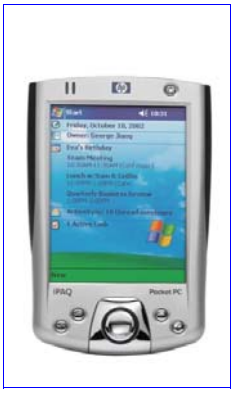
Prosurv cEZ

Digital Level Guide



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Thank you for purchasing the Digital Level Add-on module for Prosurv cEZ!

Two modes of operation

The Digital Level routines in Prosurv cEZ can operate in two modes:

- Direct connection via cable with your Digital Level instrument. With one button-tap, Prosurv cEZ instructs your Digital Level to shoot the rod, waits for the data to return, then stores the raw data and computes the elevation automatically.
- Manual mode

You can combine your Digital Level measurements with manual readings at any time. A simple check box allows you to use the Leveling routines in manual mode whenever needed.

Raw Data and Coordinate Data

Prosurv cEZ treats Level shots just like any shot collected with a total station. When you take a shot, Prosurv cEZ stores data in both the raw data table, and the coordinate data table of your Prosurv cEZ job. Here's how it works:

Note: A Prosurv cEZ job file that you create contains several "tables", including a Raw Data table and a Coordinate table.

- When using a Digital Level, the instrument provides Prosurv cEZ with the **Distance** to the rod and the **Mid-wire** reading. Prior to each shot, Prosurv cEZ allows you to enter a Vertical Offset which is added to the mid-wire reading. Prosurv cEZ stores this and other vital data in the Raw Data table of your job.
- The computed elevation of the point is stored using the next Auto Point Number as a new point in the coordinate table. "Bogus" coordinates are assigned to the point's Northing and Easting. This means you can treat Level points just like regular coordinate points! You can then easily export your Level points just like you would with your coordinate points.
- You can intermix your Level and Total Station data in the same job.

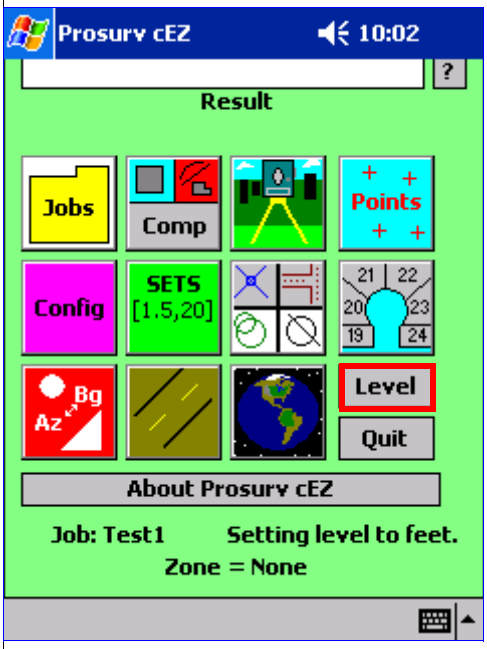
What can I do with Prosurv cEZ and the Digital Level routines?

Prosurv cEZ's powerful leveling routines make quick work of your Level jobs. Prosurv cEZ offers the following Digital Level features:

- Shoot a Backsight BM or any point to establish your HI
- Re-Shoot your Backsight at any time
  - To "check-in" at the end of your Setup
  - After breaking for lunch, but backsighting the same point (New Setup)
- Continue to the Sideshot/Turn or Staking routines without having to re-shoot your Backsight, even after leaving the routines, or leaving the job (remembers your current Setup and HI)
- Use the Sideshot/Turn routine to run a complete level circuit, with or without Sideshots, all from the same routine. Turns are automatic—just tap the **Turn** button to shoot the Foresight. The Setup screen is displayed and waits for you to move up. Once you've moved up, just tap the Continue button to shoot the point you just turned on. A new Setup is established and the new HI is displayed.
- Collect important elevation data by taking multiple Sideshots at will. The Digital Level routines have the same **Pop Up Quick Codes** and **Feature Codes** capabilities as when shooting with your Total Station!
- Take Check Shots on known elevation points (ie TBM's) just by entering the point # that already exists as your Foresight point and selecting **Check Shot**. An elevation comparison is displayed.
- To make balancing your level circuit distances easier, your cumulative Backsight and Foresight distances are displayed. Also, when making a Turn, Prosurv cEZ displays the Foresight distance and allows you to accept or reject the shot (Yes or No). Then, you can instruct your rod person to "keep going" until the desired distance is reached.

