

## User Guide



### Introduction

This printed circuit board and evaluation kit provides the designer with a convenient way to evaluate the electrical and optical performance of the Avago Technologies' Ten-Channel CFP2 100GBASE-SR10 transceiver. This user guide offers a description of the evaluation board and basic operating instructions.

The AFBR-8420EVB evaluation board is to be used in conjunction with Avago Technologies' AFBR-8420Z CFP2 SR10 module. The AFBR-8420Z is a ten-channel pluggable, parallel, fiber optic transceiver for 100 Gbps Ethernet applications.

The transceiver supports high-speed serial links over multi-mode fiber at signaling rates up to 103.125 Gb/s (a serial line rate of 10.3125 Gb/s per channel) for link distances up to 100 m with OM3 fiber and 150 m with OM4 fiber. The product is compliant with the CFP2 industry agreement for mechanical and low-speed electrical specifications. High speed electrical and optical specifications are compliant with IEEE 802.3ba Clause 86 for 100GBase-SR10 media, Clause 86A for CPPI electrical interface.

### CFP2 Evaluation Kit Features

- 20 side-mounted SMA connectors to connect to all 10 differential TX high-speed lanes
- 20 surface-mount SMA connectors to connect to all 10 differential RX high-speed lanes
- MDIO interface for module control and digital diagnostics monitoring
- Access to low-speed signals
- CFP2 compliant cage, connector and heat sink

### CFP2 Module Features

- Compliant to 100GbE specifications 802.3ba (100GBase-SR10 and CPPI) up to 100m OM3 and 150m OM4 fiber.
- Compliant to 40GbE specifications 802.3ba (40GBase-SR4 and XLPI) up to 100m OM3 and 150m OM4 fiber. Can handle 2x 40GbE Interfaces.
- Links up to 100 m using OM3 fiber and 150 m using OM4 fiber
- Utilizes standard 24 lane optical fiber with MTP® (MPO) optical connector for high density and thin, lightweight cable management
- Diagnostic features per CFP2 using MDIO real-time monitoring of:
  - Transmitter average optical power
  - Received average optical power
  - Laser bias current
  - Temperature
  - Supply voltage
- Proven high reliability 850 nm technology: Avago VCSEL array transmitter and Avago PIN array receiver

## Equipment List

CFP2 evaluation kit includes:

1. 1x AFBR-8420EVB, CFP2 evaluation printed circuit board (Figure 1)
2. 1x Avago Technologies USB-to-MDIO controller with USB cable (Figure 6)
3. 1x MDIO ribbon connector cable (Figure 5)
4. Power Supply Cables (Figure 10)
5. 2x jumpers to set up DC power inputs (Figure 3)
6. 1x user guide
7. 1x CD with graphical user interface

Note: CFP2 Module (AFBR-8420Z) is sold separately from the kit

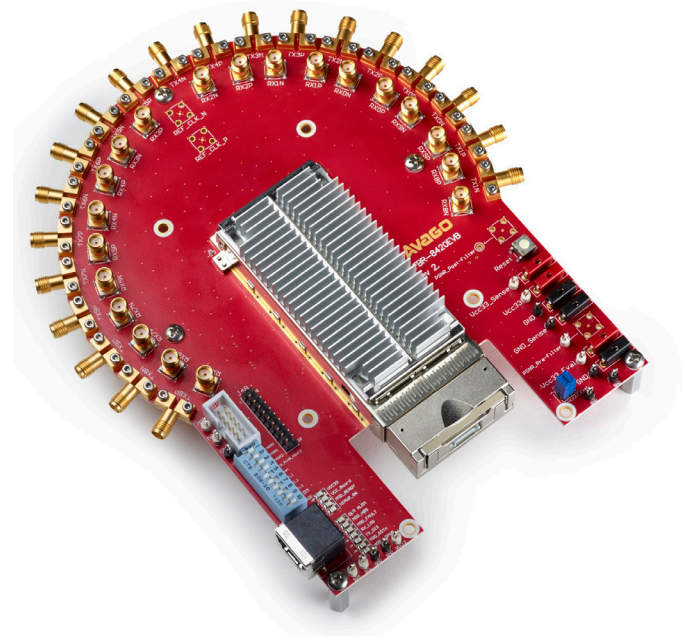


Figure 1. AFBR-8420EVB, CFP2 Evaluation board

## Additional Equipment Recommended

- Optical 24 fiber (2x12) OM3 or OM4 multi-mode patchcord for link testing. The cable must have standard MTP/MPO connector. See *Appendix I: Vendor and Part Numbers*.
- Optical 24 fiber (2x12) OM3 or OM4 multi-mode break-out cable with MTP-to-SC or FC connectors. See *Appendix I: Vendor and Part Numbers*.
- Optical 2x12 loopback cable. See *Appendix I: Vendor and Part Numbers*.
- 3.3 V DC power supply with at least a 3 A current supply capability – such as HP E3631A or equivalent
- Agilent 86100C DCA-J or equivalent Digital Communications Analyzer with Agilent 86105C or equivalent DCA plug-in module
- Agilent N4903 or equivalent pattern generator/bit error rate tester
- Optical power meter and variable optical attenuator
- High-frequency coaxial cables with SMA connectors
- Laptop/Computer running Windows 7 (or Windows XP)
- Torque wrench
- Fiber cleaner
- ESD protection – e.g., ESD wrist strap

## CFP2 Evaluation Board Description

1. CFP2 connector-cage (with heatsink)
2. 3.3 V power supply inputs
3. MDIO interface
4. Reset buttons
5. Jumpers (See the following section for a proper jumper configuration)
6. Power probe points
7. Status LEDs
8. Differential Tx inputs (Side Mount SMAs)
9. Differential Rx outputs (Surface Mount SMAs)

