2023-12-04 PBL

Seconds in an hour

60 · 60 = 3600

Seconds in a day

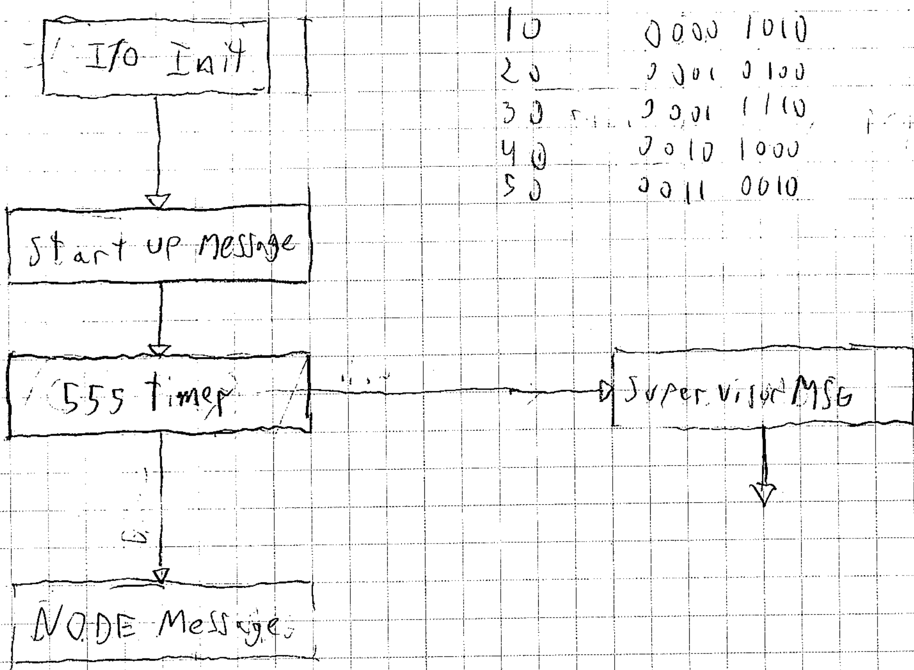
3600 · 24 = 86400

86400 > 65535

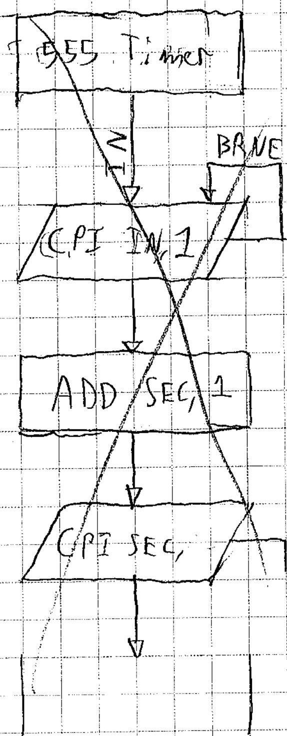
Seconds in 12 hours

3600 · 12 = 43200

43200 < 65535



d	b
10	0000 1010
20	0001 0100
30	0001 1110
40	0010 1000
50	0011 0010




```
LDI  R#c, $30   ; For ASCII conversion
CPI  MIN, 10  R20
BRSH MIN10
LDI  R#d, $30   ; MSB
LDS  R#e, Min   ;
ADD  R#e, R#c   ; LSB -> ASCII

MIN10:
    CPI  MIN, 20
    BRSH MIN20
    LDI  R#d, $10
    LDS  R#e, MIN
    SUBI R#e, 10   ; MIN -> LSB
    ADD  R#e, $30  ; LSB -> ASCII
```

