# Connective Peripherals Pte Ltd

# USB2-H-500X-M FAMILY Hi-Speed USB to Multi-Ports RS485 Adapter

# Data Sheet

**Document Reference No.: CP_000029**

**Version 1.2**

**Issue Date: 2019-03-20**

| Part Number | | | | |
|---|---|---|---|---|
| USB2-H-5016-M | USB2-H-5008-M | USB2-H-5004-M | USB2-H-5002-M | USB2-H-5001-M |

The USB2-H-500X-M family provide a simple method of adapting legacy serial devices with RS485 interfaces to modern USB ports by incorporating the FTDI's Hi-Speed USB bridge chips. The adaptor which is contained within a metal enclosure is either USB powered or externally powered (depends on the number of ports) or can supply an output of +5VDC @ up to 80mA on the 5mm terminal block connectors or 30mA on the Pin 9 of DB9 connectors. Indicator LEDs provide functional status.

The USB2-H-500X-M family have been tested to be compliant with both FCC Part 15 Subpart B and European EMC Directive.

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# Table of Contents

# 1  Introduction

## 1.1  Functional Description

The USB2-H-500X-M modules are a family of communication devices.  This model, USB2-H-500X-M, provides a simple method of adapting many legacy RS485 serial devices to a modern USB port.  This is accomplished by incorporating the industry standard FTDI USB2.0 Hi-Speed serial bridge chip.

The integrated electronics of the USB2-H-100X-M utilise the FTDI FT4232H, FT2232H or FT232H plus RS485 level shifters and TXD/RXD LEDs to provide a visual indication of data traffic through the module.



**Figure 1.1 - USB2-H-5001-M**



**Figure 1.2 - USB2-H-5002-M**

**Figure 1.3 - USB2-H-5004/5008/5016-M**

The module uses a standard USB-B device connector for connection to an upstream host or hub port. RS485-level signals, including modem handshake signals, are available on an industry-standard DE-9P connector. The Single and Dual port module also provide 5mm terminal block connector, customer can use these signals friendly. The maximum RS485-level data rate is 8Mbps.

The USB2-H-500X-M module requires USB device drivers, available free from http://www.ftdichip.com/Drivers/VCP.htm, which are used to make the USB2-H-500X-M appear as Virtual COM Ports (VCP). This allows existing serial communications software, such as HyperTerminal, to exchange data through the USB2-H-500X-M to a legacy RS485 peripheral device.

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## 1.2  LED Description

The USB2-H-500X-M has three types of LEDs to indicate a valid link as well as data traffic according to the following table:

| LED Colour | Function | Description | LED quantity |
|---|---|---|---|
| Yellow | Enumerated | ON when USB2-H-500X-M is configured and ready | 1 |
| Red | TxD Activity | Flashes when data is transmitted from the USB2-H-500X-M to the attached RS485 device | Each ports have one TXLED |
| Green | RxD Activity | Flashes when data is transmitted from the attached RS485 device to the USB2-H-500X-M. | Each ports have one RXLED |

**Table 1.1 – LED Description**

## 1.3  Block Diagram

### 1.3.1 Single Port Block Diagram
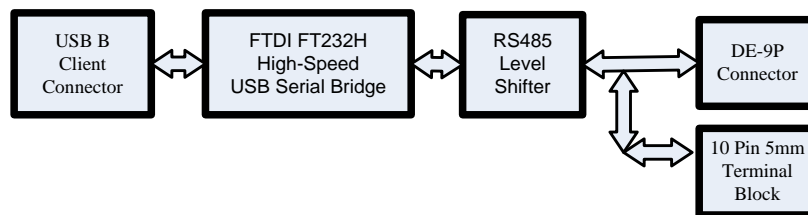


**Figure 1.4 - USB2-H-5001-M Block Diagram**

### 1.3.2 Dual Port Block Diagram
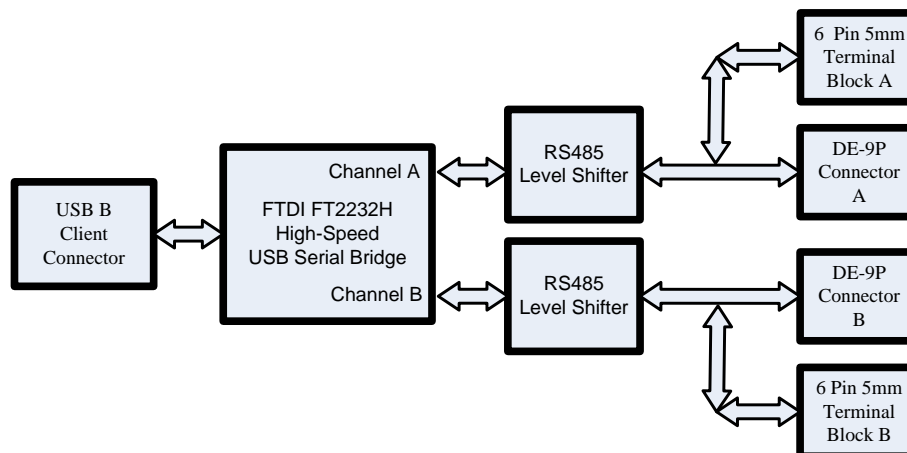


**Figure 1.5 - USB2-H-5002-M Block Diagram**

## 1.3.3 Four, Eight and Sixteen Ports Block Diagram
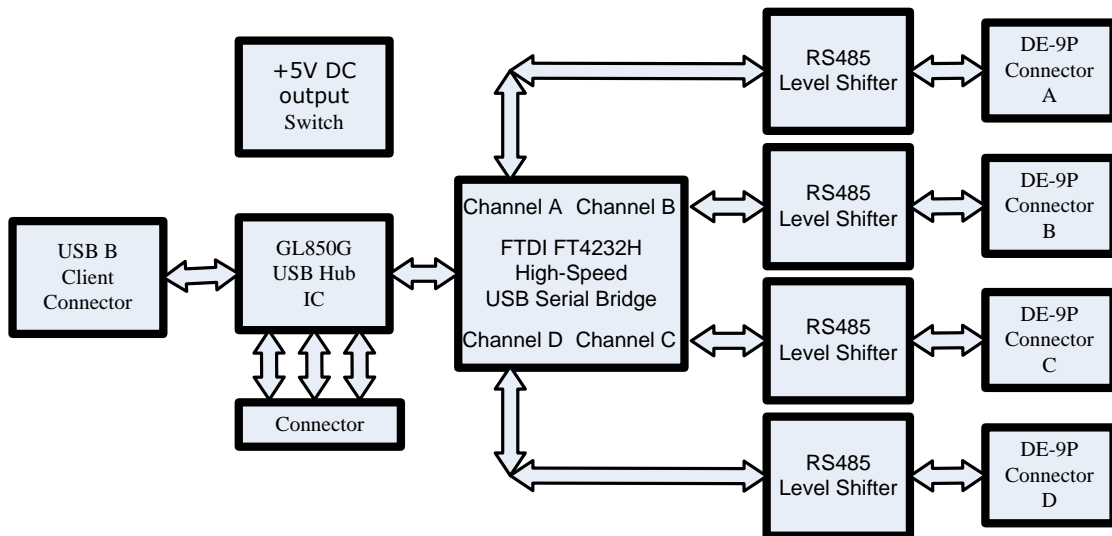


**Figure 1.6 - USB2-H-5004/5008/5016-M Main Board Block Diagram**



**Figure 1.7 - USB2-H-5008/5016-M Daughter Board Block Diagram**

## 1.3.4 Block description

**USB B Client Connector**

This connector provides the interface for connection to a USB Host or Hub port. The maximum cable length is 5 meters, according to the USB 2.0 specification.

**Genesys GL850G**

The Genesys GL850G is advanced version Hub solutions which fully comply with Universal Serial Bus

Specification Revision 2.0.

### FTDI FT4232H

The FTDI FT4232H provides the Hi-Speed USB-to-Serial conversion.  Operating system device drivers are required in order to work with the FT4232H to provide the quad Virtual COM Port serial interfaces.

### FTDI FT2232H

The FTDI FT2232H provides the Hi-Speed USB-to-Serial conversion.  Operating system device drivers are required in order to work with the FT2232H to provide the dual Virtual COM Port serial interfaces.

### FTDI FT232H

The FTDI FT232H provides the Hi-Speed USB-to-Serial conversion.  Operating system device drivers are required in order to work with the FT232H to provide the one Virtual COM Port serial interface.

### RS485 Level Shifter

The RS485 level shifter converts the signals provided by the Hi-Speed USB-to-Serial conversion of FTDI into the voltage levels required by RS485 devices.

### DE-9P Connector (Male)

The DE-9P connector is configured in an industry standard (TIA/EIA-574) pin-out to provide connection to RS485 peripherals through standard cables. See section 3.1.2

### 5mm Terminal Block

There are 5mm terminal block connectors provide the connection to RS485 peripherals devices.

### +5V DC Output Switch

This switch can disable/Enable the +5VDC to an external devices.

### Main Board

This is using on 4 and 16 ports product. When product is 4-ports that use a main board, when product is 16-ports product that use two main boards.
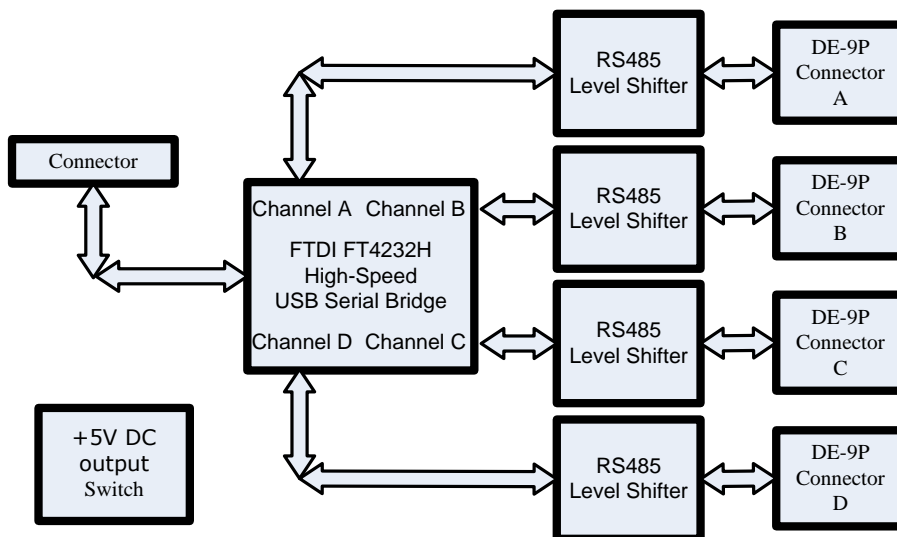
### Daughter board

This is using on 8 and 16 ports product. When product is 8-ports that use a daughter board, when product is 16-ports product that use two daughter boards.

