Hello Arduino Mega

Getting a “Hello World” with the GNU GCC toolchain

Revision	Author	Date	Description
0.01	D Snider	15/11/12	Derived from hello_uno.doc

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NOTE: WHILE THIS DOCUMENT IS BEING REFINED, META INFORMATION WILL BE IN < BRACKETS >.

1. SW Dev Environment

Google keywords	Description & URLs	tested versions
Cygwin	GNU file utils and make for Windows https://www.cygwin.com/	> make --version GNU Make 4.1
TortoiseGit	Windows based GIT: https://tortoisegit.org/ https://git-for-windows.github.io/	> git --version git version 2.6.2.windows.1
WinAvr	Windows GCC Compiler, Linker and C libraries http://sourceforge.net/projects/winavr/	> avr-gcc --version avr-gcc.exe (WinAVR 20100110) 4.3.3
Atmel Studio	Programmer Software which uses the JTAGICE3 debug pod http://www.atmel.com/tools/atmelstudio.aspx	Version: 7
putty	A serial terminal program with reliable cut & paste. http://www.chiark.greenend.org.uk/~sgtatham/putty/	Version: 0.66

2. HW tools

2.1. Atmel JTAGICE3

Google	"Atmel JTAGICE3"
Source	Digikey: http://www.digikey.com/product-detail/en/ATJTAGICE3/ATJTAGICE3-ND/
Support pages	http://www.atmel.com/tools/JTAGICE3.aspx http://www.atmel.com/webdoc/jtagice3/

3. Hello Mega

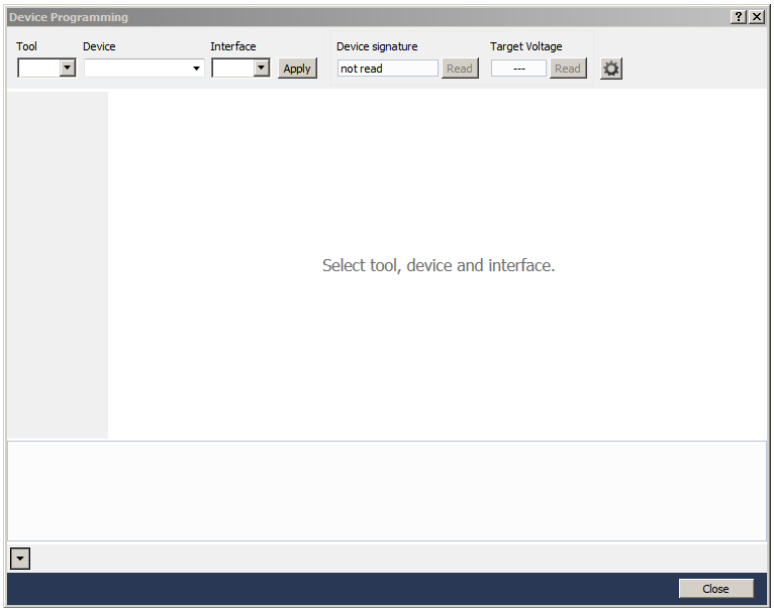
3.1. Build

```
> git clone https://github.com/dsnider0909/hello_arduino.git
> cd hello_arduino/mega
> make
...
Linking: hello_mega.elf
...
Creating load file for Flash: hello_mega.hex
…
>  ls hello_mega.hex
hello_mega.hex
```

