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# **SSA-485 Smart Serial Adapter**

Serial Converter / Stand-alone host controller

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The **SSA-485** Smart Serial Adapter is a USB/RS232 to RS485 converter, which allows you to communicate with NMC control modules such as the **PIC-SERVO**, **PIC-STEP**, and **PIC-I/O** through your host computer's USB or RS232 COM port. The **SSA-485** may also be used as a stand-alone host by adding either our **Motion Basic** chip or a PIC18F2620 microcontroller. The **SSA-485** includes the following features:

- Supports USB or RS232 serial interface with host computer. USB interface is ideal for running diagnostics on a laptop.
- Up to 32 NMC **PIC-SERVO**, **PIC-STEP**, or **PIC-I/O** modules can be controlled from a single **SSA-485** Smart Serial Adapter.
- RS232 operation support baud rates from 19,200 up to 115,200.
- USB driver support for Windows, Linux, Apple OS, and other operating systems.
- May be used as a stand-alone host with either our **Simple Sequencer** processor chip or a PIC18F2620 microcontroller.
- On-board connector for the Microchip MPLAB ICD2 In-Circuit Debugger supports optional PIC18F2620 code development in C or assembly language.
- If used with a PIC18F2620 microcontroller, 10 pin header provides additional I/O capabilities.

## **1. Use as a Basic Converter**

In normal operation, the **SSA-485** is a USB/RS232 to RS485 (4-wire, full-duplex) converter, allowing you to communicate with NMC control modules such as the **PIC-SERVO**, **PIC-STEP**, and **PIC-I/O** directly through your host computer's USB or RS232 COM port. Up to 32 NMC modules may be controlled using a single **SSA-485**. Logic power is supplied to the NMC modules and **SSA-485** from a single point and distributed through the NMC communications cables (default) or logic power can be supplied to the boards individually.

The **SSA-485** may be configured for either RS232 or USB communication with the host PC. For communications settings (such as baud rate and serial port settings) with a particular controller module, please refer to the serial communications protocol description in the corresponding **PIC-SERVO**, **PIC-STEP**, or **PIC-I/O** data sheets.

Please see *Section 3* for jumper and pin definitions.

### **1.1 RS232 Converter Mode**

Version 2 of the **SSA-485** board (p/n KAE-SSA485-BDV2) automatically selects between RS232 and USB – no jumper selection is required. For Version 1 of the board (p/n KAE-SSA485-BDV2), jumper JP8 should be set to the position marked '232' on the board.

#### **... CAUTION ...**

The **SSA-485** Smart Serial Adapter does not incorporate safeguards for fail-safe operation. As such, this board should not be used in any device which could cause injury, loss of life, or property damage. **JEFFREY KERR, LLC** makes no warranties whatsoever regarding the performance, operation, or fitness of this board for any particular purpose.

For both versions, jumpers JP3 and JP4 should be set to the position marked ‘PT’ on the board as indicated in *Figure 1*. A straight (*i.e.*, not a null modem) DB9 Male / DB9 Female extension cable should be used to connect the DB9 connector P1 to standard PC RS232 (COM) ports.

## 1.2 USB Converter Mode

Version 2 of the **SSA-485** board (p/n KAE-SSA485-BDV2) automatically selects between RS232 and USB – no jumper selection is required. For Version 1 of the board (p/n KAE-SSA485-BDV2), jumper JP8 should be set to the position marked ‘USB’ on the board

For both versions, jumpers JP3 and JP4 should be set to the position marked ‘PT’ on the board. A USB Type A male / USB Type B male extension cable should be used to connect the USB connector JP7 to standard PC USB ports.

Note that when used in USB converter mode, your host computer creates a ‘virtual’ COM port, and your host’s software will communicate with the NMC modules exactly as if you were using a standard RS232 COM port. See *Section 1.5* below for details on USB driver installation.

## 1.3 Logic Power

Logic power (7.5v to 12v D.C., 500 ma typ.) to the **SSA-485** and to NMC control modules can be supplied at a single point and distributed over the NMC network flat ribbon cables, or it can be supplied to the various boards individually. To distribute the **SSA-485**’s logic power to the network cables, insert a jumper on JP5 (default position); remove the jumper to power the board separately. Please see the schematic diagrams for your controller modules for more details on distributing logic power to the rest of your controllers over the NMC communications cables.

