```asm
1    ORG 0000H
2    LJMP START
3
4
5      ORG 001BH
6      INC A; increments A for every timer1 overflow
7      JNZ EXIT
8      MOV R2, #0FFH ; Accumulator overflow check value
9      EXIT: RETI
10
11
12
13     ORG 0030H
14     START:MOV P1,#00000000B   ; sets P1 as output port
15     CLR P3.0                  ; sets P3.0 as output for sending trigger
16     SETB P3.1                 ; sets P3.1 as input for receiving echo
17     MOV TMOD,#00100000B       ; sets timer1 as mode 2 auto reload timer
18     MOV IE, #10001000B        ; timer 1 overflow interrupt active
19
20     ACALL INIT
21
22     ACALL Disp_MSG1
23     ACALL DELAY2
24     ACALL Disp_MSG2
25     ACALL DELAY4
26
27     ACALL CLSCR
28
29     ACALL Disp_MSG3
30     ACALL DELAY2
31     ACALL Disp_MSG4
32     ACALL DELAY4
33
34     ACALL CLSCR
35
36
37
38
39     MAIN:
40     MOV TL1,#-53     ; loads the initial value to start counting from (54 count = 1cm)
41                      ; reduced to 50 to account for processing cycles
42     MOV TH1,#-53     ; loads the reload value
43                      ; use maximum 54 for 11.0592 MHZ and 58 for 12MHZ
44     MOV A,#00000000B ; clears accumulator
45
46     SETB P3.0        ; starts the trigger pulse
47     ACALL DELAY1     ; gives 10uS width for the trigger pulse
48     CLR P3.0         ; ends the trigger pulse
49
50     HERE:JNB P3.1,HERE ; loops here until echo is received
51     BACK:SETB TR1      ; starts the timer1
52     HERE1:JNB TF1,HERE1 ; loops here until timer overflows (54 count = 1cm)
53     JB P3.1,BACK       ; jumps to BACK if echo is still available.
54     CLR TR1            ; stops timer
55     MOV R0,A           ; saves the value of A to R0
56
57
58     ACALL CLSCR
59     ACALL Disp_MSG5
60     ACALL DELAY2
61     ACALL DISLOOP     ; calls the display loop
62     ACALL DELAY3
63
64     SJMP MAIN         ; jumps to MAIN loop
65
66
67
68
69     DISLOOP:
```

```asm
70      MOV A, #0C0H        ; force cursor to second line
71      ACALL initial
72
73      ACALL DELAY2
74      MOV DPTR, #VALUE     ;value lut location
75
76      MOV A,R0            ; set A to value in R0
77
78
79      CJNE R2, #0FFH, NORMAL; for values over 255
80      ;Isolating Hundreds
81      MOV B, #100D
82      DIV AB
83      MOV R2, A
84      ;Isolating tens
85      MOV A, B
86      MOV B, #10D
87      DIV AB
88      MOV R3, A
89      MOV R4, B
90
91      MOV A, R4
92      ADD A, #5D
93      MOV B, #10D
94      DIV AB
95      MOV R4, B
96
97      ADD A, R3
98      ADD A, #5D
99      MOV B, #10D
100     DIV AB
101     MOV R3, B
102
103     ADD A, R2
104     ADD A, #2D
105     MOV R2, A
106
107
108     ;Display Values
109     MOV A, R2
110     ACALL Digit_display
111     MOV A, R3
112     ACALL Digit_display
113     MOV A, R4
114     ACALL Digit_display
115
116     MOV R2, #0000H
117
118     SJMP UD ; jump to display cm
119
120     NORMAL: ; values below 255
121     MOV B, #100D
122     DIV AB
123     JZ TENS
124     ACALL Digit_display
125     ;Isolating tens
126     TENS: MOV A, B
127     MOV B, #10D
128     DIV AB
129     ACALL Digit_display
130     ;Isolating ones
131     MOV A, B
132     ACALL Digit_display
133
134     UD: MOV DPTR ,#UNITS    ; display cm routine
135     MOV A,#0D
