uM-FPU Application Note 9

Adding a Serial Connection to uM-FPU V2

Micromega Corporation

This application note describes various methods of adding a serial connection to the uM-FPU to provide support for debugging uM-FPU code and programming user-defined functions.


Introduction

The uM-FPU Integrated Development Environment (IDE) software provides support for debugging uM-FPU code and programming user-defined functions. It uses the built-in debug monitor on the uM-FPU to implement these features. To use the debug monitor, the uM-FPU TSTIN and TSTOUT pins must be configured as a serial interface, and a suitable serial connection must be made between the uM-FPU and the PC used to run the uM-FPU IDE.

## Configuring the uM-FPU for a Serial Interface

If the TSTIN pin is High when the uM-FPU is reset, the TSTIN pin is configured as a serial input and the TSTOUT pin is configured as a serial output, and the built-in debug monitor is accessed through the TSTIN and TSTOUT serial connection. The serial connection is configured as 57,600 baud, 8 bits, no parity, and one stop bit. There is no flow control. Note: The idle state of an RS-232 connection will assert a High level, so provided the uM-FPU is connected to an active idle RS-232 port when the uM-FPU is reset, TSTIN will be High, and TSTIN and TSTOUT will be properly configured as a serial interface.

Serial Interface Connection
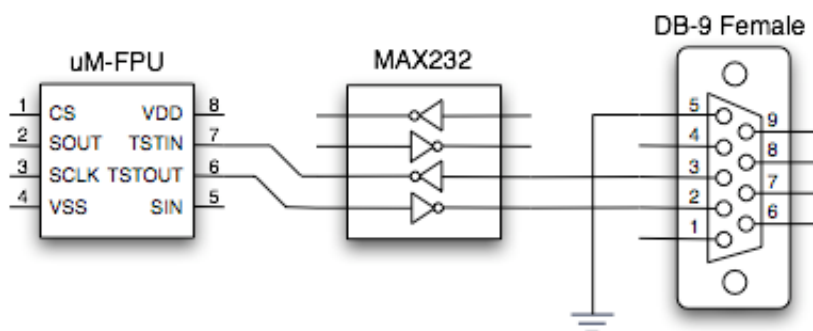
There are various ways of implementing the serial connection, ranging from a hand-wired circuit using a serial driver like the MAX232 to using one of the many RS-232 or USB serial adapters available. One of the most convenient ways of connecting the uM-FPU is by using the uM-FPU Debug Adapter and the Micromega RS-232 Adapter. Various alternatives are described in this application note.

uM-FPU Debug Adapter
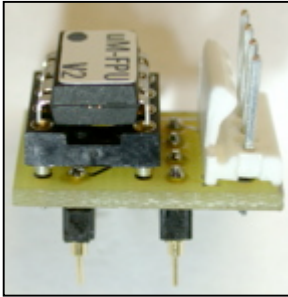
The uM-FPU Debug Adapter makes it easy to connect a serial interface to the uM-FPU chip. It has a socket that connects the uM-FPU to the original circuit, but isolates the TSTIN and TSTOUT pins. The TSTIN and TSTOUT pins are routed to a 4-pin connector along with +5V and GND.

GND
TSTIN
TSTOUT
+5V
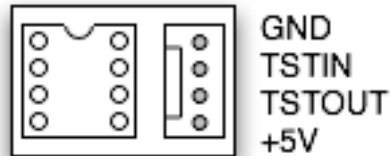
The header on the bottom of the adapter has pluggable pins so the adapter can be inserted into the original circuit, using either a socket or solderless breadboard. Since the TSTIN and TSTOUT pins are isolated, no changes are required to the original circuit (even if the original circuit has TSTIN tied to ground). An 8-pin socket can be stacked on the adapter if additional clearance is required.
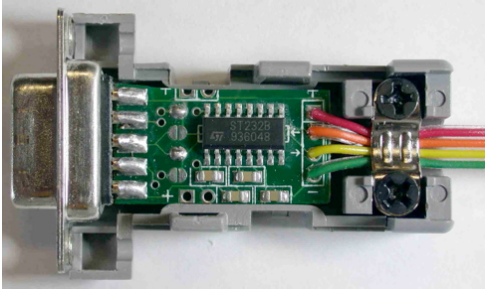
The Micromega RS-232 Adapter (or other serial adapter) is connected through a short cable to the 4-pin header. The mating connector is Digi-Key Part Number WM2002-ND.