Typically, if all NMC control modules and the **SSA-485** converter share the same logic power, power is supplied via connector JP6 on the **SSA-485** board. If this is the case, make sure that jumper JP5 is installed. In this configuration, 500 ma power supply can drive one **SSA-485** converter and approximately 4 additional NMC control modules (the converter and modules each draw about 100 ma).

## 1.4 Connection to NMC Modules

*Figure 1* below shows how to connect multiple NMC modules to you host computer via the **SSA-485**. Modules are daisy-chained with 10-wire ribbon cables connecting JP1 of one module to JP2 of the next module as shown. On the last controller in the chain, connector JP1 should be left open, and jumpers JP3, JP4, and JP5 should be installed. On intermediate modules, JP3, JP4, and JP5 should be removed.

The 10 pin header connector (JP1) can be used with 10 pin flat ribbon cables (with standard IDC type connectors) to interconnect to NMC control modules. For NMC network interconnect cables longer than 3 meters, it is recommended that you use twisted-pair flat ribbon cable.

## 1.5 USB Driver Installation

The USB interface of the **SSA-485** uses the FT232BM, a USB serial port converter chip from FTDI, Inc. Drivers for Windows, Linux, Apple OS, and other operating systems are available from FTDI’s web site [www.ftdichip.com](http://www.ftdichip.com). With the Windows drivers you can create a virtual COM port (COM1 – COM256) and communicate with NMC controllers with the same code written for use with your PC’s standard RS232 ports.

Most versions of Windows XP have drivers for the FDTI interface chip pre-installed. When you connect the **SSA-485** to your PC's USB port and apply logic power, Windows should automatically recognize the adapter and create a virtual COM port. If Windows does not recognize the driver, or if you are using a different operating system, please visit [www.ftdichip.com](http://www.ftdichip.com) to find drivers and installation instructions.

Once the driver is installed, you should open the Control Panel, double click on System, and select the Hardware Device Manager. Under "Ports" you should see listed "USB Serial Port (COMx)". If the COM port is not set to COM5 or COM6, right-click on the port and select Properties. Under the Port Settings tab, click on the 'Advanced' button and set the port to COM5 or COM6. This will insure that you have no conflicts with existing serial ports or modems.

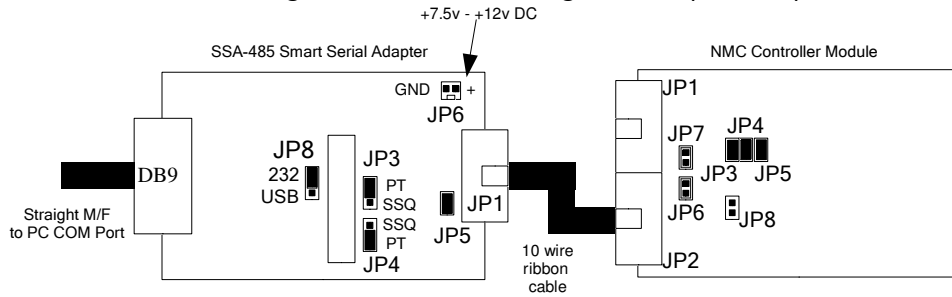
Please see the documentation included with the drivers for additional installation information.

Note that if you turn off the logic power to your NMC modules, the USB serial port will not appear in the list of ports. It appears and disappears dynamically depending on whether the **SSA-485** is plugged in and powered up.

