

```

1 ; CODELOCK program
2
3 ;=====
4 ;   HARDWARE
5 ;=====
6 ; Keyboard connections
7 ;
8 ; RB0 = scanline 0
9 ; RB1 = scanline 1
10 ; RB2 = scanline 2
11 ; RB3 = returnline 0
12 ; RB4 = returnline 1
13 ; RB5 = returnline 2
14 ; RB6 = returnline 3
15 ;(key = 3 x returnline (0,1,2,3) + scanline (0,1,2)
16 ;
17 ; RA2 = BEEPER active low
18 ;
19     ;RA3 = LED active low
20 ;
21 ; RA0 = level output
22 ; RA1 = pulse output
23 ;
24 ;
25 ;
26 ;=====
27 ; Configuration
28 ;=====
29
30 RC      equ      b'11'          ;RC oscillator
31 XT      equ      b'01'          ;XT oscillator
32 WDTE    equ      b'100'        ;watchdog timer
33 PWRTE   equ      b'1000'       ;power up timer
34 CPOFF   equ      b'10000'      ;code protection
35
36         PROCESSOR      16c84
37         __CONFIG      RC+CPOFF+PWRTE
38
39 ;=====
40 ; Constants
41 ;=====
42
43 ;general
44
45 w       equ      0
46 f       equ      1
47 indf    equ      00h          ;indirect file
48 fsr     equ      04h          ;pointer to indirect file
49 ram     equ      0ch          ;rambottom (start)
50 status  equ      03h          ;status register file

```

```

51  porta    equ    05h        ;port A
52  portb    equ    06h        ;port B
53
54  intcon    equ    0bh        ;interrupt control register
55  rbif      equ    00h        ;rb has changed, interrupt event flag
56  rbie      equ    03h        ;rb interrupt enable flag
57  gie       equ    07h        ;global interrupt enable flag
58  inte      equ    04h        ;RB0/INT interrupt enable flag
59  intf      equ    01h        ;RB0/INT interrupt event flag
60  optreg    equ    81h        ;option register
61  intedg    equ    06h        ;INT edge
62
63  trisa     equ    85h        ;port A direction register
64  trisb     equ    86h        ;port B direction register
65
66  eecon1    equ    88h        ;eeprom control register
67  eecon2    equ    89h        ;eeprom data control register
68  eedata    equ    08h        ;eeprom data register
69  eeadr     equ    09h        ;eeprom adress register
70  eeif      equ    04h        ;
71  wrerr     equ    03h        ;
72  wren      equ    02h        ;
73  wr        equ    01h        ;
74  rd        equ    00h        ;
75
76  rp0       equ    05h        ;register bank
77  zero      equ    02h        ;zero bit position in status register
78  carry     equ    00h        ;carrybit position in status register
79  PC        equ    02h        ;program counter register
80
81  ;=====
82  ; macro definitions
83  ;=====
84  jz        macro    lab1
85             btfsc   status,zero
86             goto    lab1
87         endm
88
89  jnz       macro    lab2
90             btfss   status,zero
91             goto    lab2
92         endm
93
94  jc        macro    lab3
95             btfsc   status,carry
96             goto    lab3
97         endm
98
99  jnc       macro    lab4
100            btfss   status,carry
101            goto    lab4
102        endm

```

```

102          ram
103
104 ;=====
105 ; setbank
106 ;=====
107 setbank macro   banknr
108             if   banknr == 0
109                 bcf   status,rp0
110             endif
111             if   banknr == 1
112                 bsf   status,rp0
113             endif
114             endm
115
116 ;=====
117 ; portio
118 ;
119 ; sets tris of port
120 ; usage: portio  portnr,b'10010011' ;example
121 ; 0 is output, 1 is input
122 ;=====
123 portio macro   portnr,io
124             clrf   portnr
125             setbank 1
126             movlw  io
127             if   portnr == porta
128                 movwf trisa
129             endif
130             if   portnr == portb
131                 movwf trisb
132             endif
133             setbank 0
134             endm
135
136
137 ;=====
138 ; program constants
139 ;=====
140
141 nokey    equ    0ffh
142 hekje    equ    .12
143 sterretje    equ    .10
144
145 ;=====
146 ; variables
147 ;=====
148         org     ram
149
150 del0     equ    ram+0
151 del1     equ    ram+1
152 del10    equ    ram+2
153 scanln   equ    ram+3

