

Preliminary Work for Exp. #5

```

1  PE_INP      EQU      0X40024020
2  GPIO_PORTE_IS      EQU      0X40024404
3  GPIO_PORTE_IBE      EQU      0X40024408
4  GPIO_PORTE_IEV      EQU      0X4002440C
5  GPIO_PORTE_IM      EQU      0X40024410
6  GPIO_PORTE_ICR      EQU      0X4002441C
7  GPIO_PORTE_RIS      EQU      0X40024414
8  GPIO_PORTE_DIR_R      EQU      0X40024400
9  GPIO_PORTE_AFSEL_R      EQU      0X40024420
10 GPIO_PORTE_DEN_R      EQU      0X4002451C
11 GPIO_PORTE_AMSEL_R      EQU      0X40024528
12 GPIO_PORTE_PDR      EQU      0X40024514
13 SYSCCTL_RCGC2_R      EQU      0X400FE608
14 RCGCADC      EQU      0x400FE638
15              AREA init_gpio, CODE, READONLY, ALIGN=2
16              THUMB
17              EXPORT GPIOE_Init
18 GPIOE_Init    PROC
19              LDR      R1, =RCGCADC
20              LDR      R0, [R1]
21              ORR      R0, R0, #0x01
22              STR      R0, [R1]
23              NOP
24              NOP
25              NOP
26              LDR      R1, =SYSCCTL_RCGC2_R
27              LDR      R0, [R1]
28              ORR      R0, R0, #0X10
29              STR      R0, [R1]
30              NOP
31              NOP
32              NOP
33              LDR      R1, =GPIO_PORTE_DIR_R
34              LDR      R0, [R1]
35              BIC      R0, R0, #0X08
36              STR      R0, [R1]
37              LDR      R1, =GPIO_PORTE_AFSEL_R
38              LDR      R0, [R1]
39              ORR      R0, R0, #0X08
40              STR      R0, [R1]
41              LDR      R1, =GPIO_PORTE_DEN_R
42              LDR      R0, [R1]
43              BIC      R0, R0, #0X08
44              STR      R0, [R1]
45              LDR      R1, =GPIO_PORTE_AMSEL_R
46              LDR      R0, [R1]
47              ORR      R0, R0, #0X08
48              STR      R0, [R1]
49              BX      LR
50              ENDP
51              ALIGN
52              END

```

Figure 1. GPIO

```

1  RCGCADC          EQU 0x400FE638
2  ADC0_ACTSS       EQU 0x40038000
3  ADC0_RIS         EQU 0x40038004
4  ADC0_IM          EQU 0x40038008
5  ADC0_EMUX        EQU 0x40038014
6  ADC0_PSSI        EQU 0x40038028
7  ADC0_SSMUX3      EQU 0x400380A0
8  ADC0_SSCTL3      EQU 0x400380A4
9  ADC0_SSIFIFO3    EQU 0x400380A8
10 ADC0_PC          EQU 0x40038FC4
11                 AREA init_adc, CODE, READONLY, ALIGN=2
12                 THUMB
13                 EXPORT ADC0_Init
14 ADC0_Init        PROC
15                 LDR     R1, =ADC0_ACTSS
16                 LDR     R0, [R1]
17                 BIC     R0, R0, #0x08
18                 STR     R0, [R1]
19                 LDR     R1, =ADC0_EMUX
20                 LDR     R0, [R1]
21                 BIC     R0, R0, #0xF000
22                 STR     R0, [R1]
23                 LDR     R1, =ADC0_SSMUX3
24                 LDR     R0, [R1]
25                 BIC     R0, R0, #0x000F
26                 STR     R0, [R1]
27                 LDR     R1, =ADC0_SSCTL3
28                 LDR     R0, [R1]
29                 ORR     R0, R0, #0x06 ;
30                 STR     R0, [R1]
31                 LDR     R1, =ADC0_PC
32                 LDR     R0, [R1]
33                 ORR     R0, R0, #0x01
34                 STR     R0, [R1]
35                 LDR     R1, =ADC0_ACTSS
36                 LDR     R0, [R1]
37                 ORR     R0, R0, #0x08
38                 STR     R0, [R1]
39                 BX      LR
40                 ENDP
41                 ALIGN
42                 END

```

Figure2. init_gpio.s

GPIO and ADC initializations are same for questions. I only show them here not in all parts.

