



CONDUANT



Adding a Conduant StreamStor® Recorder to a Xilinx Development Board

APPLICATION NOTE

Revision 1.2 - March 12, 2020

Xilinx® produces several development boards with PCI Express and optical interfaces that can be used for various user-defined applications. Some applications may produce a high-speed stream of data to be recorded while others may require the injection of a continuous-speed data stream.

Conduant [StreamStor®](#) can record or play back real-time data streams at rates up to 20 GB/s (160 Gb/s or 1 Terabyte every 50 seconds) regardless of the type of data (RF, RADAR, imaging, etc.). StreamStor® can connect optically or with copper wires through its high-speed serial interface lanes. This application note focuses on the optical connection. Since StreamStor® products are designed with Xilinx FPGAs, they are highly configurable and easily interface with Xilinx development boards or other Xilinx-based designs.

Almost any Xilinx development board that has high-speed serial optical lanes can connect with StreamStor® using one of many different protocols (Aurora, Interlaken, Serial RapidIO, etc.). For the purposes of this article, however, the [Xilinx VCU118](#) (Figure 1) was chosen to demonstrate interconnections because it has



Figure 1. Xilinx VCU118 development board. The VCU118 has a Samtec FireFly™ 4-lane socket and two QSFP28 4-lane sockets.



Figure 2. Conduant Cobra FPGA interface card



Figure 3. Conduant StreamStor® recording system

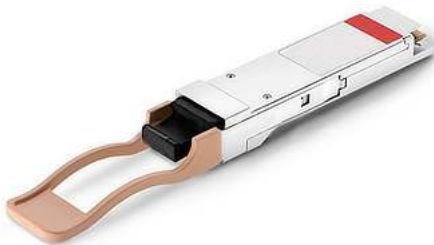


Figure 4. QSFP28 MTP/MPO optical 4-lane transceiver

both QSFP28 (4-lane, 8-fiber) and [Samtec FireFly™ Micro Flyover System™](#) (4-lane, 8 fiber) interconnect options.

The Conduant Cobra board (Figure 2) provides the optical interface to the StreamStor® recorder (Figure 3). The Samtec FireFly™ Optical cable assembly on Cobra delivers 12-lane connectivity through a 24 fiber MTP/MPO connector. The differences in types of transceiver modules and lane-widths between Cobra and the VCU118 board provide an ideal example for demonstrating various ways to optically connect to StreamStor®.

This application note will show:

- It is easy to add a StreamStor® recorder/ player to a Xilinx development board.
- A method of adjusting between endpoints of different lane widths.
- A method of adjusting between transceivers of different types.

XILINX VCU118 EVALUATION BOARD

The Xilinx VCU118 evaluation board (Figure 1) provides 12 lanes of high-speed serial connectivity that is spread across three groups of four lanes. Two of the three groups connect to QSFP28 pluggable sockets which are located on the rear-panel-end of the board. The remaining 4 lanes are accessed through a socket on the board into which a Samtec FireFly™ 4-lane optical transceiver is inserted.

QSFP28-to-MTP/MPO Optical Transceivers

The two QSFP28 sockets can each connect up to 4 lanes (4 transmit and 4 receive) of signaling for a total of 8 lanes. QSFP28 pluggable optical transceiver modules are available that present their 4 lanes (8 fibers) through a 12-fiber (4 fiber ports are unused) MTP/MPO socket. One example of a QSFP28 MTP/MPO transceiver module is the Cisco QSFP-100G-SR4-S (or compatible, Figure 4). See figure 5 for fiber

Fiber Number	Function	Fiber Color
1	Tx 1	Blue
2	Tx 2	Orange
3	Tx 3	Green
4	Tx 4	Brown
5	-	Grey
6	-	White
7	-	Red
8	-	Black
9	Rx 4	Yellow
10	Rx 3	Purple
11	Rx 2	Pink
12	Rx 1	Aqua