3.2. Connect ISP pod to Atmel Studio and Mega

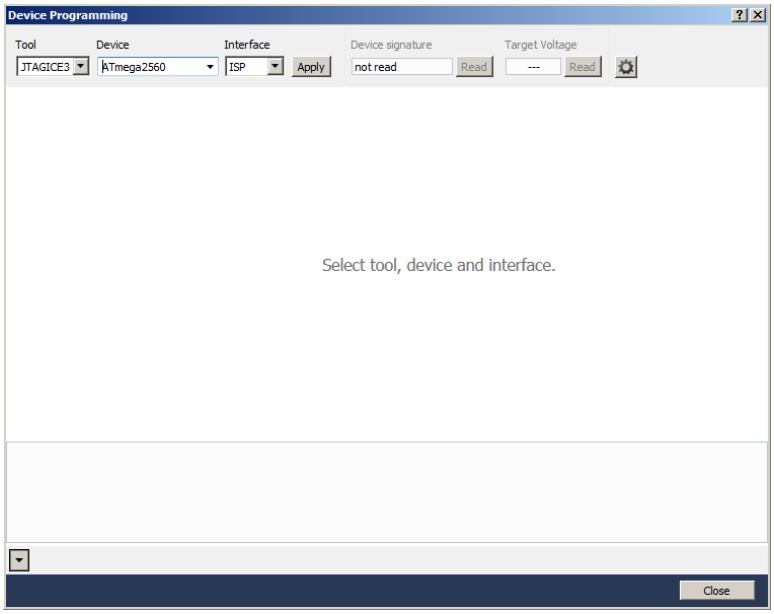
Connect to ISP pod

Within Atmel Studio, Select: Tools→ Device Programming



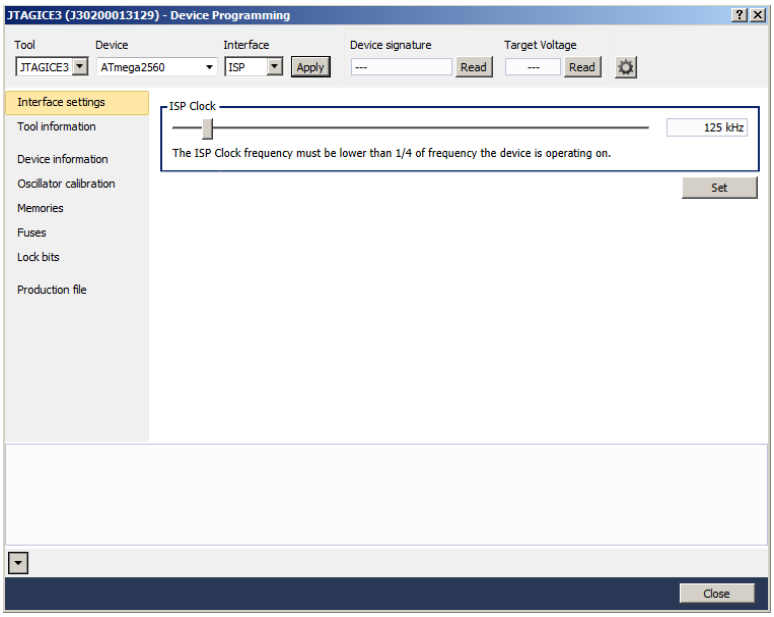
Connect the JTAGICE3 pod to a Windows PC USB port.

Configure:
Tool: JTAGICE3
Device: ATmega2560
Interface: ISP



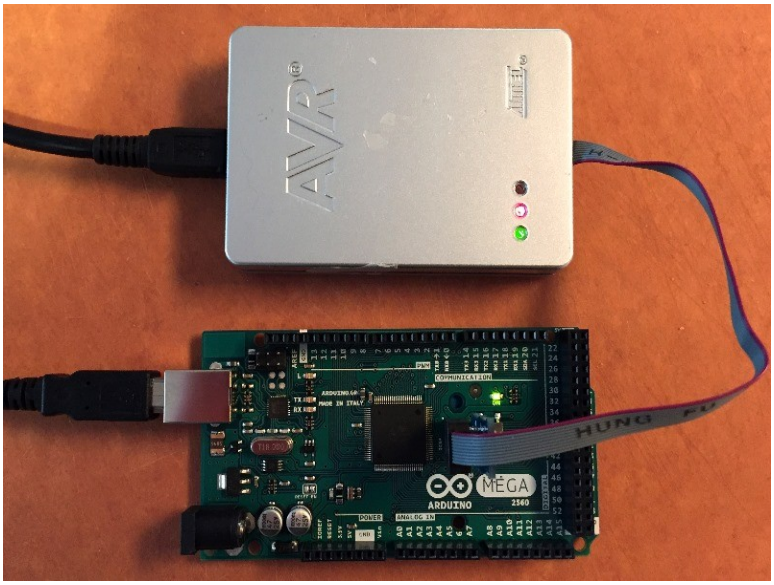
Select: Apply

If the pod is found, the following screen should show:



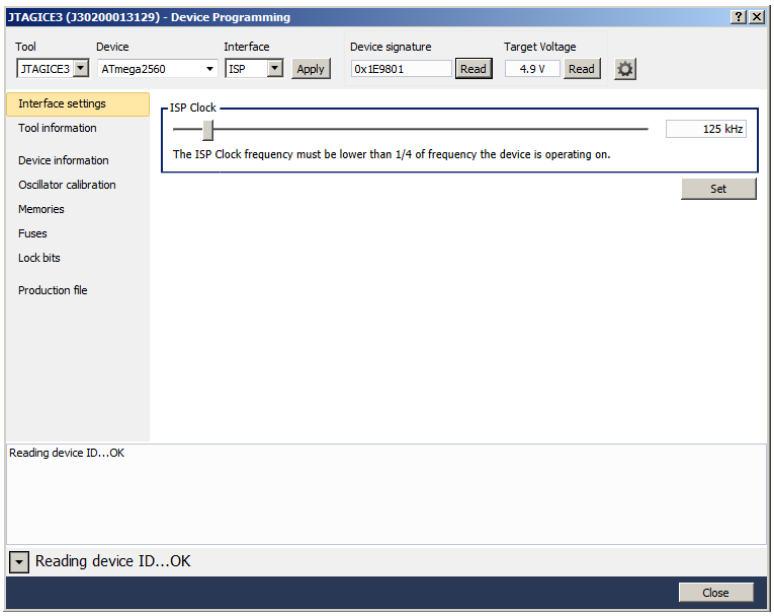
Verify Pod connection to Atmega2560

Connect the Arduino Mega board to a USB cable.
Connect this USB cable to another Windows PC for both power and serial I/O.
Connect the JTAGICE3 6pin ISP header to the Mega header: ICSP.



Select: Target Voltage → Read
It should return 3 to 5V.

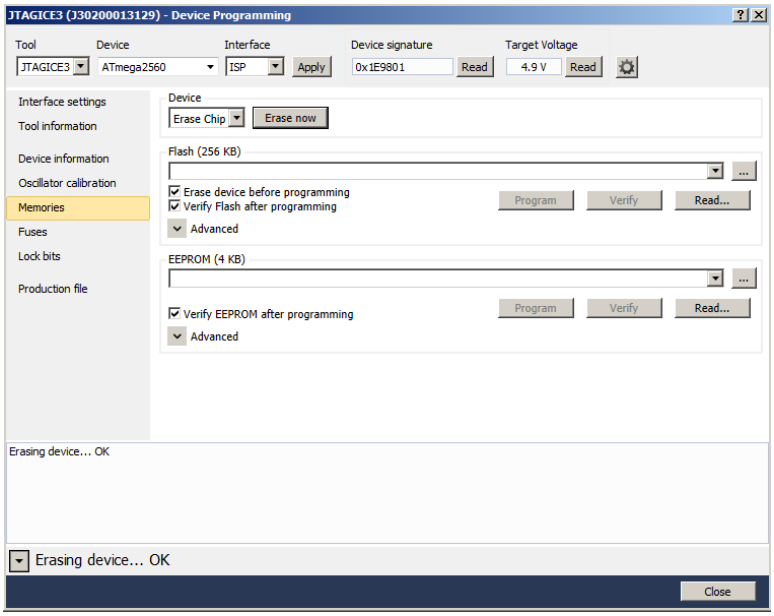
Select: Device signature → Read
There should be no error messages of Device ID mismatch.
For the Atmega2560, the signature should be 0x1E9801.