```

```

154 retval equ ram+4
155 retln equ ram+5
156 key equ ram+6
157 scankey equ ram+7
158 newkey equ ram+8
159 digit equ ram+9
160 match equ ram+0Ah
161
162 ncode0 equ ram+0Bh
163 ncode1 equ ram+0Ch
164 ncode2 equ ram+0Dh
165 ncode3 equ ram+0Eh
166 ncode4 equ ram+0Fh
167 ncode5 equ ram+10h
168
169 tries equ ram+11h
170
171 ;last ram locatation = ram + 23h
172
173 ;=====
174 ; reset adres
175 ;=====
176 org 0
177 goto start
178
179 ;=====
180 ; identify interrupt source
181 ;=====
182 org 4
183 goto interrupt
184
185 ;=====
186 ; rdeeprom
187 ; reads byte from eeprom
188 ; entry EEADR, exit EEDATA
189 ;=====
190 rdeeprom:
191 bsf status, rp0
192 bsf eecon1, rd
193 bcf status, rp0
194
195 return
196
197
198 ;=====
199 ; wreeprom
200 ;
201 ; writes a byte of data to eeprom
202 ;
203 ; entry: eedata, eeadr
204 ;=====

```

```

205 wreeprom:
206
207     bcf    intcon,gie    ;disable ints
208     bsf    status,rp0    ;bank 1
209     bsf    eecon1,wren    ;enable write
210
211     ;write sequence
212
213     movlw  55h
214     movwf  eecon2
215     movlw  0aah
216     movwf  eecon2
217     bsf    eecon1,wr    ;begin write
218
219 waitwr:
220     btfsc  eecon1,wr
221     goto   waitwr    ;wait for writecycle complete
222
223     bcf    status,rp0    ;bank 0
224     bsf    intcon,gie    ;reenable ints
225
226     return
227
228
229     ;=====
230     ; interrupt routines
231     ;=====
232 interrupt:
233     retfie
234
235     ;=====
236     ;
237     ;=====
238     ;=====
239     ; Init
240     ;=====
241 init:
242     portio  porta,b'00000'
243     portio  portb,b'11111000'
244
245     bcf    porta,0    ;clear level output
246     bcf    porta,1    ;clear pulse output
247
248     bsf    porta,2    ;beeper off
249
250     ;     bsf    porta,3    ;led off
251
252     movlw  7h
253     movwf  portb    ;set keyboard scanlines
254
255     movlw  1
256     movwf  newkev

```

```

256         movlw    00h,
257
258         clrf     tries
259
260         ;test if signature is written in EEPROM
261         ;if not then write signature and initial code
262         ;else do nothing
263         ;signature = AAh,55h,CCh, initial accescode = 1 2 3 4 5 6
264
265         movlw    6
266         movwf    eaddr           ;first signature adress
267         call     rdeeprom
268         movlw    0AAh
269         subwf    eedata,w
270         jnz     nosig
271
272         incf     eaddr
273         call     rdeeprom
274         movlw    055h
275         subwf    eedata,w
276         jnz     nosig
277
278         incf     eaddr
279         call     rdeeprom
280         movlw    0CCh
281         subwf    eedata,w
282         jnz     nosig
283
284         ;signature match, do nothing
285         return
286 nosig:
287         ;no valid signature (first startup), write signature and
288         accescode
289
290         clrf     eaddr
291         movlw    1
292         movwf    eedata
293 wrcod:
294         call     wreeprom
295         incf     eedata
296         incf     eaddr
297         movlw    6
298         subwf    eaddr,w
299         jnz     wrcod
300
301         ;code written, write signature
302
303         movlw    0AAh
304         movwf    eedata
305         call     wreeprom
306         incf     eaddr

```

```

307         movlw    055h
308         movwf    eedata
309         call     wreeprom
310         incf     eeadr
311
312         movlw    0CCh
313         movwf    eedata
314         call     wreeprom
315
316         return
317
318         ;=====
319         ; beep
320         ; beeps 50mS
321         ;=====
322 beep:
323         bcf      porta,2
324         movlw    .5
325         movwf    del10
326         call     delay10
327         bsf      porta,2
328
329         return
330
331         ;=====
332         ; delay10
333         ; delays del10 x 10mS
334         ;=====
335 delay10:
336         ;delayloop 10 mS
337         movlw    .40
338         movwf    del1
339 dec250u:
340         ;delayloop 250 uS
341         movlw    .83
342         movwf    del0
343 declu:
344         decfsz   del0
345         goto     declu
346
347         decfsz   del1
348         goto     dec250u
349
350         decfsz   del10
351         goto     delay10
352
353         return
354         ;=====
355 delay    macro    dly00
356         movlw    dly00
357         movwf    del10
358         ..