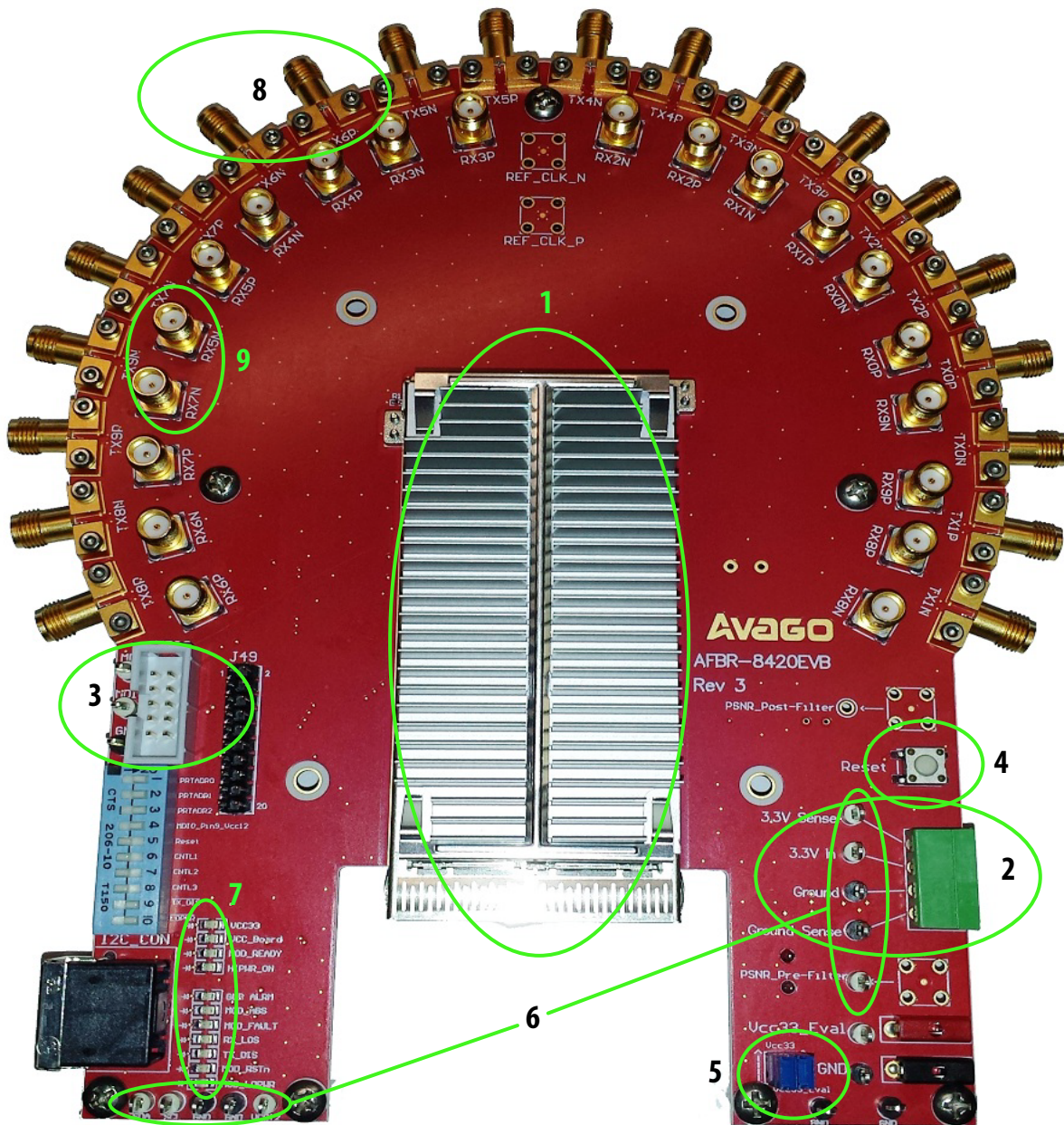


Figure 2. CFP2 Evaluation board Description

## CFP2 Evaluation Board Configuration

### CFP2 Evaluation Board Power Jumper Configuration

On the CFP2 Power Input section there are 3 sets of power supply inputs:

- Vcc33 and GND
- Vcc33\_Eval and GND
- Vcc33\_Sense and GND\_Sense

1. To run both the evaluation board and the CFP2 module off of a single 3.3 V supply, configure the power jumper on the CFP2 evaluation board as follows:

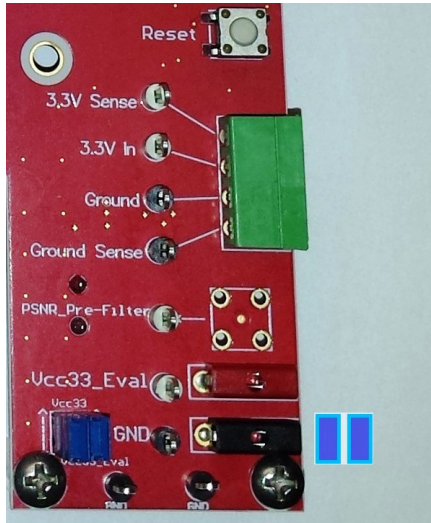


Figure 3. Evaluation Board Jumper Configuration, single supply

The configuration buses the Vcc33\_Eval evaluation board rail and the Vcc33 module rail together.

2. To run the evaluation board and CFP2 module off of two different 3.3V supplies, remove the jumpers.

**The recommended operating power supply voltage spec at the input of the CFP2 module, per the datasheet, is 3.135V to 3.465V. Use the Vcc33\_Sense line to ensure the module receives this voltage.**

**With CDRs ON the absolute maximum power consumption is 9 W. So at maximum power and lowest voltage the current through the wire can be:  $9W/3.135V = 2.9 A$ . The user must ensure that the power supply is not current limited. In addition, there will be an IR drop through the power cables @  $\sim 2.9 A$ ; use the Sense line to compensate for this drop. It is recommended that the Power Supply implements settings for max Voltage (say 4V) and max Current draw (say 3.5A) to prevent any over-voltage or over-current situation when using the sense lines.**

### CFP2 Evaluation Board DIP Switch CFP2 Evaluation Board

Configure the DIP switch on the CFP2 evaluation board as follows (board should have this default configuration):

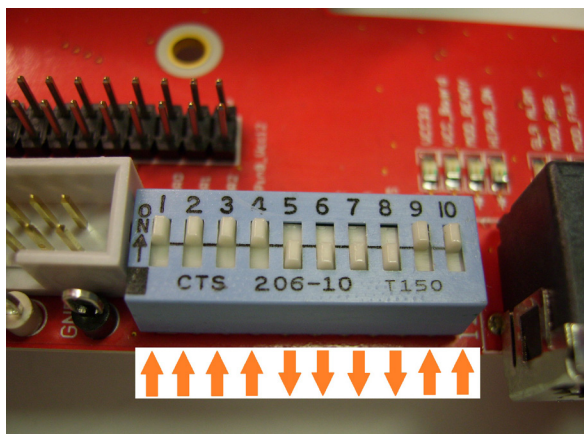


Figure 4. DIP Switch Configuration

## Avago Technologies USB-to-MDIO Controller

### USB-to-MDIO Controller Configuration

1. Connect the ribbon cable and the USB cable to the MDIO controller, as shown in Figure 6.
2. Connect the ribbon cable to the CFP2 evaluation board, as shown in Figure 7.
3. Connect the USB end of the cable to the laptop or computer running Windows 7 or Windows XP. See section 'USB-to-MDIO Controller Driver Installation'.



Figure 5. Ribbon Cable for MDIO-to-CFP2 Evaluation Board Connection



Figure 6. Avago Technologies USB-MDIO Controller – USB for power; MDIO communication



Figure 7. Avago Technologies USB-MDIO controller connection to CFP2 evaluation board

## USB-to-MDIO Controller Driver Installation

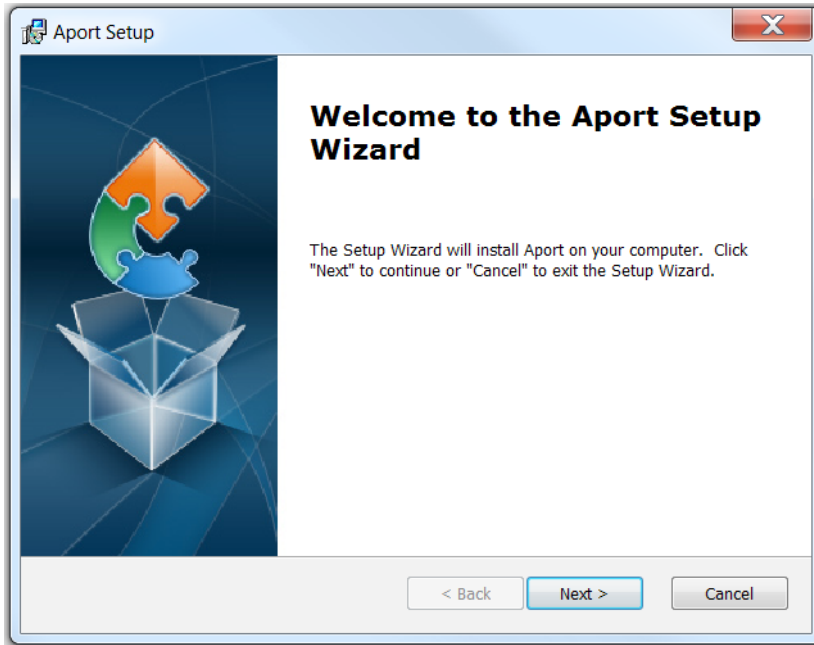
Included with the Avago Evaluation Kit is a CD that contains the driver for the USB to MDIO Controller (Also known as 'A port'). Place the CD into the CD/DVD drive of the desktop PC or laptop and find the file "Aport.msi".