- You can use the Prosurv cEZ Digital Level routines to **Stake** elevation-critical **points**!
  - Enter a point list, or a pre-defined SET of points to be staked
  - The elevation of each point being staked is used as the "proposed grade" for the stakeout
  - You can pre-select from a list of descriptions such as "Top of Curb" to indicate what you're staking to
  - You can also stake sequentially, up or down, by entering a + or - after one point number, such as 52+
  - You can turn on any staked point after recording the staked point. Prosurv cEZ remembers where you left off, whether given a point list, or staking sequentially
  - Each recorded point is stored in the Prosurv cEZ coordinate table of your job, just like when staking using a Total Station. So, you can just export your points and have an instant "cut sheet", since the description of each point contains the Cut/Fill and Staked Point # information.
  - You can Skip+ or Skip– through the point list or sequentially

Using Prosurv cEZ's Digital Level Routines

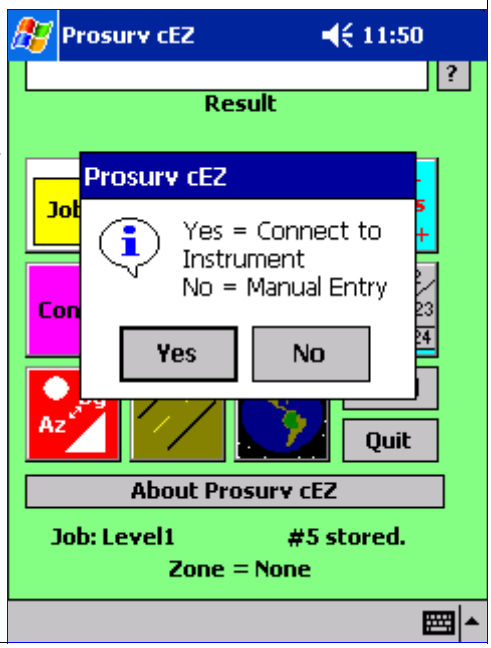


Once you've created a job, you can tap the **Level** button to begin.

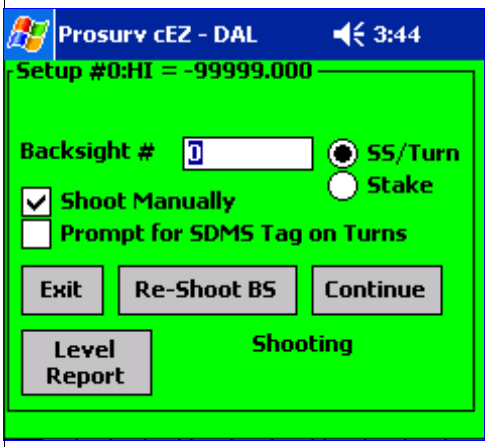
When you tap the **Level** button, Prosurv cEZ asks you if you're connected to an instrument (Digital Level). If you are, answer Yes. If not, or you wish to use the Digital Level routines in **manual** mode, then answer No.

When you tap **Yes**, Prosurv cEZ will send a signal to the Digital Level to change to the units of your Prosurv cEZ. For example, if your job is in US Foot (you can set your job Units in the purple **Config** routine), Prosurv cEZ will instruct your Digital Level to measure in US Foot.

This also acts as a way to verify that you have communication with your Digital Level. Many Digital Levels will beep when their units are changed.

