

Solar Observation

Survey **Solar Observation**

The Solar Observation screen is used to compute the azimuth to an arbitrary backsight based on the position of a celestial body; typically the sun.

WARNING! Direct viewing of the sun without a proper filter will cause serious eye damage. Pointing a total station directly toward the sun without a solar filter can also damage the EDM components.

Find Azimuth Using Ephemeris Data: select this method if you plan to enter data from an ephemeris.

Find Azimuth Using Date and Time: select this method if you do not plan to use an ephemeris.

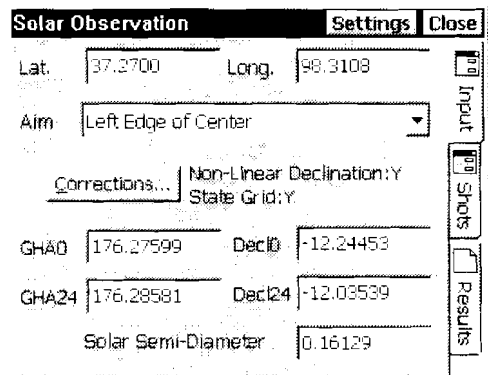
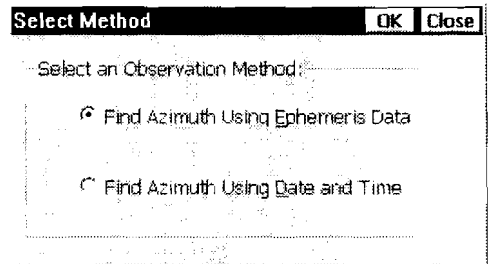
Note: The fields within the Solar Observations screen will vary depending on the method selected above. All of the fields from each method are described below.

Settings: located at the top of the screen, is a shortcut to the Date/Time Settings screen (Page R-36).

Lat. / Long.: is the latitude and longitude of the total station. These values can be scaled from a map, such as a U.S.G.S. 7.5-minute quadrangle sheet or collected with a handheld GPS unit.

Aim: selects the portion of the celestial body that where you intend to aim. You can select Left Edge of Center, Center, or Right Edge of Center.

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Note: Typically Left Edge of Center is selected when performing a sun shot in the northern hemisphere and Center is selected for star shots.

Corrections		OK	Close
<input checked="" type="checkbox"/>	Non-Linear Declination Correction		
<input type="checkbox"/>	Correct to Grid	<input type="checkbox"/>	Use Zone Constant
<input type="text" value="0000"/>	<input type="text" value="000"/>		
Center Meridian	Zone Constant		

Corrections: displays which corrections are currently selected with an N for no, or a Y for yes. When tapped, the **Corrections** dialog box opens where the following corrections are configured.

- Non-linear Declination Correction:** applies a correction for the linear interpolation of the declination of the sun for the time that an observation is taken. This error is usually negligible, but is removed when this is checked. (This should only be checked when performing sun shots.)
- Correct to State Grid:** when selected, the computed azimuth is referenced from the local State Plane grid rather than true north.
- Center Meridian / Zone Constant:** these values are used to adjust the computed azimuth to the local State Plane grid. Appendix A lists these values for the United States.

GHA0: is the Greenwich Hour Angle of the sun at zero hour Universal Time, Greenwich, on the current date.

Decl0: is the declination of the sun at zero hour on the current date.

GHA24: is the Greenwich Hour Angle of the sun at zero hour Universal Time, Greenwich, on the following day (24-hours later).

Decl24: is the declination of the sun at zero hour on the following day.

Solar Semi-Diameter: is the semi-diameter of the sun, expressed in minutes and seconds.

Shots

Number of sets: is the number of sets that will be taken to the celestial object.

Reverse Shots : When checked, reverse shots will be required with each set. When unchecked, only direct shots are required.

Shoot: accesses the Enter Shot Data screen, described below, where the shot data is entered for the selected observation.

Toss / **Incl**: will toggle the selected observation so that it will be hidden or un-hidden, respectively. When an observation is hidden, it will not be used when calculating the final azimuth.

Dir	Azimuth	UT1 Time	H. Ang
<input checked="" type="checkbox"/> BD	---	---	0°00'0"
<input checked="" type="checkbox"/> D1	353°10'23"	07:12:25.003	241°43'
<input checked="" type="checkbox"/> D2	353°10'27"	07:13:07.001	241°51'
<input checked="" type="checkbox"/> D3	353°09'52"	07:13:39.002	241°57'
<input checked="" type="checkbox"/> BP	---	---	180°00'
<input checked="" type="checkbox"/> R2			

At the bottom of the dialog are buttons for 'Shoot', 'Toss', 'Incl', and 'Reset'. On the right side, there are vertical buttons for 'Input', 'Shots', and 'Results'.