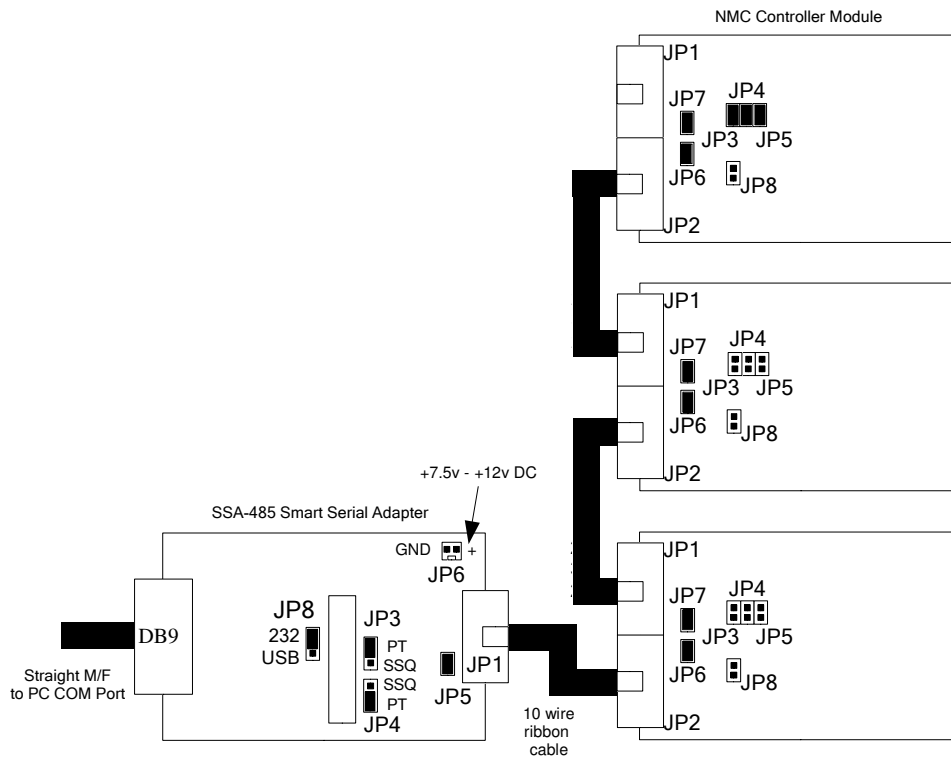
You are now ready to run the NMCTest utility program to test your **SSA-485** and NMC controller modules. (Make sure you have downloaded the latest version of this program from [www.jrkerr.com/software.html](http://www.jrkerr.com/software.html) which supports COM5 and COM6). Run this program and use whichever COM port you selected for the converter in the Control Panel.

The **SSA-485** converter and our NMC modules have all been tested at baud rates up to 115,200. In your own applications, it may be possible to use faster baud rates, but these are untested and it is up to the user to verify the reliability of higher speed connections.

## Single Controller Configuration (RS232)



## Multiple Controller Configuration (RS232)



**Caution: Connecting communications cables incorrectly, or installing jumpers JP3, JP4, JP5 (on the NMC Controller board) in the wrong location may damage the NMC Controller board or the controller chip!**

*Note: Jumper JP8 is not present on Version 2 of the SSA-485 board. Version 2 automatically selects between RS232 and USB.*

Figure 1 – SSA-485 used as a basic converter.

## 2. Use as a Stand-alone Host

The socket U4 is designed to accept our **Motion Basic** processor chip or a PIC18F2620 microcontroller to create stand-alone motion control systems. If you are using the **Motion Basic**, you will also need to populate the socket U5 with a 24LC256 EEPROM chip.

The **Motion Basic** chip and the 24LC256 EEPROM chip can be purchased from JEFFREY KERR, LLC. PIC18F2620 microcontrollers can be obtained from Digikey ([www.digikey.com](http://www.digikey.com)), Mouser ([www.mouser.com](http://www.mouser.com)) or other electronics distributors.

A 20 Mhz crystal is included on the board for use with the **Motion Basic** or the PIC18F2620. The **Motion Basic** requires a 20 Mhz crystal, but the PIC18F2620 may be used with other frequencies. In particular, you can use the PIC18F2620 with a 10 Mhz crystal and the 4x PLL oscillator mode to give an effective clock frequency of up to 40 Mhz. If you need to use a different frequency, you will have to unsolder the crystal X2 and replace it.

### 2.1 Motion Basic Operation

The **Motion Basic** is a programmable controller for creating Basic motion control programs. It is programmed using a simple Windows programming environment which requires no formal programming skills. Please refer to the **Motion Basic** documentation (available at [www.jrkerr.com/software.html](http://www.jrkerr.com/software.html)) for complete details.

