INTRODUCTION ON 40G/100G MPO CONFIGURATION

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ABSTRACT: In this white paper, the methods to build 40G/100G MPO channel have been discussed. A simple configuration formula is introduced, aiming at helping you to fast recognize the polarity of the whole channel no matter how "Type A" and "Type B" components are mixed together.

Basic MPO building blocks - 40G Transceiver/MPO Adaptor/MPO Trunk Cable

To better understand how to configure a MPO channel, the basic building blocks, i.e. MPO Transceiver, MPO adaptor and MPO trunk cable will be briefly introduced first.

- **40G Transceiver**

40G/100G MPO configuration can be complex, an easier way to understand it is to think from the two ends. No matter how complex it is in the middle, the two ends are always equipment – transceiver. The light needs to go from one transceiver to the other one for data transmission purpose.

Figure 1 Illustration of 40G MPO Transceiver [1]

If looking at the cross section of a 12-core transceiver below, you will soon notice that for 40G application, port 1-4 will be used for transmit while port 9-12 for receive.

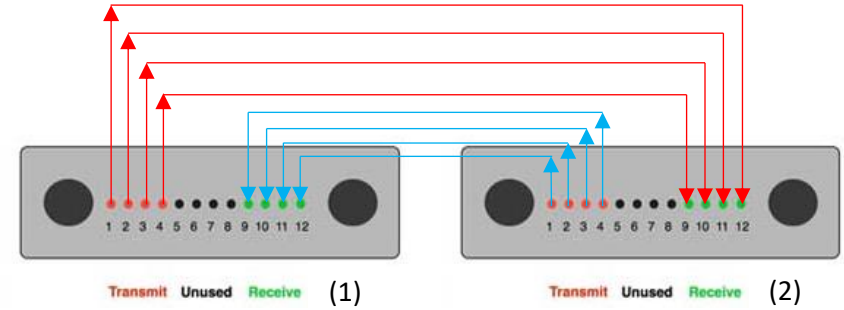


Figure 2 Correct Fibre Mapping of 40G MPO Configuration

Light from transceiver (1) port 1 needs to travel to transceiver (2) port 12, (1) port 2 to (2) port 11, (1) port 3 to (2) port 10, (1) port 4 to (2) port 9 and vice versa. This is very important for understanding the MPO configuration, please keep it in mind.

- **MPO Adaptor**

In the ANSI/TIA-568C3 standard, there're only two kinds of MPO adaptor configuration, "Type A" and "Type B", illustrated below.

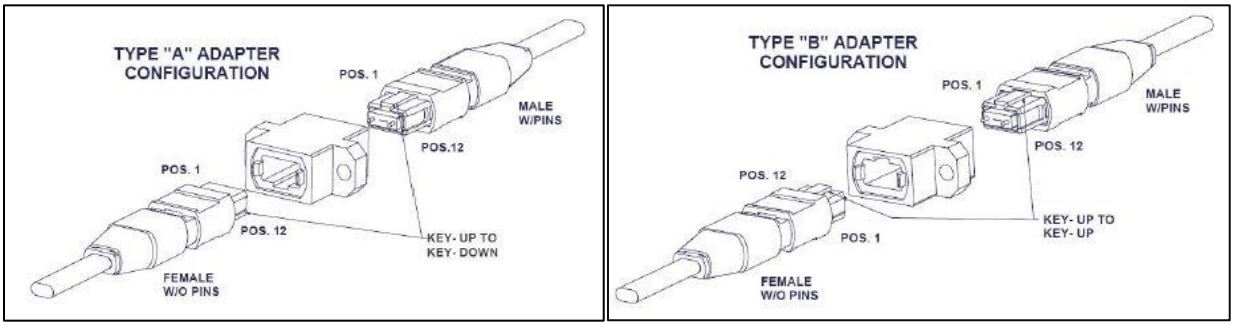
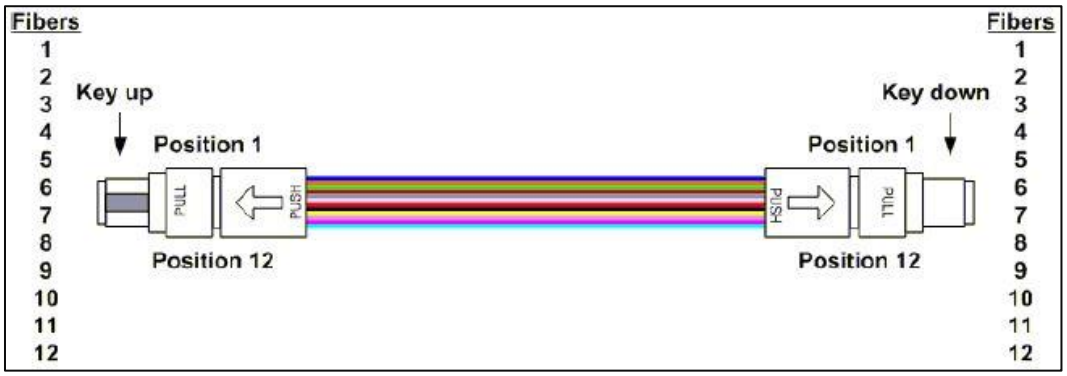


