

# Syscone Robotics

## **USB-AD43** High Speed USB Adapter to 4 Serial COM (TTL), JTAG, SPI, I2C, Dynamix. Pony Programmer



Based on the FTDI's 5<sup>th</sup> generation of USB devices (FT4232H), the USB-AD43 adapter allows your PC to communicate with Dynamix. bus devices (AX-12, AX-S1, etc.). It provides 4 Serial (COM) ports with TTL levels, two MPSSE engines used to emulate JTAG, SPI, I2C (TWI), Bit-bang, other synchronous serial modes, a PonyProg adapter (memory/microcontroller programmer), and complete driver support across Windows, Mac OS X, Linux and many other operating systems. The USB-AD43 adapter has the following advanced features:

- USB 2.0 Hi-Speed (480Mbps/s) to quad serial interfaces with a variety of configurations.
- USB to 1 JTAG channel plus 3 configurable channels.
- USB to 1 SPI channel plus 3 configurable channels.
- USB to 1 I2C channel plus 3 configurable channels.
- USB to 1 Dynamix. plus 3 configurable channels.
- USB to 1 Pony Programmer plus 3 configurable channels.
- Numerous combinations of 4 channels.
- Two Multi-Protocol Synchronous Serial Engine (MPSSE) on channel A and channel B to simplify synchronous serial protocol (USB to JTAG, I2C, SPI or bit-bang) design.
- Independent baud rate generators.
- Serial port (UART) Transfer Data Rate up to 12Mbaud.
- UART Interface supports 7/8 bit data, 1/2 stop bits, and Odd/Even/Mark/Space/No Parity.
- FTDI's royalty-free Virtual Com Port (VCP) and Direct (D2XX) drivers.
- USB 2.0 High Speed (480Mbps/Second) and Full Speed (12Mbps/Second) compatible.
- Compatible TTL (5v) Buffered outputs (25mA)
- Protected USB port against electrostatic discharge (ESD).
- USB powered (no power supply required).
- Provides +5V(100mA to 500mA, dependent on USB port limitations)
- Provides +3.3V(100mA to 500mA, dependent on USB port limitations)
- Low operating and USB suspend current.
- Fully assisted hardware or X-On / X-Off software handshaking.
- UHCI/OHCI/EHCI host controller compatible.
- USB Bulk data transfer mode (512 byte packets in High Speed mode).
- 2kbytes Tx and Rx data buffers per channel
- Dedicated Windows DLLs available for USB to JTAG, USB to SPI, and USB to I2C applications.
- Extended -40°C to 85°C industrial operating temperature range.
- ESD protection for FT4232H IO's:

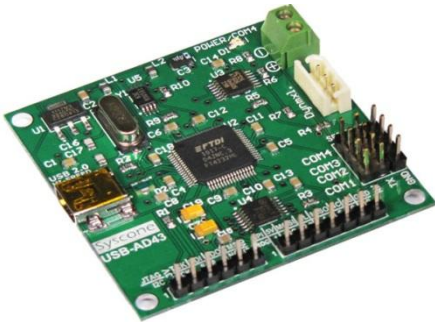
Human Body Model (HBM)  $\pm 2kV$ ,  
Machine Mode (MM)  $\pm 200V$ ,  
Charge Device Model (CDM)  $\pm 500V$ ,  
Latch-up free.

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## 1 Introduction

The **USB-AD43** universal adapter provides 4 serial ports (COM) with TTL levels, I2C (TWI) standard interface, SPI interface, JTAG interface, Pony Programmer (memory/microcontroller programmer), an Enhanced Bit-Bang Mode interface and allows to communicate with Dynamixel bus devices (AX-12, AX-S1, etc.).



**Figure 1.1** USB-AD43 Universal Adapter

The **USB-AD43** adapter uses FTDI's 5th generation "**FT4232H**" single chip USB 2.0 High Speed (480Mb/s) to quad serial ports. The device features four interfaces that can be configured for asynchronous or synchronous serial or parallel FIFO interfaces; two of these have the option to be independently configured as MPSSE engines. This allows the FT4232H to operate as two UART/Bit-Bang ports plus two MPSSE engines used to emulate JTAG, SPI, I2C, Bit-bang or other synchronous serial modes.

The **FT4232H** has four independent UART/MPSSE Controllers. These blocks control the UART data or control the Bit-Bang mode if selected by the SETUP command. The blocks used on channel A and channel B also contain a MPSSE (Multi-Protocol Synchronous Serial Engine) in each block, which can be used independent of each other and the remaining UART channels. It can be configured under software command to have 1 MPSSE + 3 UARTS (each UART can be set to Bit Bang mode to gain extra I/O if required) or 2 MPSSE + 2 UARTS.

The Independent Baud Rate Generators consists of a 14 bit pre-scaler and 4 register bits which provide fine tuning of the baud rate (used to divide by a number plus a fraction). This determines the Baud Rate of the UART which is programmable from 183 baud to 12 million baud.