3.3. Programming Atmega2560

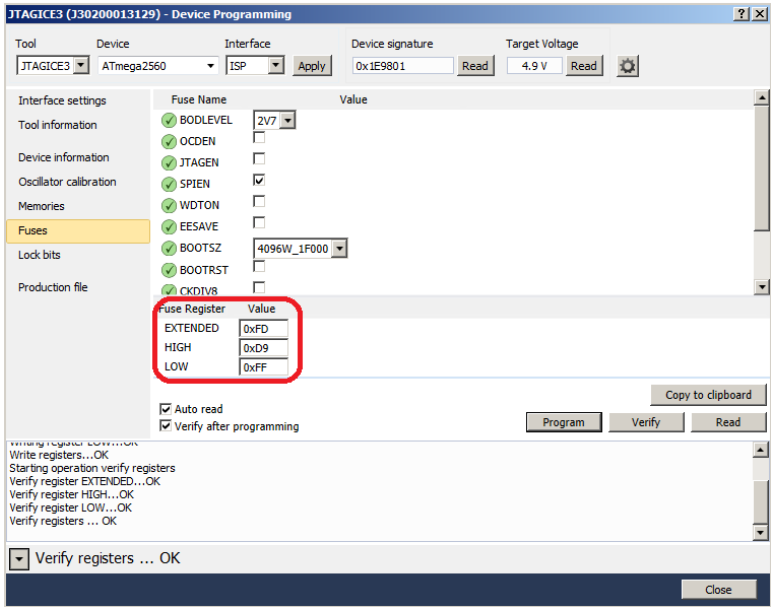
Erase Chip

Select: Memories → Device: Erase Chip → Erase Now



Fuses

Select: Fuses



For Arduino Mega - ATmega2560:

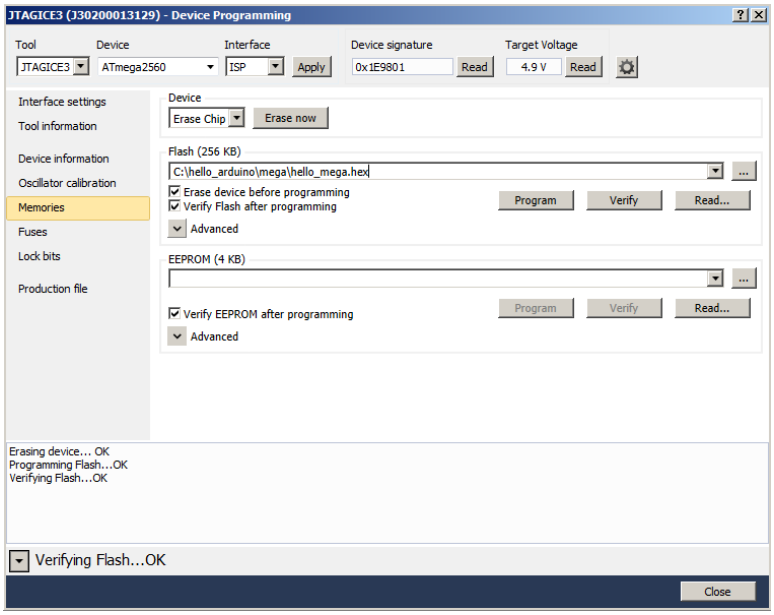
EXTENDED: 0xFD

HIGH: 0xD9

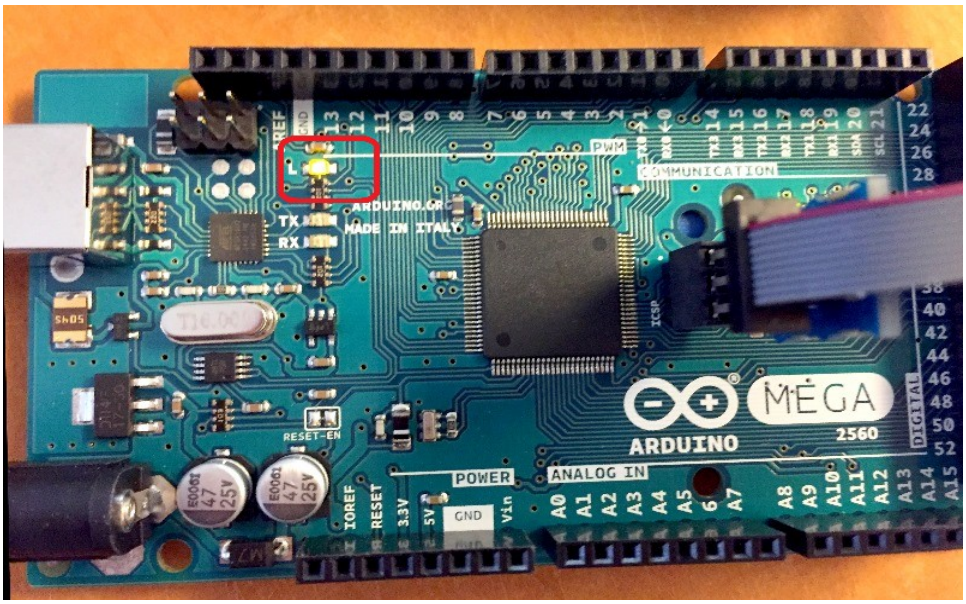
LOW: 0xFF

Load hello_mega.hex

Select: Memories
Select: Flash: hello_arduino\mega\hello_mega.hex
Select: Program



