Using the AccuStar® Serial Electronic Clinometer with a microcontroller

RoHS

Introduction

The AccuStar I 'Serial' output clinometer has been specifically designed to easily transmit its data to a microcontroller. This is accomplished through a three I/O interface. The output of the sensor resolves the angle of tilt to 17 bits of data. A complete handshaking routine is used in order to eliminate timing and transmission problems.

Procedure

STEP 1 = INITIAL CONDITIONS
The clinometer during power up will have its ready/working line low. The user will monitor this line waiting for it to go high (25 ms). The user request/hold line shall be low at this time.

STEP 2 = REQUEST DATA
User sets the request/hold line high, and monitors the ready/working line to see if the request was received.

STEP 3 = CLINOMETER ABOUT TO WORK
Clinometer ready/working line goes low to acknowledge request received.

STEP 4 = CLINOMETER GOES TO WORK
User detects the ready/working line has gone low, sets the request/hold line low, and monitors the ready/working line for a high (data ready).

STEP 5 = DATA READY
Clinometer sets ready/working line high to indicate data bit is ready for transmission.

STEP 6 = CONTROLLER READS DATA BIT
User detects ready/working line has gone high, reads the logic level value, and stores it in the appropriate register.

***** The user now repeats steps 2 thru 6 sixteen additional times for a total of 17 bits of data. The first bit indicates the polarity and is high for a clockwise rotation and low for a counterclockwise rotation. The second bit is DB15 and is the most significant bit. The following bits are DB14 thru DB0, and are in true magnitude form. With the scale factor being 1000 counts per degree, a decimal conversion of the data will give a direct indication of the angle (ie; 1000 counts = 1.000 degrees).

Notes

1) Averaging of eight or more readings improves repeatability.
2) Ignoring the clinometer for two seconds during data transmittal will cause a reset.
3) On power-up and reset the clinometer delays 25 ms.
4) The request/hold line has a pull down resister to allow for multiplexing. This eliminates false triggering.
5) Clinometer and user I/O grounds must be common.
6) The interface between the clinometer and the user I/O device must be at 5 volt CMOS or TTL levels.

Using the AccuStar® Serial Electronic Clinometer with a microcontroller

Sample assembly program

Part of an application program written for the Micro-chip PIC16C54 microcontroller is attached. The application was read from the serial clinometer and displayed the results on an LCD module.

```
;  PROGRAM CONTINUOUSLY READS SERIAL CLINOMETER AND STORES RESULTS IN
;  REGISTERS "POL, H_BYTE, AND L_BYTE"
;*************************************************************************
;Note: data line = RB,0
;      ready/working = RB,1
;      request/hold = RB,2

pol     equ     08
H_byte  equ     0B
L_byte  equ     0C
PIC54   equ     1FF
INDF    equ     0
RTCC    equ     1
PC      equ     2
STATUS  equ     3
FSR     equ     4
RA      equ     5
RB      equ     6
;*************************************************************************
; protocall
;*************************************************************************
protoc  bsf     RB,2            ; request start/data


wfw     btfsc   RB,1            ;see if slave is working
        goto    wfw
        bcf     RB,2            ; hold data


wfr     btfss   RB,1            ;see if slave is ready
        goto    wfr
                                ;measurment is finished or data
                                ;is ready

        RETLW   0
;
;*************************************************************************
;getdata
;*************************************************************************
getdata btfss   RB,1                    ;see if slave is ready
        goto    getdata


        call    protoc                  ; take measurement,polarity bit
        clrf    pol
        clrf    H_byte
        clrf    L_byte
        bcf     STATUS,0                ; clear the carry bit
        movf    RB,W                    ;read port
        andlw   01                      ;mask
        movwf   pol                     ;save polarity bit

        call    protoc                  ; db15
        movf    RB,W                    ;read port
        andlw   01                      ;mask
        iorwf   H_byte                  ;save  bit
```

