Chapter 9

DNA 10 Digital Level

Table of Contents

A. Raw Data 9-2
B. Equipment 9-2
1. Instrument and Tripod Setup 9-3
C. Level Operation 9-4
1. Job Setup 9-4
D. Collimation Error Correction 9-9
E. Check and Adjust Procedure 9-10
1. A x Bx Method 9-12
2. A x Bx Method 9-19
F. Line Leveling 9-23
1. Setup 9-23
2. Starting the Run 9-28
3. Check Shots 9-34
G. Allowable Misclosure 9-37
H. Transferring Data 9-40
I. Warning Messages 9-40
1. Meas. below limit! 9-41
2. Distance Bal. too big! 9-43
3. Meas. Dist too big! 9-44

9. DNA 10 Digital Level

The Leica DNA 10 level is the latest digital level utilized by WYDOT. These levels began replacing the older Leica NA2002 digital levels in 2004. There are several advantages inherent with digital levels:

- Typically, readings can be taken faster with a digital level than with an optical level.
- Increased accuracy can be achieved by taking and averaging multiple readings.
- Human errors associated with reading and recording observations are eliminated.

Any digital level can also be used as an optical level. By not turning the instrument on, the instrument crosshairs may be used in the same manner as an optical level.

A. Raw Data

The collected data is stored in the instrument's internal memory. After the level line or loop has been collected, the data is transferred via memory card to a desktop computer or laptop where it is saved as a *.GSI file. WYDOT field office personnel can send this file along with a copy of the field notes to the State Photogrammetry & Surveys Engineer. The raw data will be processed with Leica Geo Office (LGO) software and the results sent back. Refer to Chapter 10 in this manual for more information on transferring survey data.

There is a limited amount of space in the instrument's internal memory. The digital level is able to store a maximum of 13 jobs. When the maximum number of jobs are stored in the internal memory and another job creation is attempted, the message "Memory full!" will be displayed. When this occurs, one or more of the stored jobs will need to be deleted before another one can be created.

The internal memory will store a maximum number of turns (i.e. backsight and foresight shots) within a single job. The total number is set at approximately 450 turns. When approaching the maximum amount, the message "Job is almost full!" will be displayed. The operator will have a total of 8 turns to finish the level run. If it will take more than 8 turns, the instrument person will have to find a place to end the run (e.g. monument, flight line target, or hub). The line or loop can be continued in another job. When the data is processed, the *.GSI files from separate jobs can be combined to complete the line or loop.

When the maximum number of measurements has been reached, the message "Actual job is full!" will be displayed. At this point, the instrument will not store additional measurements for the level run. The message "Store data in another job!" will then be displayed. Therefore, it is important to ensure there is enough internal memory available before starting a level run.

B. Equipment

The following equipment is necessary to complete level lines or loops with the DNA 10 digital level.

- DNA 10 digital level.
- Battery and battery charger.
- Memory card.

- Fixed-legged tripod.
- Bar-coded level rod.
- Field book.
- Temporary turning platform (turtle).
- 1" x 1" wooded hubs or railroad spikes (used for the peg test).

1. Instrument and Tripod Setup

As shown if Figure 9-2, place the digital level on the tripod and tighten the central fixing screw to securely fasten the level to the tripod. Turn the tribrach foot screws to their middle positions. Set the tripod such that the tripod plate is as level as possible. Using the foot pegs on the tripod, firmly press the leg points into the ground. Center the circular bubble by adjusting the foot screws.

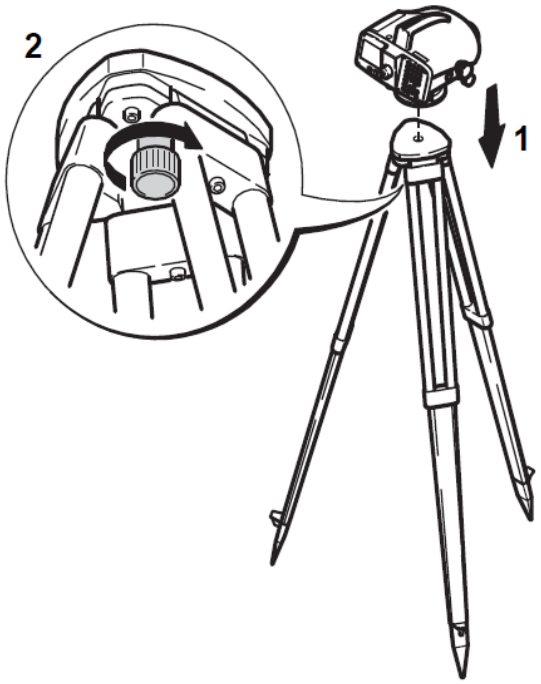

Figure 9-1. Instrument and tripod setup.

C. Level Operation

1. Job Setup

Turn on the DNA 10 by pressing the on/off button, indicated by the red arrow.

Figure 9-2. On/off button

After the level is turned on, the *MEAS & REC* screen will be displayed.