To use the uM-FPU Debug Adapter, do the following:
- Turn off power to the circuit
- Remove the uM-FPU chip from original circuit
- Insert into uM-FPU chip into the socket on the Debug Adapter
- Insert the Debug Adapter in place of the uM-FPU in the original circuit
- Connect the serial adapter and cable
- Apply power to the circuit
- Use the uM-FPU IDE to debug code or program stored functions
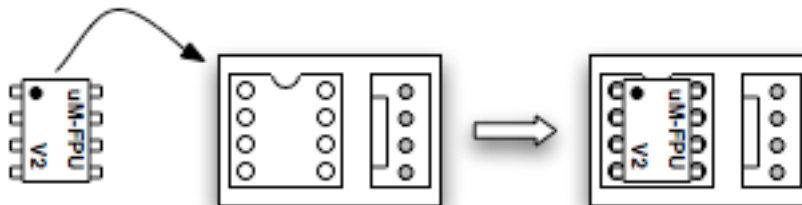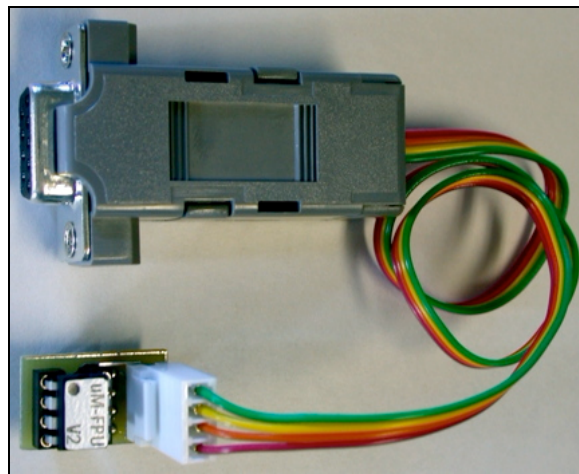
Micromega RS-232 Adapter

The Micromega RS-232 Adapter has a MAX232 circuit mounted inside a DB-9 Shell to provide a self-contained general purpose RS-232 interface. It plugs directly into the uM-FPU Debug Adapter to provide a complete serial interface for connecting the uM-FPU to the serial port on a PC.

Signals on the 4-pin Connector
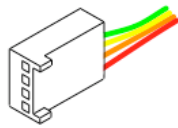
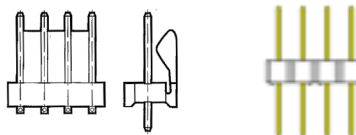Green   GND
Yellow   RX (data from the PC)
Orange   TX (data to the PC)
Red   +5V