The default **Latency Timer** is set to 16ms, but it can be altered between 0ms and 256ms. At 0ms latency you get a packet transfer on every high speed micro frame. This is really a feature of the driver and is used to as a timeout to flush short packets of data back to the PC

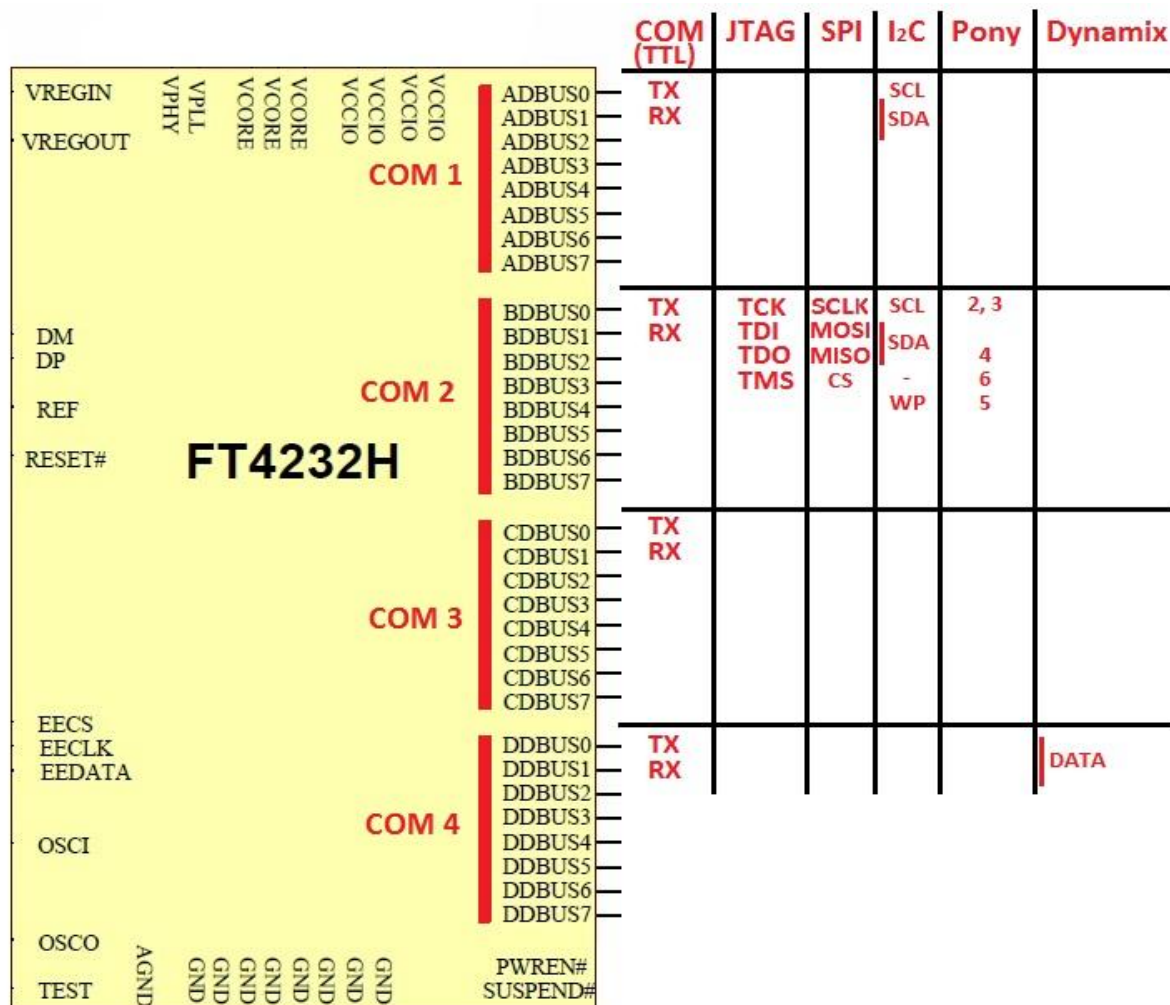
## Typical Applications

- Rapid USB integration into existing electronic systems
- USB to multi-port JTAG, SPI and I2C interfaces (Two Multi-Protocol Synchronous Serial Engines – MPSSE)
- USB to multi-port asynchronous serial interfaces (up to 4 ports available)
- Four independent ports available, two of which may be configured for MPSSE mode
- Control Dynamixel servos via USB interface
- Program EEPROM memories and microcontrollers with Pony Programmer

## 2 USB-AD43 Operation modes

Based on FT4232H, the USB-AD43 adapter features 4 UARTs. Two of these have an option to independently configure an MPSSE engine (COM1 & COM2); this allows the FT4232H to operate as two UART/Bit-Bang ports plus two MPSSE engines used to emulate JTAG, SPI, I2C, Pony Programmer, Bit-bang or other synchronous serial modes. Those ports will operate in the following configuration:

- **COM 1** will work as **Serial port (TTL)** or **I2C interface**.
- **COM 2** will work as **Serial port (TTL)** or **JTAG interface** or **SPI interface** or **I2C interface** or **Pony Programmer**
- **COM 3** will work only as **Serial port (TTL)**.
- **COM 4** will work as **Serial port (TTL)** or **Dynamix. adapter**.