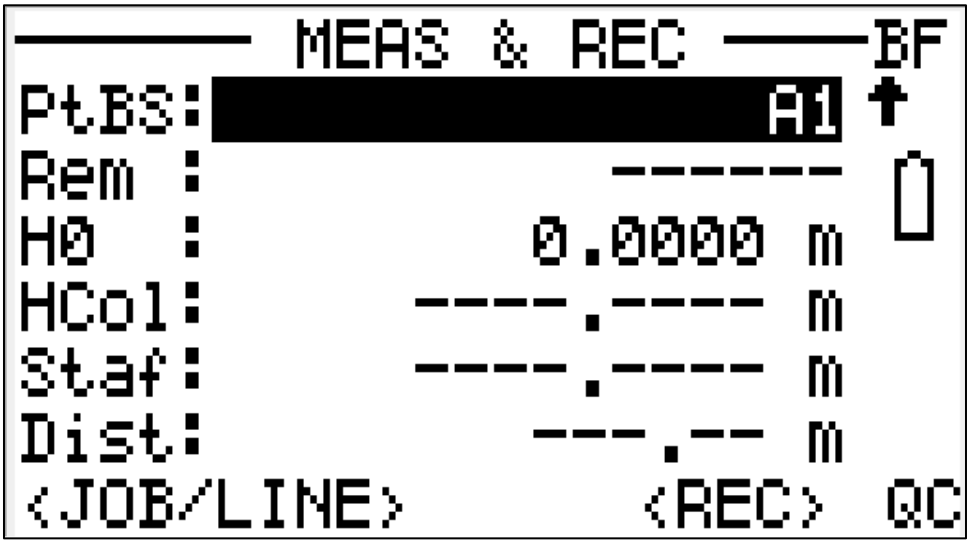

Figure 9-3. Measure and record screen.

To start a new job press the *PROG* button (red oval).

Figure 9-4. Program and enter Buttons.

When the *PROGRAMS* menu is displayed, use the yellow navigation buttons (red oval in Figure 9-6) to scroll down to option 2, *LINE LEVELLING*. Press the red *Enter* button (red square in Figure 9-4) or just press the *2* button (red circle in Figure 9-6).

Figure 9-5. Programs menu.

Figure 9-6. Navigation buttons.

At the *LINE LEVELLING* menu, create a new job. Highlight option 1, *Job* and press the *Enter* button or press the *1* button.

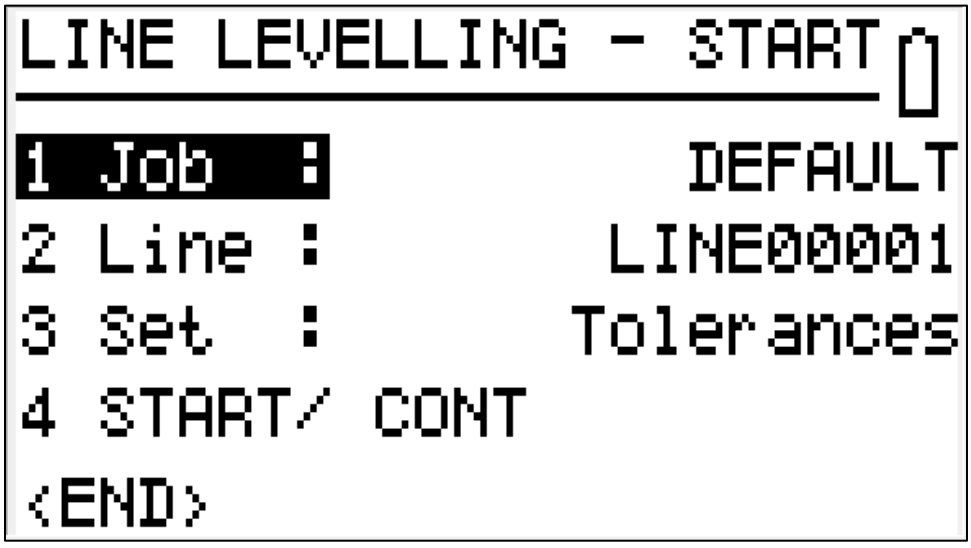

Figure 9-7. Line leveling menu.

At the *NEW JOB* menu, type in the job name (up to 16 characters). Use the white SHIFT button (red oval in Figure 9-9) to alternate between numerical digits and alphabetical letters/ special characters. After typing the job name, press *Enter* and type in the operator's name or initials then press *Enter* again.

Figure 9-8. Create new job.

Figure 9-9. Shift button.

Use the navigation buttons to scroll down to highlight *SET*, then press *Enter*. The message "Job Set!" will be briefly displayed.

Figure 9-10. New job settings.

To open an existing project from the *LINE LEVELLING* menu (see Figure 9-7), choose option 1, *Job* and press the *Enter* button. At the *SELECT JOB* menu, use the left or right navigation buttons to select the appropriate project. Then use the navigation buttons to scroll down and highlight *SET* and press *Enter*.

Figure 9-11. Select job.

At the *LINE LEVELLING* menu, use the up and down navigation buttons to scroll down and highlight *END*, then press the *Enter* button.

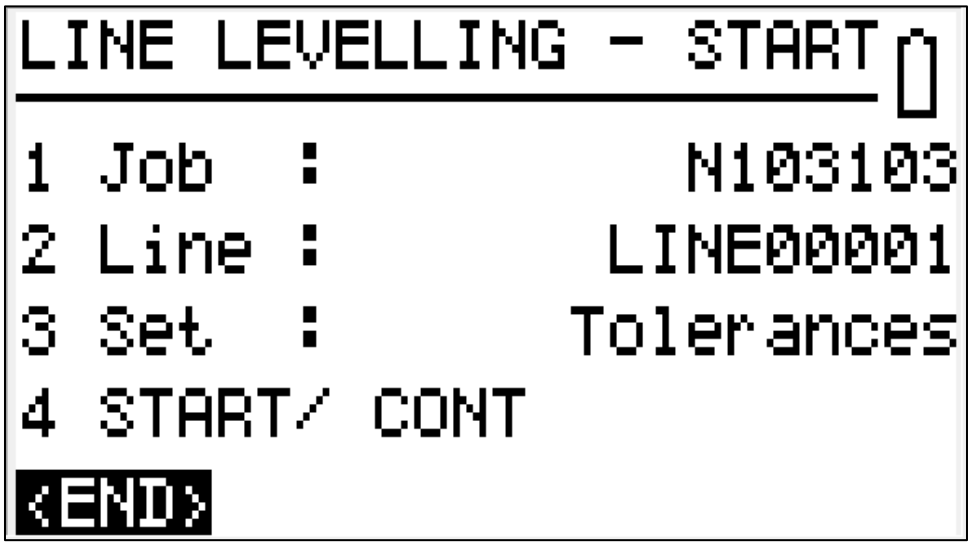

Figure 9-12. Line leveling.