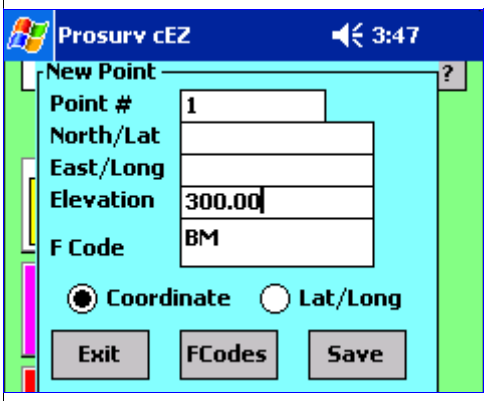


The Digital Level Setup Display

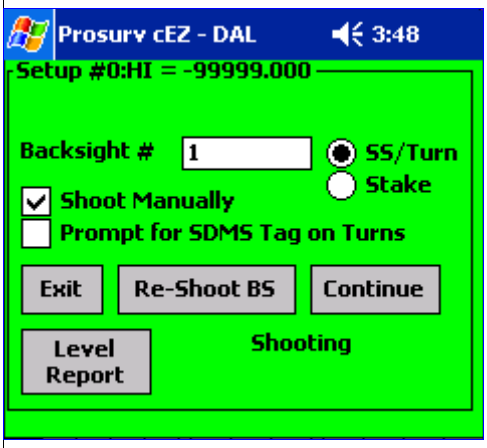


When you first enter the Digital Level routines, you will see the Setup display. When starting out, the display will show Setup #0, Backsight #0.

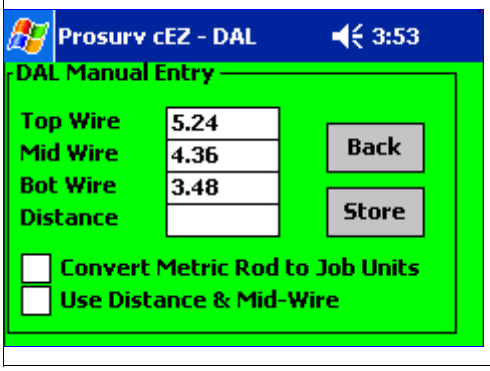
You'll need to enter a valid Backsight point # to begin. If the point exists, just tap the **Continue** button to shoot the Backsight. If the point doesn't exist, tapping the **Continue** button will cause the standard point entry screen to pop up.



You may now enter the coordinates and elevation for the point. If you ignore the Northing and Easting fields, Prosurv cEZ will automatically fill these fields with bogus coordinates when you save the point. Just enter your elevation and description and tap **Save**.



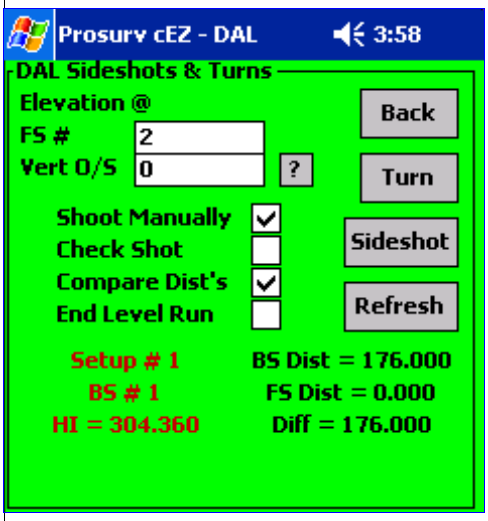
You're now ready to take your Backsight shot on your Benchmark. Just tap the **Continue** button to shoot your Backsight. If you're shooting in manual mode, the Digital Level Manual Entry screen will appear. If you're connected to a Digital Level, be sure the **Shoot Manually** checkbox is not checked, and Prosurv cEZ will activate the instrument to shoot the rod.



The Manual Entry screen is shown here. Simply enter your Top, Mid, and Bottom wire readings to complete the 'shot'. More information about using Manual Entry is found later in this guide.

If using a Digital Level, the rod is shot and the new Setup is stored automatically.