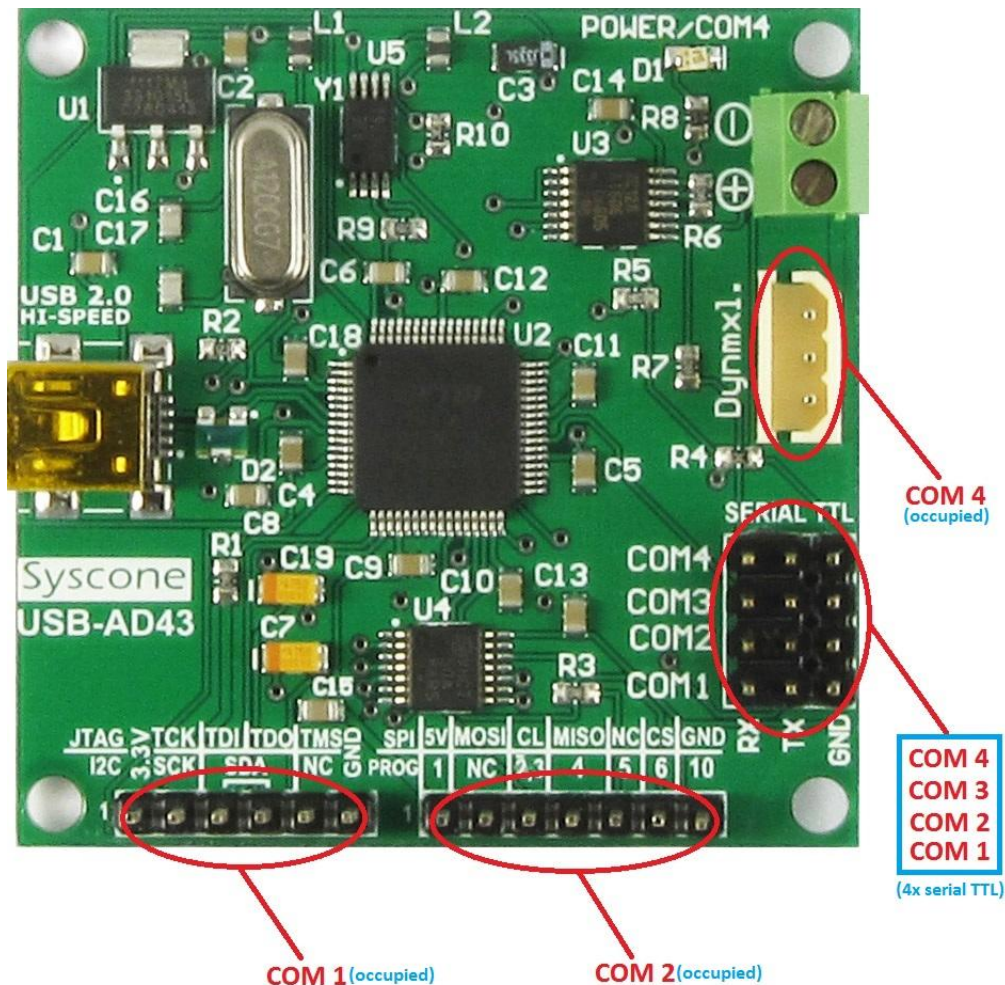
**Figure 2.1** USB-AD43 Interfaces Diagram

## 3 Functions Description

### 3.1 USB-AD43 Serial port/UART (TTL) Interface

The USB-AD43 adapter can be used as 4 Serial ports interface with TTL levels (0-5V) or can be configured as a mixture of the available interfaces, in case of combining those (interfaces) the corresponding port used (ex. JTAG, SPI, I2C, Pony Programmer and Dynamix.) will be occupied.

As an example, if the Dynamix. interface is used (connected to the white connector), then the Serial TTL port "COM 4" will be occupied (COM1, COM2, COM3 will be available as Serial TTL port adapter).