Z = 30 · 31

Y = 28 · 29

X = 26 · 27

20

21

22

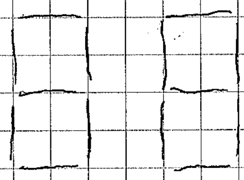
23

2023-12-04 PBL

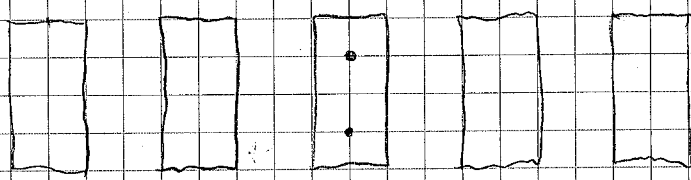
ASCII

$30-39
0-9

7 seg



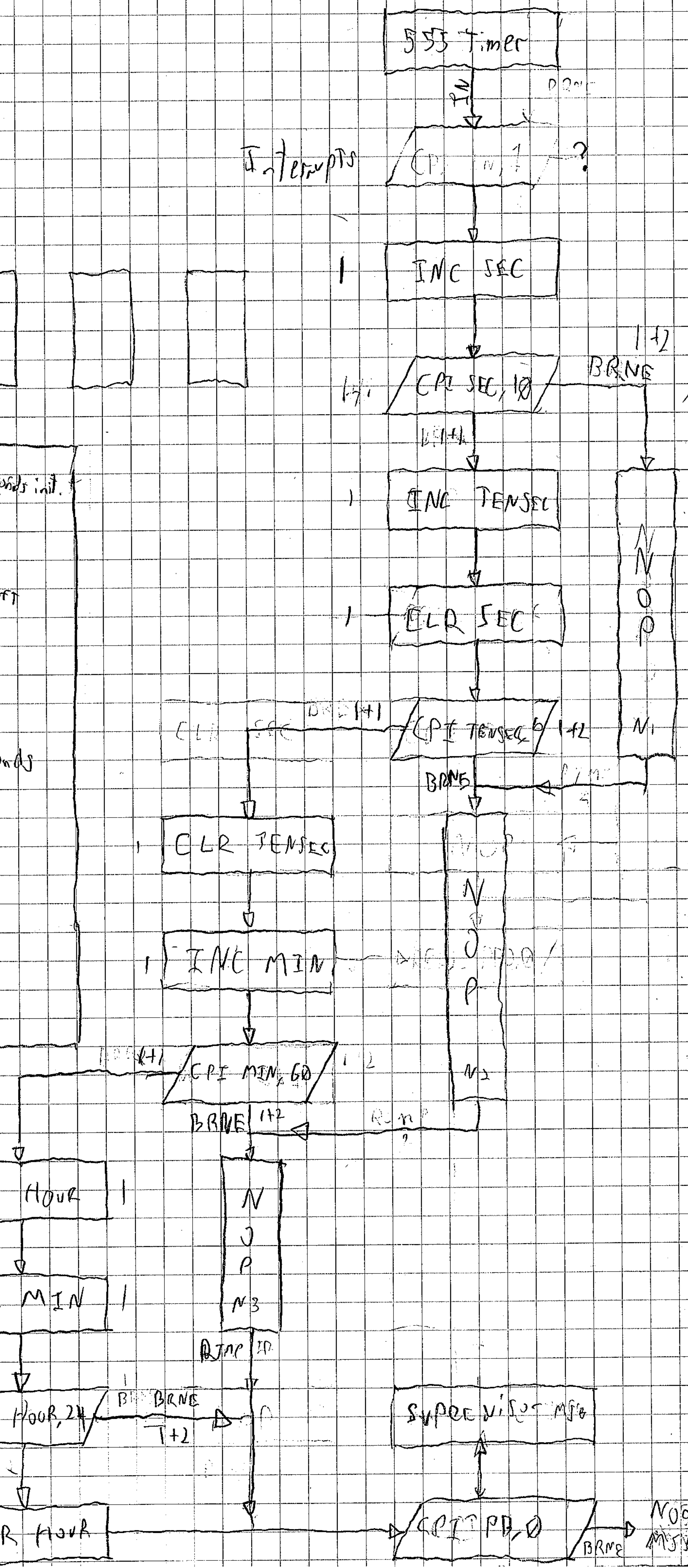
LCD



```
CSInI:                 ; Combine seconds init.
    PUSH   R#a
    PUSH   R#b
    LDI    R#a, 4
TSSH:                  ; TEN SEC shift
    LSL    TENSEC
    DEC    R#a
    BRNE   TSSH

CSEC:                  ; Combine seconds
    LDS    R#a, SEC
    LDS    R#b, TENSEC
    ADD    R#a, R#b
    OUT    [place holder], R#a
    POP    R#a
    POP    R#b
    RET
```

	N3	N2	N1
1	1	1	1
1+1	1+1	1+1	1+2
1	1	1	
1	1	1	
1+1	1+1	1+2	3
1	1	1	
1	1	1	2
1	1+2	3	
1			
1	0		
1+1			
1	2	2	
cycles 16	16	16	16
	2 NOP	4 NOP	4 NOP



2023-12-04 PBL

LCD – $2000

$\frac{\log(16 \cdot 1024)}{\log(2)} = 14$ address lines

ADC																			C	B	A	$\overline{Y}$
start	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1000	$= \overline{A13} \cdot A12 \cdot \overline{A11}$	L	H	L	2
END	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	17FF					
7seg																						
start	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1800	$= \overline{A13} \cdot A12 \cdot A11$	L	H	H	3
end	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1FFF					
LCD																						
C	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2000	$= A13 \cdot \overline{A12} \cdot \overline{A11}$	H	L	L	4
	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1	27FF					
	A15	14	A13	A12																		