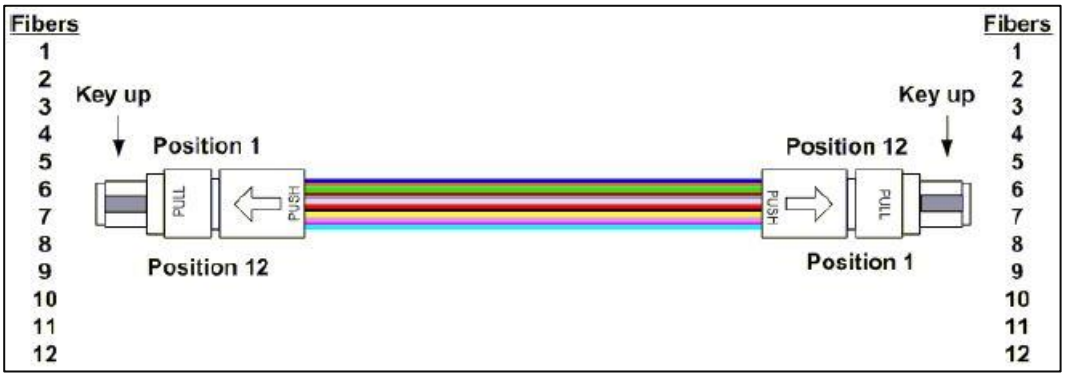
Figure 3 Illustration of "Type A" and "Type B" MPO Adaptor

- **MPO trunk cable**

There're three kinds of trunk cable in the ANSI/TIA-568C3 standard, "Type A", "Type B" and "Type C" For 40G to 40G application, only "Type A" and "Type B" will be involved.



"Type A"



"Type B"

Figure 4 Illustration of "Type A" and "Type B" MPO Trunk Cable

Those're all the important components you need to know to understand the MPO configuration.

MPO configuration

Here two most commonly used configurations will be introduced, i.e. direct connection from transceiver to transceiver and transceiver to transceiver with cross connect in the middle.

- **Direct connection from transceiver to transceiver**

Direct connection is using a single trunk cable to connect two equipment (transceiver), most probably from two separate racks.

The MPO connector that connects the 40G transceiver is **Key-up Female type**.

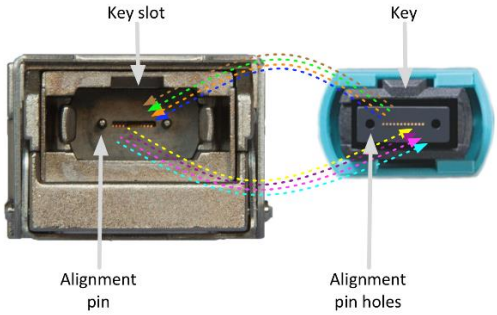


Figure 5 Correspondence between MPO Connector and Transceiver [2]

For direct transceiver to transceiver connection, a **"Type B" Female to Female truck cable** is used. Refer to below fibre mapping for better understanding.

Imagine a light signal sent from port 1 in the right transceiver, it will travel through fibre 1 at position 12 at the right side of the trunk cable all the way to the left at position 1, ending up at port 12 in the left transceiver as illustrated in below **Figure 6**. Recall the figure in part **40G Transceiver**, that's exactly the mapping we need for the 40G transmission.