3.4. Verify 1sec LED

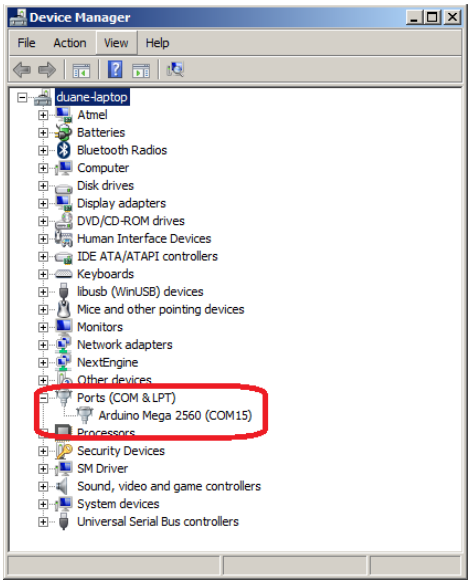


This should precisely transition once a second.

3.5. One-time Windows Driver Install

Within Windows, Open the “Device Manager”
Select: Start, at the prompt enter: devmgmt.msc

Check whether there is a “Ports – COM port” defined,
or an “Other devices/ Arduino Mega” showing?



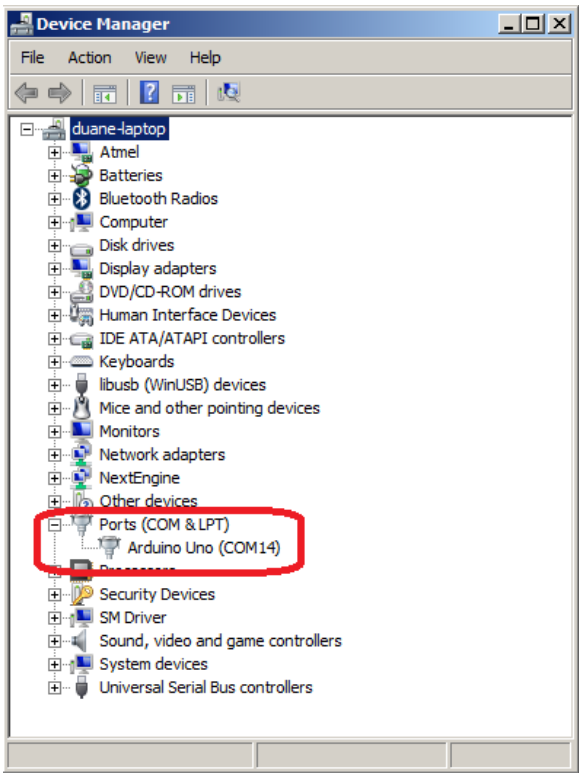
The “Other devices/ Arduino Mega” means a driver needs to be installed:
Right Click “Other Devices / Arduino Mega”
Select Driver Update and point the update to the directory:
'hello_arduino/mega/doc' directory for the *.inf file

References:

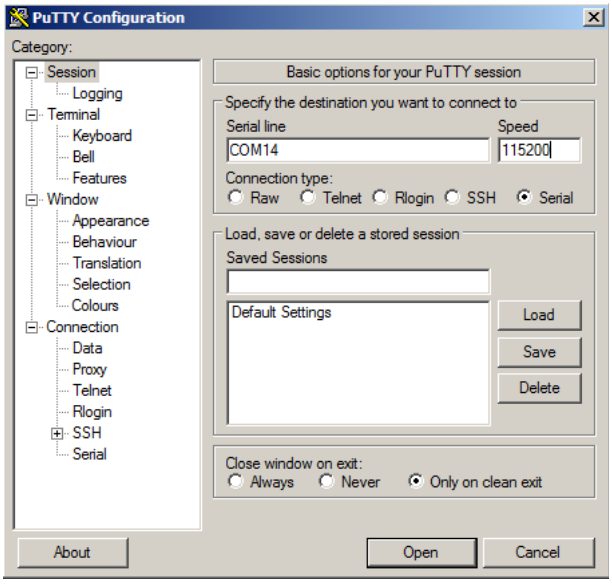
https://www.arduino.cc/en/Main/USBSerial
https://www.arduino.cc/en/Guide/Windows#toc4