D. Collimation Error Correction

The collimation error is the vertical angle between the actual line-of-sight and the ideal horizontal line.

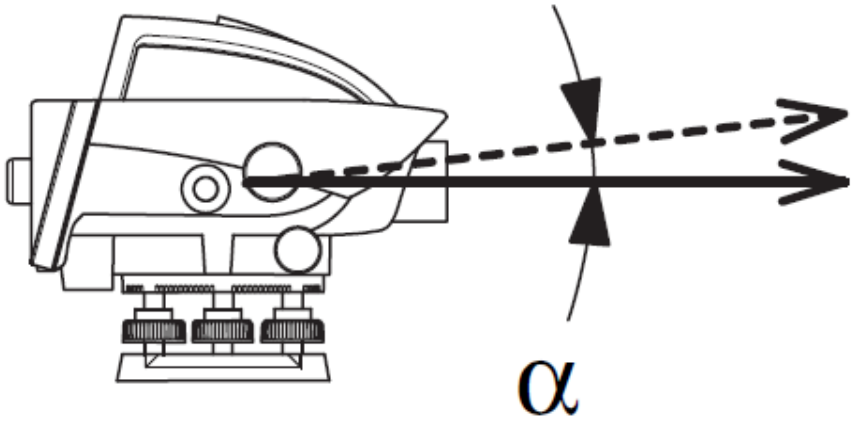

Figure 9-13. Collimation error.

With the DNA 10, optical and electronic collimation errors can occur. Staff readings are automatically corrected for the electronic collimation error and stored in the instrument. Optical collimation errors are eliminated by adjusting the reticle (cross-hairs) with the ocular (eye-piece).

A check and adjust procedure (two-peg test) is performed to determine the collimation error and should be conducted on a regular basis. At a minimum, a two-peg test should be performed at the beginning a every job or when the instrument has been significantly jarred. The level should be allowed to acclimate to the ambient temperature for at least 10 minutes before starting the two-peg test.

E. Check and Adjust Procedure

At the *PROGRAMS* menu, highlight option 4, *CHECK & ADJUST* and press the *Enter* button.

Figure 9-14. Check & Adjust.

In the *CHECK & ADJUST* menu, the job that was previously created should be active. Highlight option 2, *Meth.* to choose a two-peg test method then press *Enter*.

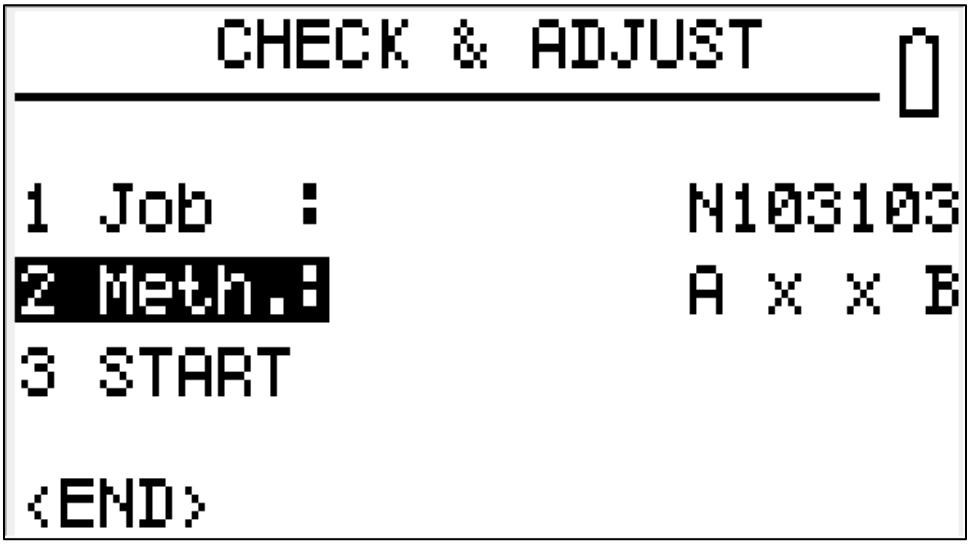

Figure 9-15. Two-peg test.

Use the left or right navigation arrow buttons to select *A x x B* or *A x Bx*.