```

```

358         call    delay10
359         endm
360
361         ;=====
362         ; scankeyboard
363         ; scans the keyboard
364         ; returns scankey = 1..12, 0ffh = nokey
365         ; scankey is nokey if no key is pressed
366         ; scanlines = RB0..RB2
367         ; returnlines = RB3..RB6
368         ;=====
369 scankeyboard:
370
371         ;find scanline
372
373         movlw   0
374         movwf  portb
375         clrf   scanln
376         bsf    portb,0
377         nop
378         movf   portb,w
379         andlw  b'01111000'
380         jnz    retl
381         incf   scanln
382         bsf    portb,1
383         nop
384         movf   portb,w
385         andlw  b'01111000'
386         jnz    retl
387         incf   scanln
388         bsf    portb,2
389         nop
390         movf   portb,w
391         andlw  b'01111000'
392         jnz    retl
393         goto   nokeyp           ;no keypress
394
395         ;scanline found, find returnline
396 retl:
397         clrf   retln
398         movf   portb,w
399         movwf  retval
400         rrf    retval
401         rrf    retval
402         rrf    retval
403 nxtrl:
404         bcf    status,carry
405         rrf    retval
406         jc     keyfound
407         incf   retln
408         movlw  4
409         subwf  retln,w

```

```

410         jnz     nxtrl
411
412         ;no (new) key pressed, exit
413 nokeyp:
414         movlw   nokey
415         movwf   scankey
416         return
417
418 keyfound:
419
420         ;key found, calculate keynumber = 3x RL + SL + 1
421         movf    retln,w
422         bcf     status,carry
423         rlf     retln           ;2x
424         addwf   retln,f         ;3x
425         movf    scanln,w
426         addwf   retln,w
427         movwf   scankey
428
429         incf    scankey
430
431         return
432
433 ;=====
434 ; getkey
435 ; exits key:1..12,nokey
436 ; debounced filtered output
437 ;=====
438 getkey:
439         call    scankeyboard
440         movf    scankey,w
441         movwf   key
442         movlw   .2
443         movwf   del10
444         call    delay           ;delay 20mS
445         call    scankeyboard
446         movf    scankey,w
447         subwf   key,w
448         jnz     getkey
449
450         ;debounce complete
451
452         ;test if the key is a new keypress, if not return nokey=0ffh
453
454         movlw   nokey
455         subwf   key,w
456         jnz     exitkey
457         movlw   1
458         movwf   newkey         ;next key is new
459         goto    pkey
460

```

```

461 exitkey:
462     movlw    1
463     subwf   newkey,w
464     jnz     pkey
465     clrf   newkey
466     return
467
468 pkey:    ;exit nokey
469     movlw   nokey
470     movwf   key
471     return
472     ;=====
473     ; readkey
474     ; reads keyboard until key pressed
475     ; exits key = 1..12
476     ;=====
477 readkey:
478     call    getkey
479     movlw   nokey
480     subwf   key,w
481     jz      readkey
482     call    beep
483
484     return
485
486     ;=====
487     ; main program
488     ;=====
489 start:
490     call    init
491     call    beep
492
493 rdkey:
494     call    readkey           ;wait for key
495
496     ;key pressed
497
498     movlw   sterretje
499     subwf   key,w
500     jnz    rdkey
501
502     ; '*' pressed
503
504 nxkey0:
505     call    readkey
506
507     ;find out if second key is a number, '*' or '#'
508
509     movlw   sterretje
510     subwf   key,w
511     jz      deactivate      ;'**' pressed, deactivate ouput,

```

```

restart input
512
513     movlw   hekje
514     subwf   key,w
515     jz      getcode           ;'*#' goto new code input
516
517     ;'*number' pressed, read code, key holds first digit
518
519     movlw   6
520     movwf   digit           ;digit count, 6
521     movlw   1
522     movwf   match          ;code match to input flag
523     clrf   eeadr           ;start with eeprom adress 0
524 rdee:
525     call    rdeeprom
526     movf   eedata,w
527     subwf   key,w           ;compare stored codedigit to key
528     jz      eq00
529     clrf   match
530 eq00:
531     decfsz  digit
532     goto   nxtdg00
533
534     ;6 digits compared
535     btfss  match,0
536     goto   nomatch0        ;no match, do nothing, return to
input start
537
538     ;codes match, set outputs
539     clrf   tries
540     bsf    porta,0          ;set level
541 ;     bcf    porta,3          ;LED on
542
543
544     ;pulse 1 sec
545     ;beep 1 sec
546     bcf    porta,2
547     bsf    porta,1          ;set pulse
548     delay  .100
549     bcf    porta,1
550     bsf    porta,2
551
552     goto   rdkey
553
554 deactivate:
555     bcf    porta,0          ;deactivate output
556 ;     bsf    porta,3          ;LED off
557     goto   nxkey0
558
559 nxtdg00:
560     call   readkey          ;wait for key
561