## 1.4 Features

- RS-485 serial ports by connecting to Hi-Speed USB 2.0 interface.
- Easy plug & play installation and RS-485 device connection
- Provide USB2.0 Hi-Speed(480Mbps) interface and works with USB 1.1 & 2.0 Host and Hub ports
- Industry Standard FTDI chip set & device drivers for maximum compatibility
- Microsoft Windows® WHQL-certified, Mac OS X, Linux and Windows CE device drivers
- Installs as standard Windows COM ports
- COM port number can be changed to any available COM port number, to support HyperTerminal, or any other serial communications software application running in Windows
- Supports Windows Server 2008, 2003, Vista, XP 2000, Linux, Mac OS X
- FIFO: USB2-H-5004/5008/5016-M -  FT4232H 2K byte transmit buffer, 2K byte receive buffer
      USB2-H-5002-M - FT2232H 4K byte transmit buffer, 4K byte receive buffer
      USB2-H-5001-M FT232H 1K byte transmit buffer, 1K byte receive buffer
- RS-485 data signals: Data+, Data-, GND
- Single, dual and quad Ports product are Powered by USB port. No external power adapter is required. Note that they can also be powered from external power adapter.

- Serial port speed up to 8Mbps
- Serial Communication Parameters
  - Parity: None, Even, Odd
  - Data bits: 7, 8
  - Flow control: X-ON/X-OFF, None
- The standard DE-9P male connectors
- LEDs indicate USB Enumeration, RxD, TxD for monitoring port status & easy diagnostics
- Operating temperature of -40°C to +85°C
- 5mm terminal block connectors
- Echo and non-Echo two modes can be selected.
- Termination ON and OFF two modes can be selected.
- +5V DC power output for external devices
  - The maximum current of 4, 8 and 16 port are 30mA
  - The maximum current of 1 and 2 port are 80mA

**Note 1:** The Windows CE5.0 can only support COM0~COM9, When the FTDI COM ports are over the Windows CE available COM ports, you cannot use FTDI COM port.

**Note 2:** HyperTerminal is no longer provided with Windows 7/Vista.

## 1.5 Performance Figures

| Parameter | Performance |
|---|---|
| USB Interface | 480Mbps USB 2.0 High-Speed |
| RS485 Interface | Standard Windows baud rates (300bps to 921.6Kbps)<br><br>Custom baud rates (300bps to 8Mbps) through baud rate aliasing.  See FTDI Application Note: AN_120_Aliasing_VCP_Baud_Rates |
| Max Cable Length | USB = 5m, RS485 =12m (at 10Mbps) |

**Table 1.2 - Performance Figures**

| Part Number | Description |
|---|---|
| USB2-H-5016-M | Hi-Speed USB to 16-Ports RS485 module |
| USB2-H-5008-M | Hi-Speed USB to 8-Ports RS485 module |
| USB2-H-5004-M | Hi-Speed USB to quad-Port RS485 module |
| USB2-H-5002-M | Hi-Speed USB to dual-Port RS485 module |
| USB2-H-5001-M | Hi-Speed USB to single-Port RS485 module |

**Table 1.3 - Ordering Information**

# 2  Installation

## 2.1  Hardware Configurations

Insert the A-plug of USB cable into an available USB Host or Hub port.  Insert the B-plug of USB cable into the B-receptacle on the USB2-H-500X-M.

### 2.1.1  Wiring

RS485 cables have followed a standard 9-pin configuration on a D-sub connector since the mid-1980s. The USB2-H-500X-M family follows this standard as a Data Terminal Equipment (DTE) device.  If the RS485 equipment being connected is a Data Communication Equipment (DCE) device, it's typical that a straight-through cable can be used.

| DTE Pin Number | Signal Name | Expected  Connect Signal |
|---|---|---|
| 1 | DATA- = Transmit/Receive Data, negative polarity | DATA- |
| 2 | DATA+ = Transmit/Receive Data, positive polarity | DATA+ |
| 3 | N/A | N/A |
| 4 | N/A | N/A |
| 5 | GND = signal ground | GND |
| 6 | N/A | N/A |
| 7 | N/A | N/A |
| 8 | N/A | N/A |
| 9 | PWR = +5V DC output<br><br>(4, 8 and 16 ports product.) | PWR |

**Table 2.1 – RS485 DTE to DCE connection**

Single-Port Switch Setting

| SW1<br>Position | Open<br>(off) | Closed<br>(on) |
|---|---|---|
| 1 | Echo ON | Echo OFF |
| 2 | Termination OFF | Termination ON |

**Table 2.2 – Switch Setting Configuration of USB2-H-5001-M**

**Dual-Port Switch Setting**

The Dual-Port has two switches to control the Termination and Echo function of the two channels.

Channel 1:

| SW1 Position | Open (off) | Closed (on) |
|---|---|---|
| 1 | Echo ON | Echo OFF |
| 2 | Termination OFF | Termination ON |

**Table 2.3 – SW1 Setting Configuration of the USB2-H-5002-M**

Channel 2:

| SW2 Position | Open (off) | Closed (on) |
|---|---|---|
| 1 | Echo ON | Echo OFF |
| 2 | Termination OFF | Termination ON |

**Table 2.4 – SW2 Setting Configuration of the USB2-H-5002-M**

**4 Ports Switch Setting**

| SW1 Position | Ports Position | Open (off) | Closed (on) |
|---|---|---|---|
| 1 | CH4 | | |
| 2 | CH3 | Echo ON | Echo OFF |
| 3 | CH2 | | |
| 4 | CH1 | | |

**Table 2.5 – SW1 Setting Configuration of the USB2-H-5004-M**

| SW2 Position | Ports Position | Open (off) | Closed (on) |
|---|---|---|---|
| 1 | CH4 | | |
| 2 | CH3 | Termination OFF | Termination ON |
| 3 | CH2 | | |
| 4 | CH1 | | |

**Table 2.6 – SW2 Setting Configuration of the USB2-H-5004-M**

| SW3 Position | Ports Position | Open (off) | Closed (on) |
|:---:|:---:|:---:|:---:|
| 1 | CH4 | | |
| 2 | CH3 | 5V Out Disable | 5V Out Enable |
| 3 | CH2 | | |
| 4 | CH1 | | |

**Table 2.7 – SW3 Setting Configuration of the USB2-H-5004-M**

**8 Ports Switch Setting**

| SW Position | | Ports Position | Open (off) | Closed (on) |
|:---:|:---:|:---:|:---:|:---:|
| SW1 | 1 | CH4 | | |
| | 2 | CH3 | Echo ON | Echo OFF |
| | 3 | CH2 | | |
| | 4 | CH1 | | |
| SW4 | 1 | CH8 | ECNo ON | ECNo OFF |
| | 2 | CH7 | | |
| | 3 | CH6 | | |
| | 4 | CH5 | | |

**Table 2.8 – Echo function Switch Setting Configuration of the USB2-H-5008-M**

| SW Position | | Ports Position | Open (off) | Closed (on) |
|:---:|:---:|:---:|:---:|:---:|
| SW2 | 1 | CH4 | | |
| | 2 | CH3 | Termination OFF | Termination ON |
| | 3 | CH2 | | |
| | 4 | CH1 | | |
| SW5 | 1 | CH8 | Termination OFF | Termination ON |
| | 2 | CH7 | | |
| | 3 | CH6 | | |
| | 4 | CH5 | | |

**Table 2.9 – Termination function Switch Setting Configuration of the USB2-H-5008-M**

| SW<br>Position | | Ports<br>Position | Open<br>(off) | Closed<br>(on) |
|---|---|---|---|---|
| SW3 | 1 | CH4 | 5V Out Disable | 5V Out Enable |
| | 2 | CH3 | | |
| | 3 | CH2 | | |
| | 4 | CH1 | | |
| SW6 | 1 | CH8 | 5V Out Disable | 5V Out Enable |
| | 2 | CH7 | | |
| | 3 | CH6 | | |
| | 4 | CH5 | | |

**Table 2.10 – 5V Out Switch Setting Configuration of the USB2-H-5008-M**

**16 Ports Switch Setting**

| SW<br>Position | | Ports<br>Position | Open<br>(off) | Closed<br>(on) | SW<br>Position | | Ports<br>Position |
|---|---|---|---|---|---|---|---|
| SW1 | 1 | CH4 | Echo ON | Echo OFF | SW7 | 1 | CH12 |
| | 2 | CH3 | | | | 2 | CH11 |
| | 3 | CH2 | | | | 3 | CH10 |
| | 4 | CH1 | | | | 4 | CH9 |
| SW4 | 1 | CH8 | | | SW10 | 1 | CH16 |
| | 2 | CH7 | | | | 2 | CH15 |
| | 3 | CH6 | | | | 3 | CH14 |
| | 4 | CH5 | | | | 4 | CH13 |

**Table 2.11 – Echo function Switch Setting Configuration of the USB2-H-50016-M**

| SW<br>Position | | Ports<br>Position | Open<br>(off) | Closed<br>(on) | SW<br>Position | | Ports<br>Position |
|---|---|---|---|---|---|---|---|
| SW2 | 1 | CH4 | Termination<br>OFF | Termination<br>ON | SW8 | 1 | CH12 |
| | 2 | CH3 | | | | 2 | CH11 |
| | 3 | CH2 | | | | 3 | CH10 |
| | 4 | CH1 | | | | 4 | CH9 |

| SW Position | Ports Position | | | SW Position | Ports Position |
|---|---|---|---|---|---|
| SW5 | 1 | CH8 | | SW11 | 1 | CH16 |
| | 2 | CH7 | | | 2 | CH15 |
| | 3 | CH6 | | | 3 | CH14 |
| | 4 | CH5 | | | 4 | CH13 |

**Table 2.12 – Termination function Switch Setting Configuration of the USB2-H-5008-M**

| SW Position | Ports Position | Open (off) | Closed (on) | SW Position | Ports Position |
|---|---|---|---|---|---|
| SW3 | 1 | CH4 | 5V Out Disable | 5V Out Enable | SW9 | 1 | CH12 |
| | 2 | CH3 | | | | 2 | CH11 |
| | 3 | CH2 | | | | 3 | CH10 |
| | 4 | CH1 | | | | 4 | CH9 |
| SW6 | 1 | CH8 | 5V Out Disable | 5V Out Enable | SW12 | 1 | CH16 |
| | 2 | CH7 | | | | 2 | CH15 |
| | 3 | CH6 | | | | 3 | CH14 |
| | 4 | CH5 | | | | 4 | CH13 |

**Table 2.13 – 5V Out Switch Setting Configuration of the USB2-H-5008-M**

**5V Out:**

This +5V supply is available after the USB2-H-500X-M is fully enumerated and device drivers are loaded, and each port provides a maximum current of 30mA.