136     ACALL Digit_display
137     MOV A,#1D
138     ACALL Digit_display
```

```asm
139
140      RET
141
142      Initial: ACALL DELAY2 ; initialization subroutines
143      MOV P1, A
144      CLR P2.0
145      SETB P2.1
146      ACALL DELAY2
147      CLR P2.1
148      RET
149
150      Digit_display: ACALL DELAY2
151      MOVC A,@A+DPTR   ; gets the digit drive pattern for the content in A
152      MOV P1, A
153      SETB P2.0
154      SETB P2.1
155      CLR P2.1
156      RET
157
158      DELAY1: MOV R6,#4D     ;~10uS delay
159      L: DJNZ R6,L
160      RET
161
162
163      DELAY2: MOV R6, #4D  ;~1 ms delay
164      L1: MOV R7, #125D
165      L2: DJNZ R7, L2
166      DJNZ R6, L1
167      RET
168
169
170      DELAY3:MOV R5, #125D   ; ~10 sec delay
171      D1: MOV R6, #200D
172      D2: MOV R7, #200D
173      INNER: DJNZ R7,INNER
174      DJNZ R6, D2
175      DJNZ R5, D1
176      RET
177
178
179
180      DELAY4:MOV R5, #150D   ; ~ 3 sec delay
181      D14: MOV R6, #100D
182      D24: MOV R7, #100D
183      INNER4: DJNZ R7,INNER4
184      DJNZ R6, D24
185      DJNZ R5, D14
186      RET
187
188
189
190      Disp_MSG1:
191      MOV A, #080H
192      ACALL Initial
193
194
195      MOV DPTR, #MESSAGE1
196      MOV R1, #15D
197
198      MSG1: MOV A,#00H
199      ACALL Digit_display
200      INC DPTR
201      DJNZ R1, MSG1
202
203      RET
204
205
206      Disp_MSG2:
207      MOV A, #0C0H
```

```asm
208        ACALL Initial
209
210
211        MOV DPTR, #MESSAGE2
212        MOV R1, #11D
213
214        MSG2: MOV A,#00H
215        ACALL Digit_display
216        INC DPTR
217        DJNZ R1, MSG2
218
219        RET
220
221        Disp_MSG3:
222        MOV A, #80H
223        ACALL Initial
224
225
226        MOV DPTR, #MESSAGE3
227        MOV R1, #16D
228
229        MSG3: MOV A,#00H
230        ACALL Digit_display
231        INC DPTR
232        DJNZ R1, MSG3
233
234        RET
235
236        Disp_MSG4:
237        MOV A, #0C0H
238        ACALL Initial
239
240
241        MOV DPTR, #MESSAGE4
242        MOV R1, #13D
243
244        MSG4: MOV A,#00H
245        ACALL Digit_display
246        INC DPTR
247        DJNZ R1, MSG4
248
249        RET
250
251
252        Disp_MSG5:
253        MOV A, #080H
254        ACALL Initial
255
256
257        MOV DPTR, #MESSAGE5
258        MOV R1, #16D
259
260        MSG5: MOV A,#00H
261        ACALL Digit_display
262        INC DPTR
263        DJNZ R1, MSG5
264
265        RET
266
267
268
269
270        INIT:MOV A, #38H   ; use 2 lines and 5*7
271        ACALL initial
272        ACALL DELAY2
273        MOV A, #0EH   ;cursor blinking off
274        ACALL initial
275        ACALL DELAY2
276        ACALL CLSCR
```

```asm
277    RET
278
279
280    CLSCR:MOV A, #01H    ;clear screen
281    ACALL initial
282    ACALL DELAY2
283    RET
284
285
286
287
288    VALUE:DB '0'
289          DB '1'
290          DB '2'
291          DB '3'
292          DB '4'
293          DB '5'
294          DB '6'
295          DB '7'
296          DB '8'
297          DB '9'
298
299    UNITS: DB 'c'
300           DB 'm'
301
302    MESSAGE1: DB 'ULTRASONIC DIST',0
303    MESSAGE2: DB 'MEASUREMENT',0
304    MESSAGE3: DB 'BY JEREMY INYEGA',0
305    MESSAGE4: DB 'F17/1323/2018'
306    MESSAGE5: DB 'THE DISTANCE IS:',0
307
308    END
```