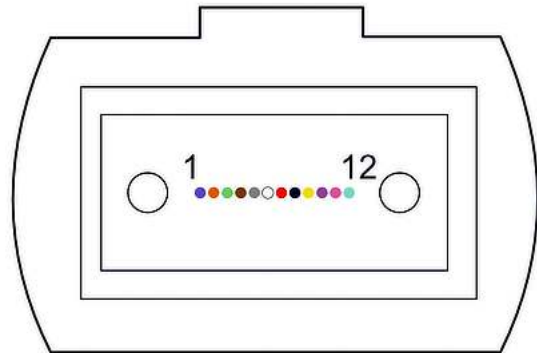


Figure 5. Signal mapping of the QSFP28 signals to the 12 fiber ports on the MTP/MPO socket on the transceiver module. Note that there are 4 transmit fibers, 4 receive fibers, and 4 dark (unused) ports. Fiber colors are for reference only within this figure, as QSFP28 modules do not have any exposed fibers.



Figure 6. Samtec FireFly™ Optical 4-lane



Figure 7. MTP/MPO bulkhead adapter

mapping of this module.

Samtec FireFly™ Micro Flyover System™

The VCU118 has a single socket on the circuit board to insert a four-lane Samtec FireFly™ optical transceiver (REF-193848-01, Figure 6). The FireFly™ optical transceiver module plugs directly into the socket and provides an 8 fiber “tail” that comes out to a 12-fiber MT ferule. The MT ferule is then mounted into a MTP/MPO adapter (Figure 7) that can be mounted on the endplate of the VCU118 board.

As shown in Figure 8, the native mapping of the four lanes of FireFly™ is opposite that of the

QSFP28 MPO signals. In other words, Tx and Rx fibers are end-to-end reversed. For this application, we want the FireFly™ fiber arrangement to match that of the QSFP28 modules. This is accomplished by mounting the FireFly™ MPO male connector in an **unaligned** adapter such as a Senko 774-K or similar. This adapter reverses the order of the FireFly™ fibers so that its Tx and Rx positions match those of the QSFP28 MPO connectors.

Copper Alternative

Note that the Samtec FireFly™ Micro Flyover System™ and QSFP28 also provide copper cable assembly options (ECUE series) for when copper is desired in lieu of optical, but this option is not