The single and dual port models do not have the switch but they can provide a maximum current of 80mA (when powered from the USB BUS). When using the external power adapter the maximum current can be increased.

## 2.2 Device Driver Installation

The USB2-H-500X-M Series adaptor drivers are available for download from:

http://www.ftdichip.com/Drivers/VCP.htm.

### 2.2.1 Microsoft Windows

With the device drivers being Windows Hardware Quality Labs (WHQL) certified, they are also available through download directly from the Microsoft® Windows® Update service.  This is the best choice when connecting the USB2-500X-M Series to a computer running Windows Vista.  Additional installation options are noted below:

**Installation Executable on Windows XP**

1) Login to your system as Administrator, or a user with Administrator rights.

2) Prior to connecting the USB2-500X-M Series to the USB Host or Hub port, download the latest device driver version from http://www.ftdichip.com/Drivers/VCP.htm.

| Operating System | Release Date | x86 (32-bit) | x64 (64-bit) | Comments |
|---|---|---|---|---|
| Windows* | 2011-04-12 | 2.08.14 | 2.08.14 | 2.08.14 WHQL Certified<br>Available as setup executable Release Notes |
| | 2011-08-26 | 2.08.17 (Beta) | 2.08.17 (Beta) | 2.08.17 Beta Version<br>Release Notes |

3) Run this executable to install the device drivers.

4) Connect the USB2-500X-M Series to your computer.  A notification will appear near the task bar indicating that new hardware has been installed and is ready for use.  It is normal if this notice appears twice.
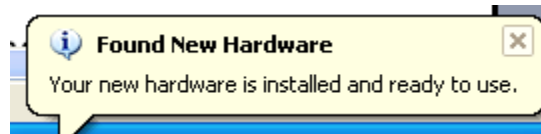


**Figure 2.1 - Hardware Ready**

**Windows Update shown on Windows XP**

You must have an active Internet connection and the Windows Update Service enabled.

1) Connect the USB2-500X-M Series to your USB Host or Hub.

2) The "Found New Hardware" Wizard will appear.  The first dialog should ask whether it is acceptable to use the Windows Update Service to find the device driver.



**Figure 2.2 – Found New Hardware Wizard**

3) Select one of the "Yes" choices and click "Next".

4) The following screen appears:



**Figure 2.3 – Automatic Install**

5) Wait while the driver is found, downloaded, and installed.  This step may take a couple minutes depending on the Internet speed.

6) After the files are found and installed, click "Finish" to complete the installation.


**Figure 2.4 - Complete Hardware Installation**

7) Steps 2 through 6 will repeat.  The first time installs the basic USB Serial Converter in the USB device tree.  The second time installs the Virtual COM Port layer in the Ports tree and assigns the COM port number.

8) When both portions of the device driver have been installed successfully, the following message will appear, indicating that the device is ready.
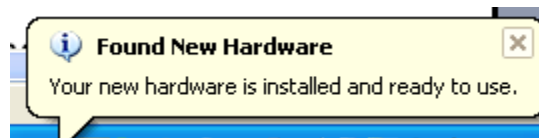

**Figure 2.5 - Hardware Ready**

### COM Port Assignment

Next, to determine which COM port has been assigned, open the Windows Device Manager from the System Control Panel.
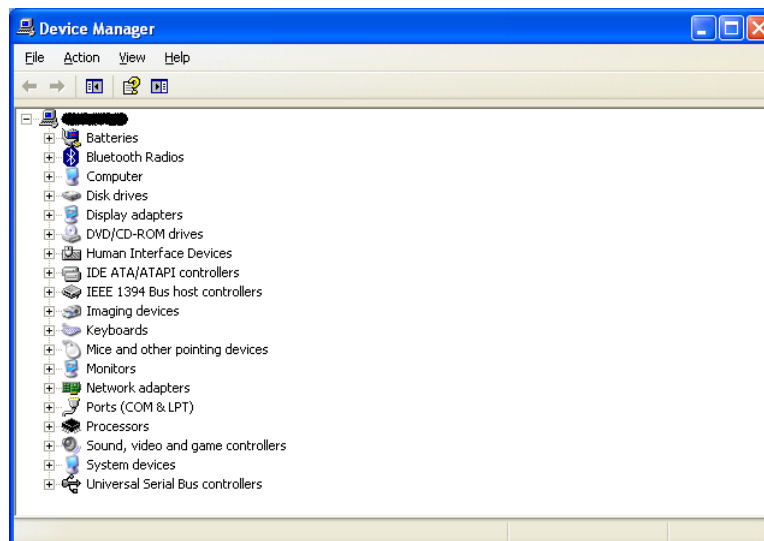

**Figure 2.6 - Device Manager**

Click on the Plus "+" sign next to the Ports tree to list the available COM port.  You will see "USB Serial Port", followed by a COMn assignment.  In the figure below, the USB2-H-500X-M-Dual port is assigned to COM3 to COM4, so how many COM Ports are depend on your device.
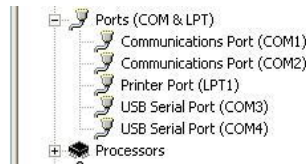

**Figure 2.7 - COM Port Assignment**

Use this COM port number with your application software in order to access the USB2-H-500X-M.

If an application requires use of a different COM port number, the assignment may be changed through the Advanced Driver Options settings.

From the Device Manager listing above, right-click on the USB Serial Port and select Properties.
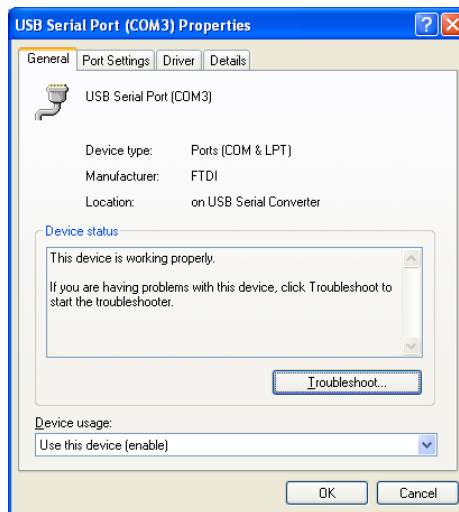

**Figure 2.8 – Access COM Port Properties**

Next, click on the "Port Settings" tab.
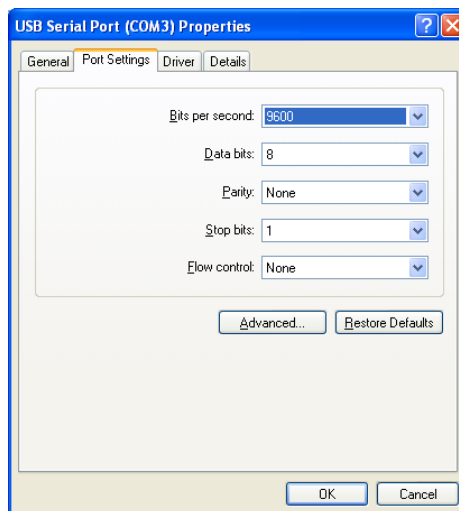

**Figure 2.9 - Settings Tab**

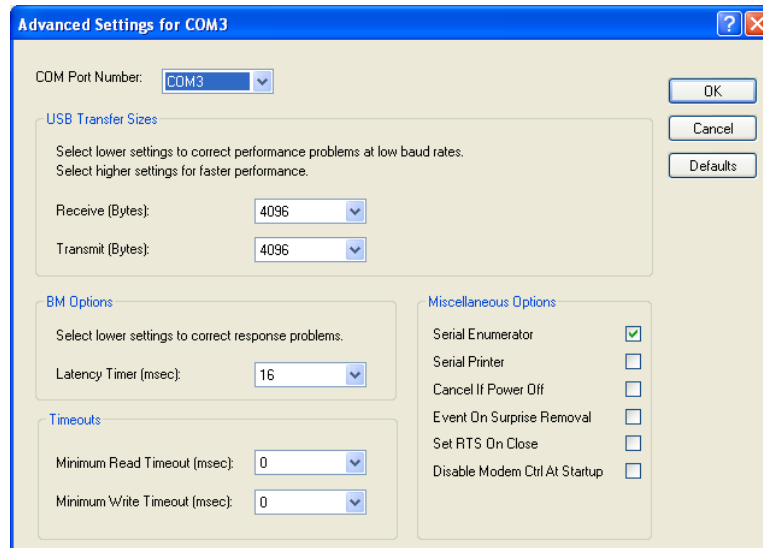Then click on the "Advanced…" button.

**Figure 2.10 - Advanced Options**

This will display the various advanced settings.  Note the COM port assignment in the upper left.  Clicking on the drop-down list will display the available port numbers.  Select one that is not in use and click OK on each dialog box to activate the selection.  Windows will remember this COM port number.

## 2.2.2 Mac OS X, Linux, Windows CE

Device drivers and FTDI installation guides for Mac OS X, Linux and Windows CE are available for download on the Connective Peripherals web site.  Follow the respective FTDI installation guides for the chosen operating system.

The Windows CE5.0 can only support COM0~COM9, When the FTDI COM ports are over the Windows CE available COM ports, you could not use FTDI COM port.