To configure the **SSA-485** for **Motion Basic** operation, install the **Motion Basic** chip (P/N KAE-MBV1-DP) in the socket marked U4 and install the 24LC256 chip in the socket marked U5. Set jumpers JP3 and JP4 in the position marked 'MB' (Version 1 of the board is marked with 'SSQ' instead of 'MB'.) If using Version 1 of the **SSA-485** board, set JP8 for either USB or RS232 host communications. In this configuration, USB/RS232 signals from a host will connect to serial port 0 of the **Motion Basic**, and the RS485 signals from the NMC network will be connected to serial port 1 of the **Motion Basic**.

Logic power connections and connections to NMC Modules are described in *Section 1*.

### 2.2 PIC18F2620 Processor Operation

The **SSA-485** supports stand-alone host development using a PIC18F2620 microcontroller. In this configuration, users can insert the 28 pin PIC18F2620 into socket U4 and develop code to use the **SSA-485** as a stand-alone host. The PIC18F2620 is a general purpose microcontroller with a variety of standard peripheral features such as analog inputs, timers, etc.. If you need special processor features, Microchip ([www.microchip.com](http://www.microchip.com)) offers a wide variety of other 28 pin processor chips in the PIC18Fxxxx series which may also be compatible with the **SSA-485**. Please refer to the Microchip PIC18Fxxxx series data sheets for more information.

#### 2.2.1 Configuration

To configure the **SSA-485** for PIC processor operation, install a PIC18F2620 processor in the socket marked U4, and set jumpers JP3 and JP4 in the position marked 'MB'. (Socket U5 may be left empty.) If using Version 1 of the **SSA-485** board, set JP8 for either USB or RS232 host communications. In this configuration, the USB/RS232 signals will be connected to the PIC's hardware UART, and the RS485 signals from the NMC network will be connected to pins RC0 and RC5 which are to be used as a software UART.

### 2.2.2 Microchip MPLAB ICD 2 Interface

Connector JP9 connects directly to the Microchip MPLAB ICD2 In-Circuit Debugger. The MPLAB ICD2 In-Circuit Debugger, available from Microchip ([www.microchip.com](http://www.microchip.com)), is a complete assembly and C language programming development environment. The MPLAB ICD2 allows users to develop, download, and debug PIC18F2620 code on the **SSA-485**.

Note that when using the ICD2, you should configure it so that Vcc is supplied by the target. See the MPLAB ICD2 User's Guide for details on installing and using the MPLAB ICD2 In-Circuit Debugger.

### 2.2.3 Auxiliary I/O Connector

Connector JP2 on the **SSA-485** connects to 8 I/O pins on the PIC18F2620 processor. This provides your system with additional I/O capabilities in addition to whatever NMC control modules you may have connected. These pins can be used as general purpose digital I/O, but 3 of the pins can also be used for analog input, 2 can be used for PWM output, and 3 can be used for generating interrupts. See *Section 3* for connector pin definitions.

Note that these additional I/O capabilities are only available if programming your own PIC18F2620 processor. The **Simple Sequencer** does not make use of these I/O pins.

### 2.2.4 SSA-485 Motion Control Library

The **SSA-485** Motion Control Library is a library of C language functions for communicating with the **PIC-SERVO**, **PIC-STEP**, and **PIC-I/O** modules. This library is for use with Microchip's MCC18 C compiler. (A basic version of this compiler, along with the MPLAB development environment, can be downloaded free from [www.microchip.com](http://www.microchip.com). An enhanced version of the compiler can be purchased from Microchip.)

Included in the library are high level routines for initializing, controlling, and managing the **PIC-SERVO**, **PIC-STEP**, and **PIC-I/O** modules. The library and example programs are available from [www.jrkerr.com/software.html](http://www.jrkerr.com/software.html).

