Fundamentals of Embedded Systems Design
&
Programming

U.C. Irvine Division of Continuing Education

EECS X497.32

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Programming Assignment:
Serial Communication Program

Serial Communication Program

Universal Synchronous and Asynchronous Serial Receiver Transmitter (USART) on XMEGA A3BU

- 6 USARTs on XMEGA A3BU
  USARTC0, USARTC1, USARTD0, USARTD1, USARTE0 and USARTF0
- Three modes
  - Asynchronous Normal
  - Asynchronous Double
  - Synchronous Master
- Read section 23 of Xmega AU Manual on USART
  http://ww1.microchip.com/downloads/en/DeviceDoc/Atmel-8331-8-and-16-bit-AVR-Microcontroller-XMEGA-AU_Manual.pdf

Serial Communication Program
USART Baud Rate

Universal Serial Asychronous Receiver Transmitter (USART) on XMEGA AU

Table 23-5. USART baud rate.

Baud rate (bps)	f_{osc} = 32.0000MHz					
	CLK2X = 0			CLK2X = 1		
	BSEL	BSCALE	Error [%]	BSEL	BSCALE	Error [%]
2400	12	6	0.2	12	7	0.2
4800	12	5	0.2	12	6	0.2
9600	12	4	0.2	12	5	0.2
14.4k	34	2	0.8	34	3	0.8
	138	0	-0.1	138	1	-0.1
19.2k	12	3	0.2	12	4	0.2

23.15.6 BAUDCTRLA – Baud Rate register A

Bit	7	6	5	4	3	2	1	0
+0x06	BSEL[7:0]							
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W
Initial Value	0	0	0	0	0	0	0	0

23.15.7 BAUDCTRLB – Baud Rate register B

Bit	7	6	5	4	3	2	1	0
+0x07	BSCALE[3:0]				BSEL[11:8]			
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W
Initial Value	0	0	0	0	0	0	0	0

Serial Communication Program
USART Interrupt

Universal Serial Asychronous Receiver Transmitter (USART) on XMEGA AU

- Three USART Interrupts
  - Data Register Empty Interrupt
  - Transmit Complete Interrupt
  - Receive Complete Interrupt

23.15.3 CTRLA – Control register A

Bit	7	6	5	4	3	2	1	0
+0x03	–	–	RXCINTLVL[1:0]		TXCINTLVL[1:0]		DREINTLVL[1:0]	
Read/Write	R	R	R/W	R/W	R/W	R/W	R/W	R/W
Initial Value	0	0	0	0	0	0	0	0

Serial Communication Program
USART Status Bits

Universal Serial Asychronous Receiver Transmitter (USART) on XMEGA AU

- Frame Error
- Buffer Over flow
- Parity

23.15.2 STATUS – Status register

Bit	7	6	5	4	3	2	1	0
+0x01	RXCIF	TXCIF	DREIF	FERR	BUFOVF	PERR	–	RXB8
Read/Write	R	R/W	R	R	R	R	R	R/W
Initial Value	0	0	1	0	0	0	0	0

Serial Communication Program
USART Control Register

Universal Serial Asychronous Receiver Transmitter (USART) on XMEGA AU

- Setting Asynchronous, parity, stop bit, character size

23.15.5 CTRLC – Control register C

Bit	7	6	5	4	3	2	1	0
+0x05	CMODE[1:0]		PMODE[1:0]		SBMODE	CHSIZE[2:0]		
+0x05(1)	CMODE[1:0]		–	–	–	UDORD	UCPHA	–
Read/Write	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W
Initial Value	0	0	0	0	0	0	1	1
	0	0	0	0	0	1	1	0

Serial Communication Program Assignment Details

1. Download the UART_Base_AVR1522 zipped file

1. The UART_Base_AVR1522 code has 3 task projects built.
   Use the Task1 for this project(Polling method).

2. Program the XMega board with the task1.hex file
   Location: Task1-Polling Controlled -> Debug -> task1.hex

3. Connect the USB to Serial adapter to your PC

4. Connect Pin 3(Tx) and 4(Rx) on J1 Jumper to the Serial Port Rx and Tx
   (Cross wired: Pin 3(Tx) connects to Rx on Serial Port, and vice versa for Pin 4)

5. Download the Tera Term (Serial Port Terminal program)

6. Configure the USB to Serial COM Port with 9600 baud, 8 bit, No Parity, 1 stop bit on the Tera Term and hit Connect

7. Unplug and plug back the Xplained USB cable

8. You should see characters displayed on the Tera Term

9. Now modify the code so that when you enter a character key on the keyboard in the Tera Term window, that character is echoed back to the Tera Term.