# 3  Connections

## 3.1  External Connectors

### 3.1.1 USB

The USB2-H-500X-M family are a downstream USB 2.0 High-speed Device.  A standard USB Series "B" receptacle is mounted inside the USB2-H-500X-M FAMILY to facilitate connection to an upstream USB Host or Hub.

| Pin Number | Pin Type | Description |
|---|---|---|
| 1 | Power | VBUS – USB Power provided from upstream USB Host or Hub |
| 2 | Bidirectional | D− = USB data signal, negative polarity |
| 3 | Bidirectional | D+ = USB data signal, positive polarity |
| 4 | Ground | GND = USB signal ground |
| Shield | Case Ground | Drain = typically connected to the host PC case |

**Table 3.1 – USB "B" Receptacle Pin-Out**

### 3.1.2 RS485

The RS485 ports are configured as Data Terminal Equipment (DTE), with a 9-contact D-Sub Pin connector.  Pin assignments are according to TIA/EIA-485.  In addition, pin9 of DB9 provides +5VDC to an external device with a maximum current draw of 30mA once the USB2-H-500X-M has been enumerated by the system.

| Pin Number | Pin Type | Description |
|---|---|---|
| 1 | DATA- = Transmit/Receive Data, negative polarity | DATA- |
| 2 | DATA+ = Transmit/Receive Data, positive polarity | DATA+ |
| 3 | N/A | N/A |
| 4 | N/A | N/A |
| 5 | GND = signal ground | GND |
| 6 | N/A | N/A |
| 7 | N/A | N/A |
| 8 | N/A | N/A |
| 9 | PWR = +5V DC output | PWR |

**Table 3.2 – DE-9P RS485 Pin-Out**

## 3.1.3 5mm Terminal Block

The single and dual port product also provides another interface for customer using that is 5mm terminal block connector. Each RS485 signals also connected through a 5mm terminal block connector. This is shown in the following table:

**Single Port Terminal Block**

| Single Port Terminal Block | | |
|---|---|---|
| **Terminal Block Pin Number** | **Pin Type** | **Description** |
| 1 | Input | Channel 1 DATA- |
| 2 | Input | Channel 1 DATA+ |
| 3 | N/A | N/A |
| 4 | N/A | N/A |
| 5 | Ground | GND = RS485 signal ground |
| 6 | N/A | N/A |
| 7 | N/A | N/A |
| 8 | N/A | N/A |
| 9 | N/A | N/A |
| 10 | PWR output | +5V DC output |

**Table 3.3 – USB2-H-5001-M Terminal Block interface**
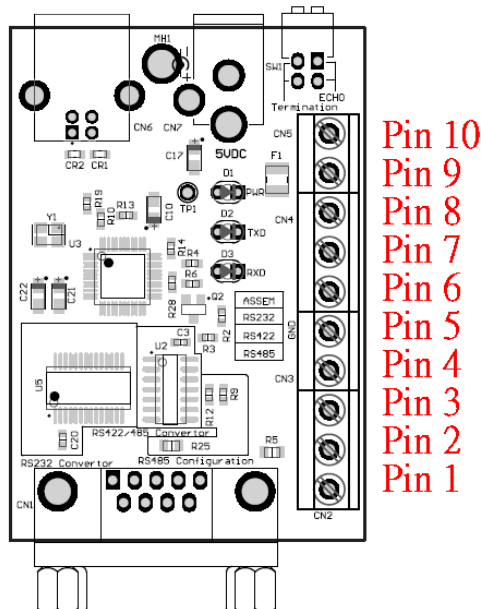


**Figure 3.1 - USB2-H-5001-M Terminal Block Connector Assignment**

**Dual Port Terminal Block**

| Dual Port Terminal Block | | |
|---|---|---|
| **Terminal Block Pin Number (Channel 1 and Channel 2)** | **Pin Type** | **Description** |
| 1 | Input | Channel 1 DATA- |
| 2 | Input | Channel 1 DATA+ |
| 3 | N/A | N/A |
| 4 | N/A | N/A |
| 5 | PWR output | +5V DC output |
| 6 | Ground | GND = RS485 signal ground |

**Table 3.4 –USB2-H-5002-M Terminal Block interface**
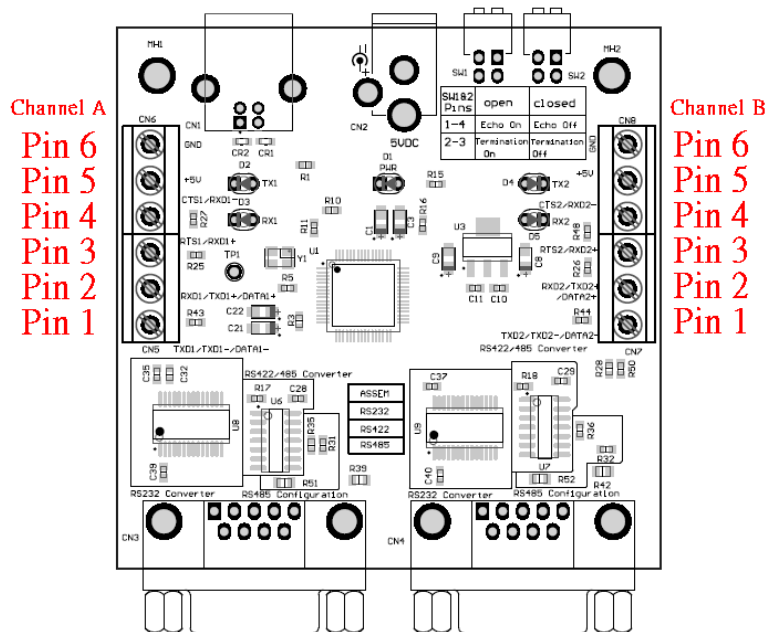


**Figure 3.2 - USB2-H-5002-M Terminal Block Connector Assignment**

In addition, one pin of terminal block connector can provide +5VDC to an external device with a maximum current draw of 80mA once the USB2-5001/5002-M has been enumerated by the system.

# 4 Termination and BIAS Resistors Setting

Figure 4.1 shows a general-purpose RS-485 network which has 4 devices. Each node has a transceiver that interfaces between RS-485 and TTL logic levels. Each node also has two 10KΩ biasing resistors which hold the line in a known state when no drivers are enabled.
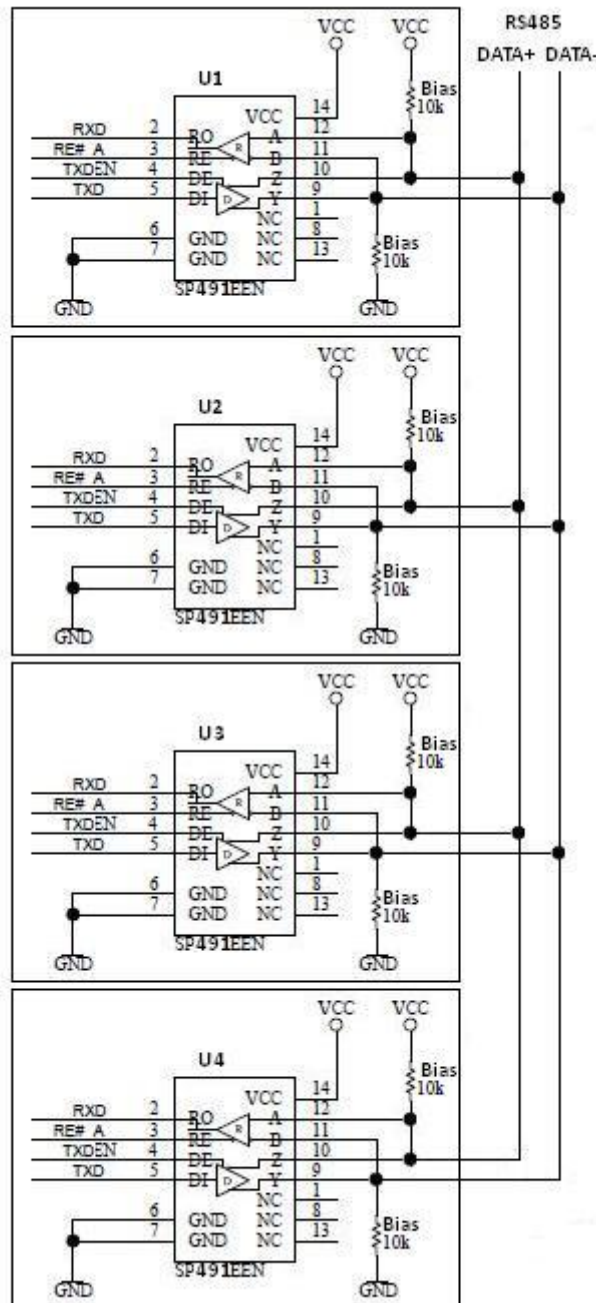


**Figure 4.1 – An example for RS485 network (Without Terminations)**

The USB2-H-500X-M has these biasing circuits fitted internally. The unit is supplied with a 10K Ω pullup from line Data+ to VCC and a 10K Ω pulldown from line Data- to ground. When no drivers are enabled, the biasing resistors hold line Data+ more positive than line Data-. Note that these are sufficient when no termination is enabled on the bus, but additional resistors may be required if termination is enabled. Please refer to Figure 4.2 in this case.

If there are over 20 devices in the network, the parallel value of bias resistors will reduce to 500 Ω, and the value will be too small and the transceiver output may not drive the signal high or low correctly. Removing the internal bias resistors from some nodes to reduce the combined value to greater than 500 Ω will improve the signal quality in this case. There should not be issues if the parallel value of the bias resistors is over 500 Ω.

Adding terminations will reduce voltage reflections that can cause the receiver to misread logic levels. The receiver sees reflected voltages as output switches, and the line settles from its initial current to its final current. The termination eliminates reflections by making the initial and final currents equal. The circuit has two 120-Ω terminating resistors connected in parallel, at or just beyond the final node at each end of the link. One end of the link also has two 750-Ω biasing resistors.
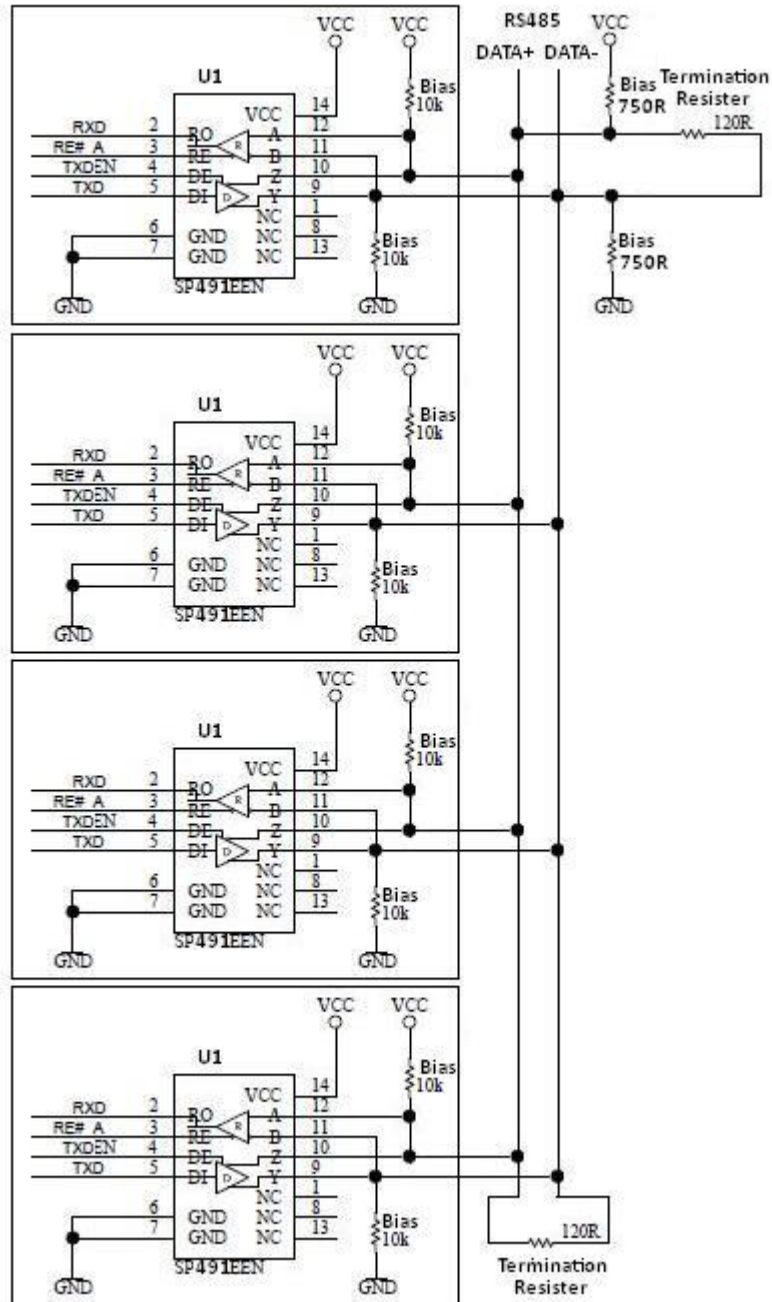


**Figure 4.2 – An example for RS485 network (With Terminations)**

The final current is a function of the line termination, the receivers' input impedance, and the line's series impedance. In a typical RS-485 line without a termination, the initial current is greater than the final current because the characteristic impedance is less than the receivers' combined input impedance.