1) Program the ATD conversion system on the board to convert the analog signal to a 12-bit number between 0x000 and 0xFFF. The input is taken from PE3. The output value stored in R0.

```

1  ADC0_RIS      EQU 0x40038004
2  ADC0_PSSI     EQU 0x40038028
3  ADC0_SSIFIFO3 EQU 0x400380A8
4  ADC0_ISC      EQU 0x4003800C
5
6  AREA main, CODE, READONLY, ALIGN=2
7  THUMB
8  IMPORT GPIOE_Init
9  IMPORT ADC0_Init
10 EXPORT __main
11
12 __main        PROC
13 BL GPIOE_Init
14 BL ADC0_Init
15 LDR R3, =ADC0_RIS
16 LDR R4, =ADC0_SSIFIFO3
17 LDR R2, =ADC0_PSSI
18 LDR R6, =ADC0_ISC
19
20 Smp1          LDR R0, [R2]
21               ORR R0, R0, #0x08
22               STR R0, [R2]
23
24 Cont          LDR R0, [R3]
25               ANDS R0, R0, #8
26               BEQ Cont
27
28               LDR R0, [R4]
29               MOV R0, #8
30               STR R0, [R6]
31               B Smp1
32 ENDP
33 END

```

Figure 1. MAIN OF Q1

Register	Value
R0	0x00000fff
R1	0x40038000
R2	0x40038028
R3	0x40038004
R4	0x400380a8
R5	0x00000000
R6	0x4003800c
R7	0x00000000
R8	0x00000000
R9	0x00000000
R10	0x00000000
R11	0x00000000
R12	0x00000000
R13 (SP)	0x20000400
R14 (LR)	0x0000034d
R15 (PC)	0x00000366
xPSR	0x01000000
Banked	
System	
Internal	
Mode	Thread
Privilege	Privileged
Stack	MSP
States	0
Sec	0.00000000
FPU	

Figure 2. Screenshots of Registers in different situations

2) I assume that there is a 1.65 Volt DC offset in my input. I subtract the value corresponding to this offset from my reading. Put a screenshot of Registers window on your report.

SUB R0, #2048

Register	Value
R0	0x000007ff
R1	0x40038000
R2	0x40038028
R3	0x40038004
R4	0x400380a8
R5	0x00000000
R6	0x4003800c
R7	0x00000000
R8	0x00000000
R9	0x00000000
R10	0x00000000
R11	0x00000000
R12	0x00000000
R13 (SP)	0x20000400
R14 (LR)	0x0000034d
R15 (PC)	0x0000036a
xPSR	0x01000000
Banked	
System	
Internal	
Mode	Thread
Privilege	Privileged
Stack	MSP
States	0
Sec	0.00000000
FPU	

Figure 2. Screenshots of Registers at max and min values

3) I convert the resulting value to a BCD number with two decimal places (X.YZ) between -1.65 and 1.65.

```

1  ADC0_RIS      EQU 0x40038004
2  ADC0_PSSI     EQU 0x40038028
3  ADC0_SSFIPO3  EQU 0x400380A8
4  ADC0_ISC      EQU 0x4003800C
5
6              AREA    messages, DATA, READONLY
7              THUMB
8
9  print        DCB "Measured Voltage is : "
10             DCB 0x4
11
12  new_line     DCB "\n "
13             DCB 0x4
14  floating_point DCB "."
15             DCB 0x4
16  voltage      DCB " V\n"
17             DCB 0x4
18
19              AREA main, CODE, READONLY, ALIGN=2
20              THUMB
21
22              IMPORT  GPIOE_Init
23              IMPORT  ADC0_Init
24              EXTERN  OutStr
25              EXTERN  OutChar
26              EXTERN  DELAY100
27              EXPORT  __main
28
29
30
31  __main        PROC
32              BL      GPIOE_Init
33              BL      ADC0_Init

```

```

32              BL      GPIOE_Init
33              BL      ADC0_Init
34
35
36              LDR      R3, =ADC0_RIS
37              LDR      R4, =ADC0_SSFIPO3
38              LDR      R2, =ADC0_PSSI
39              LDR      R6, =ADC0_ISC
40
41  Smp1          LDR      R0, [R2]
42              ORR      R0, R0, #0x08
43              STR      R0, [R2]
44
45  Cont          LDR      R0, [R3]
46              ANDS     R0, R0, #8
47              BEQ      Cont
48
49              LDR      R0, [R4]
50              MOV      R6, #330
51              MOV      R7, #4095
52              MUL      R0, R6
53              UDIV     R0, R7
54              SUB      R0, #165
55              ;MOV      R0, #8
56              ;STR      R0, [R6] ; clear flag
57              MOV      R8, #100
58              LDR      R5, =print
59              BL      OutStr
60              UDIV     R10, R0, R8
61              ADD      R5, R10, #0x30
62              BL      OutChar
63              LDR      R5, =floating_point
64              BL      OutStr