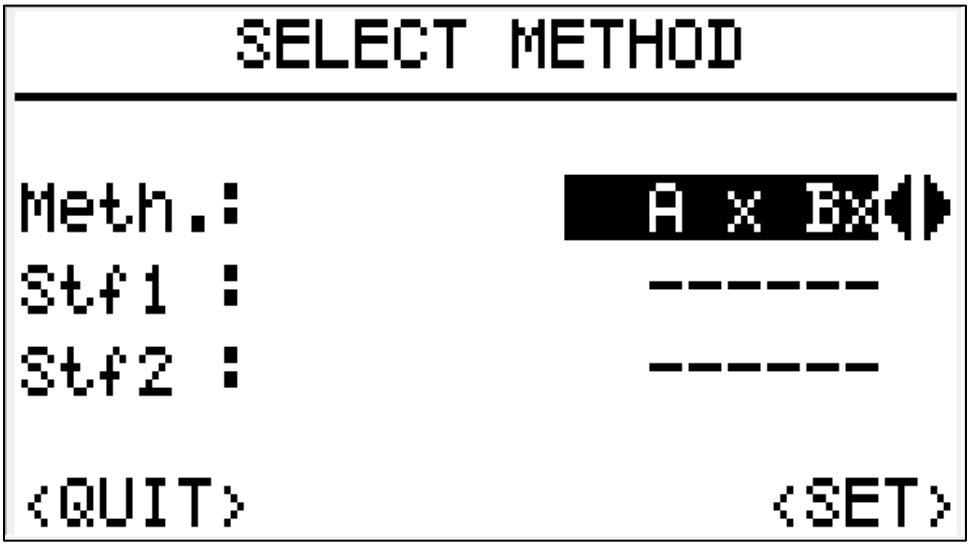

Figure 9-16. Select peg test method.

Once the peg test method has been selected, use the up and down navigation arrow buttons to scroll down and highlight *SET*. Leave the *Stf1* and *Stf2* lines blank. Press the *Enter* button to continue. The message "Method Set!" will be briefly displayed.

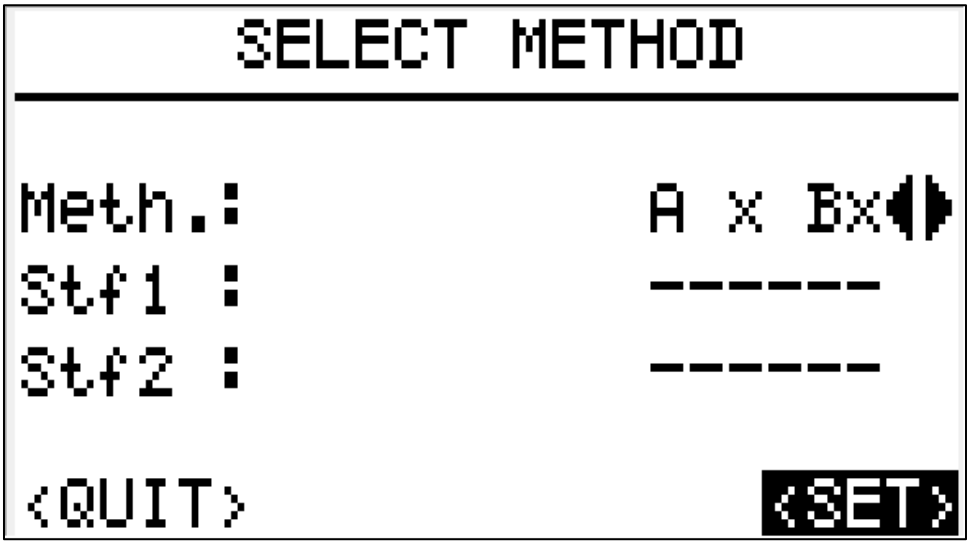

Figure 9-17. Set the peg test method.

At the *CHECK & ADJUST* menu, highlight option 3, *START* and press the *Enter* button to begin the two-peg test.

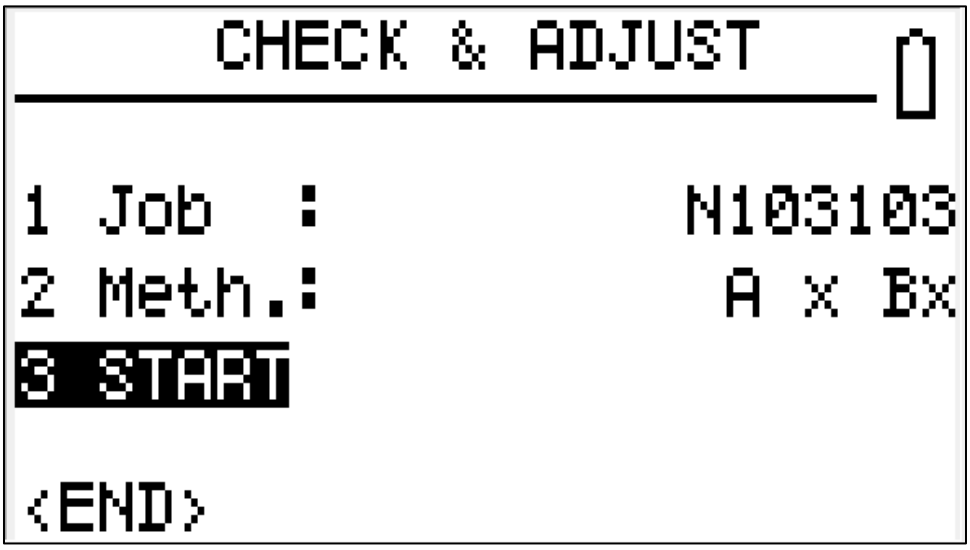

Figure 9-18. Start the peg test.

1. A x Bx Method

Pound a 1" x 1" wooden hub or railroad spike in the ground at stations A and B. The distance between A and B is approximately 30 meters. When performing a two-peg test, choose a site with reasonably level terrain.