On a line without a termination, the first reflection occurs when the initial current reaches the receiver. The receiver's input can absorb only a fraction of the current. The rest reflects back to the driver. As the current reverses direction, its magnetic field collapses and induces a voltage on the line. As a result, the receiver initially sees a greater voltage than what was transmitted.

When the reflected voltage reaches the driver, which has lower impedance than the line, the driver absorbs some of the reflection and bounces the rest back to the receiver. This reflection is of opposite polarity to the first reflection and causes the receiver to see a reduced voltage. The reflections bounce back and forth like this for a few rounds before they die out and the line settles to its final current.

If the line terminates with a resistor equal to the line's characteristic impedance, there are no reflections. When the initial current reaches the termination, it sees exactly what it was expecting—a load equal to the line's characteristic impedance. The entire transmitted voltage drops across the load. In a network with two parallel terminations, the drivers drive two lines with each ending at a termination.

When two 120Ω termination resistors are added, the difference between Data+ and Data- shrinks to a few millivolts, much less than the required 200 mV. The solution is to add smaller resistors in parallel with the internal biasing so that a greater proportion of the series voltage drops across the termination.

The size of the biasing resistors is a trade-off. For a greater voltage difference and higher noise immunity on an idle line, use smaller values. For lower power consumption and a greater differential voltage on a driven line, use larger values.

The table 4.1 below shows the component numbers of the bias resistors in each module. All termination resistors in the USB2-H-500X-M can be enabled or disabled by switches. Please refer to table 2.12. The user can also remove or modify the internal bias resistors to meet their requirements. All default value of bias resistors is 10KΩ.

| Modules Name | Bias Resistor Numbers | |
|---|---|---|
| | **Daughter Board** | **Main Board** |
| USB2-H-50016-M | (R41,R47),(R46,R48),(R49,R67),(R66,R68) | (R38,R40),(R39,R41),(R42,R48),(R47,R49) |
| USB2-H-5008-M | (R41,R47),(R46,R48),(R49,R67),(R66,R68) | (R38,R40),(R39,R41),(R42,R48),(R47,R49) |
| USB2-H-5004-M | R38,R40),(R39,R41),(R42,R48),(R47,R49) | |
| USB2-H-5002-M | (R51,R53),(R52,R54) | |
| USB2-H-5001-M | R25,R26 | |

**Table 4.1 –Bias Resistor Numbers of Each Modules**

# 5  Electrical details

## 5.1  USB

| Parameter | | Description | Minimum | Typical | Maximum | Units | Conditions |
|---|---|---|---|---|---|---|---|
| USB_VCC | | Input Power Voltage* | 4.25 | 5.0* | 5.25 | V | *Present when USB cable is attached and USB Host or Hub powered. |
| 1 port | $I_{cc}$ | USB current | | 61 | 62 | mA | ***Does not include power supplied to external device when RI/PWD pin is configured for +5V output |
| 2 ports | | | | 85 | 100 | | |
| 4 ports | | | | 115 | 135 | | |

**Table 5.1 - USB Electrical Details**

## 5.2  5V Power Adapter

| Parameter | | Description | Minimum | Typical | Maximum | Units | Conditions |
|---|---|---|---|---|---|---|---|
| 5V Power adapter_VCC | | Power Voltage | 4.75 | 5 | 5.25 | V | Adapter provide 5V 2A of power. |
| 8 ports | $I_{cc}$ | Power adapter current | | 300 | 320 | mA | ***Does not include power supplied to external device when RI/PWD pin is configured for +5V output |
| 16 ports | | | | 535 | 555 | | |

**Table 5.2 - 5V Power Adapter Electrical Details**

## 5.3  RS485

| Parameter | Description | Minimum | Typical | Maximum | Units | Conditions |
|---|---|---|---|---|---|---|
| $V_{trans}$ | Transmitter output voltage swing | 2 | | | V | RL = 50R□□CL = 50pF |
| $V_{rec}$ | Receiver input voltage range | -7 | | +12 | V | RL = 50R□□CL = 50pF |
| ESD HBM | N/A | | ±15 | | KV | For all RS-485 Inputs and Outputs pin |

**Table 5.3 –RS485 Electrical Details**

## 5.4 Power Output

The USB2-H-500X-M provides +5V DC for an external device that requires power on pin9 of DB9 and termination block connector. The +5V output is only enabled when the USB interface is not in suspend and the switch is setting in closed.

| Parameter | Description | Minimum | Typical | Maximum | Units | Conditions |
|-----------|-------------|---------|---------|---------|-------|------------|
| $I_O$ | Single and Dual port Output Power Current | 0 | | 80 | mA | USB interface is not in SUSPEND. This is the total current available on all ports |
| | 4, 8 and 16 ports Output Power Current | 0 | | 30 | mA | The Switch is set in +5V DC enable, and USB interface is not in SUSPEND. |

**Table 5.4 - Power Output for USB2–H-500X-M**

# 6  Physical Environment Details

## 6.1  Storage Temperature

| Parameter | Description | Minimum | Typical | Maximum | Units | Conditions |
|-----------|-------------|---------|---------|---------|-------|------------|
| T | Storage Temperature Range | -65 | | +150 | ºC | |

**Table 6.1 - Storage Temperature**

## 6.2  Operating Temperature

| Parameter | Description | Minimum | Typical | Maximum | Units | Conditions |
|-----------|-------------|---------|---------|---------|-------|------------|
| T | Operating Temperature Range | −40 | | +85 | ºC | 5% to 95% RH, non condensing |

**Table 6.2 - Operating Temperature**

# 7   Physical Dimensions

All dimensions are in mm, and the tolerances are +/-0.1mm.