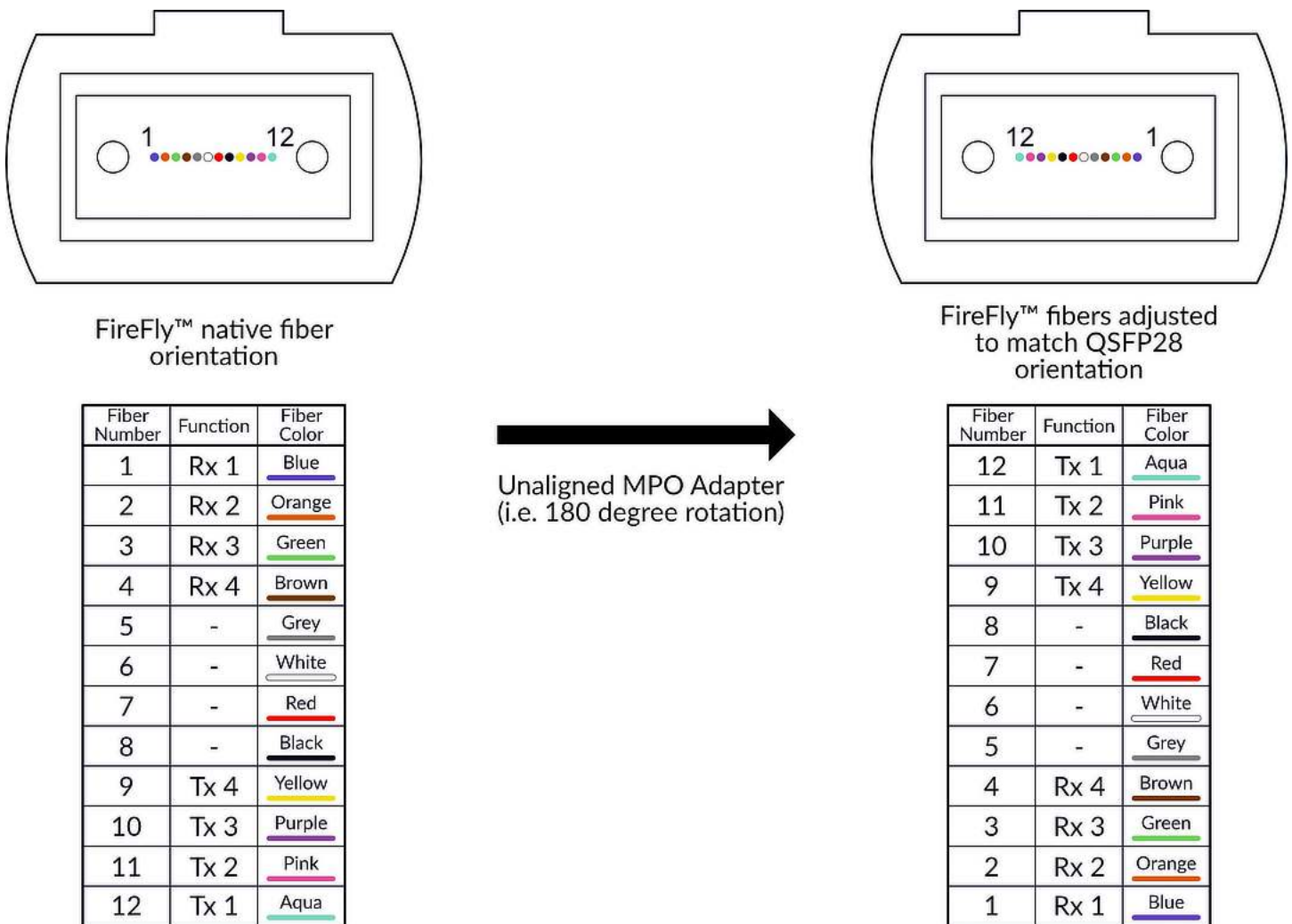


Figure 8. The native mapping of the four lanes of FireFly™ is opposite that of the QSFP28 MPO signals.

shown in this document.

CONDUANT COBRA BOARD

24-Fiber MTP/MPO Connectors

The Conduant Cobra board is the hardware engine that manages data flow and optical connectivity for the StreamStor® recorder/player. Its two front-panel MTP/MPO connectors each bring out 12 lanes (12 transmit and 12 receive fibers) that can move data at rates of up to 16.3Gb/s per lane. Thus the pair of connectors can be used to provide 24 lanes of optical connectivity to a StreamStor® recorder.

When the aggregate record/playback bandwidth

is less than or equal to 5 GB/s (40 Gb/s) Cobra can provide up to 24 lanes of connectivity with its two optical connectors. This is useful for applications in which a large number of slower devices must be connected.

When higher bandwidth is needed, rates up to 20 GB/s (160 Gb/s or 1 Terabyte every 50 seconds) are achieved though a single 12-lane port. The remaining 12-lane port is used by Cobra to extend the bandwidth with a connection to additional Cobra boards.

See figure 9 for the signal map of the 24-fiber MTP/MPO connector on Cobra.