Note: The **Toss** / **Incl** buttons perform the same function as checking / un-checking the checkbox in front of each observation.

Note: A backsight observation cannot be tossed.

Del: permanently deletes the most current observation if it is selected allowing you to shoot that shot again.

Reset: permanently deletes all observations. A warning prompt will appear before the observations are deleted.

The Enter Shot Data Dialog Box

Enter Shot Data - Backsight Direct						OK	Close
Horizontal Angle:	0.0000						
Current Date/Time	01/01/2000		13:22:43		DUT: 0.0		
Date:	MM	DD	YYYY				
	01	01	2000				
Time:	Hrs To GMT	HH	MM	SS	sss		
	0	13	22	43	000		
Take Shot		Get Local Time					

Horizontal Angle: displays the horizontal angle measured by the total station. This value is updated with the **Take Shot** button, described below.

Current Date / Time: displays the current date, time, and DUT. These settings can be changed from the Date/Time Settings screen (Page R-36).

Date: if incorrect, the current date should be entered here.

Time: is where the precise time that the observation occurred is entered.

Hrs to GMT: is the number of hours that the time at the current location differs from Greenwich Mean Time.

Take Shot: records the horizontal angle from the total station.

Get Local Time: fills in the Time field with the current time that is set in the data collector. This function is not available when shooting the backsight.

Sun Shot Procedure Summary

1. Point the telescope ahead of the path of the sun and lock the horizontal movement of the total station.
2. Immediately record the horizontal angle from the total station using the **Take Shot** button.
3. When the target becomes properly aligned with the crosshairs, record the current time as accurately as possible. The time can be automatically read from the data collector using the **Get Local Time** button, or measured from an external time piece and manually entered in the appropriate fields.
4. When finished, tap the **OK** button to complete the current observation.

When all observations are complete, the Results page displays the computed azimuth to the backsight.

Results

BS D/R: is the horizontal angle recorded to the backsight for the particular direct/reverse observation.

Azi D/R: is the computed azimuth to the backsight for the particular direct/reverse observation.

Avg: is the computed average azimuth of the backsight, relative to true north.

Grid Avg: is the computed average azimuth of the backsight, relative to the local State Plane grid. This field is only displayed when a state grid correction is applied.

Note: See the User's Manual for more information on the usage of the Solar Observation routine.

Solar Observations

The Solar Observation screen is used to compute the azimuth to an arbitrary backsight based on the position of a celestial body, typically the sun.

You can either use the time set in the system clock on the data collector or an external timepiece. Whichever you choose, you should calibrate it against Coordinated Universal Time shortly before performing the solar observation. An accurate timepiece is critical when performing solar observations.

Two solar observation methods are available. One method requires data taken from an ephemeris and the other method does not. The example below illustrates performing a sun shot using ephemeris data since that method requires additional steps.

WARNING! Direct viewing of the sun without a proper filter will cause serious eye damage. Pointing a total station directly toward the sun without a solar filter can also damage the EDM components.

Performing a Sun Shot

1. Setup over a point with known or assumed coordinates and aim the total station at the backsight point to where you want to determine the azimuth.
2. From the Main Menu, select Survey, Solar Observation.
3. A dialog will open asking you to select an observation method. For this example, select the Find Azimuth Using Ephemeris Data option and tap OK.

Solar Observation		Settings	Close
Lat.	37.2700	Long.	98.3108
Aim	Left Edge of Center		
Corrections...	Non-Linear Declination:Y State Grid:Y		
GHA0	176.27599	Decl0	-12.24453
GHA24	176.28581	Decl24	-12.08539
Solar Semi-Diameter	0.16129		

4. Enter the latitude and longitude for your occupy point in the Lat. and Long. fields, respectively.

Note: Your latitude and longitude should have enough accuracy if it is scaled from a topographic map or measured using a handheld GPS unit.

5. In the Aim field, select the area of the celestial body where you plan to take your measurements. For sun shots, the trailing edge is usually used. (The left edge when in the northern hemisphere.)
6. Tap the **Corrections...** button if the correction settings displayed to the right of the button need to be changed.
 - If performing a sun shot, check the Non-Linear Declination Correction checkbox. (Leave it unchecked for star shots.)
 - Check the Correct to State Grid checkbox if you want the computed azimuth corrected to align with the local state plane coordinate system.

Note: The Central Meridian and Zone Constant values for the United States are provided in Appendix A of the Reference Manual.

7. Refer to a current ephemeris and fill in the remaining five values. When the screen is correctly filled in, tap the Shots tab.

Note: The GHA0 and Decl0 values are read from the ephemeris for the current date. The GHA24 and Decl24 values are listed in the ephemeris for the following day. The semi-diameter is in minutes and seconds so your value will look something like 0.16084.