32K | 32K

A12 = A | A12 = A

A13 = B | A13 = B

A14 = C | A11 = C

A11 — A

A12 — B

A13 — C

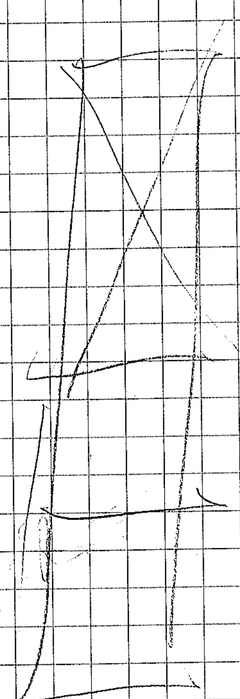
Vcc — G1

A14 — $\overline{G2A}$

A12 = A

A13 = B

A14 = C



2023-12-06
PBL

AVR

AVR	ADC	LCD (R/W=GND)	NOT A	NOT B	NOT C	138	MAX232
AD0 (P39)	DB0 (P18)	P7					
AD1	DB1 (P17)	P8					
AD2	DB2 (P16)	P9					
AD3	DB3 (P15)	P10					
AD4	DB4 (P14)	P11					
AD5	DB5 (P13)	P12					
AD6	DB6 (P12)	P13					
AD7 (P32)	DB7 (P11)	P14					
A15 (P28)							
A14						G2A/B (P4/5)	
A13						C (P3)	
A12						B (P2)	
A11						A (P1)	
A10							
A9							
A8 (P21)		P4 (RS)					
RxD (P10)							
TxD (P11)							
$\overline{WR}$ (P16)			1				
$\overline{RD}$ (P17)							
138							
Y0 (P15)							
Y1 (P14)							
Y2 (P13)	$\overline{CS}$ (P1)						
Y3 (P12)							
Y4 (P11)				1			
Y5 (P10)							
Y6 (P9)							
Y7 (P8)							
NOT							
4Y							
3Y							
2Y							
1Y		P6 (E)					

AVR ISP

AVR	ISP
P6	P1
P7	P5
P8	P4
P9	P3

0 1 2 3 4 5 6 7 8 9 10 11 12

// DetFUMON_5_4

a AQ 1 0

'a' + 4 = 'e'
'Q' + 4 = 'U'
1 + 4 = 5
0 + 4 = 4

'A' = $41
'a' = $61
'Q' = $51
'0' = $30
'1' = $31

'$' = $24

2023-12-11
PBL

Node: 1) - 255 samples at 1 sample/2ms ≈ 510ms

2) - Store in memory buffer

3) - Display values above(H) & below(L) trim level (2.5V)

4) - Display A & L on second line of LCD

5) - 5us pulse on PE0 for each voltage sample

datasheet → ADC is initiated by the code sample
P. 11, 18, 19, 23 by code

3 5
WR ↔ INTR

CS ↔ RD
1 2

```
node_init:
    LDI   R31, HIGH(node_msg<<1)
    LDI   R30, LOW(node_msg<<1)
    LDI   R26, LOW(buf)
    LDI   R27, HIGH(buf)
    LDI   R'a', 255     ; number of samples to be taken
    LDI   R'd', 0       ; below trim count
    LDI   R'e', 0       ; above trim count
node:
    LDS   R'b', $1000
    CP    R'b', R'c'    ; R'c' is the trim level
    BRLO  LTRIM
    INC   R'e'
    DEC   R'a'          ST X+, R'b'
    BRNE  node
    RJMP  node_finish
LTRIM:
    INC   R'd'
    DEC   R'a'
    BRNE  node
```

2023-12-16

PBL

555 Timer

$f = \frac{1.44}{(R_1 + 2R_2)C_1} = \sim 60\,Hz$

R_1 = ~~3.9kΩ~~ ~~39kΩ~~ 31 kΩ

R_2 = ~~1kΩ~~ 100kΩ

C_1 = ~~1μF~~ ~~105~~ 0.1μF = 104

$f = \sim 60.25\,Hz$

Control pin = ~~0.1μF~~ 0.01μF = 103

1850 = Seconds

2150 = minutes

2151 = hours

A: acquire new sample set

S:XXXXS: Display the sum of sample set

XX T: Prompts for new ADC trim lvl

10100000 → 1

01010000 → 1

00101000 → 1

00010100 → 1

00001010 → 1

PDL

2023-12-18

R3:R2

R27:26 X1

Start sum:

CLR R3

CLR R2

sumloop:

LD R0, X1

LD R1, X2

ADD R2, R0

ADC R3, R21

~

DEC R21

BRNE sumloop

?