## 3. Connectors and Jumpers

### 3.1 Connector Pin Definitions

Logic Power Connector **JP6** (1x2 pin locking header – 0.100" spacing)

(Use only if logic power is *not* supplied via network communications cable)

Pin	Definition
1	7.50- 12vdc (pin marked +)
2	Ground (pin marked GND)

RS232 Serial Connector **P1** (female DB9 connector)

Pin	Definition
2	RS232 Transmit Data Output
3	RS232 Receive Data Input
5	Ground
1,4, 6-9	Not Used

USB Connector **JP7** (female USB Type B Socket)

<i>Pin</i>	<i>Definition</i>
1	5 vdc (from USB port)
2	-Data
3	+Data
4	Ground

Modular Jack **JP9** (female 6 pin modular jack)

Connector to Microchip MPLAB ICD2 In-Circuit Debugger

<i>Pin</i>	<i>Definition</i>
1	Vpp/~MCLR
2	5 vdc (configure ICD 2 so that Vcc is supplied by the target.)
3	Ground
4	Program Data
5	Program Clock
6	NC

Network Connector **JP1** – 10 Pin Flat Ribbon IDC Socket

<i>Pin</i>	<i>Definition</i>
1	<b>SSA-485</b> XMT+
2	<b>SSA-485</b> XMT-
3	<b>SSA-485</b> RCV+
4	<b>SSA-485</b> RCV-
5	N.C.
6	GND
7	Logic Power (7.5 – 12vdc)
8	GND
9	Logic Power (7.5 – 12vdc)
10	GND

Auxiliary I/O Connector JP2 (1x10 pin locking header – 0.100” spacing)

<i>Pin</i>	<i>Definition</i>
1	5vdc ( <i>rightmost pin</i> )
2	PIC Pin 2 (RA0/AN0) – digital I/O or analog input
3	PIC Pin 3 (RA1/AN1) – digital I/O or analog input
4	PIC Pin 4 (RA2/AN2) – digital I/O or analog input
5	PIC Pin 21 (RB0/INT0) – digital I/O or interrupt input
6	PIC Pin 22 (RB1/INT1) – digital I/O or interrupt input
7	PIC Pin 23 (RB2/INT2) – digital I/O or interrupt input
8	PIC Pin 12 (RC1/CCP2) – digital I/O or PWM output
9	PIC Pin 13 (RC2/CCP1) – digital I/O or PWM output
10	GND ( <i>leftmost pin</i> )

### 3.2 Jumpers

#### SSA-485 Jumpers

Pin	Definition
JP3, JP4	Selects operating mode. Jumper pins marked PT (Pass through) for operation as a simple converter (default). Jumper pins marked MB (Motion Basic) for optional stand-alone operation.
JP5	Logic power interconnection. Inserting JP5 connects logic power to the network connector JP1. Normally this jumper is installed.
JP8	Used to select RS232 or USB communications with the host computer. Jumper pins marked 232 (default) or USB for RS232 or USB operation.  <i>Note:</i> This jumper is not present on Version 2 of the <b>SSA-485</b> board. Version 2 automatically selects between USB or RS232.

### 3.3 Physical Dimension

Figure 2 below gives overall board dimensions and the location of the 4 mounting holes. The RS232 connector and the RS485 NMC network connector are right-angle connectors mounted on the ends of the board. The USB and ICD2 connectors are vertical connectors mounted in the center of the board. The Auxiliary I/O connector and the logic power connector are vertical headers mounted along the top edge of the board.

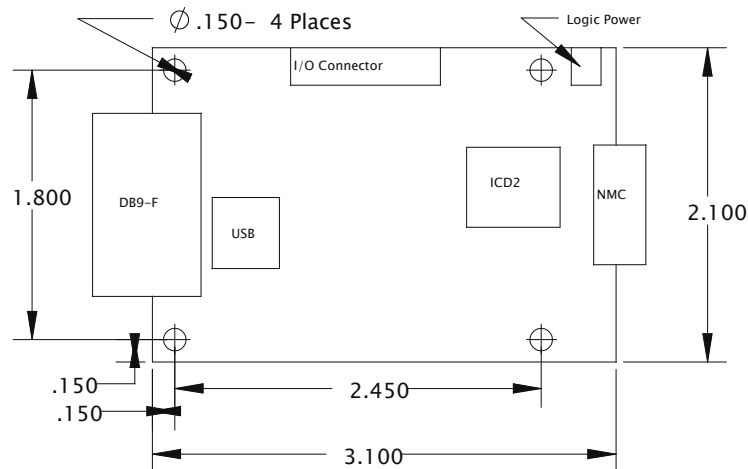


Figure 2 – SSA-485 board dimensions.