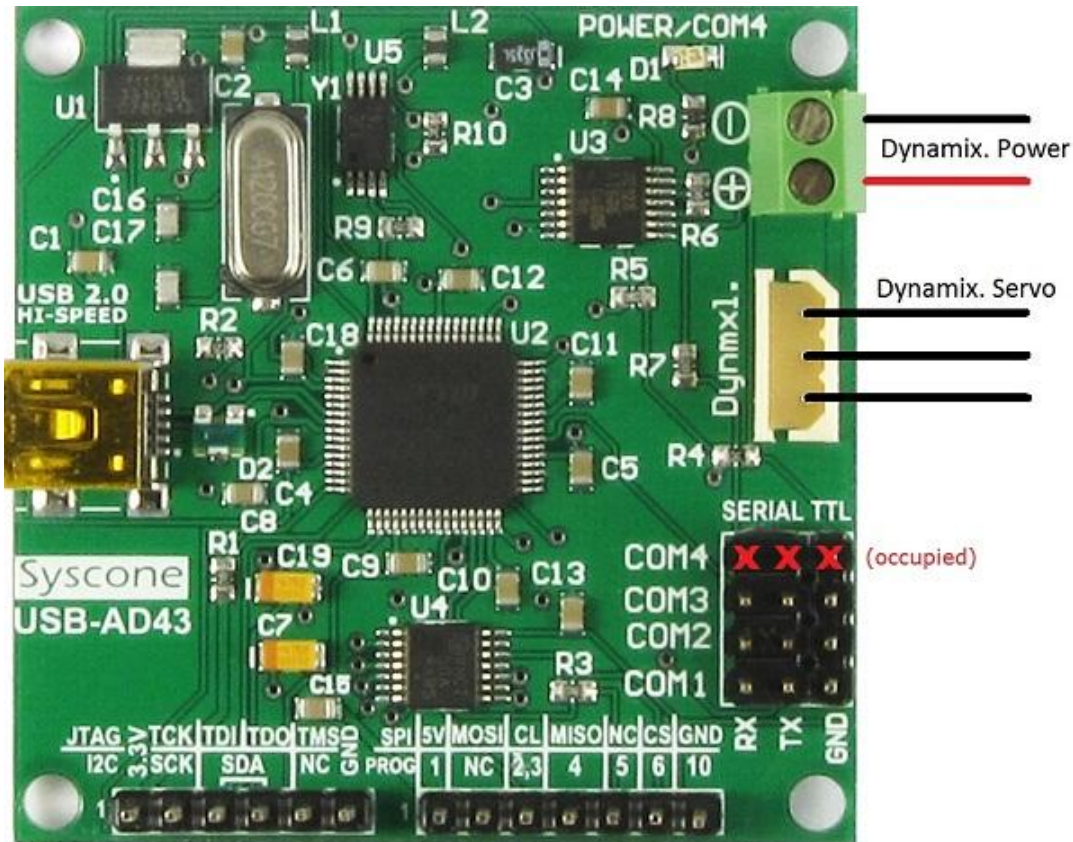
**Figure 3.1** Illustrates which ports are used for different interfaces.



### 3.2 USB-AD43 Dynamix. Interface Description

The USB-AD43 adapter can be configured as Dynamix. interface for devices like AX-12, AX-S1, etc.

In this case the Serial port COM 4 will be occupied (not available for other interfaces), however the rest of the ports are available for interfaces like Serial port adapter (COM 1 to COM 3) or interfaces like JTAG, SPI, I2C, Pony Programmer (COM 1 and COM 2).