**Note:**

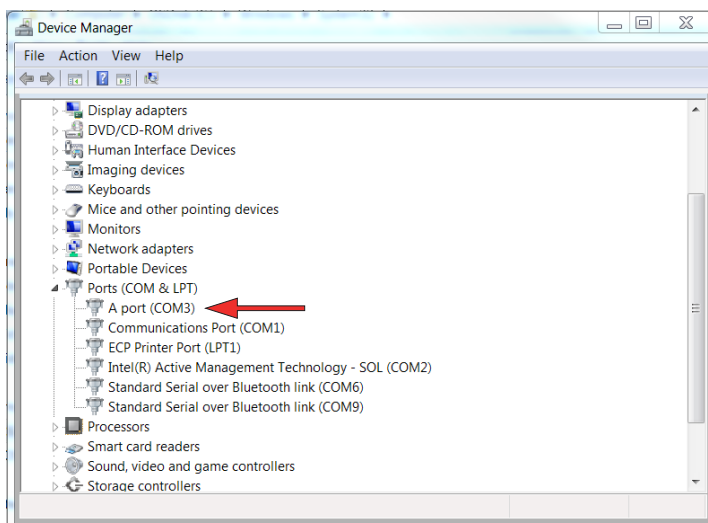
The installation of CFP2 User GUI should install the driver for MDIO host as well. This section should be used only if the user experiences any issues or if the user does not intend to install the CFP2 User GUI.

1. Run the Aport.msi program
2. Follow the installation Wizard Instructions



**Figure 8. Run CMD.exe as administrator**

3. Plug-in the MDIO controller. Navigate to Device Manager and confirm that Windows shows the device under Device Manager → Ports (COM & LPT) → A port.



**Figure 9. Device Manager - Verify 'A port' has been installed**

## CFP2 Test Setup

**CAUTION! Always use proper ESD protection! At a minimum, use a properly grounded ESD wrist strap when handling the parts and boards.**

1. Ensure the evaluation kit comes with all piece parts
2. Ensure the evaluation board jumpers and DIP switches are correct.
3. Connect the Avago Technologies USB-to-MDIO controller to the laptop or computer using the USB cable.
4. Connect ribbon fiber from the Avago Technologies USB-to-MDIO controller to CFP2 board.
5. Connect 3.3V DC power to the CFP2 evaluation board.

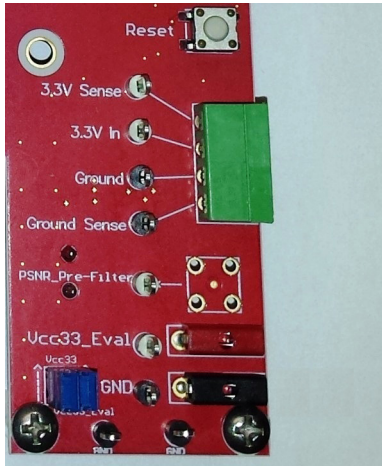


Figure 10. 3.3 V Power Supplies – power cables

6. Insert an Avago Technologies' AFBR-8420Z CFP2 SR10 module into the connector/cage.

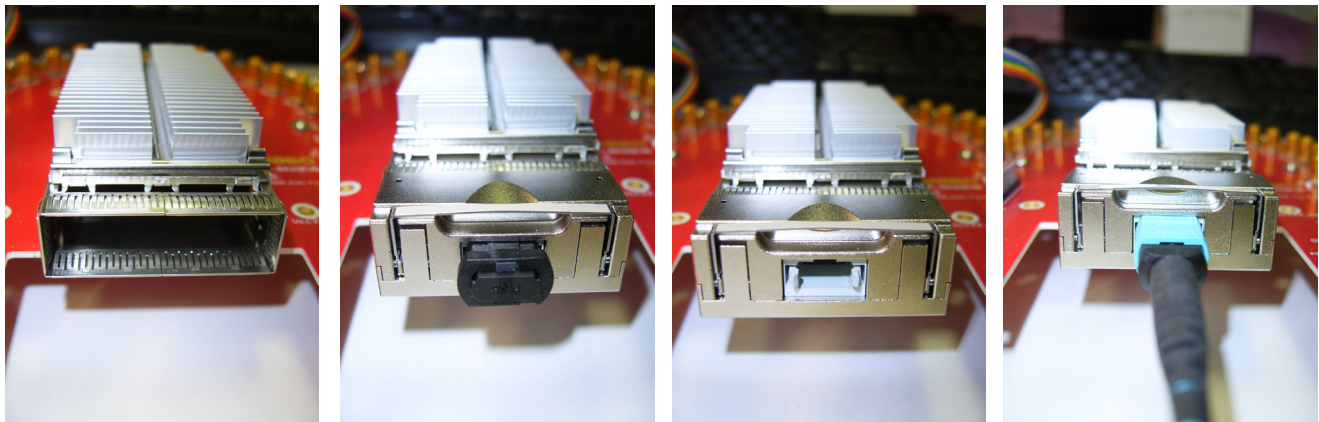


Figure 11. Insertion of the CFP2 Module and Insertion of MTP 24 fiber optic cable (2x12)

**CAUTION:** It is advised that normal static precautions be taken in handling and assembly of this component to prevent damage and/or degradation which may be induced by ESD.



## Installing the Avago CFP2 Viewer Software

Included with the Avago evaluation kit is a CD that contains the self-install customer user interface software. This user interface software is PC and Windows 7 and XP compatible.

Place the CD into the CD/DVD drive of the desktop PC or laptop. The Install CD front page should appear automatically. If this does not happen, then open 'My Computer' and double-click the CD-ROM drive.

Right-click setup.exe and "Run as administrator". Follow the the installation prompts.