Digital Level Sideshots and Turns



Once you've completed the Setup, the Sideshot and Turns window will appear. In this routine, you can:

- Continue your level circuit by turning on a point
- Take multiple Sideshots
- Perform check shots on known points
- Mark the next shot as the end of the level run
- Turn on known points

- Tap the **Back** button to go back to the Setup display
- Tap the **Turn** button to shoot a Foresight and Turn on that Foresight shot
- Tap the **Sideshot** button to shoot a Foresight without Turning
- Tap the **Refresh** button to refresh your cumulative BS and Foresight Distances (of your current level run)
- The **Vert O/S** amount can be used to shoot culverts or other objects where the rod itself is not long enough to obtain a reading. For example, you could measure down from the top of a headwall to the bottom of the culvert, then enter that amount in the Vert O/S text box. Then take the shot on the rod with the rod resting on the top of the headwall. The Vertical Offset entered will be added to the mid-wire reading of the rod, and the elevation will then be determined and stored with the new point.
- The Current Setup information is displayed for your convenience

Sideshots

Tapping the **Sideshot** button lets you take as many shots as you need from the current Setup. The Auto# is used for each Sideshot. During the Sideshot, you can select from the Pop Up Quick Codes list, or the full Feature Code list, as well as be prompted for Attribute information (such as a Benchmark's Name, Stamped Elevation, and Date), the same as when using Prosurv cEZ with a Total Station.

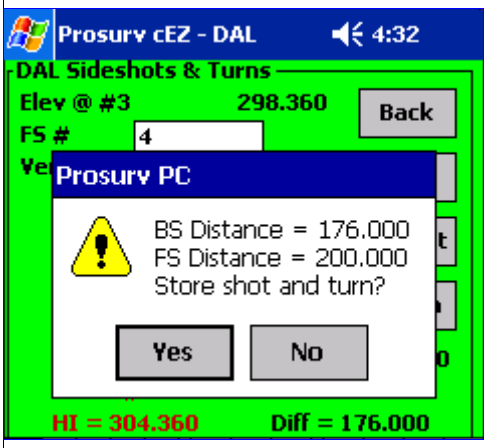
When the instrument has completed shooting the rod, Prosurv cEZ will store the Raw Data and compute and store the coordinate (elevation) data. This will allow you to quickly and easily shoot grade-critical points with your Digital Level, such as needed when cross-sectioning runways.

If you check the **Check Shot** box, the Sideshot's elevation will be compared to the given Foresight point #. For example, if you enter **10** for the Foresight point, when the shot is taken, the computed elevation of the shot is compared to the elevation of point #10. The comparison is displayed, and the new point (shot point) is stored using the next auto point number.

If the **Check Shot** box is ***not checked***, and ***if the Foresight point # already exists,*** Prosurv cEZ will display a comparison of the elevations of the shot point vs. the 'known' point, ***and allows you to OVERWRITE the elevation of the known point***.

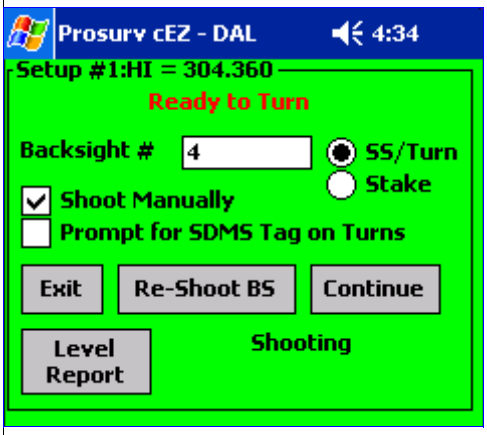
Turns

Turning on a point with Prosurv cEZ and your Digital Level is virtually automatic. Simply tap the **Turn** button to shoot the Foresight. Once the Foresight is shot, Prosurv cEZ takes you right to the Setup screen, and waits for you to 'move up'.



If the **Compare Distances** box was checked prior to the shot, then you'll be given the opportunity to reject the shot, if the distance to the shot does not meet with your approval. This is useful if you're trying to keep your Backsight and Foresight distances balanced during your level run.

