



# PIC Source Code Application Note

# TABLE OF CONTENTS

- PIC Source Code**.....3
- Notices**.....8
  - Copyright Notice.....8
  - Technical Notice.....8
  - Warranty Disclaimer.....8
- Change History**.....9

# PIC SOURCE CODE

The following Assembler source is taken from our firmware, which is used in our DS00000 DemoBoard prototyping kit. The DemoBoard is operated by a PIC16F627/8.

```
*****
;
;           Sample Code, derived from DemoBoard           *
*****
;
;   Filename:      Sample source PIC.asm                 *
;   Date:         13.02.2004                             *
;   File Version:  First Revision 26.01.2004             *
;   Author:       Reinhard Engstler                     *
;   Company:      [E3] Engstler Elektronik Entwicklung GmbH *
*****
;
;   Files required: p16f628.inc                          *
*****
;
;   Notes:  actual code snippets not tested              *
;           just cut and paste from working demoboard   *
*****

        list      p=16f628      ; list directive to define processor
        #include  p16f628.inc   ; processor specific variable definitions

__CONFIG _CP_OFF & _WDT_OFF & _BODEN_ON & _PWRTE_ON & _INTRC_OSC_NOCLKOUT
& _MCLRE_OFF & _LVP_OFF

; '__CONFIG' directive is used to embed configuration data within .asm
file.
; The labels following the directive are located in the respective .inc
file.
; See respective data sheet for additional information on configuration
word.

*****
;
;           Memory Definitions
*****
;
        cblock 0x20
KeyMask      ; PortMask for writing LCD Data
SABitCount   ; Bitcounter for LCWrite
SABuf        ; transmit buffer for LCD
LCParity     ; count '1' bits for parity generation
PortAMask    ; save point for TRISA
PortBMask    ; save point for TRISB
Time         ; count Time interrupts
TimeOut      ; Count Time interrupts until Power OFF
TimeOutH     ; High Byte Count
```

```

RunCMD          ; Samples RunCMDs on every Timer IRQ
wpattern        ; which pattern to be used
Keyold          ; last key press
bcount         ; how many bytes to go
vTest          ; general purpose test
Colour         ; hand over for Colour value
tmp            ; guess what
Pointer:2      ; Pointer into Program Memory to read tables
RGB:3          ; 7bit values for RedGreenBlue
    endc

```

```

w_temp         equ    0x7E    ; variables used for context saving
STATUS_temp    equ    0x7F    ; memory always mapped to bank 0

```

```

;*****
;
;          Bit Definitions
;*****
;
;          Defines
;*****
;

```

```

#define SA_CLK          PORTB,3 ; LC Clock on RB3
                        ; Can't be changed, as PWM is used!!!!!!
                        ; for permanent clock tests

```

```

#define SA_DATA        PORTA    ; Data Lines on RA2, RA3
#define Key1           02      ; RA2 handles Data of Key1
#define Key2           03      ; RA3 handles Data of Key1

```

```

#define LED_OFF        0x00

```

```

#define Dark_Red       0x10

```

```

#define Red            0x20

```

```

#define Bright_Red     0x30

```

```

;

```

```

#define Dark_Green     0x04

```

```

#define Green          0x08

```

```

#define Bright_Green   0x0c

```

```

;

```

```

#define Dark_Blue      0x01

```

```

#define Blue           0x02

```

```

#define Bright_Blue    0x03

```

```

#define Dark_White     0x15

```

```

#define White          0x2a

```

```

#define Bright_White   0x3f

```

```

#define SA_CMD_WrDisplay 0x40 ; Set Adr of Display (3 nibbles) and Bitmap
(128, 216, 512 nibbles)

```

```

#define SA_CMD_SetColour 0x41 ; Set Colour awaits one param: '00rrggbb'

```

```

#define SA_CMD_EndTr    0x43 ; end of current command execute

```

```

#####
    ORG    0x000    ; processor reset vector
    goto   COLD    ; go to beginning of program

    ORG    0x004    ; interrupt vector location
    retfie    ; return from interrupt

COLD
    bcf    STATUS,5    ; set page to 0 (RP0)
    bcf    STATUS,6    ; (RP1)
    call   InitREG    ; Initialise Register
    call   InitHW     ; Initialise HW
; -----
main
    movlw  0x0c
    movwf  KeyMask    ; Key1 and Key2 active

    call   WaitKeyReleased    ; Wait for ....
    clrf  RunCMD     ; deactivate all flagged functions

    movlw  .32
    call  WAIT      ; to ensure power OK and Keys ready

    incf   Colour, F    ; next Colour
    call   SA_SetColour ; and show it

    movlw  .32
    call  WAIT      ; wait some time
    ; as last command already send endofcmd

    bsf   KeyMask, Key1 ; Select Key1
    bcf   KeyMask, Key2 ; DeSelect Key2
    call  SetBitMap6432 ; Setup Address Pointer
    call  TrBitMap     ; Write Bitmap to Keys

    goto  main

#####
GetData
    movf  Pointer,w    ; Get address byte high
    movwf PCLATH      ; Set Address Byte high to point to Data
    movf  Pointer+1,w ; get address byte low
    movwf PCL         ; change Program counter to access data
;
IncPointer
    incf  Pointer+1,f ; increment address byte low
    btfsc STATUS,Z   ; do we need to correct address byte high
    incf  Pointer,f  ; if do it
    return
;