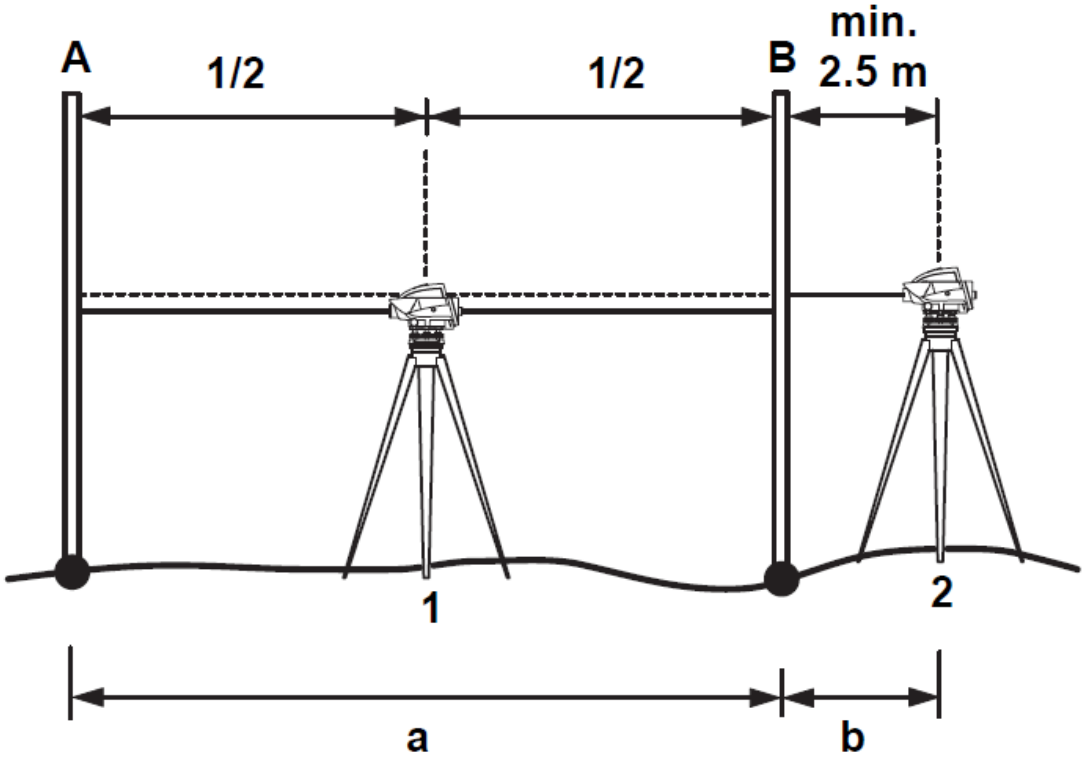

Figure 9-19. A x Bx method.

For the first set of measurements, the instrument is setup at position 1 while the level rod is set on a hub or spike at station A. At the *CHECK & ADJUST* screen, press the *Enter* button to continue.

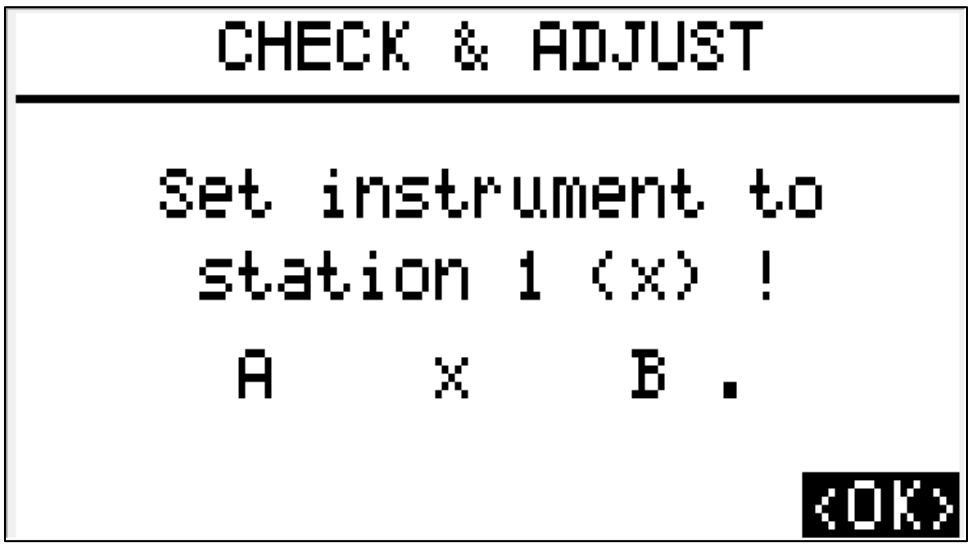

Figure 9-20. First peg test setup.

Aim the instrument at the level rod located at station A. If necessary, adjust the focusing knob (indicated by the blue arrow in Figure 9-21) to clearly focus the cross-hairs on the level rod.

Figure 9-21. Focus knob and measure button.

To take the first measurement, press the red measure button on the right side of the instrument (indicated by the red arrow in Figure 9-21). The DNA 10 will average three readings for each measurement.