The example shown here indicates that your Foresight distance is 24' longer than your Backsight distance. You could instruct the rod person to walk back towards the instrument 24' in order to balance the shots. Simply tap **No**, and you will be able to re-shoot the Foresight. Tap **Yes** to use the Turning point that was shot.

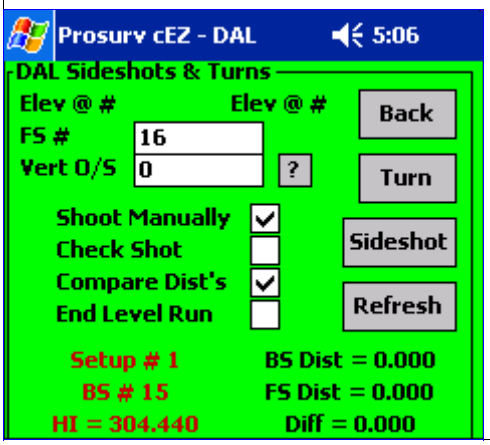


As the instrument operator, once you've 'moved-up', all you need to do is tap the **Continue** button. Prosurv cEZ will activate the instrument to shoot your Backsight.

Once the new Backsight is shot, Prosurv cEZ takes you right back to the Sideshot/Turn screen.

Establishing Vertical Control on Known Points

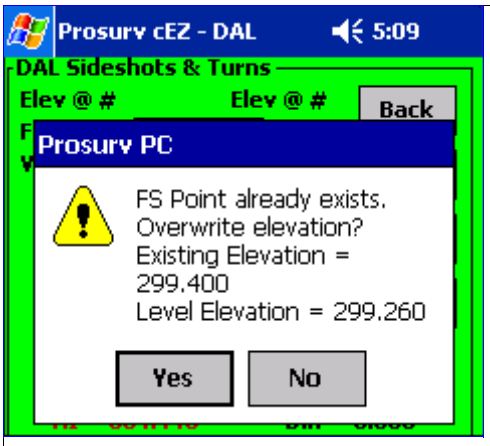
Prosurv cEZ Digital Leveling includes a very useful tool that let's you run a level circuit through known (or already established) control points. For instance, let's say you've set control points down a road, five points in all, numbered 15-19. You may have used RTK GPS or a Total Station to establish your Horizontal control on the points. Each point already has an elevation, but you'd like to establish better vertical control on the points by using your Digital Level.



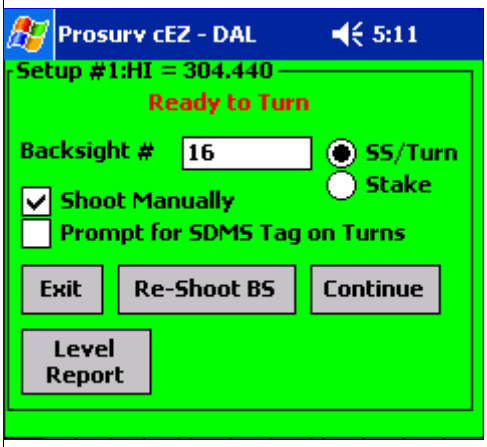
The points are spaced fairly evenly, and you plan on starting your level run by backsighting #15 and turning on each consecutive point. **By simply entering the point # of each existing point, and tapping the Turn button, Prosurv cEZ will allow you to overwrite the elevation of the existing point with the level elevation, and will use the level elevation for the turn!**

When you're done, points 15-19 will have 'good' level elevations.