```

```

63      LDR R5,=floating_point
64      BL OutStr
65      MUL R3,R10,R8
66      SUB R2,R0,R3
67      MOV R9,#10
68      UDIV R11,R2,R9
69      ADD R5,R11,#0X30
70      BL OutChar
71      MUL R12,R11,R9
72      SUB R2,R12
73      ADD R12,R2,#0X30
74      MOV R5,R12
75      BL OutChar
76      LDR R5,=voltage
77      BL OutStr
78      LDR R1,=ADC0_ISC
79      MOV R0,#0x08
80      STR R0,[R1]
81      BL DELAY100
82      B     Smp1
83      ENDP
84      END

```

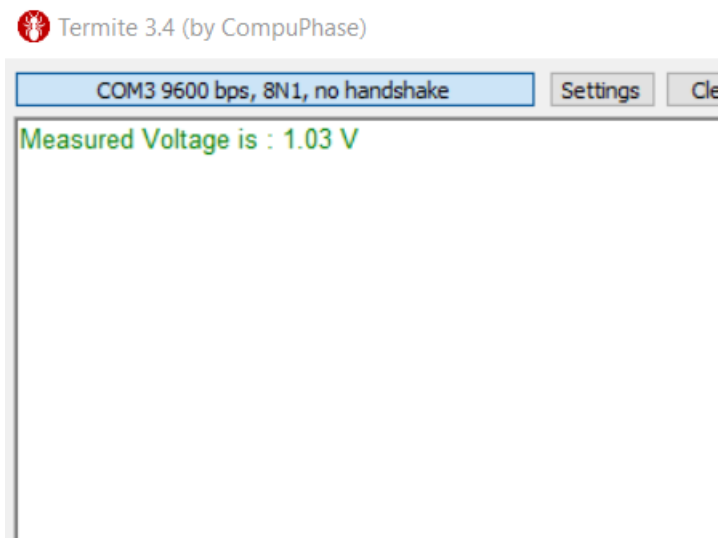
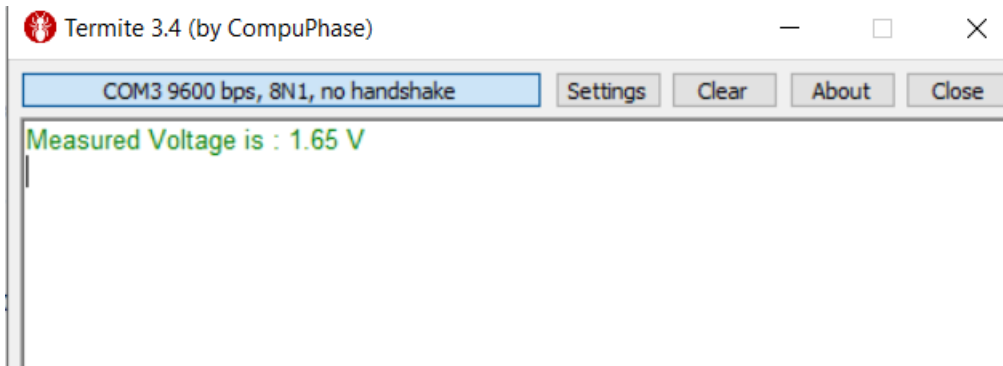


Figure 3. The code and some examples

4.

```

1  ADC0_ADCACTSS      EQU 0x40038000
2  ADC0_ADCEMUX       EQU 0x40038014
3  ADC0_ADCSSCTL3     EQU 0x400380A4
4  ADC0_ADCPC        EQU 0x40038FC4
5  ADC0_ADCPSSI       EQU 0x40038028
6  ADC0_RIS          EQU 0x40038004
7  ADC0_ADCSSFIFO3    EQU 0x400380A8
8  ADC0_ISC          EQU 0x4003800C
9  ADC0_SSMUX3       EQU 0x400380A0
10 RCGCADC           EQU 0x400FE638
11 GPIO_PORTE_DIR     EQU 0x40024400
12 GPIO_PORTE_AFSEL   EQU 0x40024420
13 GPIO_PORTE_DEN     EQU 0x4002451C
14 GPIO_PORTE_AMSEL   EQU 0x40024528
15 GPIO_PORTE_PCTL    EQU 0x4002452C
16
17
18 SYSTCTL_RCGCGPIO   EQU 0x400FE608
19
20                     AREA    messages, DATA, READONLY
21                     THUMB
22
23 print              DCB "Measured Voltage is : "
24                   DCB 0x4
25
26 new_line           DCB "\n "
27                   DCB 0x4
28 floating_point     DCB "."
29                   DCB 0x4
30 voltage            DCB " V\n"
31                   DCB 0x4
32
33