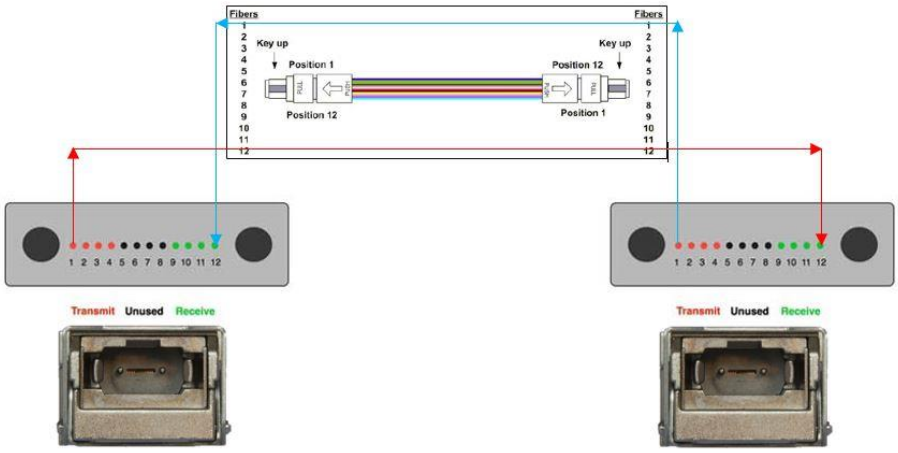


Figure 6 Port correspondence - direct connection from transceiver to transceiver

- **Transceiver to transceiver with cross connect in the middle**

Compare to the direct connection, this configuration is more complex, as MPO patchcord, MPO adaptor patch panel and trunk cable are involved.

The configuration is illustrated below and can be divided into five parts:

Part 1: Inter rack connection: Equipment to patch panel

- For Part 1, **"Type A" Female to Male MPO patch cord** and **"Type A" MPO adaptor** are used.

Part 2: Intra rack connection: Patch panel to patch panel

- For Part 2, **"Type A" Female to Female MPO trunk cable** is used.

Part 3: Cross connect: Patch panel to patch panel

- For Part 3, **"Type A" adaptor**, **"Type A" Male to Male MPO patch cord** and **"Type A" adaptor** are used.

Part 4: Intra rack connection: Patch panel to patch panel

- For Part 4, **"Type A" Female to Female MPO trunk cable** is used.

Part 5: Inter rack connection: Patch panel to equipment

- For Part 5, **"Type A" adaptor** and **"Type B" Male to Female MPO patch cord** are used.

For a better understanding, the fibre mapping is illustrated below in **Figure 7**. Imaging a light signal sent from port 1 in the left transceiver, it will travel through fibre 12 at position 12 all the way from the left MPO patch cord, left MPO trunk cable, middle MPO patch cord, right MPO trunk cable, to the right MPO patch cord at position 1, ending up at port 12 in the right transceiver. Recall the figure in part **40G Transceiver** again, that's exactly the mapping we need for the 40G transmission.