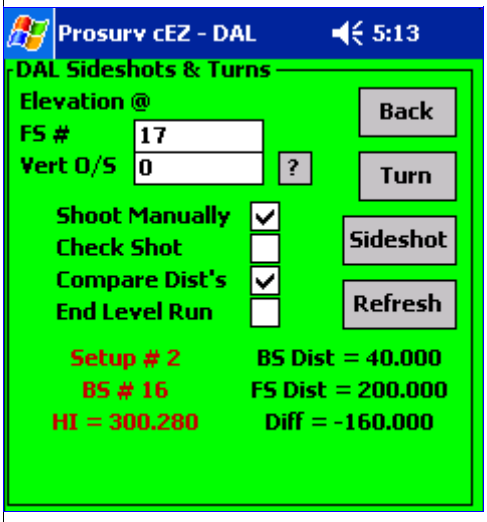
Just enter #16 as the Foresight # for your Turn...



A message allows you to overwrite the existing point's elevation with your level elevation. And, since you're turning on the point, by answering **Yes**, you will be turning using the new level elevation.

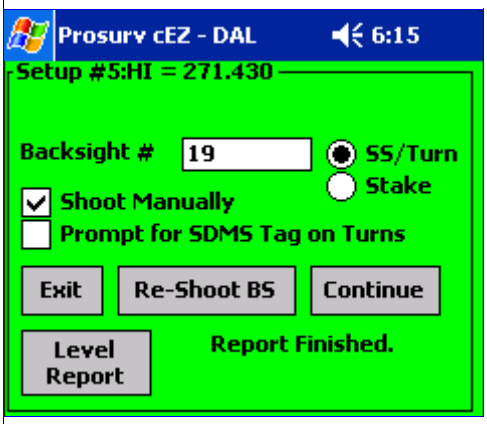


You're now ready to turn on point #16, using the point's new elevation.



To continue using the existing points, simply enter 17 for your next foresight point, and tap **Turn** when you're ready to go.

Continuing with a Setup



If you leave the DAL routines, or even if you switch jobs, Prosurv cEZ remembers where you left off in your level run, and which Setup you're currently on.

So, as long as you haven't picked up your instrument, you can continue with the same Setup simply by tapping the **Continue** button.

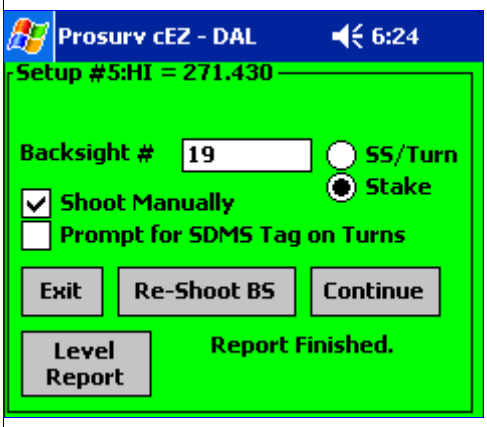
If the Backsight point # is the same as your current Backsight point, Prosurv cEZ will go directly into the SS or Stake screen. If you change the Backsight #, or the Backsight hasn't been shot yet, Prosurv cEZ will shoot the Backsight.

Re-Shooting your Backsight

If you've picked up your instrument, but need to shoot the same backsight, simply tap the **Re-Shoot BS** button. Prosurv cEZ will take a new shot on your Backsight and store a new Setup.

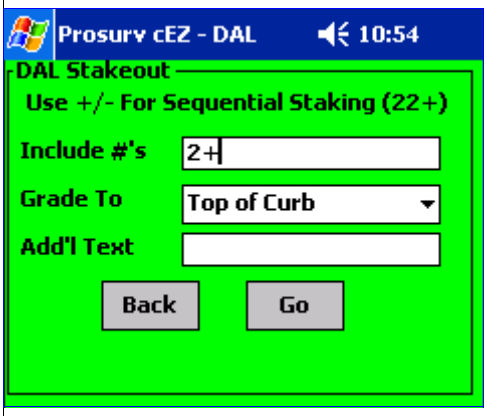
Staking Points with a Digital Level

The Prosurv cEZ Digital Level routines contain a powerful Stakeout function. First, you establish a Setup using the Setup routine. Click on the **Stake** option, then tap **Continue** to shoot your Backsight point.