Fiber Number	Function	Fiber Color
1	Rx 0	Blue
2	Rx 1	Orange
3	Rx 2	Green
4	Rx 3	Brown
5	Rx 4	Grey
6	Rx 5	White
7	Rx 6	Red
8	Rx 7	Black
9	Rx 8	Yellow
10	Rx 9	Purple
11	Rx 10	Pink
12	Rx 11	Aqua

Fiber Number	Function	Fiber Color
13	Tx 0	Blue
14	Tx 1	Orange
15	Tx 2	Green
16	Tx 3	Brown
17	Tx 4	Grey
18	Tx 5	White
19	Tx 6	Red
20	Tx 7	Black
21	Tx 8	Yellow
22	Tx 9	Purple
23	Tx 10	Pink
24	Tx 11	Aqua

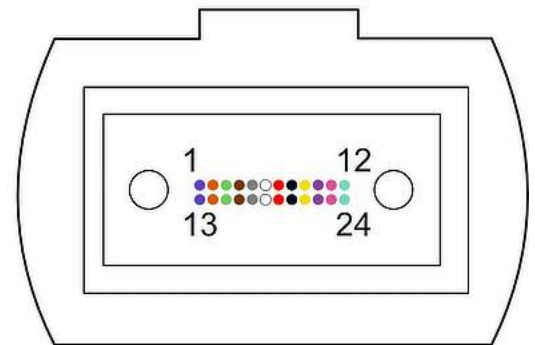
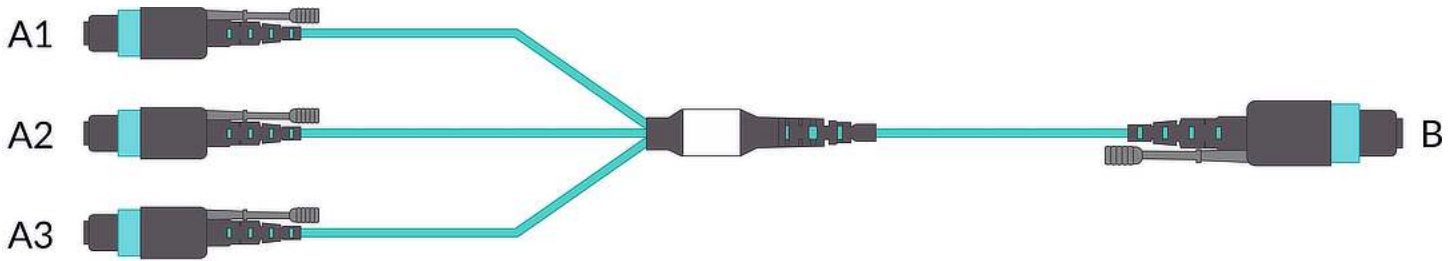


Figure 9. Signal map of 24-fiber MTP/MPO connector on Conduant Cobra.

WAVE2WAVE 3-TO-1 OPTICAL ADAPTER CABLE

To this point in the document all 4-lane transceiver ports on the VCU118 have been brought out to 12-fiber MTP/MPO connector sockets. The objective now is to connect the three 4-lane ports to a single 12-lane port on the Cobra board. This is accomplished with a Wave2Wave Fiber Patch Cord.

The Wave2Wave Fiber Patch Cord (Figure 10) establishes a 12-lane connection between a 12-lane port on Cobra and three 4-lane ports on the VCU118 board. The cable connects each group of 4 lanes on one end to different groups of 4 lanes in the 12-lane connector thus creating a 12-lane connection between boards. The fiber mapping of this cable is also shown in figure 10.



Fiber Mapping (A1)		
A1 Pin	Fiber Color	B Pin
A1-1	Blue	B-13
A1-2	Orange	B-14
A1-3	Green	B-15
A1-4	Brown	B-16
A1-5	Not Used	N/A
A1-6	Not Used	N/A
A1-7	Not Used	N/A
A1-8	Not Used	N/A
A1-9	Brown	B-4
A1-10	Green	B-3
A1-11	Orange	B-2
A1-12	Blue	B-1

Fiber Mapping (A2)		
A2 Pin	Fiber Color	B Pin
A2-1	Grey	B-17
A2-2	White	B-18
A2-3	Red	B-19
A2-4	Black	B-20
A2-5	Not Used	N/A
A2-6	Not Used	N/A
A2-7	Not Used	N/A
A2-8	Not Used	N/A
A2-9	Black	B-8
A2-10	Red	B-7
A2-11	White	B-6
A2-12	Grey	B-5