Using the AccuStar® Serial Electronic Clinometer with a microcontroller

```
rlf     H_byte

call    protoc                  ; db14
movf    RB,W                    ;read port
andlw   01                      ;mask
iorwf   H_byte                  ;save  bit
rlf     H_byte

call    protoc                  ; db13
movf    RB,W                    ;read port
andlw   01                      ;mask
iorwf   H_byte                  ;save  bit
rlf     H_byte

call    protoc                  ; db12
movf    RB,W                    ;read port
andlw   01                      ;mask
iorwf   H_byte                  ;save  bit
rlf     H_byte

call    protoc                  ; db11
movf    RB,W                    ;read port
andlw   01                      ;mask
iorwf   H_byte                  ;save  bit
rlf     H_byte

call    protoc                  ; db10
movf    RB,W                    ;read port
andlw   01                      ;mask
iorwf   H_byte                  ;save  bit
rlf     H_byte

call    protoc                  ; db09
movf    RB,W                    ;read port
andlw   01                      ;mask
iorwf   H_byte                  ;save  bit
rlf     H_byte

call    protoc                  ; db08
movf    RB,W                    ;read port
andlw   01                      ;mask
iorwf   H_byte                  ;save  bit
bcf     STATUS,0                ; clear the carry bit

call    protoc                  ; db07
movf    RB,W                    ;read port
andlw   01                      ;mask
iorwf   L_byte                  ;save  bit
rlf     L_byte

call    protoc                  ; db06
movf    RB,W                    ;read port
andlw   01                      ;mask
iorwf   L_byte                  ;save  bit
rlf     L_byte

call    protoc                  ; db05
movf    RB,W                    ;read port
andlw   01                      ;mask
iorwf   L_byte                  ;save  bit
```

```
        rlf     L_byte

        call    protoc                  ; db04
        movf    RB,W                    ;read port
        andlw   01                      ;mask
        iorwf   L_byte                  ;save  bit
        rlf     L_byte

        call    protoc                  ; db03
        movf    RB,W                    ;read port
        andlw   01                      ;mask
        iorwf   L_byte                  ;save  bit
        rlf     L_byte

        call    protoc                  ; db02
        movf    RB,W                    ;read port
        andlw   01                      ;mask
        iorwf   L_byte                  ;save  bit
        rlf     L_byte

        call    protoc                  ; db01
        movf    RB,W                    ;read port
        andlw   01                      ;mask
        iorwf   L_byte                  ;save  bit
        rlf     L_byte

        call    protoc                  ; db00
        movf    RB,W                    ;read port
        andlw   01                      ;mask
        iorwf   L_byte                  ;save  bit
        bcf     STATUS,0                ; clear the carry bit

        RETLW   0

;*****************************************************************************
;               Main Program
;*****************************************************************************
main    nop
        movlw   08              ;bits 0,1,2 output, 3 input
        tris    RA
        movlw   0B              ;bits 2,4,5,6,7 output, 0,1,3 input
        tris    RB
        clrf    RB
        clrf    RA

;NOTE: ADD 50mS DELAY TO INSURE THE SERIAL CLINOMETER IS UP AND RUNNING

        call    getdata ;polarity in register pol, 1 = CW , 0 = CCW
                        ;DB15-DB7 in register H_byte
                        ;DB8-DB0 in register L_byte

        org     1FF
        goto    main

        END
```

Using the AccuStar® Serial Electronic Clinometer with a microcontroller

Measurement Specialties, Inc. (NASDAQ MEAS) offers many other types of sensors. Data sheets can be downloaded from our web site at: http://www.meas-spec.com/datasheets.aspx

*MEAS acquired Schaevitz Sensors and the **Schaevitz**® trademark in 2000.*

Technical contact information

NORTH AMERICA	EUROPE	ASIA
Measurement Specialties, Inc. 1000 Lucas Way Hampton, VA 23666 United States Phone: +1-800-745-8008 Fax: +1-757-766-4297 Email: sales@meas-spec.com Web: www.meas-spec.com	MEAS Deutschland GmbH Hauert 13 D-44227 Dortmund Germany Phone: +49-(0)231-9740-0 Fax: +49-(0)231-9740-20 Email: info.de@meas-spec.com Web: www.meas-spec.com	Measurement Specialties China Ltd. No. 26, Langshan Road High-tech Park (North) Nanshan District, Shenzhen 518057 China Phone: +86-755-33305088 Fax: +86-755-33305099 Email: info.cn@meas-spec.com Web: www.meas-spec.com