## 7.1  USB2-H-5001-M Dimension
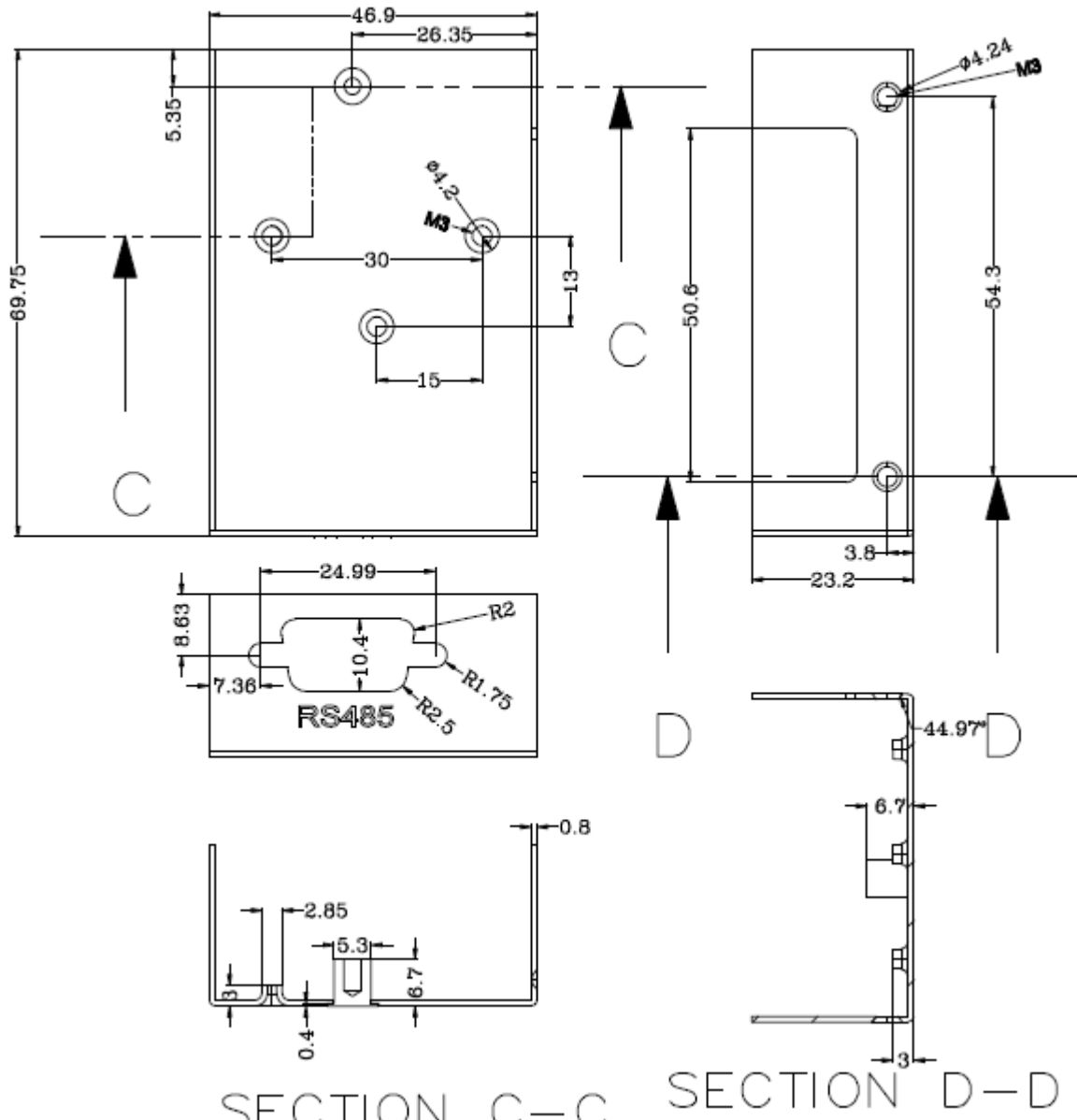


**Figure 7.1 - USB2-H-5001-M Top Cover of Dimension**
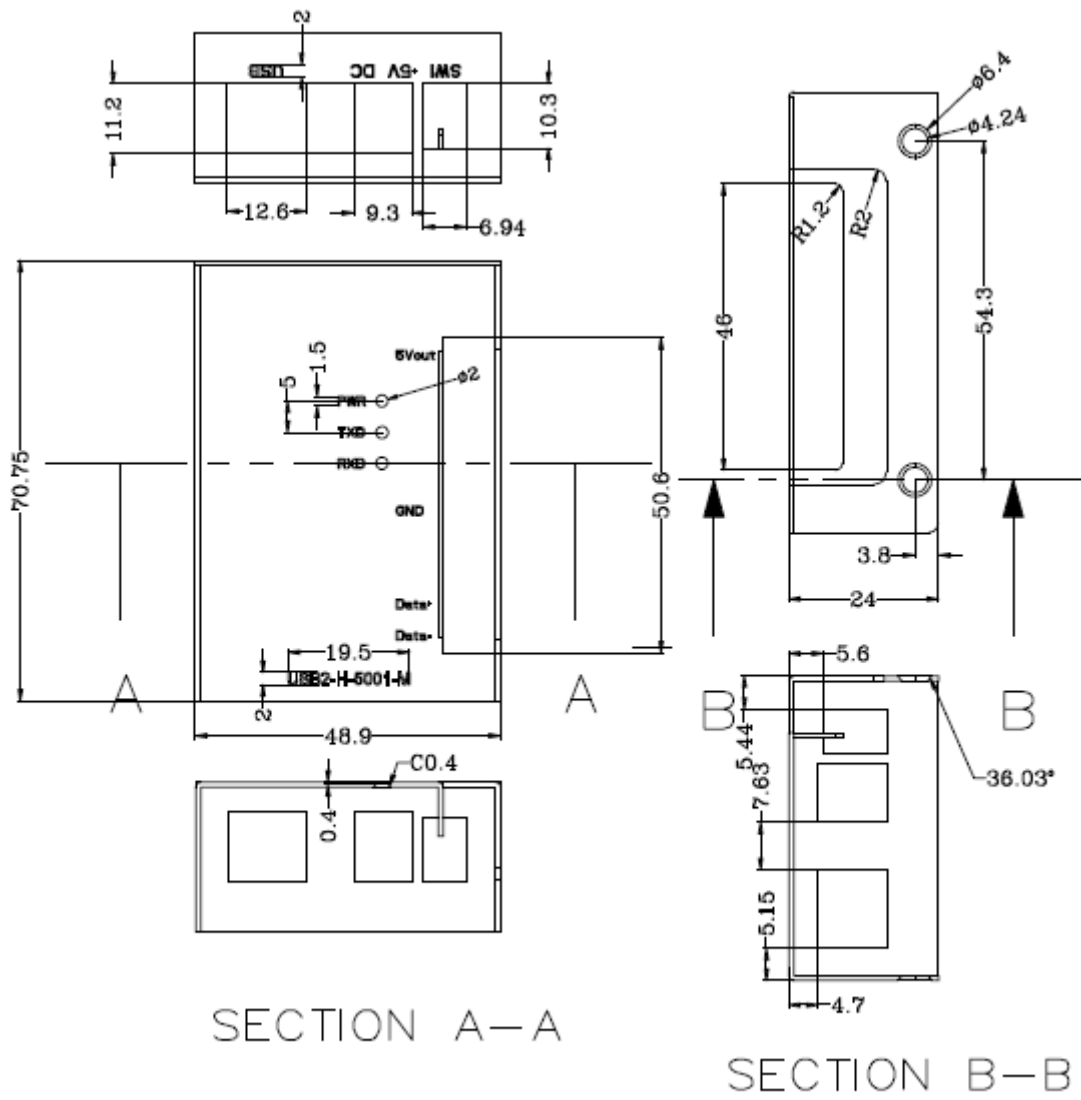
**Figure 7.2 - USB2-H-5001-M Bottom Cover of Dimension**

## 7.2 USB2-H-5002-M Dimension
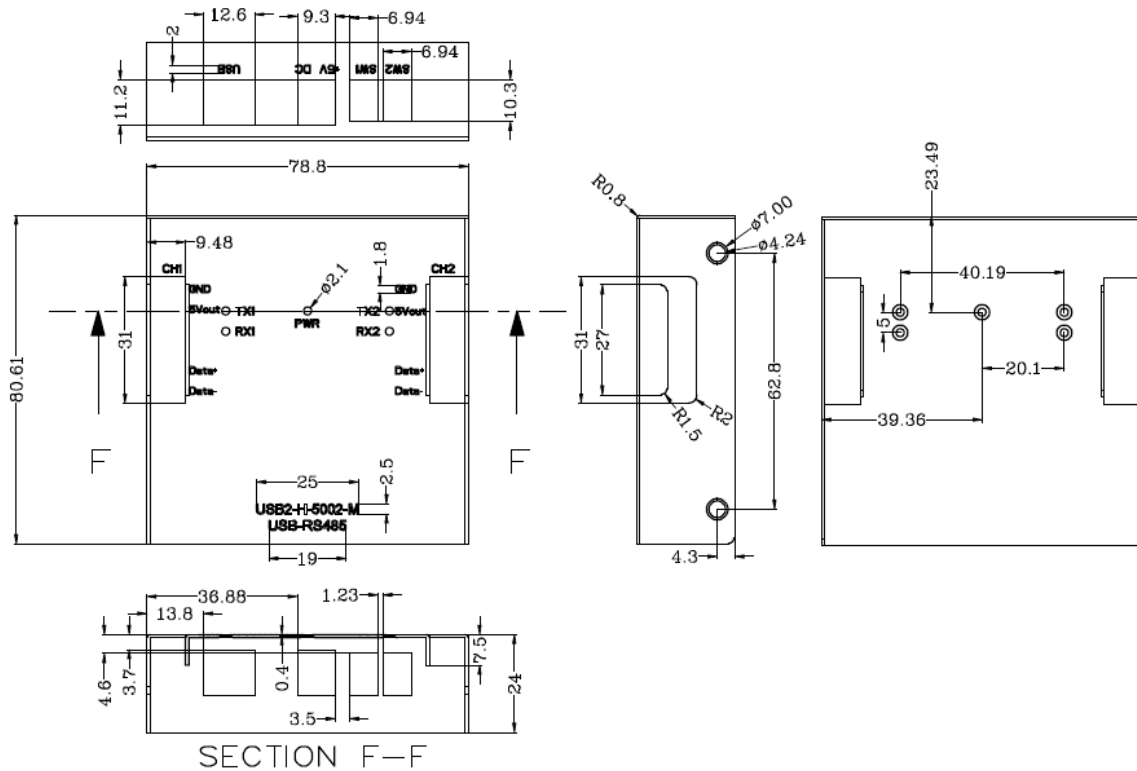
**Figure 7.3 - USB2-H-5002-M Top Cover of Dimension**
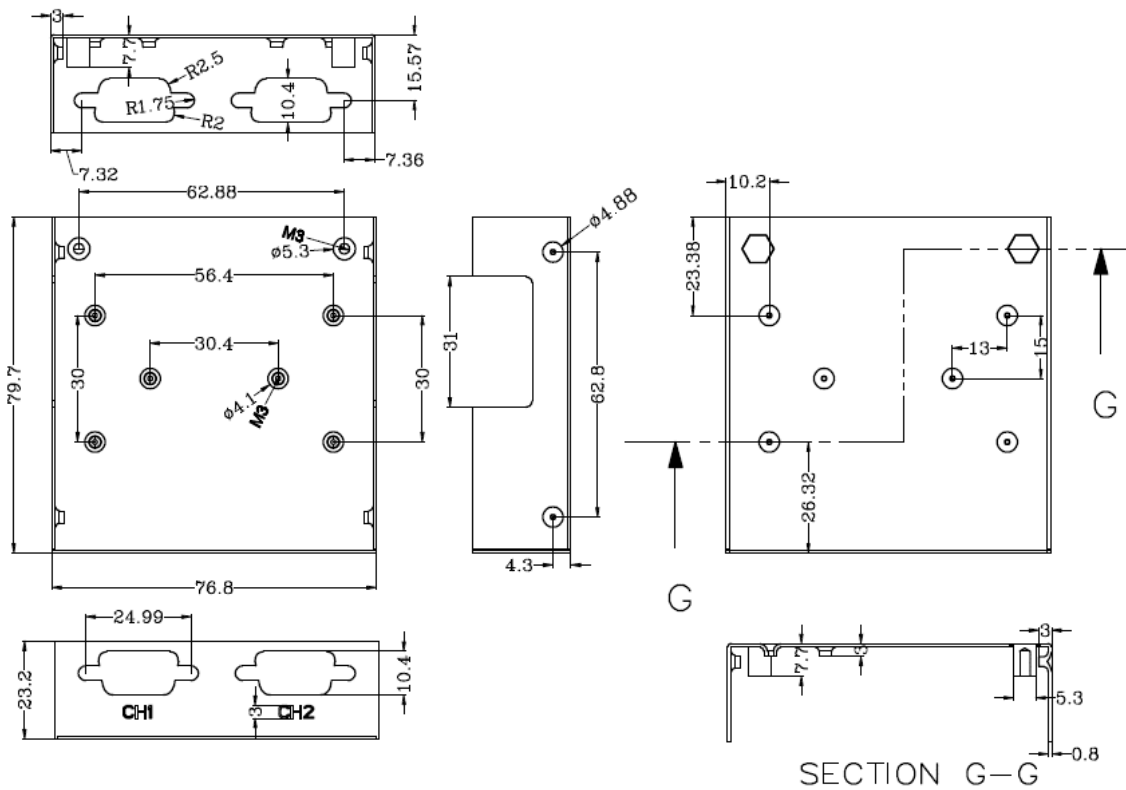
**Figure 7.4 - USB2-H-5002-M Bottom Cover of Dimension**