uM-FPU Debug Adapter with Micromega RS-232 Adapter

The Micromega RS-232 Adapter is a general purpose RS-232 Adapter that could be used for other projects. It mates with a 4-pin header (Digi-Key Part Number A1922), or can be easily connected to a solderless breadboard using a 4-pin header strip.
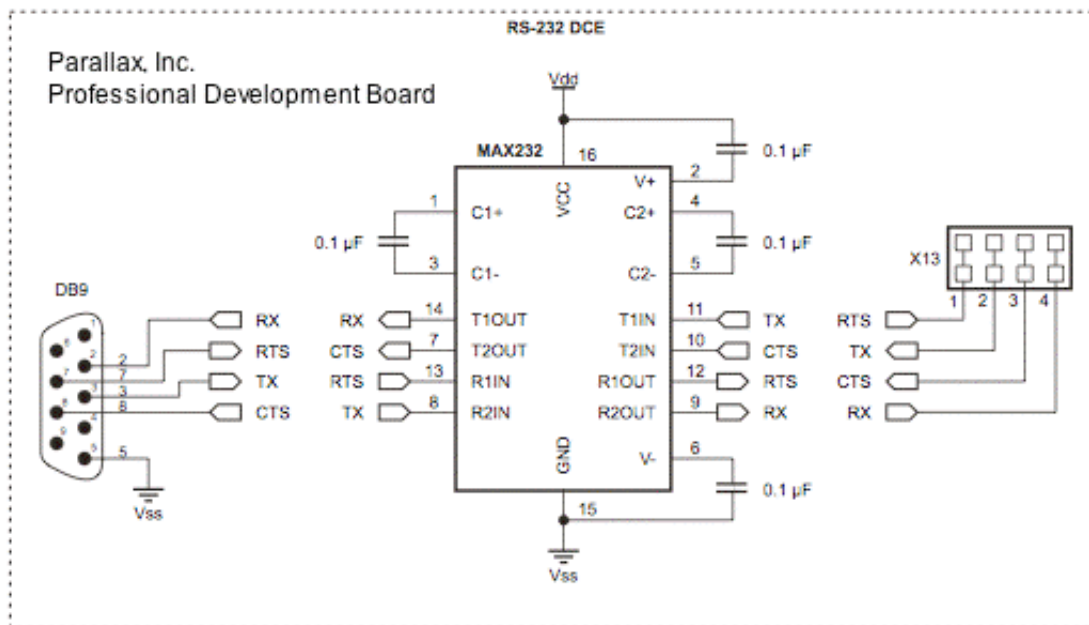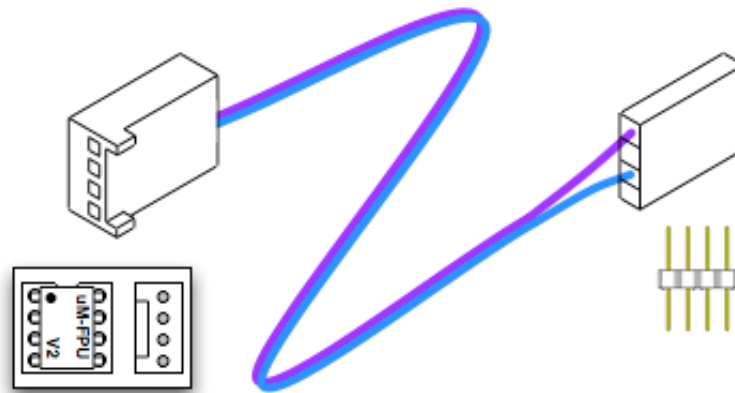
Parallax Professional Development Board

The Parallax Professional Development Board contains an extra RS-232 serial port that is accessible through connector X13. The power connections are already provided, so the cable from the uM-FPU only needs to connect `TSTIN` and `TSTOUT` to X13.

Signal Connections

uM-FPU	Development Board
TSTIN	X13-RX
TSTOUT	X13-TX

Parallax RS-232 DCE AppMod

The Parallax RS-232 DCE AppMod can be plugged into the expansion header on various Parallax development boards to provide a serial port. The power connections are provided through the expansion connector, so the cable from the uM-FPU only needs to connect TSTIN and TSTOUT to the AppMod.

Signal Connections

| uM-FPU	Appmod
TSTIN	RX
TSTOUT	TX
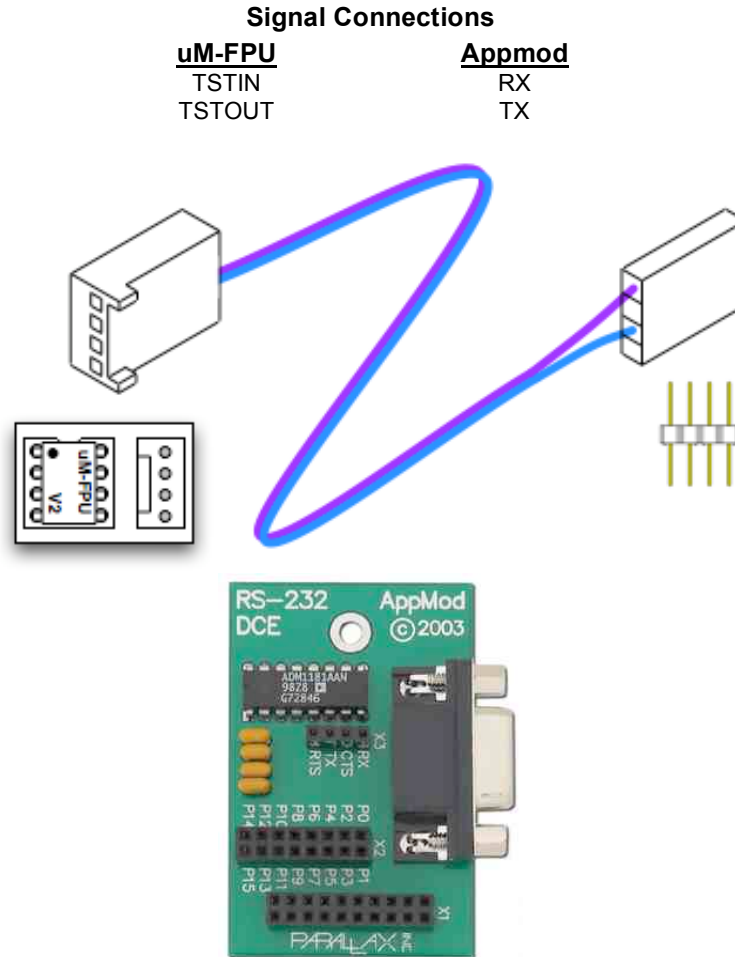
HVW Technologies RS-232 Driver Module - DCE