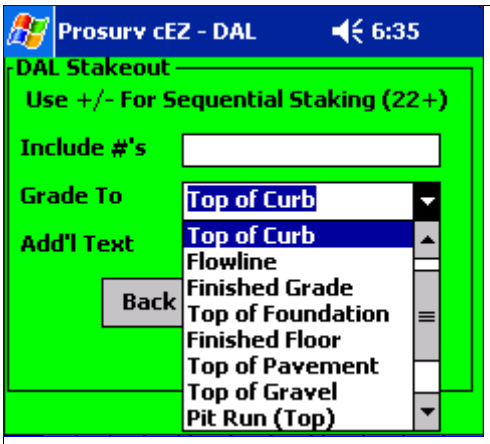
Using your Digital Level and Prosurv cEZ's DAL staking routine, you can perform elevation-critical grading for any construction project in record time.

For example, you may have a project that requires Top of Curb grades for 1000' of new curb. You've already used a Total Station and Prosurv cEZ to set the offset hubs, and now you need high-accuracy cuts/fills on those hubs.



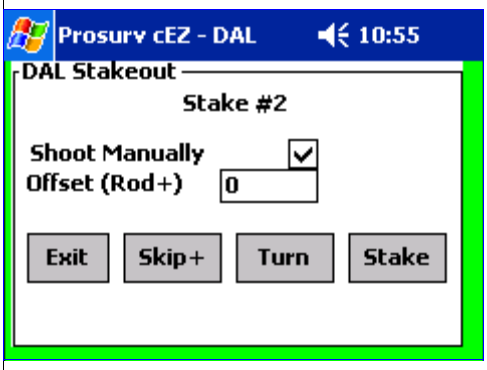
Using the DAL Stakeout routine is really not much different than using the Radial Stakeout routine with a Total Station. First, you enter the points that need to be staked:

- Enter a point list such as **3,5,10.15**, or
- Sequentially stake up by entering a +, such as **2+**
- Sequentially stake down by enter a -, such as **520-**
- Stake a pre-defined **SET** of points, such as **;5** (SET #5)



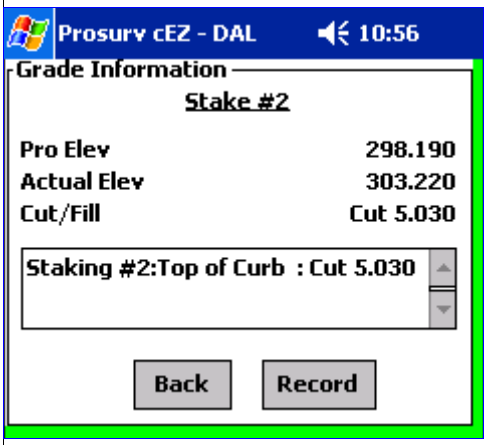
Just like the Radial Stakeout routine, Prosurv cEZ lets you pre-select descriptors for the staked points that will automatically appear when you record the shot.

Tap the **Go** button to begin staking.



Tap the **Stake** button to shoot the rod.

You can Skip through your point list, or consecutively one up or one down by tapping the **Skip+** (or **Skip-**) button.



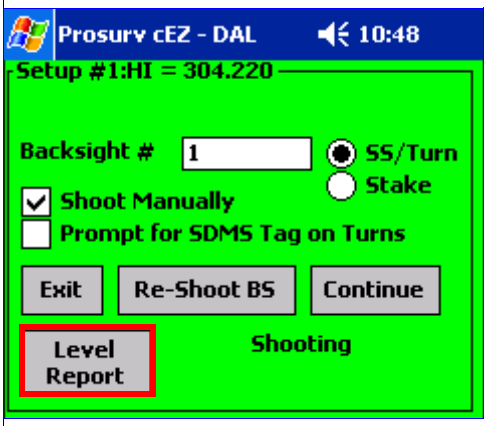
Once the rod is shot, the grading information is displayed. Note the Cut/Fill and the automatic descriptor. If you **Record** the shot, Prosurv cEZ stores the data as a new point, using the Auto Point #. Prosurv cEZ now moves on to Stake point #3 (since 2+ was entered as the point list).