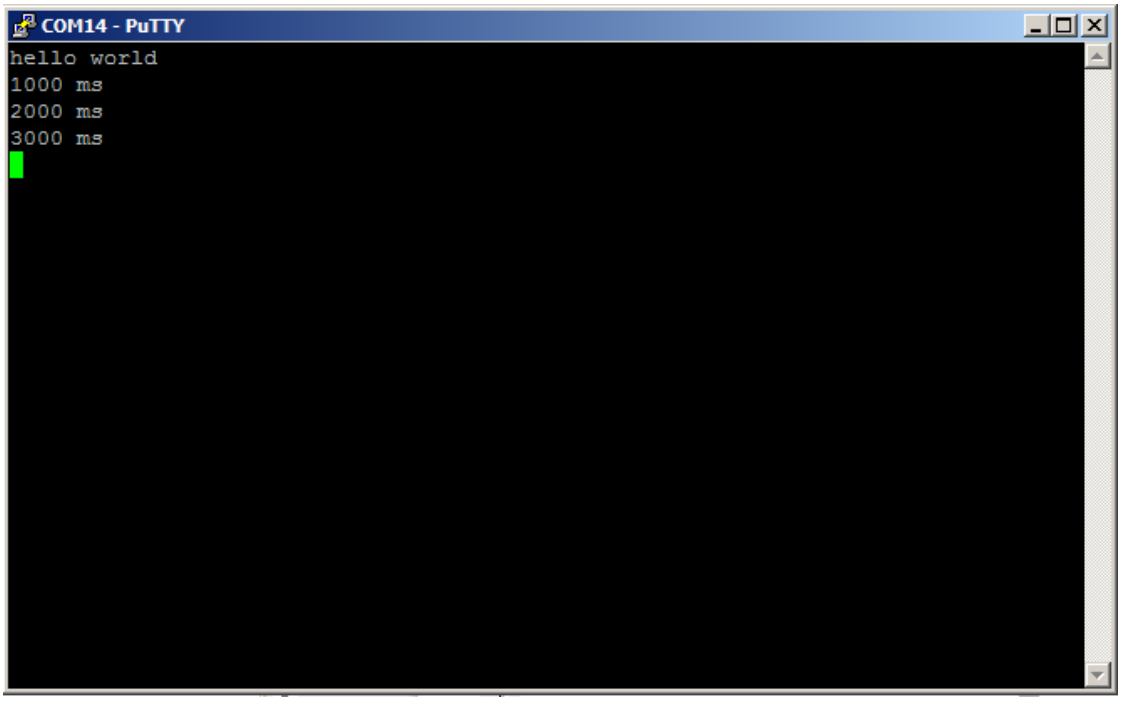
3.6. Verify Serial I/O

Open the Windows “Device Manager”
Within Windows: select Start, at the prompt enter: devmgmt.msc
Search for what COM ports are connected.