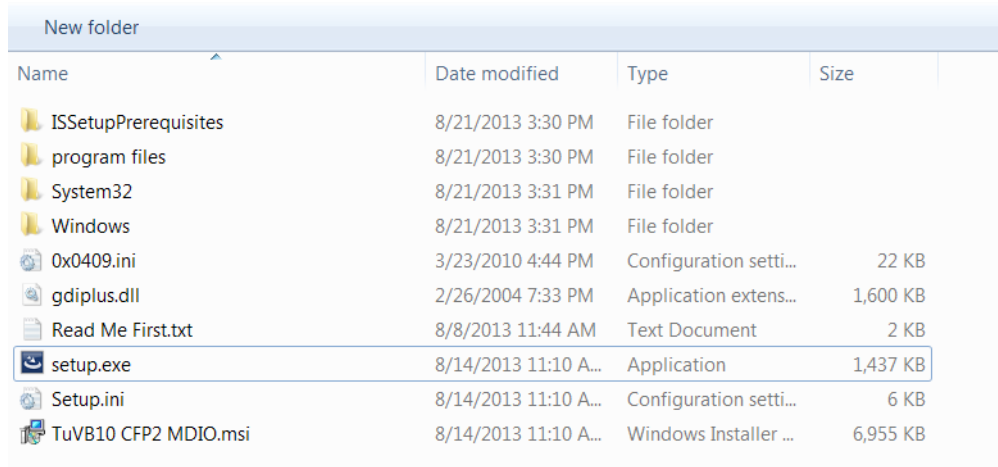


Figure 13. Install GUI – setup.exe

Follow the Installation procedure

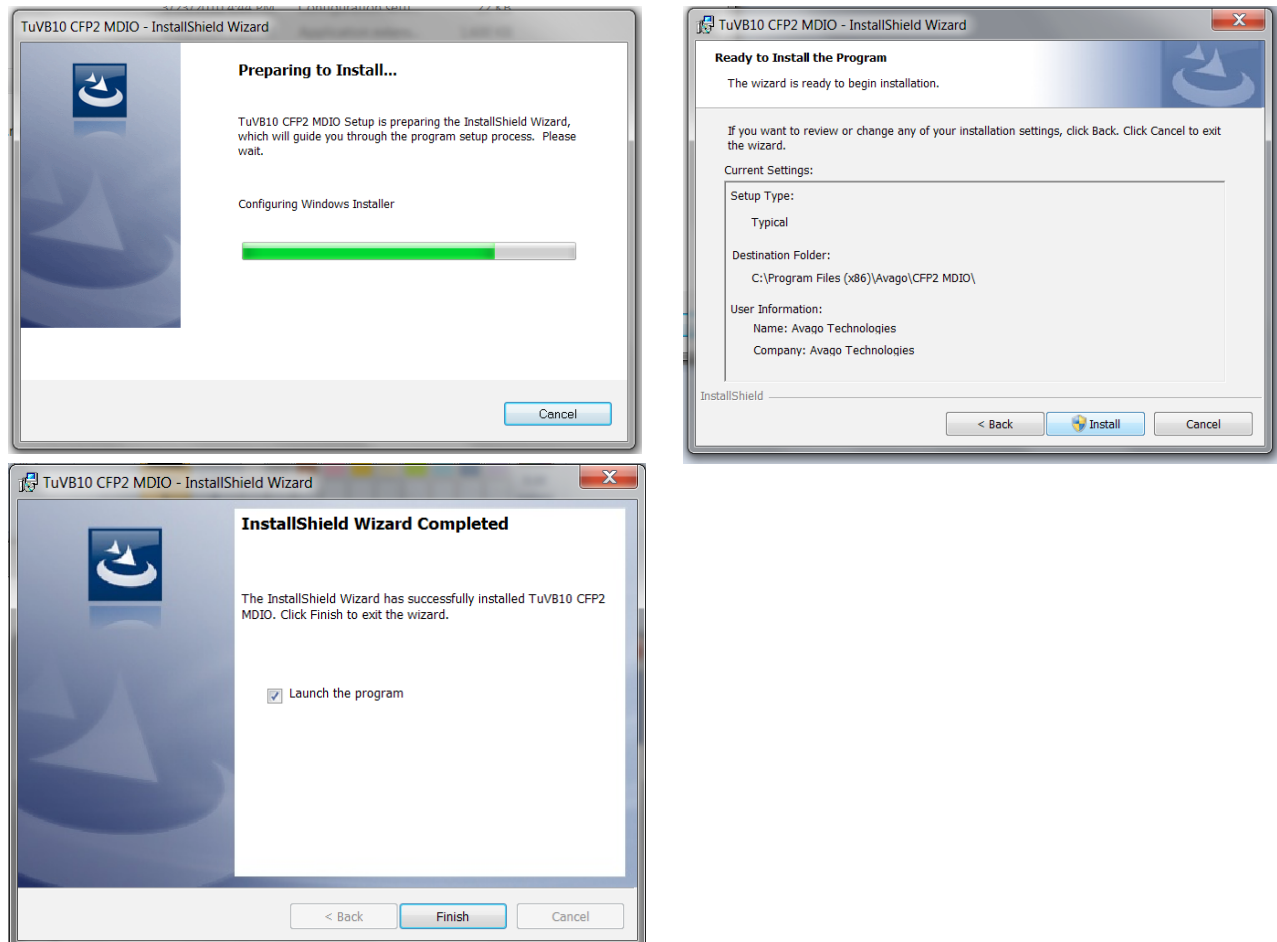


Figure 14. Install GUI Installation procedure

Once installed, an icon entitled "CFP2 MDIO" will appear on the desktop.

## Connecting the Avago CFP2 Evaluation Board

Before starting the GUI software, it is recommended that the user connects and powers up the CFP2 evaluation board, MDIO controller and cables.

Included in the Avago evaluation kit are an Avago CFP2 evaluation PCB, an MDIO controller and associated cables.

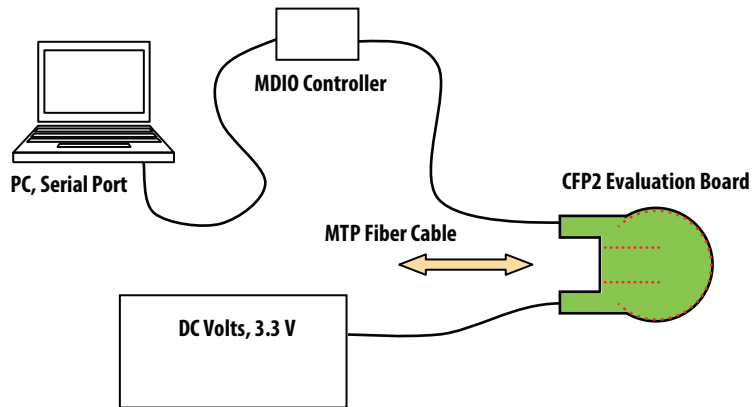


Figure 15. CFP2 Board Connections

## Using the Avago CFP2 Viewer Software

1. The evaluation software can be accessed by double-clicking the desktop icon "CFP2 MDIO". Once the software starts the front page will appear on the screen, and then it transitions to the main page.



Figure 16. CFP2 MDIO Icon and Front Page

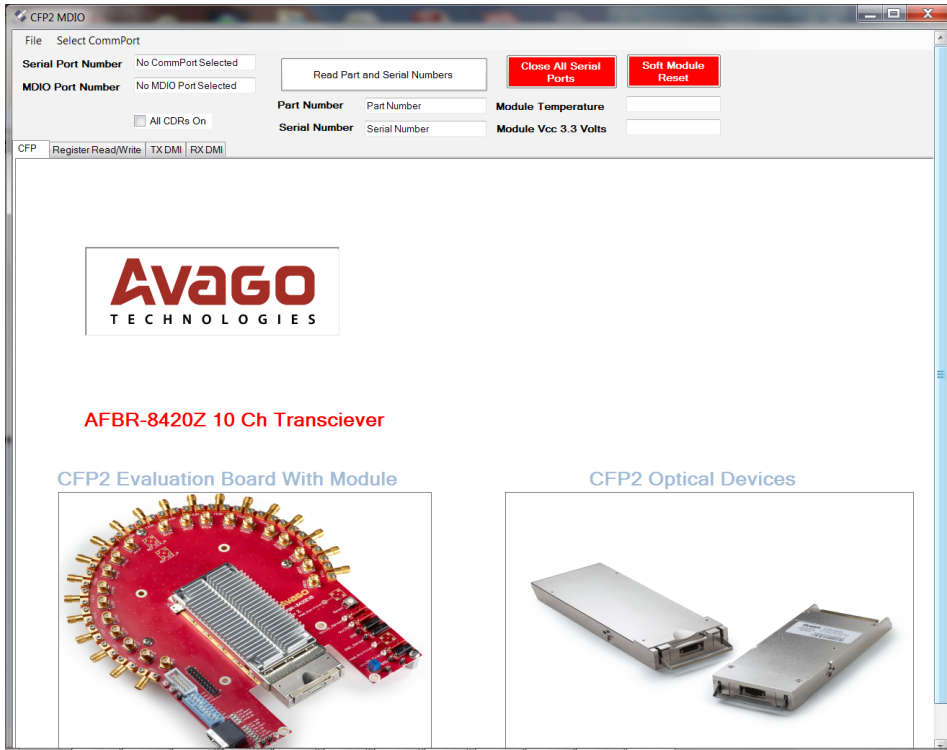


Figure 17. CFP2 GUI Main Page

2. Click "Select Commports". the PC will search the COM ports for an active MDIO device. This may take a few seconds. If the software cannot find a COM port to use, check the MDIO and computer connections or reconfigure the COM port assignments on the computer.