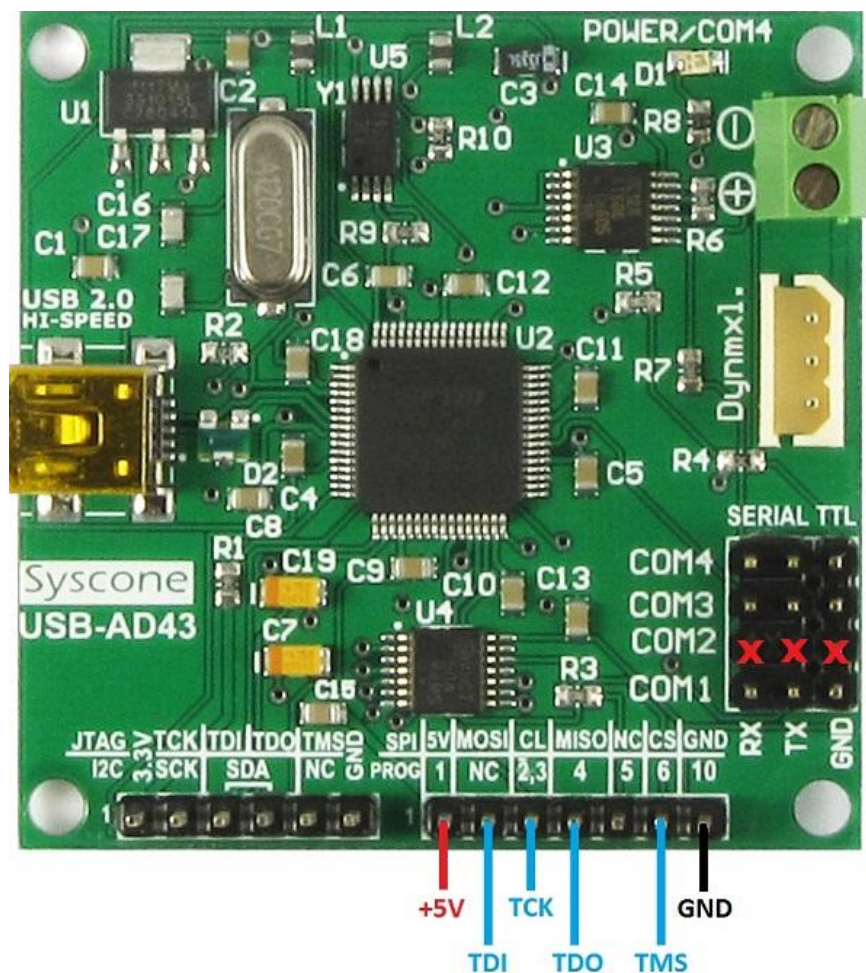
**Figure 3.2** USB-AD34 - Dynamix. Mode

In the Dynamix. Utility/Configurator the port assigned to the Dynamix. interface will be COM 4(the fourth port on the list)

### 3.3 USB-AD43 JTAG Interface Description

The USB-AD43 adapter can be configured to work as JTAG interface.

In this case the Serial port COM 2 will be occupied (not available for other interfaces), the rest of the ports are available for interfaces like Serial port adapter (COM 1, COM 3, COM 4) or interfaces like Dynamix. (COM 4). The USB-AD43 adapter provides +5V (100mA to 500mA, depends on USB port limitations).



**Figure 3.3** USB-AD43 - JTAG Mode.

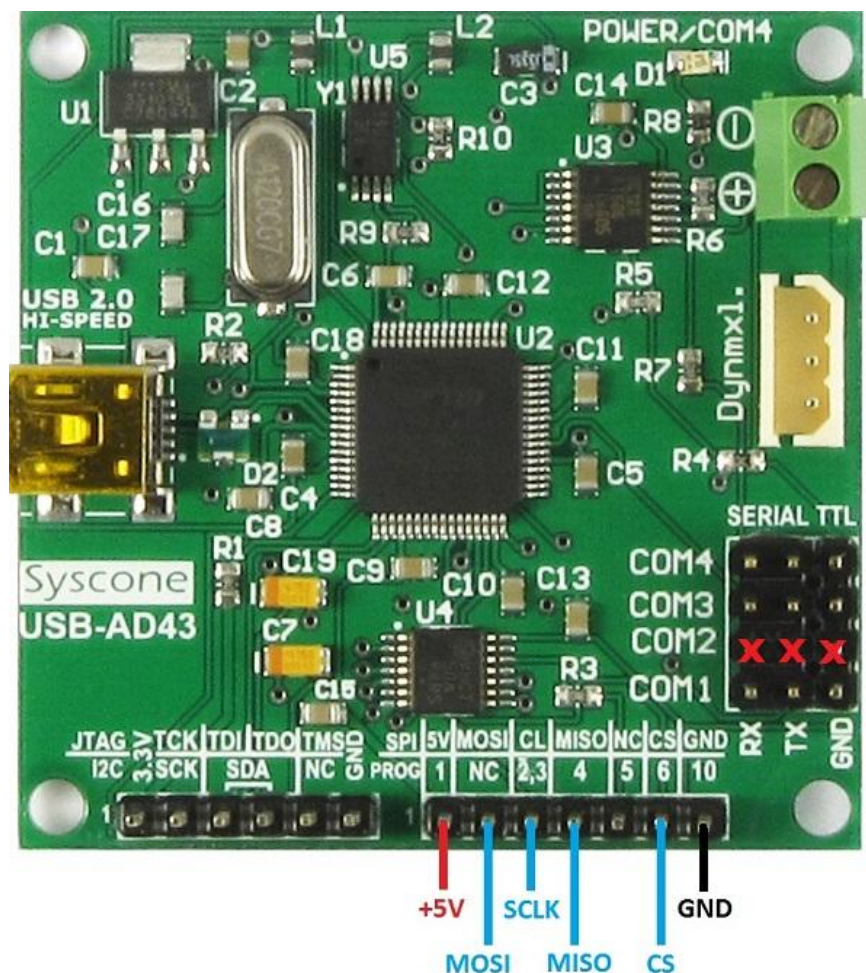
Example project and the source code for the application are available on FTDI's website:

<http://www.ftdichip.com/Support/SoftwareExamples/MPSSE.htm#JTAG>

### 3.4 USB-AD43 SPI Interface Description

The USB-AD43 adapter can be configured to work as SPI interface.