```

```

33
34                     AREA    main, READONLY, CODE
35                     THUMB
36                     EXTERN  OutStr
37                     EXTERN  SETUP
38                     EXTERN  OutChar
39                     EXTERN  CONVRT
40                     EXTERN  DELAY100
41                     EXPORT  __main
42
43 __main
44
45                     LDR R1, =SYSTCTL_RCGCGPIO
46                     LDR R0, [R1]
47                     ORR R0, R0, #0x10
48                     STR R0, [R1]
49                     NOP
50                     NOP
51                     NOP
52                     NOP
53                     LDR R0, =GPIO_PORTE_DIR
54                     MOV R1, #0x00
55                     STR R1, [R0]
56                     LDR R0, =GPIO_PORTE_AFSEL
57                     MOV R1, #0x08
58                     STR R1, [R0]
59                     LDR R0, =GPIO_PORTE_AMSEL
60                     MOV R1, #0x08
61                     STR R1, [R0]
62
63                     LDR R0, =RCGCADC
64                     MOV R1, #0x01
65                     STR R1, [R0]

```

```

65     STR R1,[R0]
66     NOP
67     NOP
68     NOP
69     NOP
70     NOP
71     NOP
72
73     LDR R1, = ADC0_ADCACTSS
74     MOV R0,#0x00
75     STR R0,[R1]
76
77     LDR R1,=ADC0_ADCEMUX
78     MOV R0,#0x00
79     STR R0,[R1]
80
81     LDR R1,=ADC0_SSMUX3
82     MOV R0,#0x00
83     STR R0,[R1]
84
85     LDR R1,=ADC0_ADCSSCTL3
86     MOV R0,#0x06
87     STR R0,[R1]
88
89     LDR R1,=ADC0_ADCPC
90     MOV R0,#0x01
91     STR R0,[R1]
92
93     LDR R1,=ADC0_ADCACTSS
94     MOV R0,#0x08
95     STR R0,[R1]
96
97

```

```

96
97
98     loop    LDR R1,=ADC0_ADCPSSI
99             MOV R0,#0x08
100            STR R0,[R1]
101
102            LDR R1,=ADC0_RIS
103            LDR R0,[R1]
104
105            CMP R0,#0x08
106            BNE loop
107
108            LDR R1,=ADC0_ADCSSFIFO3
109            LDR R0,[R1]
110
111            MOV R6,#330
112            MOV R7,#4095
113
114            MUL R0,R6
115            UDIV R0,R7
116
117            SUB R0,165
118            MOV R8,#100
119
120            LDR R5,=print
121            BL OutStr
122
123            UDIV R10,R0,R8
124            ADD R5,R10,#0x30
125            BL OutChar
126
127            LDR R5,=floating_point
128            BL OutStr

```



```

121      BL OutStr
122
123      UDIV R10,R0,R8
124      ADD R5,R10,#0X30
125      BL OutChar
126
127      LDR R5,=floating_point
128      BL OutStr
129
130      MUL R3,R10,R8
131      SUB R2,R0,R3
132
133      MOV R9,#10
134      UDIV R11,R2,R9
135      ADD R5,R11,#0X30
136      BL OutChar
137
138      MUL R12,R11,R9
139      SUB R2,R12
140      ADD R12,R2,#0X30
141      MOV R5,R12
142      BL OutChar
143
144      LDR R5,=voltage
145      BL OutStr
146      LDR R1,=ADC0_ISC |
147      MOV R0,#0x08
148      STR R0,[R1]
149      BL DELAY100
150      B loop
151      END
152

```

 Termite 3.4 (by CompuPhase)

COM3 9600 bps, 8N1, no handshake Settings

```

Measured Voltage is : 1.65 V
Measured Voltage is : 1.65 V
Measured Voltage is : 1.65 V
Measured Voltage is : 1.65 V
Measured Voltage is : 1.65 V
Measured Voltage is : 1.65 V
Measured Voltage is : 1.47 V
Measured Voltage is : 1.37 V
Measured Voltage is : 1.29 V
Measured Voltage is : 1.23 V
Measured Voltage is : 1.15 V
Measured Voltage is : 1.08 V
Measured Voltage is : 1.01 V
Measured Voltage is : 0.95 V
Measured Voltage is : 0.90 V
Measured Voltage is : 0.84 V
Measured Voltage is : 0.76 V
Measured Voltage is : 0.67 V
Measured Voltage is : 0.55 V
Measured Voltage is : 0.46 V
Measured Voltage is : 0.37 V
Measured Voltage is : 0.35 V
Measured Voltage is : 0.35 V

```

Figure 4. The code and some examples