storage, data, and high-performance computing connectivity. We provide many AOC products such as 10G SFP+ AOCs, 25G SFP28 AOCs, 40G QSFP+ AOCs, 40G QSFP+ to 4 x 10G SFP+ AOCs, 100G QSFP28 AOCs and 100G QSFP28 to 4 x 25G SFP28 AOCs. In addition, customised active optical cables are available in various lengths, Cisco compatible and other options.

Each of the Active Optical Cables from Datatronix employs fibre optic technology for the transmission of data thereby enabling reduction in the weight, density and power consumption which are actually the loopholes in traditional copper solutions. The key advantages of Active Optical Cables are small bend radius that enables easy installment, lowest weight supporting high port count architectures, assurance of greener datacentre by controlling power consumption. The Active Optical Cables from Datatronix offer low cost solution for datacentre communications and support high performance computers. Datatronix Active Optical Cables are also fully compliant with the industrial standards.