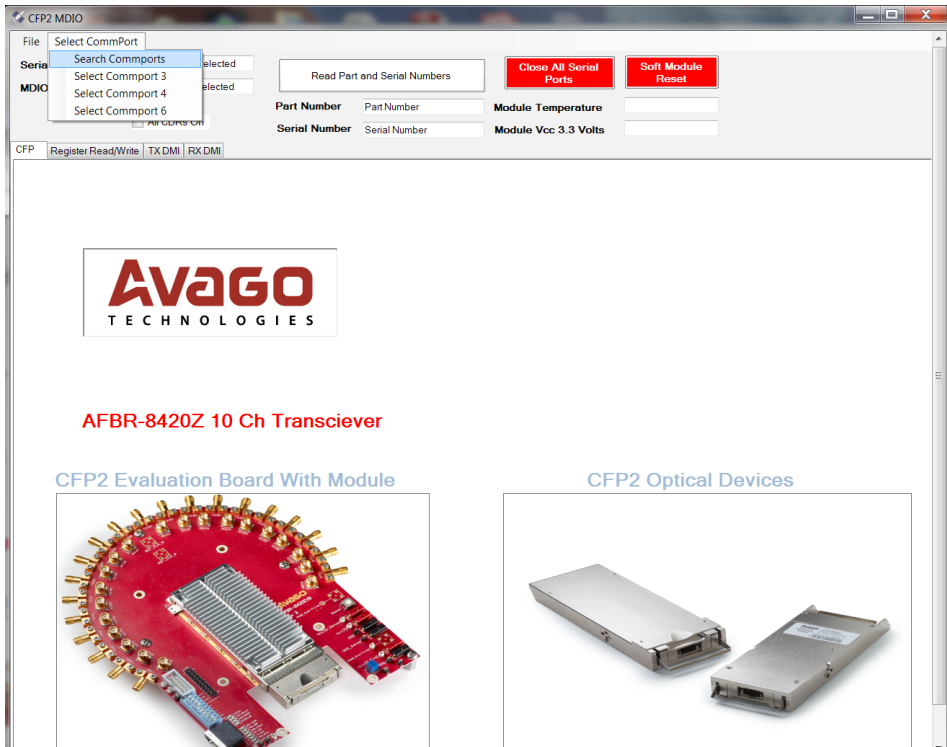
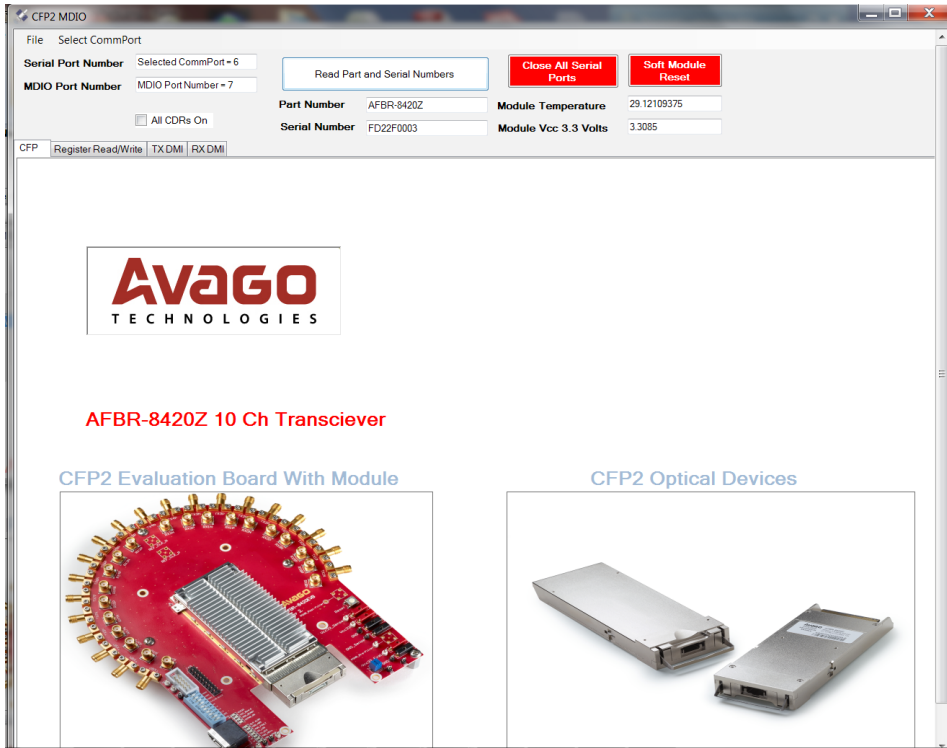


Figure 18. Search Commports

3. Click “Read Part and Serial Numbers”. This will do a read of the currently inserted CFP2 Module. The Part Number, Serial Number, Module Temperature (Real-time Digital Monitor Field) and Module Vcc 3.3 Voltage (Real-time Digital Monitor Field) will appear.



**Figure 19. Read Part and Serial Numbers**

Note: Two other buttons are at the upper right of the GUI:

- a. “Close All Serial Port” – this is to close the MDIO communication between the CFP2 module and the MDIO controller
- b. “Soft Module Reset” – this will write a reset command via MDIO interface to reset the CFP2 module

4. Click “TX DMI Tab”.

To see a snapshot of current settings, press the “Single Scan” button. To see real-time continuous reads, for example, to see real-time DMI fields, click the “Continuous Scan” button.

This view shows the transmitter-side real-time operating condition diagnostics for all 10 channels:

- Tx Power in mW and dBm
- Tx Bias

Furthermore, the user has soft control for

- Tx Disable – individual control of all 10 channels
- Host Lane Loopback – this is also known as eLoopback and will route the high speed data electrically back to the host source (i.e., the high-speed input is NOT modulated onto the laser). This is for all 10 channels.

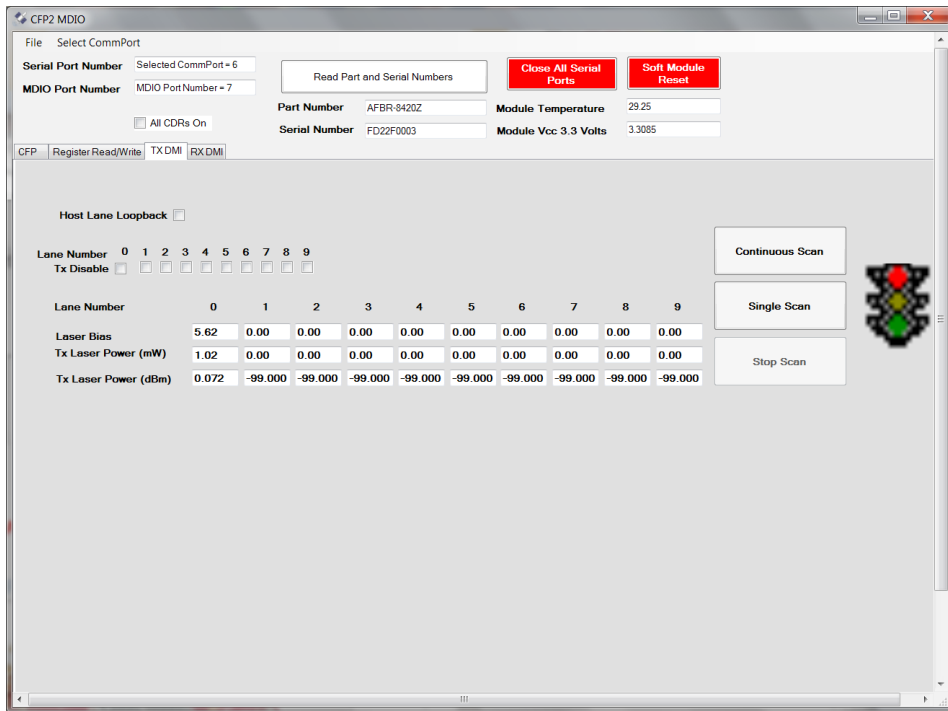


Figure 20. Tx DMI Tab

5. Click the "RX DMI Tab".

To see a snapshot of current settings, press the "Single Scan" button. To see real-time continuous reads, for example to see real-time DMI fields, click the "Continuous Scan" button.