8. Tap the **Shoot** button to open the Enter Shot Data screen.

- Enter the correct hours to GMT in the Hrs To GMT field, aim toward the backsight and tap **Take Shot** to record the horizontal angle to the backsight. (The azimuth to this point will be computed at the end of the routine.)

Enter Shot Data - Sun Shot Direct OK Close

Horizontal Angle 0.00000

Current Date/Time 12/07/1999 08:03:29

DUT: 0.0

Date MM DD YYYY

12 07 1999

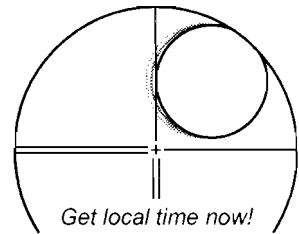
Time Hrs To GMT HH MM SS sss

-8 08 03 00 000

Take Shot Get Local Time

Note: The hours to GMT will be between -5 and -8 when in the continental United States.

- WITH A SOLAR FILTER INSTALLED,** aim ahead of the path of the sun so that the trailing edge has not yet contacted the vertical crosshair in the scope and tap **Take Shot** to record the current horizontal angle.
- Watch the movement of the sun in the scope. As soon as the trailing edge of the sun contacts the vertical crosshair, either tap the **Get Local Time** button or use an external timepiece and note the precise time. (When using an external timepiece, manually key in the noted time in the HH, MM, SS, sss fields.)



- Tap **OK** to continue. You will return to the **Solar Observation** screen and the computed azimuth for each shot taken is displayed with other shot information.

Solar Observation Settings Close

Number of sets 3 Reverse shots

Dir	Azimuth	UT1 Time	H.Ang
<input checked="" type="checkbox"/> BD	---	---	0°00'0"
<input checked="" type="checkbox"/> D1	353°10'23"	07:12:25.003	241°43
<input checked="" type="checkbox"/> D2	353°10'27"	07:13:07.001	241°51
<input checked="" type="checkbox"/> D3	353°09'52"	07:13:39.002	241°57
<input checked="" type="checkbox"/> BP	---	---	180°00
<input checked="" type="checkbox"/> R2	---	---	---

Shoot Reset

Note: You can delete and re-shoot the last shot taken by selecting it and tapping the **Del** button. This is useful if the last shot was in error.

- If additional shots are remaining, the next required shot will be selected. Tap **Shoot** to access the **Enter Shot Data** screen to take the next shot.
- Repeat Steps 10 through 12 until all forward and reverse shots have been performed.
- After completing all shots, you can scan down the list and view the computed azimuth for each one. If any of the azimuths appear incorrect, you can have those shots excluded from the

computed average azimuth from all shots. To exclude a particular shot, select the shot and then either tap the checkbox next to the shot or the **Toss** button. (You can include the shot again by selecting it and re-checking the checkbox or tapping the **Incl** button.)

Solar Observation		Settings	Close
BS: D	0°00'00"	<input type="checkbox"/>	<input type="checkbox"/> Input <input type="checkbox"/> Shots <input type="checkbox"/> Results
Azi: D	353°10'23"	<input type="checkbox"/>	
Azi: D	353°10'27"	<input type="checkbox"/>	
Azi: D	353°09'52"	<input type="checkbox"/>	
BS: R	0°00'05"	<input type="checkbox"/>	
Tossed!	352°47'32"	<input type="checkbox"/>	
Azi: R	353°07'10"	<input type="checkbox"/>	
Azi: R	353°06'31"	<input type="checkbox"/>	
Avg:	353°08'53"		

16. Tap the **Results** tab to view the average computed azimuth to the selected backsight.

What to Do Next

With the azimuth to the backsight known, you can now perform the following steps to begin your survey.

1. Without moving from the occupy point used while performing the solar observation, note the computed average azimuth from the **Solar Observation Results** screen.
2. Access the **Survey**, **Backsight Setup** screen from the **Main Menu**.
3. Toggle the **BS Point** / **BS Direction** button to **BS Direction** and enter the computed azimuth in that field.

Tip: You can use the **▼** power button and select the Past results... option to select and automatically enter the azimuth computed from the sun shot earlier. You can also access Past Results from the **Ctrl** - **[J]** hotkey.

4. Fill in the remaining fields with your current information and tap **Solve**.
5. Access the **Survey**, **Traverse / Sideshot** screen from the **Main Menu** (or use the **Ctrl-[R]** hotkey), aim toward the backsight used during the solar observation, zero your horizontal angle on the total station and tap either **Side Shot** or **Traverse**. The data collected should be aligned correctly with true north or your local state plane coordinate system.