Fiber Mapping (A3)		
A3 Pin	Fiber Color	B Pin
A3-1	Yellow	B-21
A3-2	Purple	B-22
A3-3	Pink	B-23
A3-4	Aqua	B-24
A3-5	Not Used	N/A
A3-6	Not Used	N/A
A3-7	Not Used	N/A
A3-8	Not Used	N/A
A3-9	Aqua	B-12
A3-10	Pink	B-11
A3-11	Purple	B-10
A3-12	Yellow	B-9

Fiber Diagram (B)

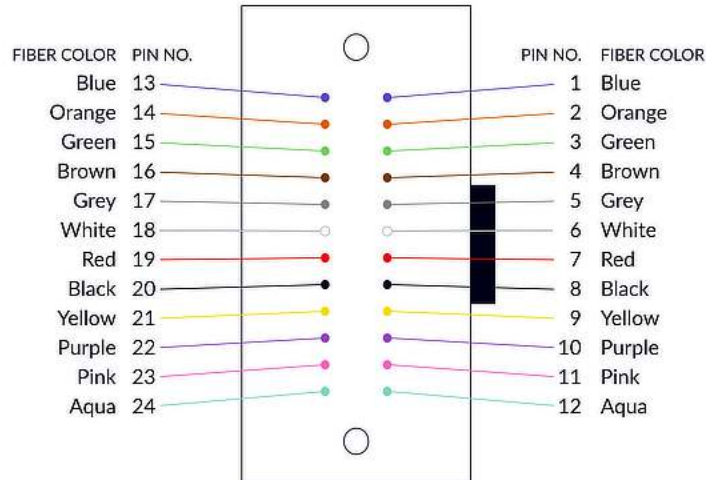


Figure 10. Wave2Wave Fiber Patch Cord with signal mapping tables & diagram.