This view shows the receiver-side real-time operating condition diagnostics for all 10 channels:

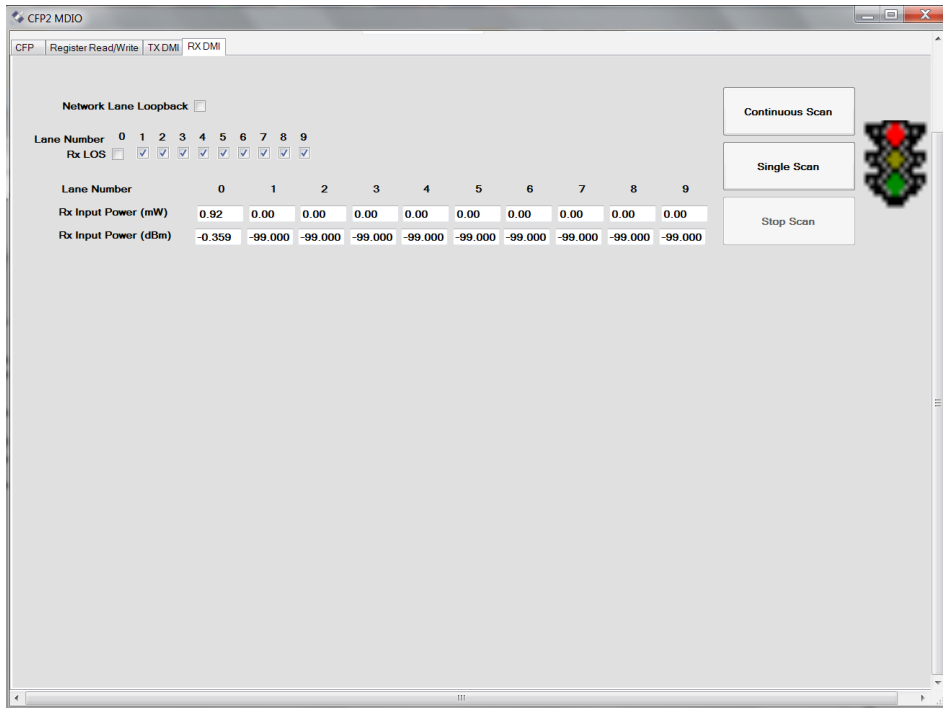
- Rx Input Power in mW and dBm

Furthermore, the user has an indication for

- Rx LOS on a per channel basis

Last, there is a soft control for

- Network Lane Loopback – this is also known as oLoopback and will modulate the received high speed optical data input onto the Laser. This is for all 10 channels.



**Figure 21. Rx DMI Tab**

1. Click the "Register Read/Write" tab.

This tab allows the user to read all sections of the Memory Map and save the entire register contents or individual pages to a .csv format. This feature can be used to log device settings, take a snapshot of the digital monitoring, and simplifying reporting.

2. To select a page of the CFP2 Memory Map the user can either use the drop-down selection "Table Select" or just click the Table Select Buttons on the far right for NVR1, NVR2, NVR3, NVR4, Vendor NVR1, Vendor NVR2, VR1, Network Lane VR1, Network Lane VR2, Network Lane NV3 and Host Lane VR1. The Base address will be reflected in the field "Base Table Address".
3. Click "Read Current Table" to update the "Hex Register Display" with the current values for the selected page.
  - The user can also highlight individual cells in the "Hex Register Display" matrix and click "Read Current Register" for a single register update.

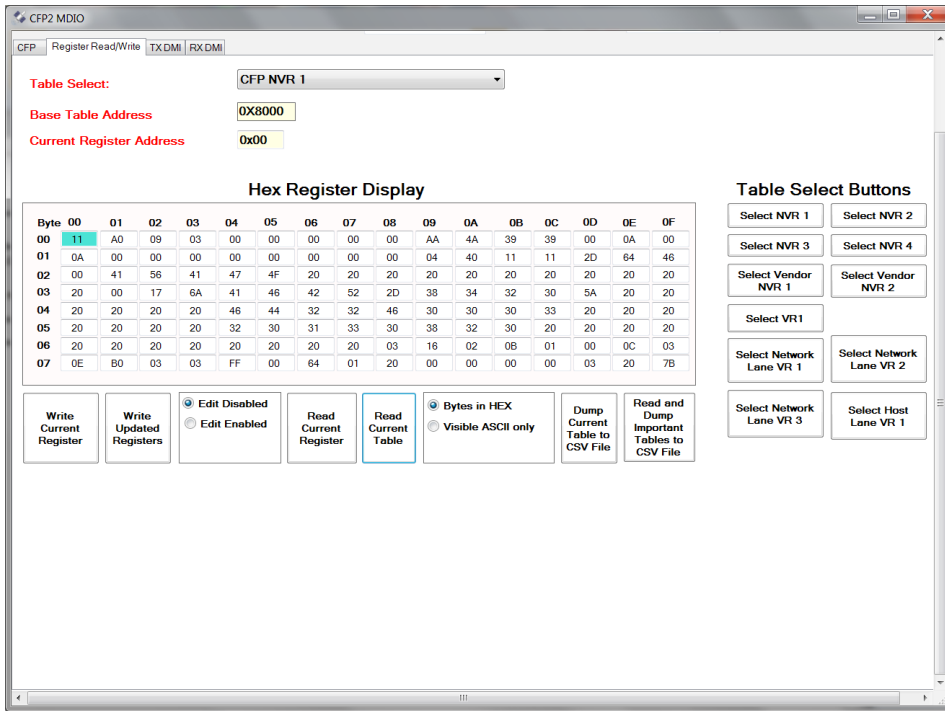


Figure 22. Read Current Table for the selected CFP2 Memory Map Page

4. The user can toggle viewing the report bytes as Raw Hex values or ASCII translated values by toggling between “Bytes in HEX” and “Visible ASCII Only”.