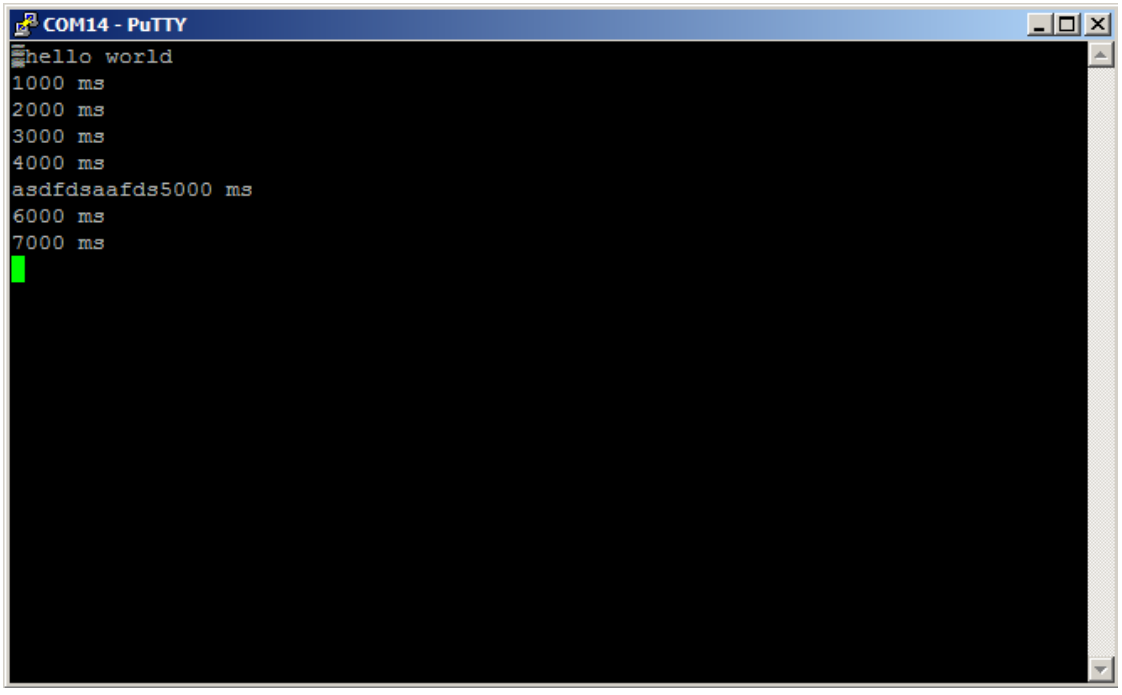


Start up a Putty Window and configure:
   Connection type: serial
   Serial line: COM14 (from this example)
   Speed: 115200
Select: Open





Hit a few keys to verify the Arduino is receiving serial data:



4. Design Notes - Fuses

```
Atmega2560 Fuse Notes:

Extended:       //  7  6  5  4  3  2  1  0
                //  1  1  1  1  1  1  1  1   => Atmel factory default: FF
            FD  //  1  1  1  1  1  1  0  1   => Ardyino Mega setting
                                     +--+--+-- BODLVL[2.0]: 111 - Disabled
                                                           100 - 4.3V
                                                           101 - 2.7V

High:           //  7  6  5  4  3  2  1  0
                //
                //  1  0  0  1  1  0  0  1   => Atmel factory default: 99
                //  1  1  0  1  0  0  0  0   => Ardino Mega original setting: D0
            D9  //  1  1  0  1  1  0  0  1
                //  |  |  |  |  |  |  |  + BOOTRST: 1 - no Boot Loader
                //  |  |  |  |  |  +--+--- BOOTSZ[1.0]: 00 - 2K words
                //  |  |  |  |  +--------- EESAVE: 1   - EEPROM not preserved
                //  |  |  |  +------------ WDTON: 1    - Watchdog timer off
                //  |  |  +--------------- SPIE: 0     - SPI programming enabled
                //  |  +------------------ JTAGEN: 1   - JTAG disabled
                //  +--------------------- OCDEN: 1    - OCD disabled


Low:            //  7  6  5  4  3  2  1  0
                //
                //  0  1  1  0  0  0  1  0   => factory default: 62
                //  1  1  1  0  0  0  1  0   => internal 8Mhz RC: E2  → F_CPU =  8000000
            FF  //  1  1  1  1  1  1  1  1   => 8-16Mhz ext crystal   → F_CPU =  xtal = 16000000
                //  |  |  |  |  |  |  |  |
                //  |  |  |  |  +--+--+--+ CLKSEL[3.0]: 0010 - internal 8Mhz
                //  |  |  |  |           |              111x - 8-16Mhz ext crystal
                //  |  |  |  |           |              110x -  3-8Mhz ext crystal
                //  |  |  |  +--+--------+ SUT[1.0],CLKSEL[0]: 11,1 - slowest start up
                //  |  |  +---------------- CKOUT:1   - CLK not out on PB0
                //  +------------------------ CKDIV8: 1 - do not divide clk by 8


Mega     : FD D9 FF
```

5. Resources

Google keywords	Description
Atmega 2560 datasheet	*The final word on register settings.* *http://www.atmel.com/devices/atmega2560.aspx* *http://www.atmel.com/Images/Atmel-2549-8-bit-AVR-Microcontroller-ATmega640-1280-1281-2560-2561_datasheet.pdf*
Arduino Mega schematic	https://www.arduino.cc/en/uploads/Main/arduino-mega2560-schematic.pdf
AVR libc	WinAVR library source and documentation http://www.nongnu.org/avr-libc/
AVR freaks	A good online community for most AVR questions http://www.avrfreaks.net/