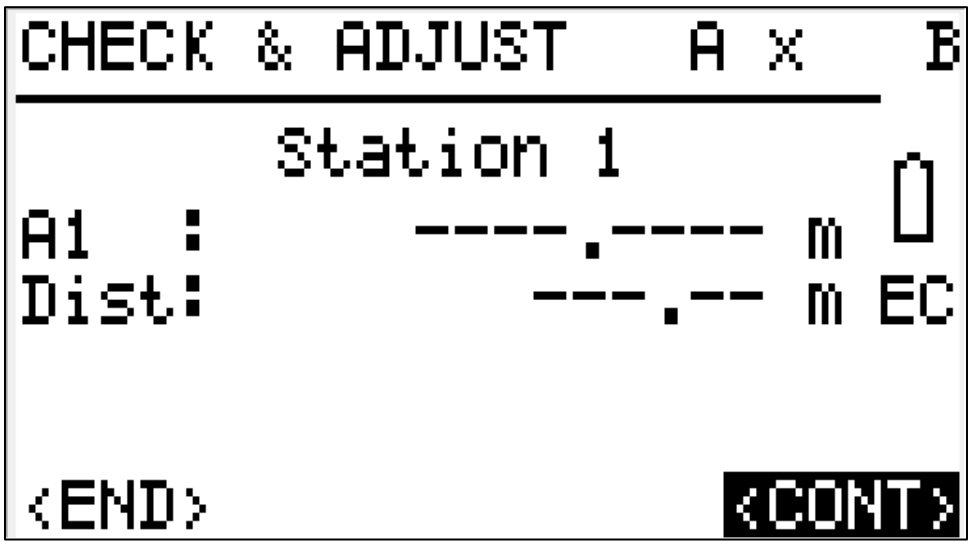

Figure 9-22. Ready for measurement.

After the first measurement has been taken, record the rod reading and distance for A1 in the field book. Accept the measurement and continue by pressing *Enter*.

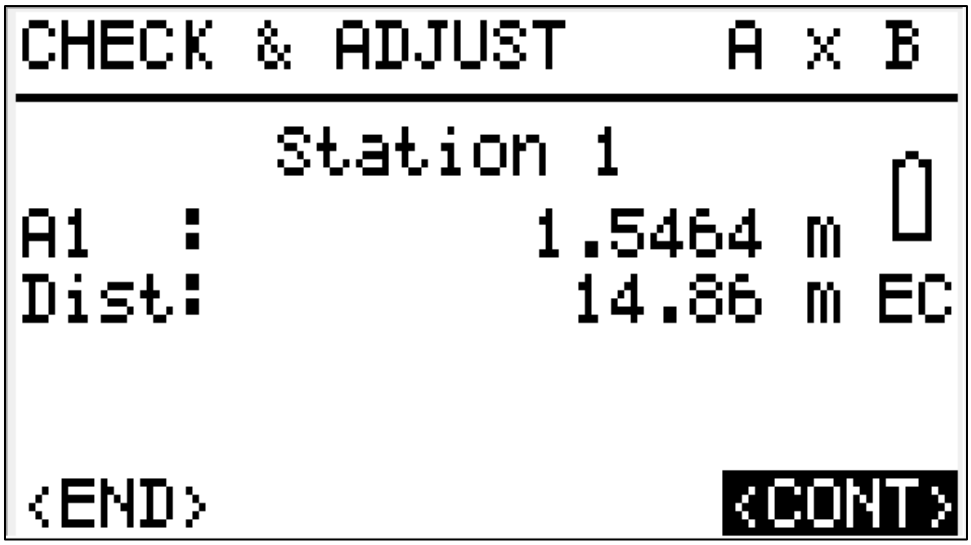

Figure 9-23. First measurement.

For the second measurement, the instrument remains at position 1 while the level rod is moved to a hub or spike at station B.

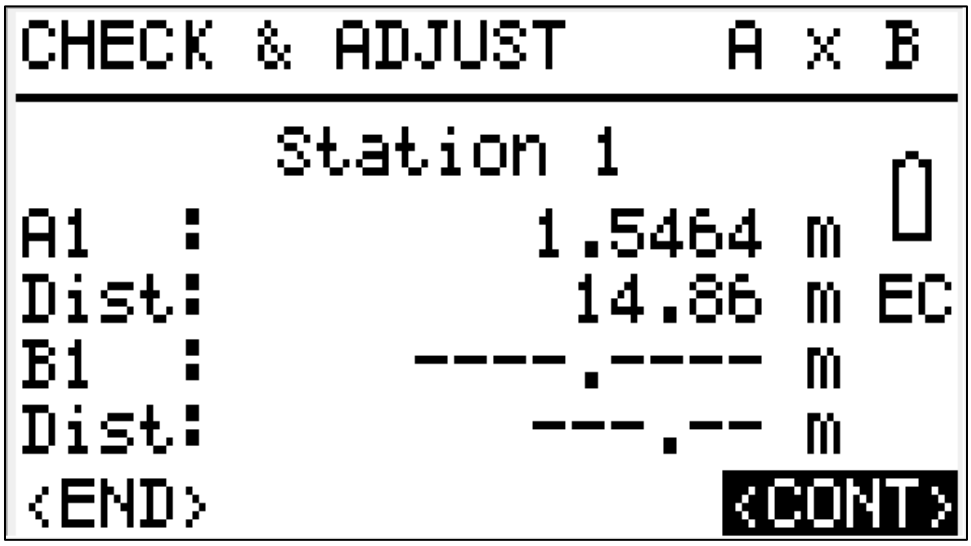

Figure 9-24. Ready for measurement.

After the second measurement has been taken, record the rod reading and distance for B1 in the field book. Accept the measurement and continue by pressing *Enter*.