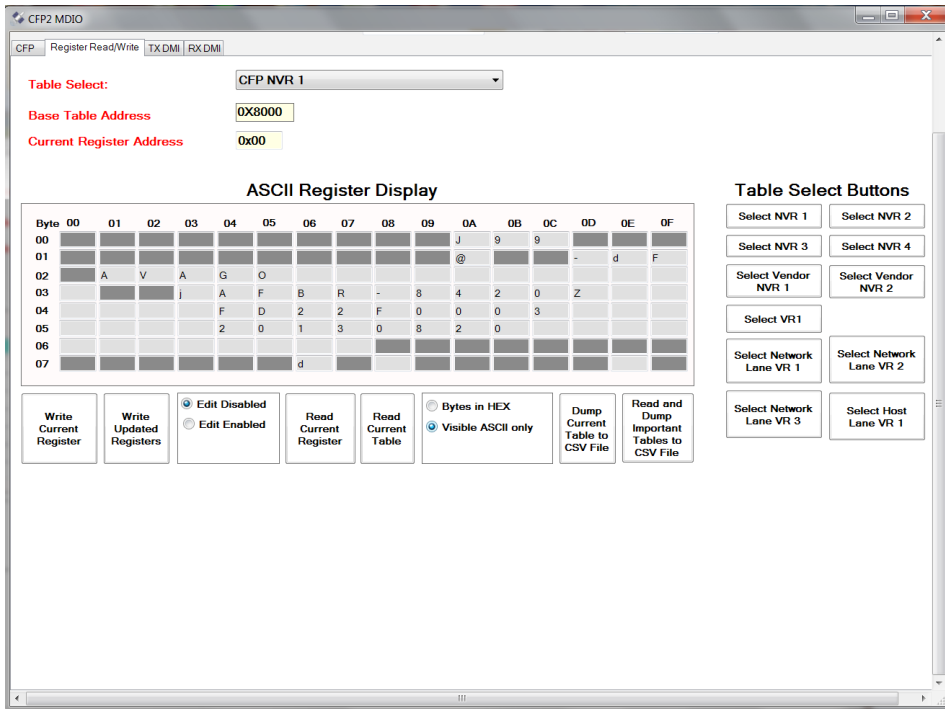


Figure 23. ASCII View option

5. Clicking “Edit Enabled” button allows the user to make direct changes to the contents of the Volatile Fields. Once Edits are enabled, the user can click in the individual cells and directly change volatile bytes or bits. Edited cells will be highlighted in yellow.

- For the change to be written into the CFP2 module, the user must click “Write Updated Register”, which will write all changes on the VR page to the module.
- Or “Write Current Register”, which will update only the single highlighted cell.

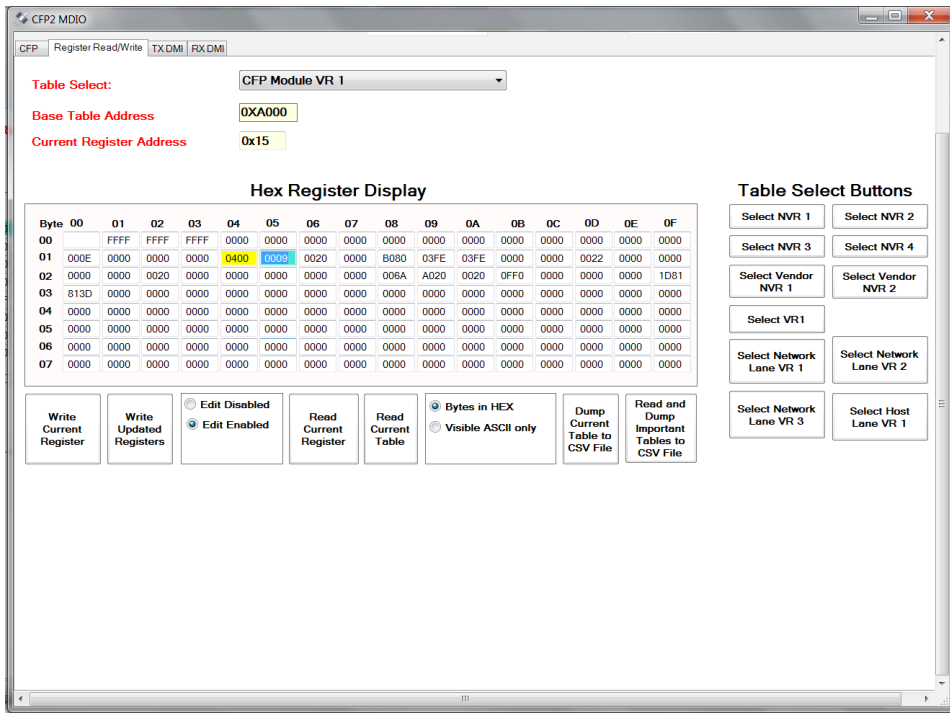


Figure 24. Edit Enabled

- By clicking "Read and Dump Important Tables to CSV File", a report will be generated for all pages indicated under the "Table Select Buttons" and the GUI will prompt the user to title and save a .csv file in a folder location.
- Alternatively, the user can click "Dump Current Table to CSV File", a report will be generated only for the current page and the GUI will prompt the user to title and save a .csv file in a folder location.

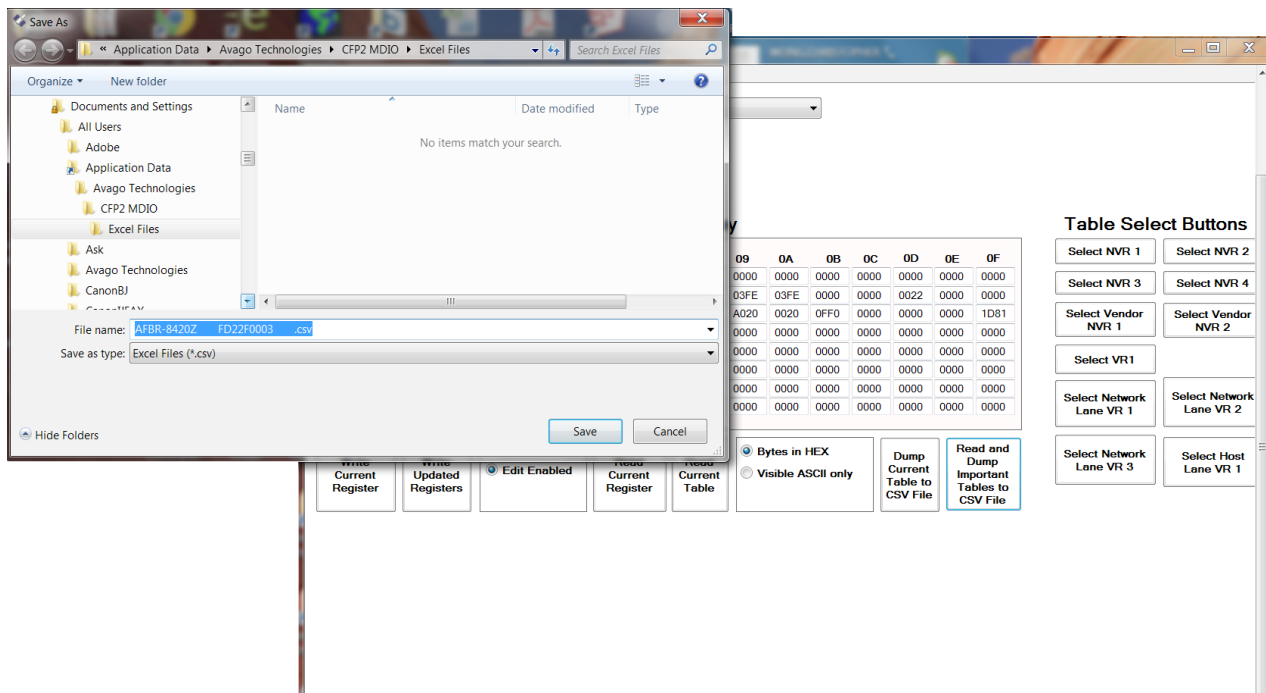


Figure 25. Save Register Dump

## Appendix I. Vendor and Part Numbers

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### Patch Cords

Vendor	Part Number	Description
Tyco	2123419-3	MTP Female to MTP Female, 24 fiber, OM3, 20 m, keyup-keydown
	2123419-1	MTP Female to MTP Female, 24 fiber, OM3, 10 m, keyup-keydown
Senko	J-224-MMF-MMF-2RXT-01 (-005)	MTP Female to MTP Female, 24 fiber, OM3, 1 m (0.5m), keyup-keydown

