

T60D Autocollimator Data Sheet (18 November 2016)

1.0 Introduction

The T60D is a compact digital autocollimator designed for use with a computer. Power input and data output are via a single USB 2.0 connection.

2.0 Manufacturer

Micro-Radian Instruments, 485 W Horton Road, Bellingham, WA 98226 USA

3.0 General Specifications

Beam diameter (nominal)	16 mm
Maximum recommended working distance*	500 mm
Recommended minimum target mirror size	25 mm diameter
Maximum calibrated measuring range*	±2500 arc-seconds (±0.69 degree)
Maximum measurement output rate (user-adjustable)	4000 readings-per-second
Output resolution	0.01 arc-second
Accuracy over entire measuring range (% of full scale)	>99.8%
Cross-coupling over entire measuring range (% of full scale)	<0.2%
Light source	red LED
Power input requirements	+5 VDC ±5%, 1 Watt
Operating temperature (calibrated)	20°C ±0.2°C
Operating/Storage temperature (maximum rated)	-40°C to +70°C

*Maximum working distance and maximum measuring range are not simultaneously achievable.

4.0 Housing

The standard T60 housing is used. It is machined from a solid block of 6061 aluminum and black anodized inside and out. The part number and serial number are permanently engraved on the bottom surface.

5.0 Electronics

The T60D contains digital electronics and outputs data via USB 2.0. The electronics include digital signal processing and a full calibration covering the entire measuring range of the device. The time average of the data and data units are user-adjustable.

6.0 Cable assembly specifications

Cable connector	USB 2.0
Cable length	3 meters
Cable shielding	internal metal braid
Cable jacket	overall black PVC
Connector pinouts	

Connector pin 1 = +5VDC \pm 5% input

Connector pin 2 = USB DM

Connector pin 3 = USB DP

Connector pin 4 = Power ground

7.0 USB output specifications

Maximum measuring range	\pm 2500 arc-seconds (\pm 0.69 degree)
Output resolution	0.01 arc-second
Output sampling rates (samples/second)	4000, 1000, 100, 10, 1, 0.1 and 0.01
Output units (user-adjustable)	arc-seconds or micro-radians
BIT output	0 or 1, corresponding to invalid (0) or valid (1) angle data
Output format	comma separated ASCII text
Output sequence for the 4000 and 1000 samples/second settings	

signed integer-only AZ data,signed integer-only EI data,BIT<carriage return>

For example:

+1234,-4321,1<carriage return>

Output sequence for 100, 10, 1, 0.1 and 0.01 samples/second settings

signed AZ data,signed EI data,BIT,signal level,head temperature<carriage return>

For example:

+1234.567,-7654.321,1,98,21.5<carriage return>

8.0 BIT (built in test) output

The BIT status output indicates whether the current data being sent by the autocollimator is valid or invalid. Invalid data will result if the mirror angle is out of range or if the autocollimator is otherwise not receiving a signal. The BIT output reads 1 when readings are valid and 0 when readings are invalid.

9.0 USB Port Commands

9.1 The following commands can be sent via the USB port to the autocollimator. Command letters are case-sensitive and only the command letter should be sent. Sending an additional character such as carriage return or line feed or an undefined character will be interpreted as an E command and will terminate data transmission.

9.2 To request data from the autocollimator, use one of the following three commands:

<u>Command</u>	<u>Result</u>
A	One reply is sent immediately
B	One reply is sent after a delay of one Output Average period
C	Replies are sent continuously at the rate of the Output Average period

9.3 To change any of the user-adjustable settings, use the following commands. The user-adjustable settings in use at the time that the autocollimator is powered down will be the default settings when the autocollimator is next powered up.

<u>Command</u>	<u>Result</u>
E	Stop data transmission
H	Set data units to Arc-Seconds
I	Set data units to Micro-Radians
O	Sends identification message
a	Set to output 4000 samples/sec (output averaging of 0 second)
b	Set to output 1000 samples/sec (output averaging of 0.001 second)
c	Set to output 100 samples/sec (output averaging of 0.01 second)
d	Set to output 10 samples/sec (output averaging of 0.1 second)
e	Set to output 1 sample/sec (output averaging of 1 second)
f	Set to output 0.1 sample/sec (output averaging of 10 seconds)
g	Set to output 0.01 sample/sec (output averaging of 100 seconds)

9.4 Identification message

The identification message reply from sending the O command includes information specific to the autocollimator. The format of the identification message is as follows:

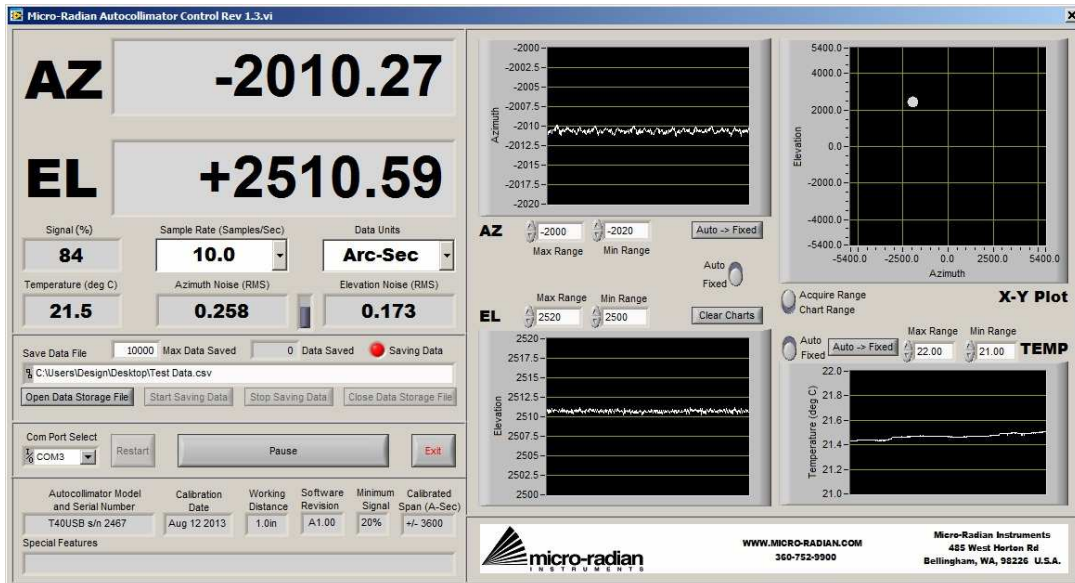
(U1AI) message identifier, autocollimator model and serial number, last calibration date, working distance, autocollimator software revision, output averaging, units, required minimum signal %, calibrated span, special calibration message

For example:

U1AI,T60D s/n 1234,MAR 18 2013,2.0 in,A1.00,0.1 sec,Arc-Sec,20,2500,Special Calibration Message

10.0 Graphical User Interface (GUI)

The autocollimator includes a USB driver and LabView-based GUI suitable for Windows XP, Vista, 7 and 8. All USB port commands can be controlled by the GUI, and data from the autocollimator is displayed numerically and graphically.



11.0 Modulation and Sampling

The optical head light source is modulated at 4 kHz and the autocollimator samples once per modulation cycle at all times regardless of the user-adjustable settings. This is one sample every 250 microseconds. The modulation source is built-in. No external modulation source is required.

For the USB output, the time period average (moving average) of this oversampled data is user adjustable. For example, the 1 sample/sec setting gives the moving average of the last 1 second of data with a delay of 250 microseconds. The maximum data rate from the USB output is 4000 samples/sec with a 250 microsecond delay.