### 4.0 Contact Information

Additional information may be found from these sources:

**JEFFREY KERR, LLC** Web Site

[www.jrkerr.com](http://www.jrkerr.com)

Your source for data sheets, application notes and test code. Technical support is provided via e-mail.

**Microchip**

[www.microchip.com](http://www.microchip.com)

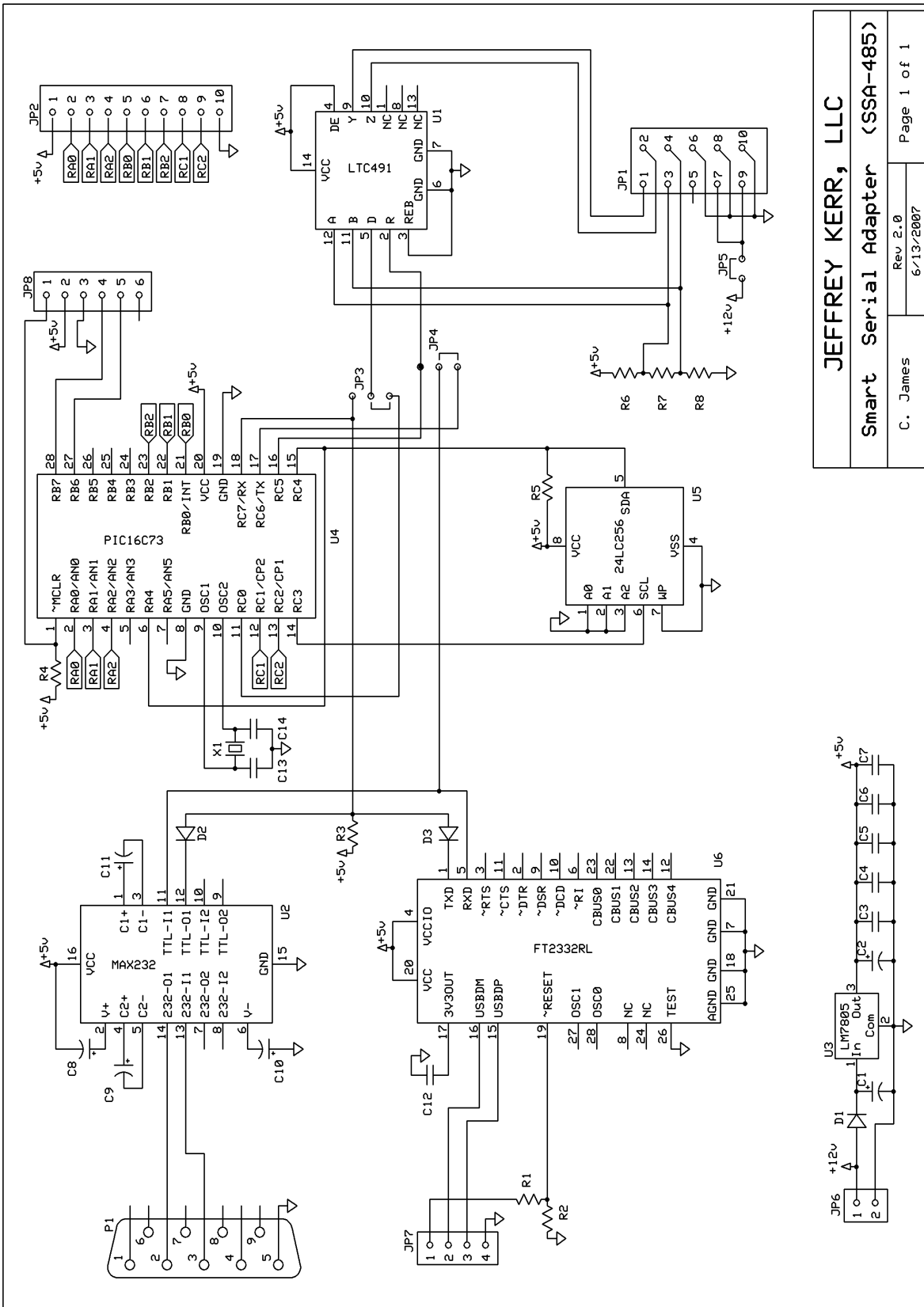
Visit Microchip's web site for information on their ICD2 development tools and their PIC18Fxxxx series microcontrollers.