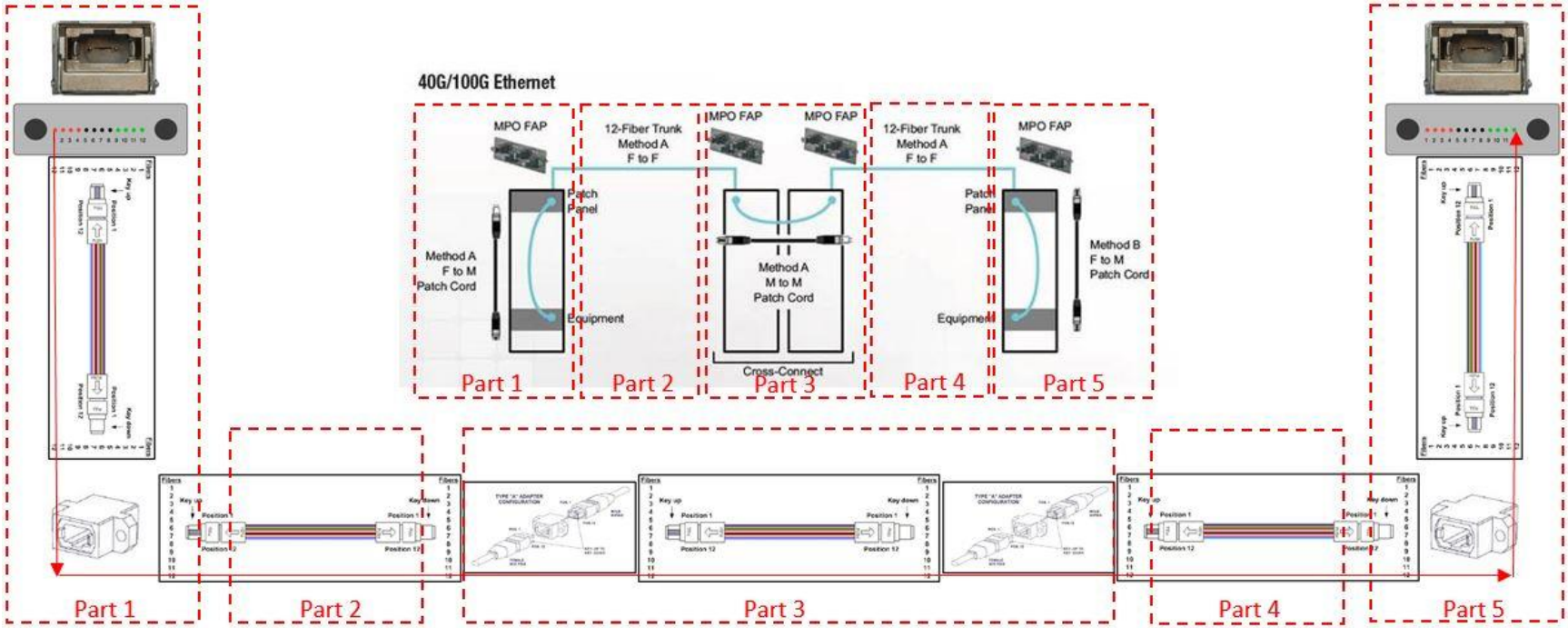


Figure 7 Port Correspondence - Transceiver to transceiver with cross connect in the middle [3]

Tips - To Recognize MPO Channel Polarity Easily and Quickly

Here, we will teach you an easy way how to fast tell the polarity of a MPO channel with mixed "Type A" and "Type B" components. "Type A" MPO cable and "Type A" MPO adaptor will be both represented as letter A, while "Type B" MPO cable and "Type B" MPO adaptor will be both represented as letter B below. The rule for combination of A and B polarity is as follows, e.g. a combination a "Type A" MPO adaptor and a "Type A" MPO trunk cable will behave as if "Type B".

AA=B	**BA=A**
AB=A	**BB=B**

To configure a channel, the sum of Type A and Type B components number needs to be odd (e.g. one piece of "Type B" trunk cable, or two pieces of "Type B" MPO adaptors + three pieces of "Type B" MPO trunk cables), and it is very important to note that to achieve 40G to 40G transceiver connection, the whole channel needs to act as "Type B" polarity, no matter how it is configurated in the middle.

For the direct transceiver to transceiver connection, as there is only one "Type B" trunk cable involved, the channel is with no doubt "Type B", and the sum of A and B components number is 1 in this case. The above rule is fulfilled.

For the transceiver to transceiver with cross connection in the middle. The whole channel can be illustrated as AAAAAAAAB. Using above tricks:

AAAAAAAAB >> BAAAAAAB >> AAAAAAB >> BAAAAB >> AAAAB >> BAAB >> AAB >> BB >> B

And the sum of A and B components number is 9 in this case, the above rule is fulfilled again.

Summary

To summarize, the basic components and how to use those basic components to configure a 40G MPO channel are discussed in this white paper. The basic and most important point for a 40G configuration is that the whole channel needs to behave as if "Type B" polarity no matter how the different components are connected in between. A simple formula is introduced in the end, aiming at helping you fast tell the polarity of a MPO channel with mixed "Type A" and "Type B" components. Keep this rule in mind, it will be much easier for you to configure a 40G MPO solution.

References

[1] https://www.google.com.sg/search?biw=1438&bih=661&tbm=isch&sa=1&ei=giJhXObzBIzZvATNrLiYAg&q=MPO+qsfp&oq=MPO+qsfp&gs_l=img.3..0i19j0i8i30i19l4.54145.54908..55124...0.0..0.198.632.0j4.....0....1..gws-wiz-img.....0i7i30j0i8i7i30.-UZhKyEZXHQ#imgrc=y3nkRA68Z99HXM:&spf=1549869754154

[2] https://www.optcore.net/understanding-100g-ethernet/

[3] Pixgallarehd Fiber: Backbone Switch images