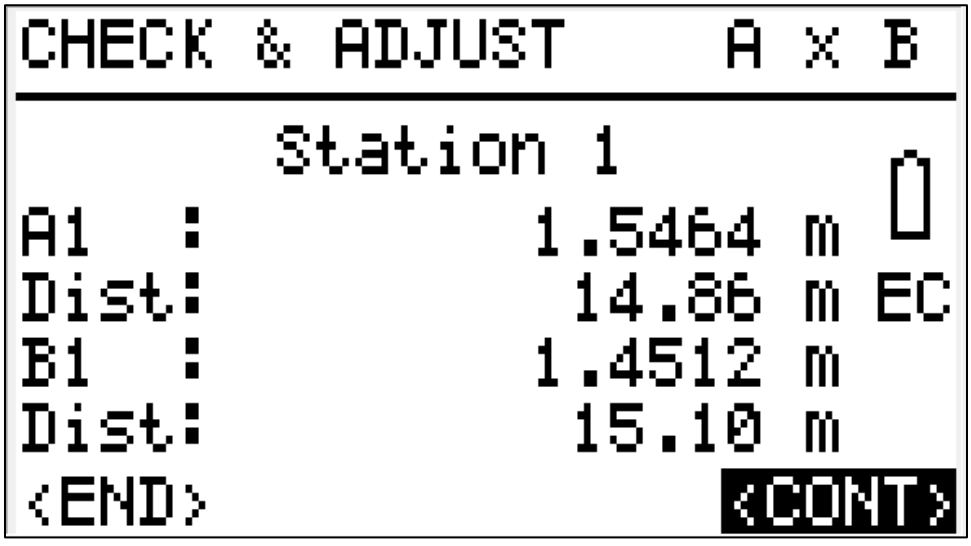

Figure 9-25. Second measurement.

When the *CHECK & ADJUST* screen is displayed, move the instrument to position 2 while the level rod remains at station B. Press the *Enter* button to continue.

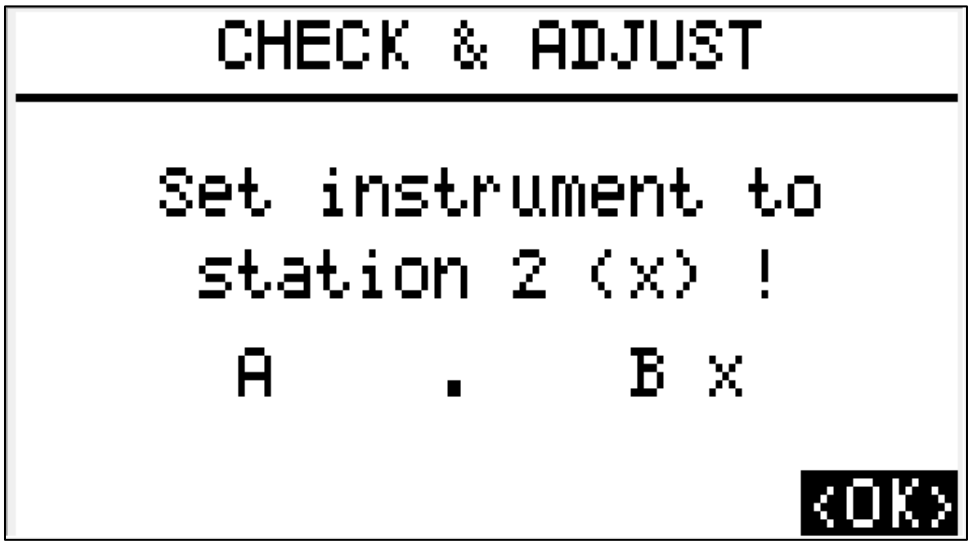

Figure 9-26. Second two-peg test setup.

The instrument is now ready for the second set of measurements.

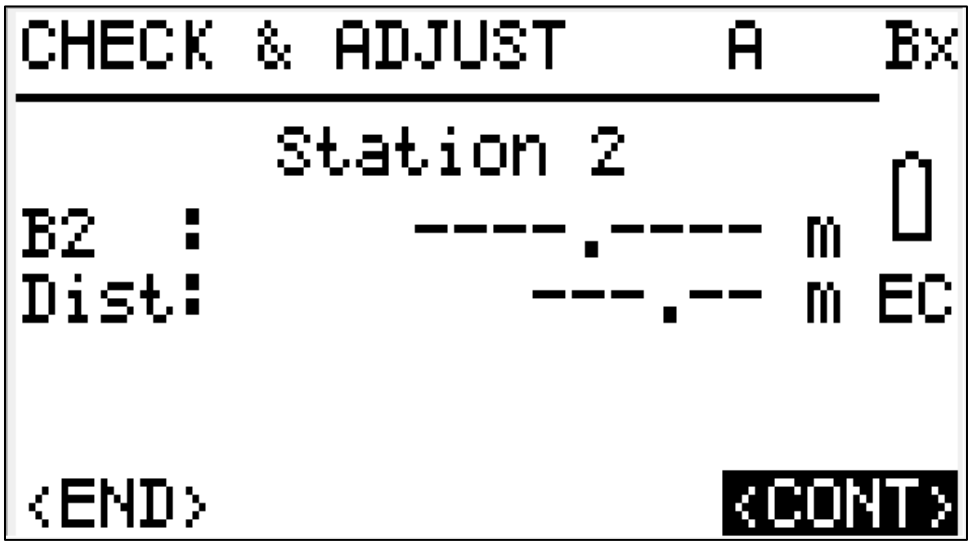

Figure 9-27. Ready for measurement.

After the measurement has been taken, record the rod reading and distance for B2 in the field book. Accept the measurement and continue by pressing *Enter*.