In this case the Serial port COM 2 will be occupied (not available for other interfaces), however the rest of the ports are available for interfaces like Serial port adapter (COM 1, COM 3, COM 4) or interfaces like Dynamix. (COM 4). The USB-AD43 adapter provides +5V (100mA to 500mA, depends on USB port limitations).



**Figure 3.4** USB-AD43 - SPI Mode.

Example project and the source code for the application are available on FTDI's website:

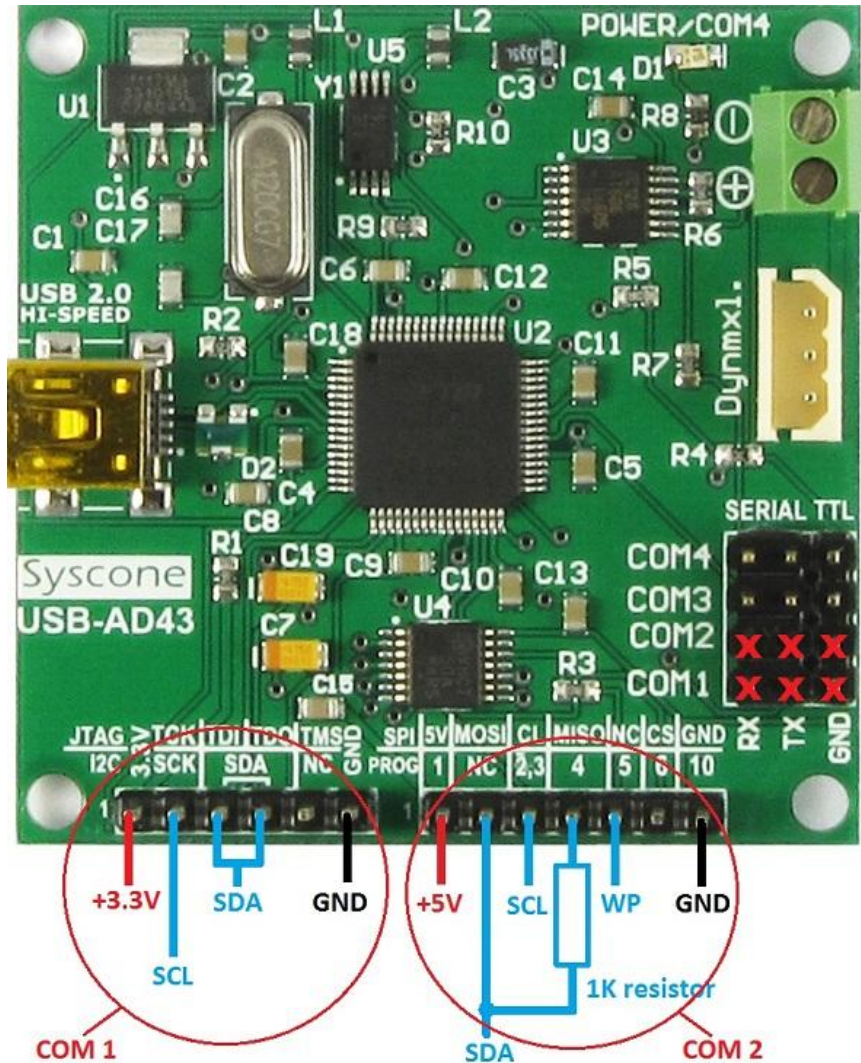
<http://www.ftdichip.com/Support/SoftwareExamples/MPSSSE.htm#SPI>



### 3.5 USB-AD43 I2C (TWI) Interface Description

The **USB-AD43** adapter can be configured to work as I2C interface **COM 1 at 3.3V** or **COM 2 at 5V** bus.

In this case the Serial port COM 1 or COM 2 will be occupied (not available for other interfaces), however the rest of the ports are available for interfaces like Serial port adapter (COM 3, COM 4) or interfaces like Dynamix. (COM 4). The USB-AD43 adapter provides +3.3V and +5V (100mA to 500mA, depends on USB port limitations).