**FTDI Chip**

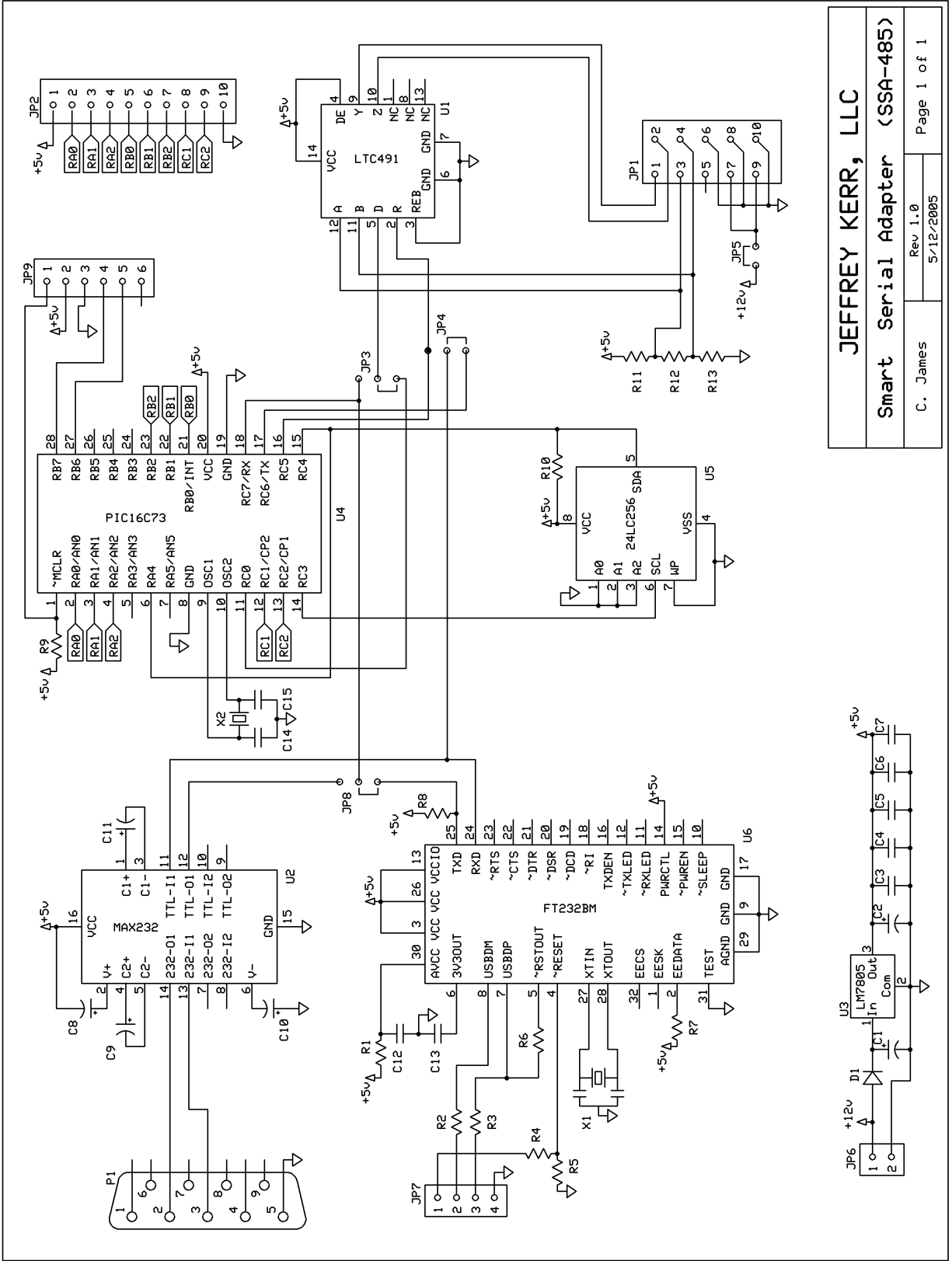
[www.ftdichip.com](http://www.ftdichip.com)

Data sheet and drivers for the FTB232BM USB chip.





Schematic for Version 2 of the **SSA-485** board



Schematic for Version 1 of the **SSA-485** board