Turning on a Staked Point

If you need to turn on a point being staked, for example, if you've reached the distance limit of the digital level, simply tap the **Turn** button instead of the **Stake** button. The grade information is displayed, just like when staking the point, but after recording the shot, Prosurv cEZ automatically displays the **Setup** screen, allowing you to re-shoot the hub as your new Backsight point. Prosurv cEZ even remembers where you left off in the Stakeout routine, so you can just continue shooting your grades!

Obtaining Your Level Data

Prosurv cEZ stores the raw level data, such as mid-wire and distance information, in your job's Raw Data Table. The raw level data is in the same location as your Total Station raw data. So, you can simply use the **Export Raw Data as Text File** routine to view all of your raw level data.



In addition to the Raw Data export, you can export your raw level data as a **Level Report**.

The Level Report gives a nicely formatted text file that displays the Raw Data of your Setups, Turns, Sideshots, and Staked Points.

Level Report Example

\My Documents\Jobs\Level4.cez Level report 11/16/03 6:13:13 PM

****

Setup #1 HI=304.440 BS #15 Mid=4.440 Off=0.000 Dist=162.000 BS Elev=300.000

Turn #16 Mid=5.180 Off=0.000 Dist=200.000 Elev=299.260

****

Setup #2 HI=300.280 BS #16 Mid=1.020 Off=0.000 Dist=40.000 BS Elev=299.260

Turn #17 Mid=10.920 Off=0.000 Dist=248.000 Elev=289.360

****

Setup #3 HI=291.910 BS #17 Mid=2.550 Off=0.000 Dist=100.000 BS Elev=289.360

Turn #18 Mid=17.100 Off=0.000 Dist=200.000 Elev=274.810

****

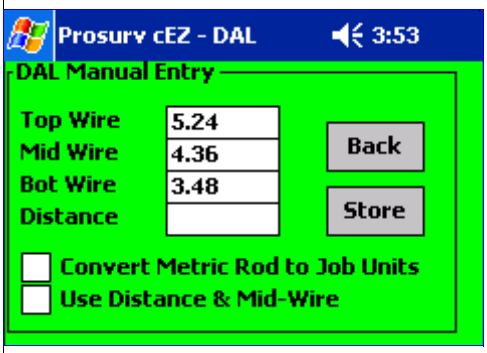
Setup #4 HI=279.780 BS #18 Mid=4.970 Off=0.000 Dist=40.000 BS Elev=274.810

Turn #19 Mid=11.650 Off=0.000 Dist=96.000 Elev=268.130

Level Elevation Data

Prosurv cEZ reduces each Digital Level shot instantly, and records each elevation as a new point in your job's coordinate table. So, obtaining your Digital Level elevations is **simply a matter of exporting your points.**

Notes About Manually Entering Level Data



Prosurv cEZ performs a check against your manually-entered raw data. It compares the difference between your Top and Mid-wire readings vs. your Mid-wire and Bottom Wire readings.

If the difference between them is greater than your DAL Tolerance, then you will be prompted to re-enter one or more readings. **This DAL Tolerance amount can be found and edited in your ProsurvCE_Defaults.txt file.**

Note that if you're used to working in US Foot, you most likely would enter the data to two decimal places, or hundredths of a foot. If working with Metric, you'll most likely be entering data to one mm, which is three decimal places. So, if using Metric, you may want your tolerance to be 0.003mm, but if you're using Feet, you may want the tolerance set to 0.02 or 0.03'. The number that appears in the defaults file is not units-related, so you need to enter the exact tolerance number that suits your needs.

Many, if not all Digital Level rods are metric. So, when reading the rod manually and working in Foot elevations, you can have Prosurv cEZ automatically convert the rod units to your Job's units.

Finally, you can use a Distance and Mid-wire reading instead of Top, Middle, Bottom. This is useful in the event that your cable goes bad, but you still want to use the Digital Level to shoot the rod, which normally gives Distance and Mid-wire, rather than a 3-wire reading.