## 7.3 USB2-H-5004-M Dimension
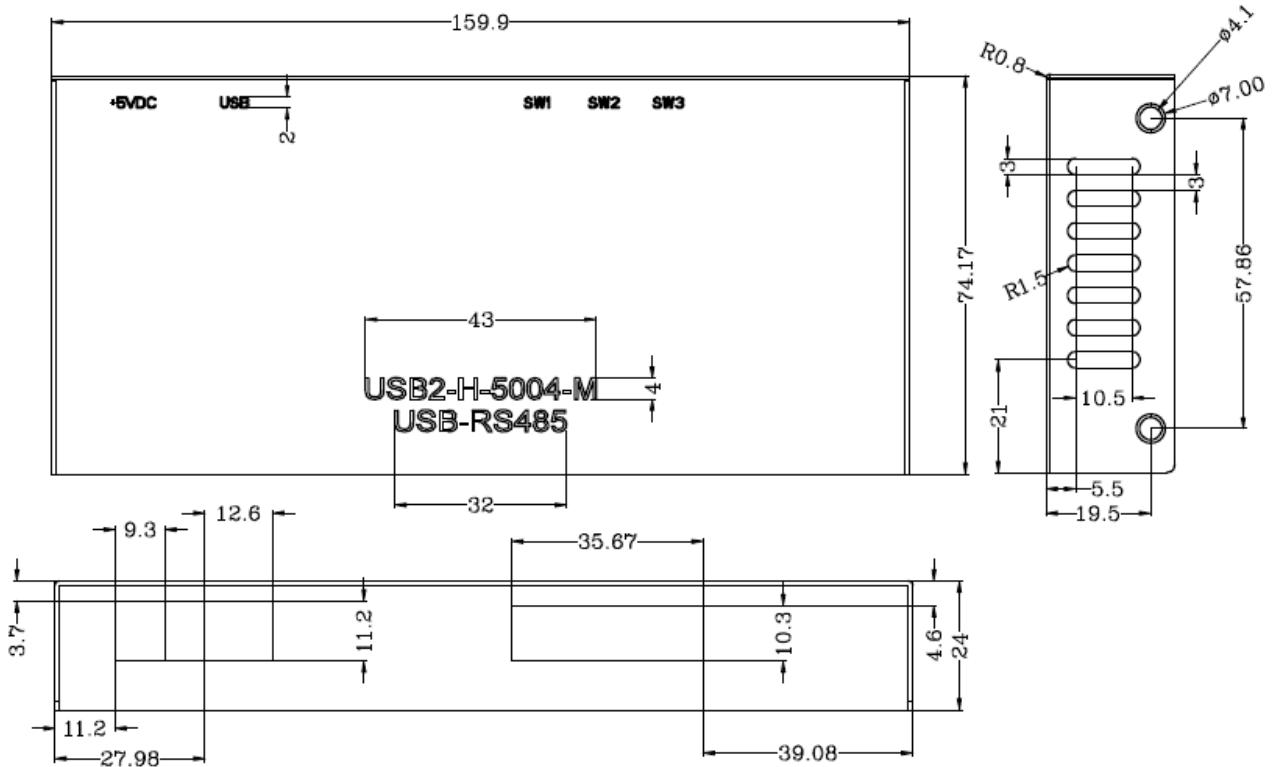


**Figure 7.5 - USB2-H-5004-M Top Cover of Dimension**
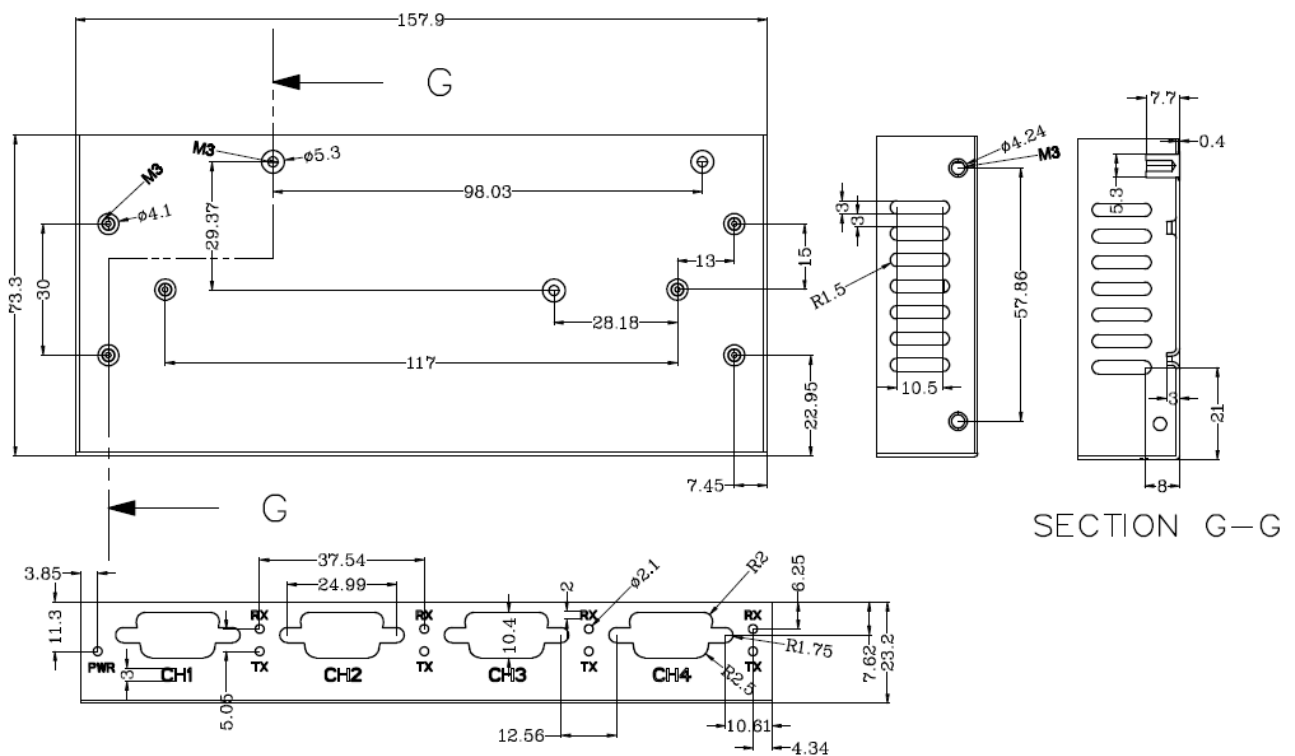


**Figure 7.6 - USB2-H-5004-M Bottom Cover of Dimension**

## 7.4  USB2-H-5008-M Dimension
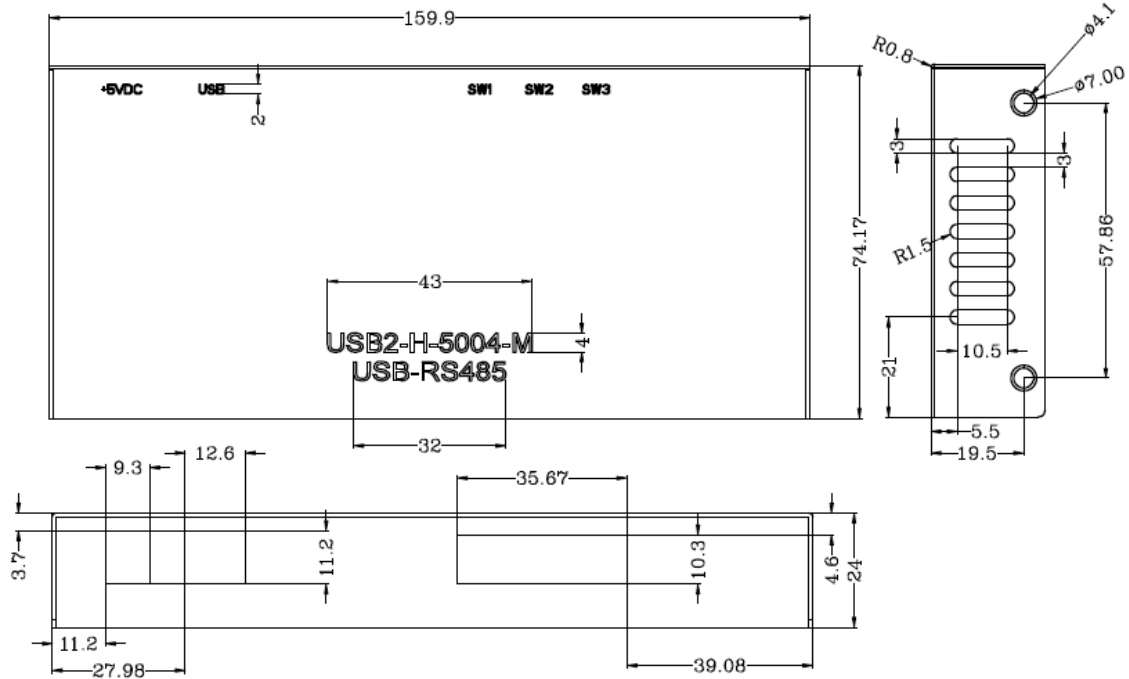


**Figure 7.7 - USB2-H-5008-M Top Cover of Dimension**
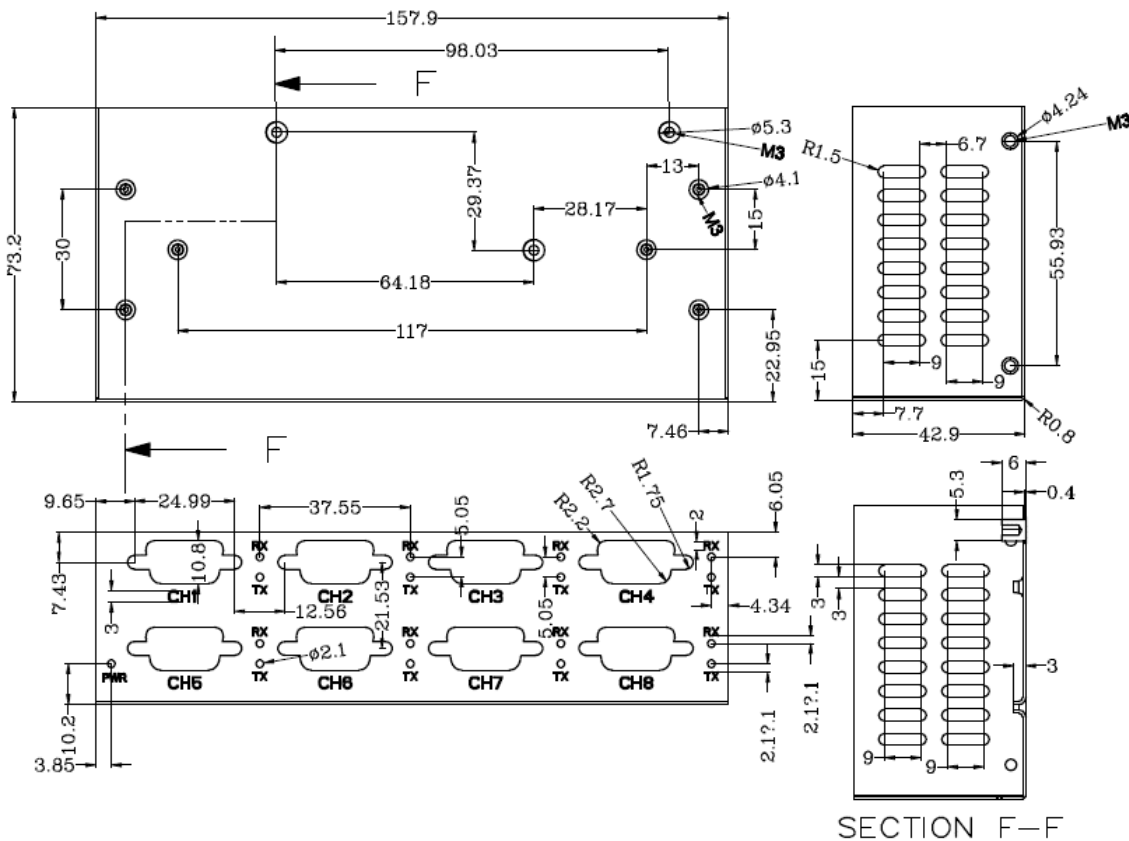


**Figure 7.8 - USB2-H-5008-M Bottom Cover of Dimension**

## 7.5  USB2-H-5016-M Dimension
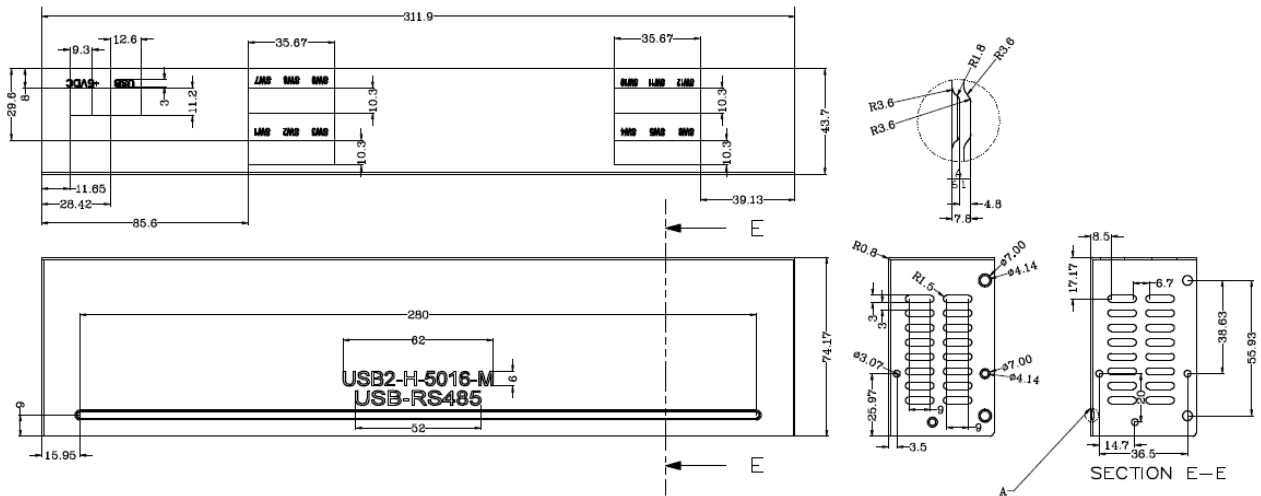


**Figure 7.9 - USB2-H-5016-M Top Cover of Dimension**
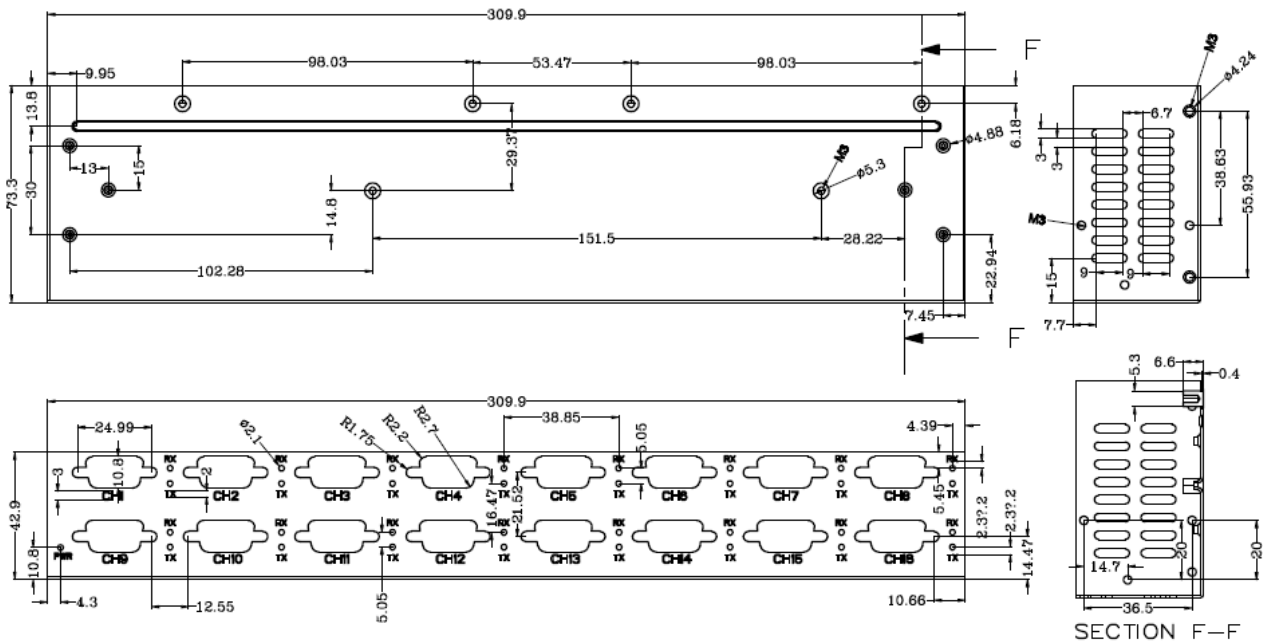


**Figure 7.10 - USB2-H-5016-M Bottom Cover of Dimension**

# 8 Environmental Approvals & Declarations

## 8.1 EMI Compatibility

**FCC and CE**

The USB2-H-500X-M family have been tested to be compliant with both FCC Part 15 Subpart B and European EMC Directive.

 C E

**NOTE:** This is a Class B product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures.

 FC

**NOTE:** This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

## 8.2 Safety

The USB2-H-500X-M-FAMILY is defined as Limited Power Supply (LPS) device, with operating voltages under 60VDC.

## 8.3 Environmental

The USB2-H-500X-M family are a lead-free device that complies with the following environmental directives: RoHS, WEEE, REACH, PFOS and DecaBDE.

## 8.4 Reliability

The USB2-H-500X-M family are designed as a robust USB-Serial module for use in many environments. There are no user-serviceable parts.  Any failure will require a replacement of the unit.

## 8.5 Import / Export Information

| Import / Export Information | |
|---|---|
| Country of Origin | China |
| Harmonized Code | 8471-80-1000 |
| Product Description | USB to RS485 Development Module, Single/Dual/Quad/Eight/Sixteen COM Port |
| USA ECCN | EAR99 – No License Required |

**Table 8.1 - Import / Export Information**

# 9  Troubleshooting

## 9.1  Hardware

Cables are the most common sources of trouble with external devices.

Check the following:

- USB cable is properly inserted at both ends

- Computer power is ON

- Computer is not in Sleep or Standby

- If a USB Hub is used, be sure it is set for "Self-Powered" operation

- If a USB Hub is used, be sure all cables are properly inserted

- If all the above are OK, the Yellow LED should be lit, indicating the device has been recognized by the USB subsystem.

RS485 cables – check the following:

- Check for specific handshake requirements of your RS485 peripheral.

- Because there are not handshake signals, ensure the application is set to "No Hardware Handshake", or equivalent.

- Test the port with a loop-back connector.  Connect DATA+ to DATA+, DATA- to DATA-.  Use a simple terminal program to check that data is transmitted and received.

- One single port product can enable the Echo function and didn't connect anything that can also verify the RS485 function.

## 9.2  Device Driver

Ensure the latest device driver is in use.  See http://www.ftdichip.com/Drivers/VCP.htm.