**Figure 3.5** USB-AD43 - I2C Mode.

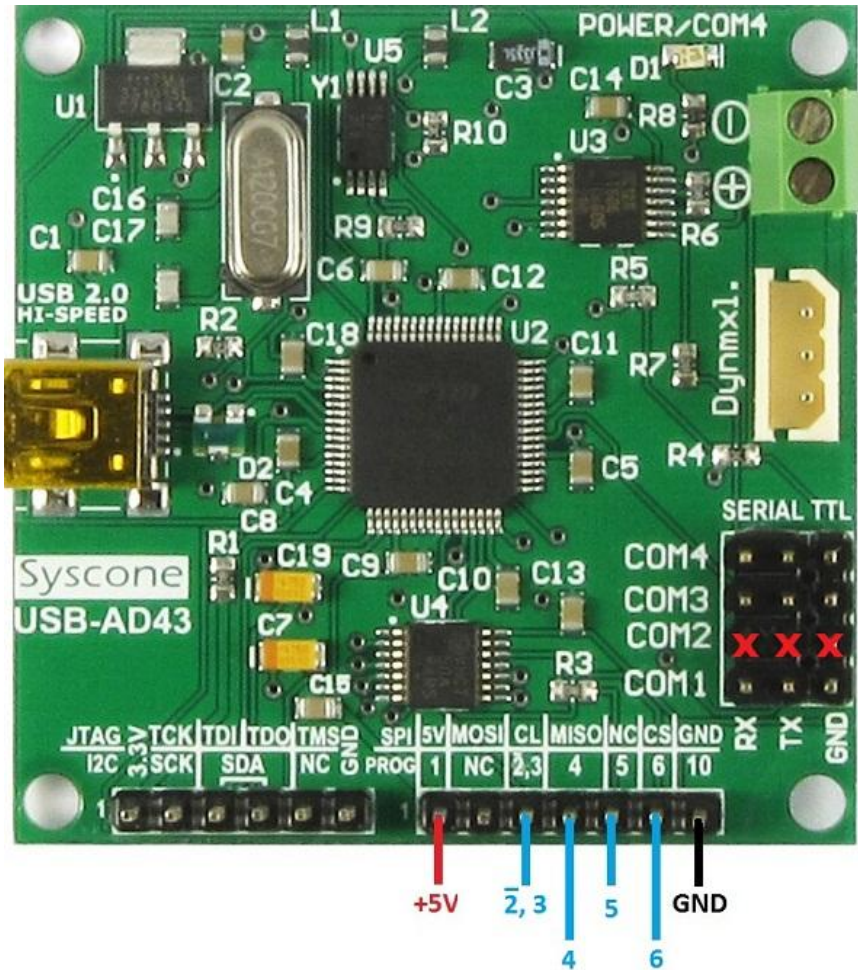
Example project and the source code for the application are available on FTDI's website:

<http://www.ftdichip.com/Support/SoftwareExamples/MPSSE.htm#I2C>

### 3.6 USB-AD43 Pony Programmer Interface Description

The **USB-AD43** adapter can be configured to work as **Pony Programmer** interface.

In this case the Serial port COM 2 will be occupied (not available for other interfaces), however the rest of the ports are available for interfaces like Serial port adapter (COM 1, COM 3, COM 4) or interfaces like Dynamix. (COM 4). The USB-AD43 adapter provides +5V (100mA to 500mA, depends on USB port limitations).



**Figure 3.6** USB-AD43 - Pony Programmer Mode.

Schematics on how to connect different types of EEPROM memories and Microcontrollers like Atmel AVR and Microchip PIC are available on Pony Programmer's website.

## 4 Driver Support

The **USB-AD43** adapter requires USB device drivers, available as a free download from <http://www.ftdichip.com>, which are used to make the USB-AD43 adapter appear as a four virtual COM ports (VCP). This also allows the user to communicate with the USB interface via a standard PC serial emulation port (TTY). Another FTDI USB driver, the D2XX driver, can also be used with application software to directly access the USB-AD43 adapter through a DLL.

### VIRTUAL COM PORT (VCP) DRIVERS <http://www.ftdichip.com/Drivers/VCP.htm> (recommended)

- Windows 2000, Server 2003, XP Server 2008
- Windows XP and XP 64-bit
- Windows Vista and Vista 64-bit
- Windows XP Embedded
- Windows CE 4.2, 5.0, 5.2 and 6.0
- Mac OS-X
- Linux (2.6.9 or later)

### D2XX Direct Drivers

<http://www.ftdichip.com/Drivers/D2XX.htm>

- Windows 2000, Server 2003, Server 2008
- Windows XP and XP 64-bit
- Windows Vista and Vista 64-bit
- Windows XP Embedded
- Windows CE 4.2, 5.0, 5.2 and 6.0
- Linux (2.4 or later) and Linux x86\_64

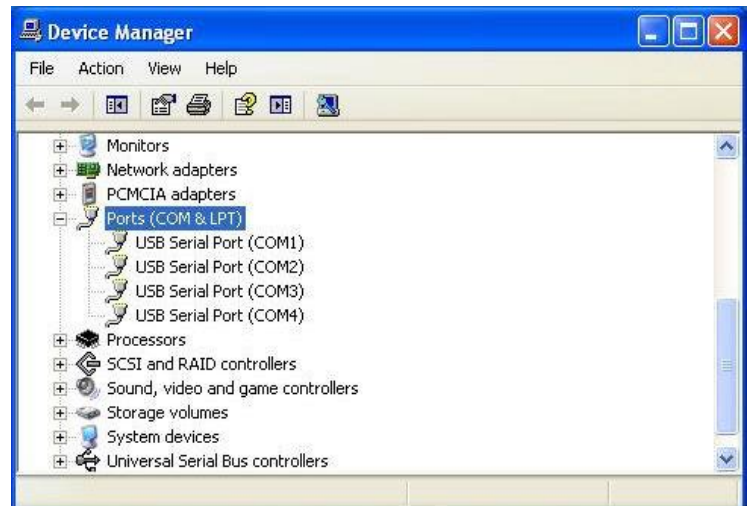


Figure 3.1 USB Serial Port (installed)