The HVW Technologies RS-232 Driver Module – DCE can be used to provide a serial port. A right angle
4-pin header (Digi-Key Part Number A1927-ND) is soldered to the four holes at the end of the board, and a
cable is constructed as follows:

Signal Connections

uM-FPU	RS-232 Driver Module
GND	GND
TSTIN	RX
TSTOUT	TX
+5V	+5V

The cable has a 4-pin connector (Digi-Key Part Number WM2002-ND) on both ends.
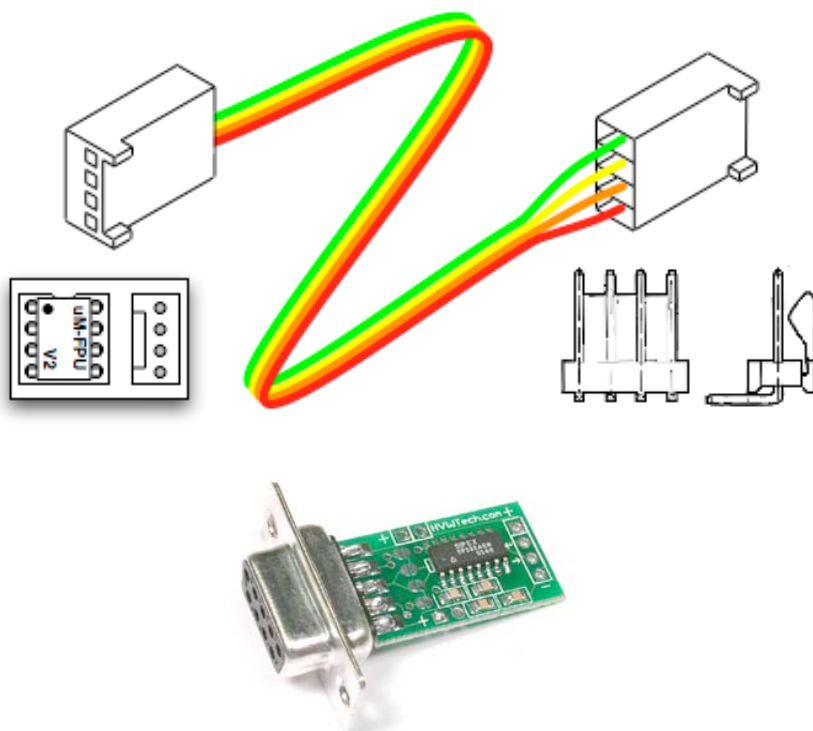
Spark Fun Electronics CP2102 USB Breakout Board

The Spark Fun Electronics CP2102 USB Breakout Board can be used to provide a serial port through the USB bus. This is an excellent solution if you only have one serial port on your PC and need to add another. USB drivers are provide by Spark Fun for Windows, Mac OS9, Mac OSX and Linux. A right angle 3-pin header (Digi-Key Part Number A19480-ND) is soldered to the three holes at the end of the board (Note: The CP2102 is powered from the USB bus, and the 3.3V connection is not used). A cable is constructed as follows:

Signal Connections

uM-FPU	CP2102
GND	GND
TSTIN	TX-O
TSTOUT	RX-I

The cable has a 4-pin connector (Digi-Key Part Number WM2002-ND) on the uM-FPU end, and a 3-pin connector (Digi-Key Part Number WM2001-ND) on the CP2102 end.
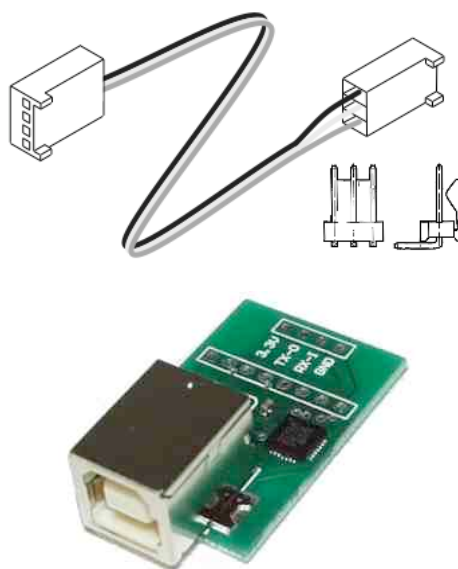
Hand-wired Circuit

If you already have parts on hand, you may want to just hand-wire a serial interface. The schematic diagram below shows an example of a circuit using the MAX232 RS-232 driver. By the time you add up the cost of a MAX232, five tantalum capacitors and a DB9 female connector, you may find it makes more sense to simply buy one of the adapters described above.
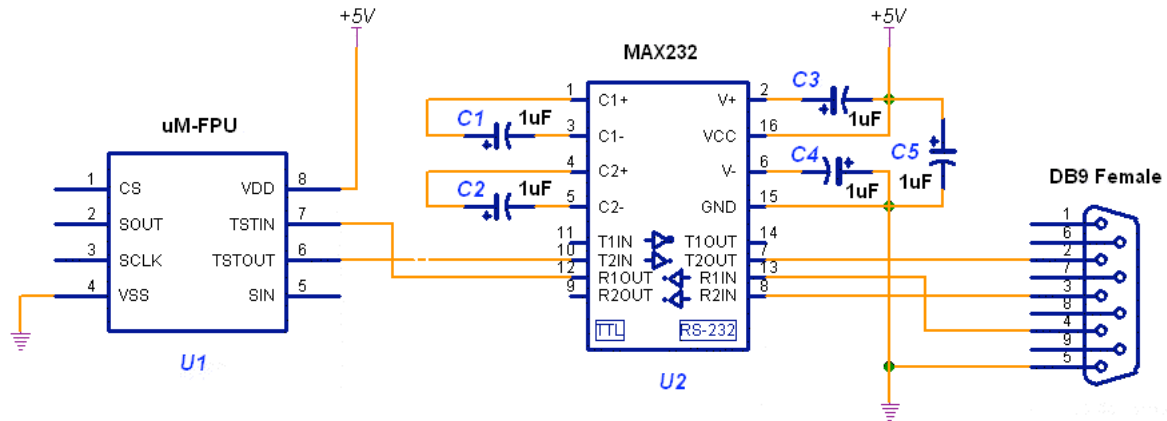
Further Information

Check the Micromega website at www.micromegacorp.com for up-to-date information. The purchase the adapters described in this application note, see the following sites:

Parallax, Inc.

http://www.parallax.com/
uM-FPU V2 Floating Point Coprocessor
uM-FPU Debug Adapter
uM-RS232 Adapter
Parallax RS-232 DCE AppMod
Parallax Professional Development Board

HVW Technologies Inc.

http://www.hvwtech.com/
uM-FPU V2 Floating Point Coprocessor
uM-FPU Debug Adapter
uM-RS232 Adapter
HVW RS-232 Driver Module – DCE
Parallax Professional Development Board

Spark Fun Electronics

http://www.sparkfun.com/
uM-FPU V2 Floating Point Coprocessor
uM-FPU Debug Adapter
uM-RS232 Adapter
Spark Fun CP2102 - USB Breakout Board