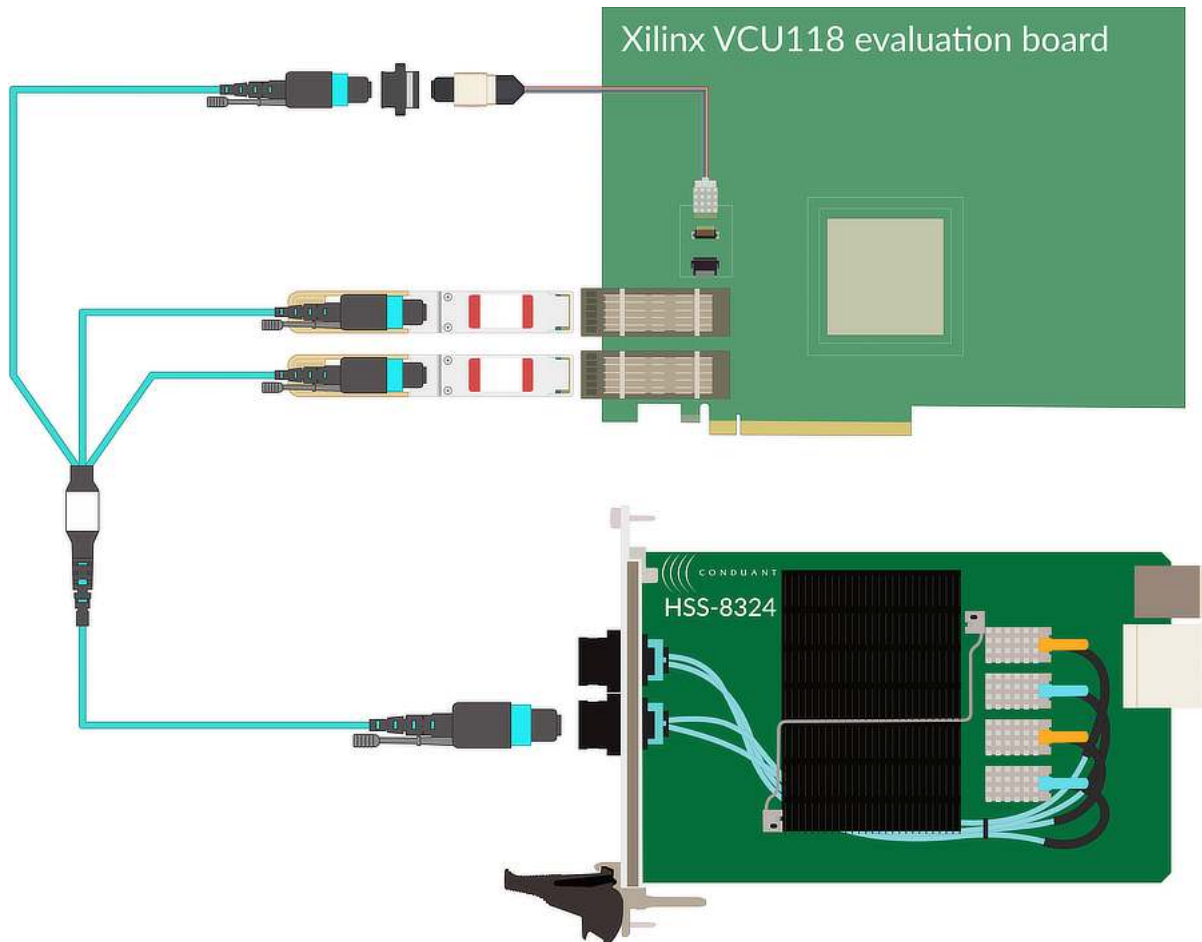


Figure 11. A complete 12-lane optical interconnection between a Conduant Cobra PXI board and a Xilinx VCU118 development board

PULLING IT ALL TOGETHER

Figure 11 shows a complete optical interconnection of three groups of 4 lanes on the Xilinx VCU118 board to a 12-lane port on a Cobra board.

OTHER CONFIGURATION POSSIBILITIES

Many Development Boards to One StreamStor®

While not shown in this document, it is also possible to connect multiple Xilinx development boards to a single StreamStor® Recorder. For instance, the three 4-lane connectors on the patch cord shown above could just as easily connect to a single 4-lane port on each of three different VCU118 signal processing boards. A 12:1 patch cable could connect a single lane

from each of 12 VCU118 boards to a single 12-lane MTP/MPO port on a Cobra board. These are just a few examples. Patch cables can be customized by manufacturers as needed for the particular application.

In an extreme configuration, up to 24 signal processing boards (one lane each) could be connected to the two 12-lane MTP/MPO ports on a single Cobra board if the aggregate bandwidth is less than or equal to 5 GB (40 Gb/s).

Out-of-Band Signaling

In addition to the high-speed data streams, there may be a need to pass additional signals between a Xilinx development board and StreamStor®. These could be used for communicating triggers or for marking positions in the recording. Conduant Cobra boards provide four MMCX coax connectors on the front panel which could be used for these or other configurable purposes.

SUMMARY

The Conduant StreamStor® Recorder/Player is designed to record and/or play back real-time data streams and is capable of sustaining very high data rates. It is easily optically interfaced with many different Xilinx evaluation boards and is the perfect companion product where this

capability is needed.

While the latest StreamStor® is packaged in a PXI Express chassis, this does not preclude the ability to optically connect it to a device of a different form factor. In cases where different form factors or operation in disparate environmental conditions are required, please [contact Conduant](#) with specific requirements.



Revised on	Version	Description
24-SEP-2019	1.0	Initial release
05-NOV-2019	1.1	Corrected all instances of typos: "MTP/MTO" → "MTP/MPO" Added Xilinx Partner logo to end of document Various consistency & clarity corrections
12-MAR-2020	1.2	Correction to use unaligned adapter on FireFly in VCU118 Added revision table

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