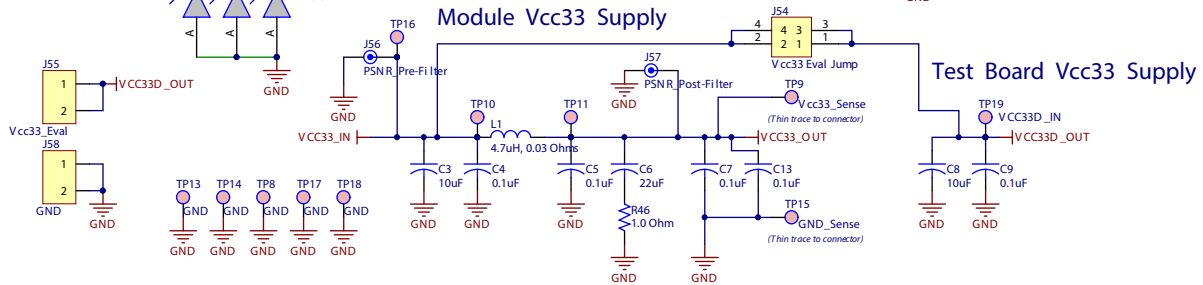
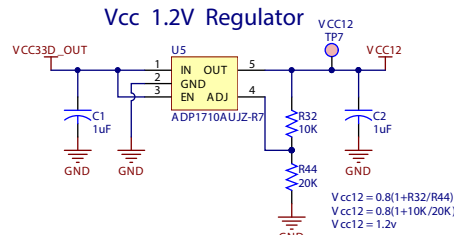
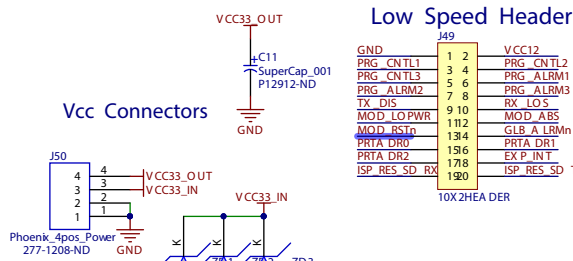
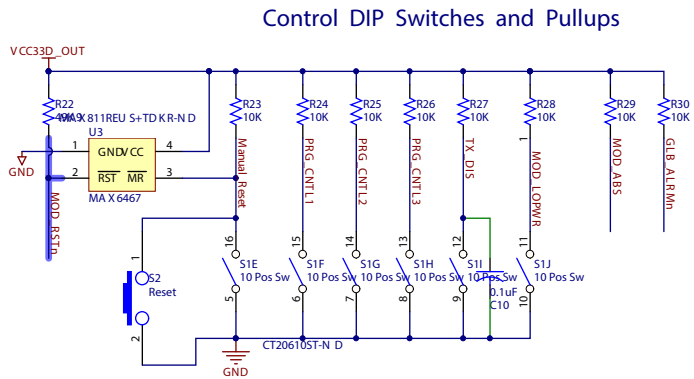
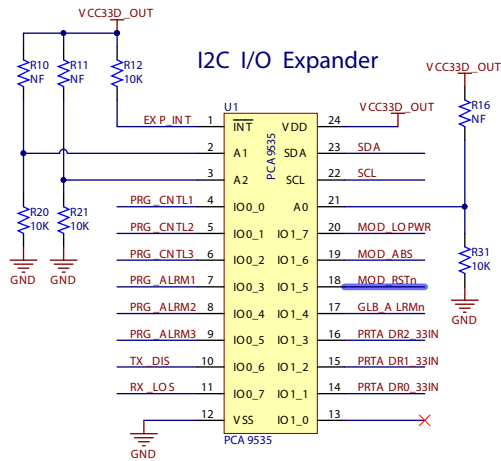
### Breakout Cable

Vendor	Part Number	Description
OFS	MPO24UPC/SCupc-G/TCF-AV-0.5M/1.5M	MTP to 24 simplex SC Breakout Cable

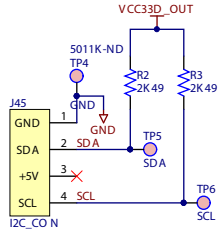
### Loopback Cable

Vendor	Part Number	Description
Timbercon	AL-756-99-01200-015	2x12, 50/125 $\mu$ m MPO(F), OM3 laser optimized, 0 dB, no cover optical loopback
Realm	JL-MTF-LB-12F-0002	2x12 MPO Loopback, OM3
OFS	301052395	2x12 MPO Loopback 24F OM3
Tyco	2123248-1	2x12 MPO Loopback, 24F, 50/125 $\mu$ m fiber, protected ribbon, 70 mm max length

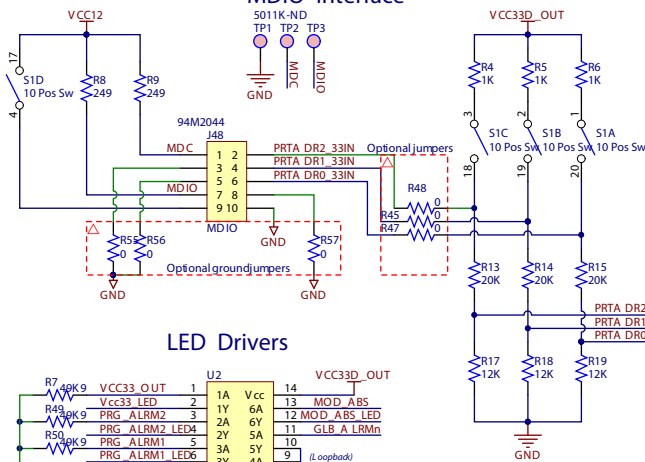
# Appendix II. Schematic



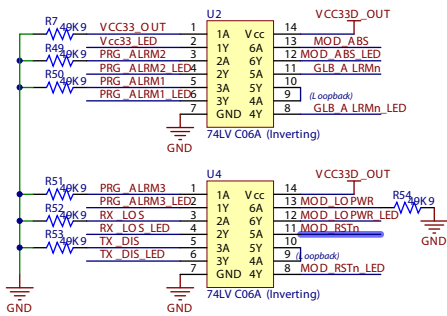
## I2C Interface



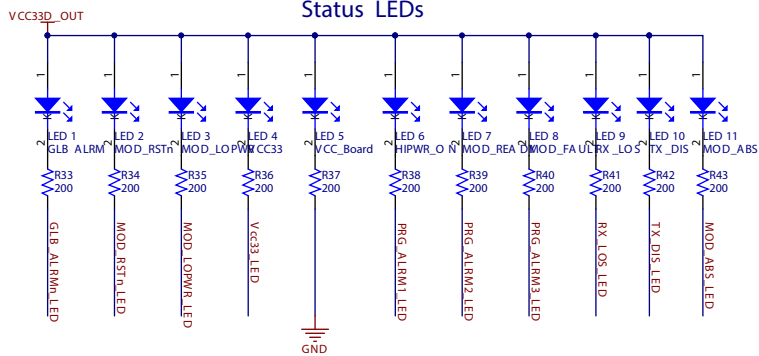
## MDIO Interface



## LED Drivers



## Status LEDs



For product information and a complete list of distributors, please go to our web site: [www.avagotech.com](http://www.avagotech.com)

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