If other devices with FTDI chips are installed in the system, check with all manufacturers of these devices for the latest device drivers.

See the installation guides for additional details:  http://ftdichip.com/Documents/InstallGuides.htm

Common Windows Device Driver Troubles:

- DEVICE TIMES OUT:  The default settings of the device driver assume typical data transfers of hundreds to thousands or more bytes at a given time.  Some applications, such as a GPS device, only send data in short packets, often only a few bytes.  If this is the case, it may be necessary to adjust the driver buffer size and/or latency timer to smaller values.  These values can be adjusted through the advanced driver options as noted in Figure 2.10.  The buffer size can be reduced to 64 bytes.  The latency timer can be set as low as 2ms.  A setting of 1ms will cause unnecessary USB traffic and could adversely affect data transmission.

- ERRATIC MOUSE POINTER:  The device driver defaults to query an attached device to find out whether it is a mouse or modem, consistent with native COM port operation.  Some RS485 peripherals constantly send short packets of data, causing the host system to "think" a mouse or modem has been attached.  These short packets will interfere with normal mouse operation causing the pointer to jump around the screen.  If this happens, disconnect the RS485 device and *uncheck the Serial Enumerator* option, also found on the advanced driver options screen in Figure 2.10.

- COM PORT IN USE:  Windows keeps track of all COM port assignments.  If multiple Connective Peripherals products have been connected to a single system, the COM port number will increase, even if the other devices are not attached.   If the higher COM port assignments are not acceptable for the application, known unused COM port numbers should be uninstalled according to the installation guide:  http://ftdichip.com/Documents/InstallGuides.htm.

## 9.3  Technical Support

Technical support may be obtained from your nearest Connective Peripherals office. See details below.

E-Mail (Support): support@connectiveperipherals.com

Web: http://www.connectiveperipherals.com/products

# 10 Contact Information

**Global Headquarters – Singapore**

Connective Peripherals Pte Ltd
178 Paya Lebar Road
#07-03
Singapore 409030

Tel: +65 67430980
Fax: +65 68416071

| | |
|---|---|
| E-Mail (Sales) | sales@connectiveperipherals.com |
| E-Mail (Support) | support@connectiveperipherals.com |
| Web Site URL | http://www.connectiveperipherals.com |
| Web Shop URL | http://www.connectiveperipherals.com |

# Appendix A – List of Figures and Tables

## List of Figures

## List of Tables

## Appendix B – Revision History

| Revision | Changes | Date |
|---|---|---|
| 1.0 | Initial release | 2012-01-19 |
| 1.1 | Change the SW Position information for 5001 and 5002 | 2012-06-25 |
| 1.2 | Re-branding to reflect the migration of the product from EasySync to Connective Peripherals name – logo change, copyright changed, contact information Changed, all internal hyperlinks changed. | 2019-03-20 |

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