```

```

562         ;key pressed
563         movlw   sterretje
564         subwf   key,w
565         jz      nxkey0           ;restart input
566
567         movlw   hekje
568         subwf   key,w
569         jz      rdkey           ;restart input
570
571         ;digit pressed
572         incf    eeadr
573         goto    rdee
574
575 nomatch0:
576         ;wrong accescode entry
577         incf    tries
578         movlw   4
579         subwf   tries,w
580         jnz    nomatch
581
582         ;four times mismatch in a row
583         ;alarm for 1 minute
584         movlw   .60
585         movwf   digit
586
587 alarm:
588         call    beep           ;50mS
589         delay   .15           ;150ms
590         call    beep           ;50
591         delay   .15           ;150
592         call    beep           ;50
593         delay   .55           ;550mS
594
595         decfsz  digit
596         goto    alarm
597         goto    rdkey
598
599 nomatch:
600         ;beep 3x
601         delay   .30
602         call    beep
603         delay   .10
604         call    beep
605         delay   .10
606         call    beep
607
608         goto    rdkey
609
610 getcode:
611         ;'*#' pressed, get new accescode
612         ;format = '*#oooooooooooooooooooo'

```

```

613         ;o = oldcode,n = newcode, m = newcode verification
614
615         ;read and verify the old code
616         movlw    1
617         movwf    match
618         movlw    6
619         movwf    digit
620         clrf    eaddr
621
622         ;read digit and verify
623 gtdg00:
624         call     readkey           ;wait for key
625         movlw    sterretje
626         subwf    key,w
627         jz       nxkey0           ;'*' pressed, restart input
628
629         movlw    hekje
630         subwf    key,w
631         jz       nomatch          ;error in input
632
633         ;digit pressed, compare to eeprom
634
635         call     rdeeprom
636         movf     key,w
637         subwf    eedata
638         jz       match00
639         clrf    match             ;mismatch in input
640 match00:
641         incf     eaddr
642         decfsz   digit
643         goto    gtdg00           ;read next
644
645
646         ;read and save new accescode
647
648         movlw    6
649         movwf    digit
650         movlw    ncode0
651         movwf    fsr             ;point to first digit
652
653 rdnc00:
654         call     readkey           ;wait for key
655         movlw    sterretje
656         subwf    key,w
657         jz       nxkey0           ;'*' pressed, restart input
658
659         movlw    hekje
660         subwf    key,w
661         jz       nomatch          ;error in input
662
663         movf     key,w

```

```

664         movwt    indt
665
666         incf     fsr
667         decfsz  digit
668         goto    rdnc00
669
670         ;new code saved
671         ;read verification of newcode and compare
672
673         movlw   6
674         movwf   digit
675         movlw   ncode0
676         movwf   fsr           ;point to saved code
677
678 rdvc00:
679         call    readkey       ;wait for key
680         movlw   sterretje
681         subwf   key,w
682         jz     nxkey0        ;'*' pressed, restart input
683
684         movlw   hekje
685         subwf   key,w
686         jz     nomatch       ;error in input
687
688         movf    indf,w
689         subwf   key,w
690         jz     mok
691         clrf   match         ;key and saved digit differ, no match
692
693 mok:
694         incf     fsr
695         decfsz  digit
696         goto    rdvc00
697
698         ;new code verified, test if matched
699
700         btfss  match,0
701         goto   nomatch       ;input mismatch, error signal, restart
input
702
703         ;codes match, store new code in eeprom
704
705         ;long beep
706         bcf    porta,2
707         delay  .100
708         bsf    porta,2
709
710         movlw   6
711         movwf   digit
712         movlw   ncode0
713         movwf   fsr
714         clrf   eeadr

```

```

715
716 store00:
717     movf    indf,w
718     movwf   eedata
719     call    wreeprom
720
721     incf    fsr
722     incf    eeadr
723     decfsz  digit
724     goto    store00
725
726     goto    rdkey           ;new code stored in eeprom, restart
input
727
728 ;=====
729 ; eeprom definition
730 ;=====
731     org    2100h
732
733     de     0,0,0,0,0,0,0,0,0
734
735
736
737     end
738
739
740

```