```

```

SetBitMap6432
    movlw    HIGH SA6432          ; get table address byte high
    movwf   Pointer              ; and set Pointer
    movlw   SA6432 & 0xff        ; get table address byte high
    movwf   Pointer+1            ; and set Pointer
    movlw   0x00                 ; set Byte Count for SA6432
    movwf   bcount
    return

;
TrBitMap
    bcf     INTCON,7              ; no Interrupts allowed
                                ; in order to ensure proper data transfer
    movlw   SA_CMD_WrDisplay      ; Start WriteDisplay sequence
    call    SAWrite               ; Transmit command
    movlw   0x00                  ; Addressnibble 0: 0
    call    SAWrite               ;
    movlw   0x00                  ; Addressnibble 1: 0
    call    SAWrite               ;
    movlw   0x00                  ; Addressnibble 2: 0
    call    SAWrite               ;

;
Trloop    call    GetData         ; get data of Bitmap
    andlw   0x0f                  ; as there is still the lower nibble
    call    SAWrite               ; and send to Key
    call    GetData               ; get same byte again
    andlw   0xf0                  ; only 4 bits allowed per transmit -SA
protocol
    movwf   tmp                   ; save data
    swapf   tmp,w                 ; data has to be in the lower nibble
    call    SAWrite               ; send next nibble of data

    call    IncPointer            ; Point to next Byte of Bitmap
    decfsz  bcount, F             ; Bitmap complete?
    goto    Trloop               ; no - nxt byte
    bsf     INTCON,7              ; allow Interrupts
    return

;*****
;
;          SAWrite
;*****
;
;
SAWrite    ; write Data = W to SA Key
    movwf  SABuf                  ; save Data to be send in SABuf

    movlw  .8
    movwf  SABitCount             ; set the #bits to 8

bitout
    btfss  SABuf,7                ; check MSB

```

```

    goto    bit_low          ; Skip if Bit was '0'
    bsf    PORTA, Key1      ; Set Data Line of selected Key (1/2) high
    bsf    PORTA, Key2      ; This can be done with both keys even not
selected!
    goto    sndbit
bit_low
    btfsc   KeyMask, Key1   ; if Key1 selected
    bcf    PORTA, Key1      ; send 0-bit to Key1
    btfsc   KeyMask, Key2   ; if Key2 selected
    bcf    PORTA, Key2      ; send 0-bit to Key2
sndbit
    bcf    SA_CLK           ; set clk low data is shifted in now
    bsf    SA_CLK           ; set clk high

    rlf    SABuf, F         ; rotate SABuf right
    ;
    decfsz SABitCount, F    ; 8 bits done?
    goto   bitout          ; no - nxt bit

    bsf    PORTA, Key1      ; Set Data Line of both Keys high
    bsf    PORTA, Key2      ; in case of auto clock

    retlw   0

end

```

If you have additional questions, please contact [techsupport@e3-keys.com](mailto:techsupport@e3-keys.com).

# NOTICES

## Copyright Notice

© 2011-2022 Copyright [E<sup>3</sup>] Engstler Elektronik Entwicklung GmbH. All rights reserved.

[E<sup>3</sup>], *The Third Evolution*<sup>™</sup> and *Legacy Mode*<sup>™</sup> are trademarks of [E<sup>3</sup>]. *The Keys to Intelligence*<sup>™</sup> is a trademark of I/O Universal Technologies, Inc. used with permission. All other trademarks are property of their respective owners.

No part of this publication may be copied, photocopied, reproduced, translated or reduced to any electronic medium or machine-readable form without the expressed written consent of [E<sup>3</sup>] Engstler Elektronik Entwicklung GmbH.

## Technical Notice

This datasheet is intended for technically qualified personnel trained in the field of electronics.

The knowledge of electronics and the technically correct implementation of the content of this datasheet are required for problem free installation, implementation and safe operation of the described product. Only qualified personnel have the required know-how to implement the specifications given in this data sheet.

For clarity, not all details regarding the product or its implementation, installation, operation, or maintenance have been included. Should you require additional information or further assistance, please contact your local [E<sup>3</sup>] distributor or [E<sup>3</sup>] Engstler Elektronik Entwicklung GmbH at [techsupport@e3-keys.com](mailto:techsupport@e3-keys.com). You may also visit our website at [www.e3-keys.com](http://www.e3-keys.com).

## Warranty Disclaimer

[E<sup>3</sup>] ENGSTLER ELEKTRONIK ENTWICKLUNG GMBH grants no warranty with respect to this data sheet, neither explicit nor implied, and it is not liable for direct or indirect damages. Some states do not grant the exclusion of incidental or consequential damages and, therefore, this statement may not be valid in such cases.

This data sheet has been produced with all due care. However, since errors cannot be excluded, [E<sup>3</sup>] Engstler Elektronik Entwicklung GmbH does not grant any warranty or accept any legal responsibility or liability in any form for erroneous statements herein.



# CHANGE HISTORY

Version	Date	Comments
1.2	10/31/19	New Format
1.3	06/30/20	New Formatting
2.0	06/20/22	Updated release document

**[E<sup>3</sup>] Engstler Elektronik Entwicklung GmbH**  
Industriering 7 • 63868 Grosswallstadt • Germany

[WWW.E3-KEYS.COM](http://WWW.E3-KEYS.COM)