

Application Note

Using the AccuStar® Serial Electronic Clinometer output format with a PC



Introduction

The AccuStar I 'Serial' output clinometer has been specifically designed to easily transmit its data to an I/O card of a PC. 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 resistor 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.
- 7) Conversion times are 50 ms nominal.

Application Note

Using the AccuStar® Serial Electronic Clinometer output format with a PC

Sample basic program

Following is part of a test program written in QB45. The test system uses a PC, and a Keithley PIO-24 24-bit parallel digital I/O board.

```

BaseIO = &H380          'Initailize PIO-24 I/O card &H380
OUT BaseIO + 3, &H92    'Set PIO-24 port A & B as input and port C as output
FOR t = 1 TO 2000: NEXT t
C = 0                  'bit increment allows use of all 8 bits per port
HEXS = 2 ^ C          'bit variable
pass = 0              'error variable
CLS
OUT BaseIO + 2, &H0    'send low to hold port C all bits
FOR t = 1 TO 10000: NEXT t      'wait > 50 msec
pause = TIMER
DO
  A = INP(BaseIO) AND HEXS      'read ready bit wait until sensor is ready
  IF TIMER - pause > 5 THEN GOTO fail 'continue when A goes high
LOOP UNTIL A = HEXS
PRINT
PRINT "  Display each bit"
PRINT
FOR j = 16 TO 0 STEP -1          'bit output collection loop
OUT BaseIO + 2, HEXS            'send high to request information
pause = TIMER
DO
  A = INP(BaseIO) AND HEXS      'wait for working low
  IF TIMER - pause > 5 THEN GOTO fail 'continue when A goes low
LOOP UNTIL A = &H0

OUT BaseIO + 2, &H0            'send low to hold all bits of port C
pause = TIMER
DO
  A = INP(BaseIO) AND HEYS      'read ready bit wait for high
  IF TIMER - pause > 5 THEN GOTO fail
LOOP UNTIL A = HEXS

IF j = 16 THEN                  'read polarity bit
  pol = INP(BaseIO + 1) AND HEXS
  polbit = 1
  IF pol = 0 THEN polbit = -1
ELSE
  B = INP(BaseIO + 1) AND HEXS   'collecting output data PIO-24
  bout = bout + B / HEXS * (2 ^ j) 'sum bit values
END IF
IF j = 16 THEN B = pol
PRINT "  bit "; 2 ^ j; " = "; B / HEXS 'print value of each bit

NEXT j                          'return to read next bit
bout = bout * polbit            'assign polarity
PRINT
pass = 1
fail: IF pass = 0 THEN          'prints -9999 if sensor fails to respond
  bout = -9999
END IF
PRINT "  The Serial Clinomteter output is ", bout 'print total bit value
INPUT "  Hit Enter when finished ", ans$
END

```

Application Note

Using the AccuStar® Serial Electronic Clinometer output format with a PC

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

The information in this sheet has been carefully reviewed and is believed to be accurate; however, no responsibility is assumed for inaccuracies. Furthermore, this information does not convey to the purchaser of such devices any license under the patent rights to the manufacturer. Measurement Specialties, Inc. reserves the right to make changes without further notice to any product herein. Measurement Specialties, Inc. makes no warranty, representation or guarantee regarding the suitability of its product for any particular purpose, nor does Measurement Specialties, Inc. assume any liability arising out of the application or use of any product or circuit and specifically disclaims any and all liability, including without limitation consequential or incidental damages. Typical parameters can and do vary in different applications. All operating parameters must be validated for each customer application by customer's technical experts. Measurement Specialties, Inc. does not convey any license under its patent rights nor the rights of others.