### To Change the COM Port Number:

1. Go to **Control Panel**, and then double-click **System**.
2. On the **Hardware** tab, click **Device Manager**.
3. Double-click **Ports (COM & LPT)**.
4. Double-click the appropriate COM port.
5. On the **Port Settings** tab, click **Advanced**.
6. In the **COM Port Number** box, click the appropriate number (from 1 to 256).
7. Click **OK**.

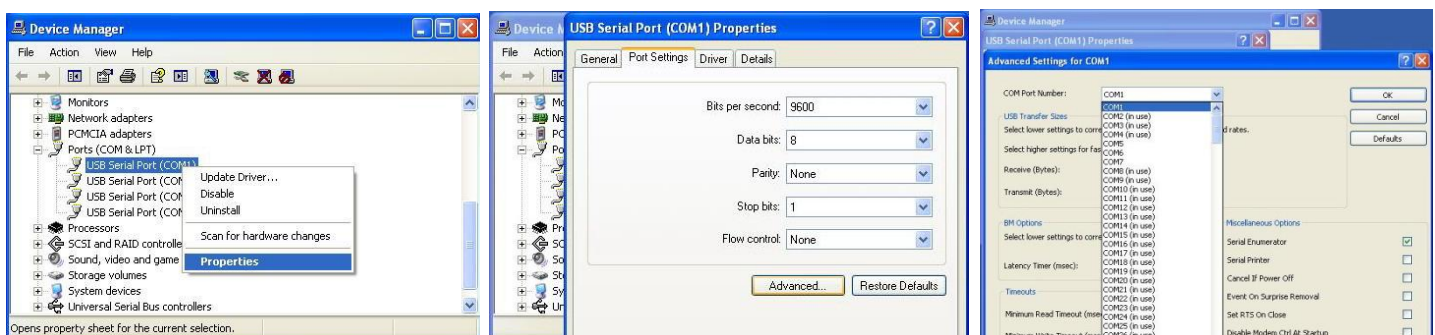


Figure 3.2 Changing the Serial Port Number



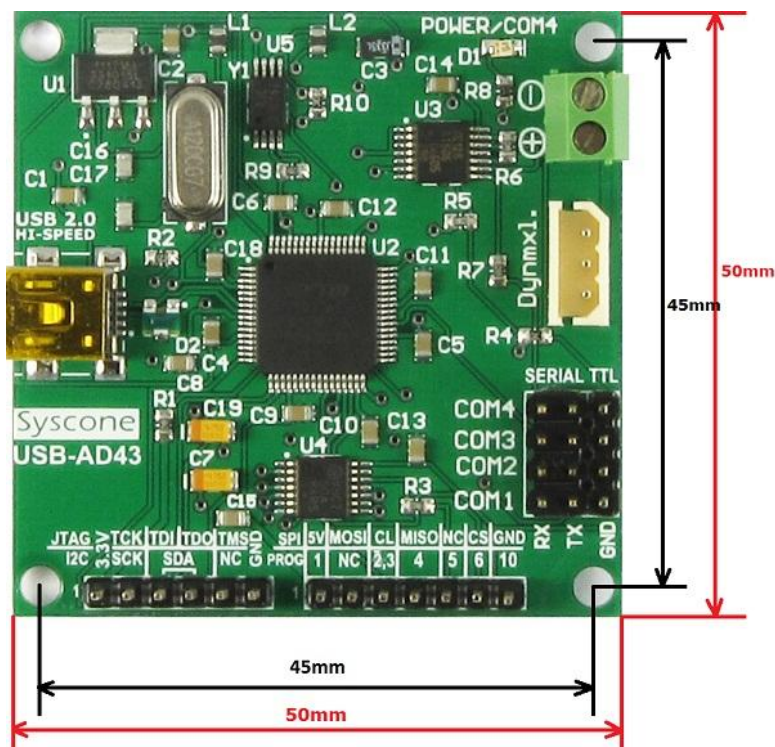
## 5 Mechanical Details

PCB size: 2" x 2" (50mm x 50mm)

Mounting holes Ø: 0.12" (3.1mm)

Weight: 0.47oz (13.4g)

Distance between the mounting holes: 1.7" (45mm).



**Figure 3.3** USB-AD43 Dimensions (50mm x 50mm)

## 6 Contact Information

For more information please visit USB-AD43 support page:

<http://www.syscone.com/support/usb-ad43>

Technical support may be obtained by email:

<http://www.syscone.com/contact>