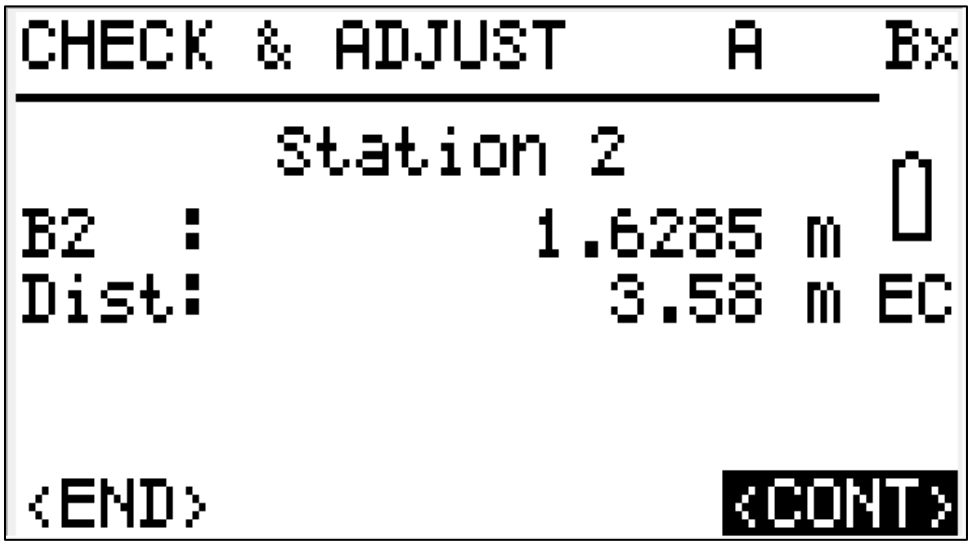

Figure 9-28. First measurement.

For the second measurement, the instrument remains at position 2 while the level rod is moved to station A.

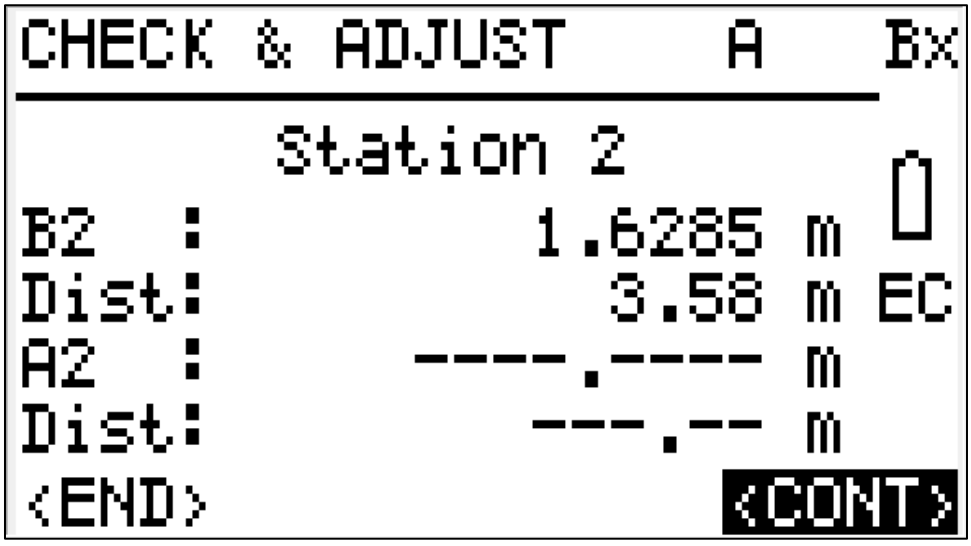

Figure 9-29. Ready for measurement.

After the second measurement has been taken, record the rod reading and distance for A2 in the field book. Accept the measurement and continue by pressing *Enter*.

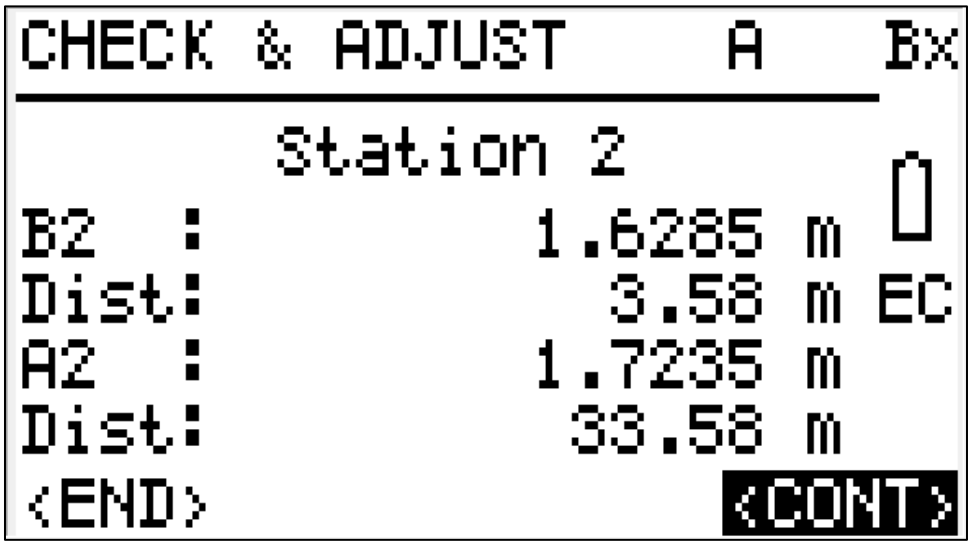

Figure 9-30. Second measurement.

The collimation results will be computed and displayed as shown in Figure 9-31. The difference between the old and new collimation errors should not be greater than ± 15". If the difference is greater than ± 15", then another peg test will need to be performed. If the 2nd peg test is still greater than ± 15", the instrument may need to be calibrated by a Leica technician.

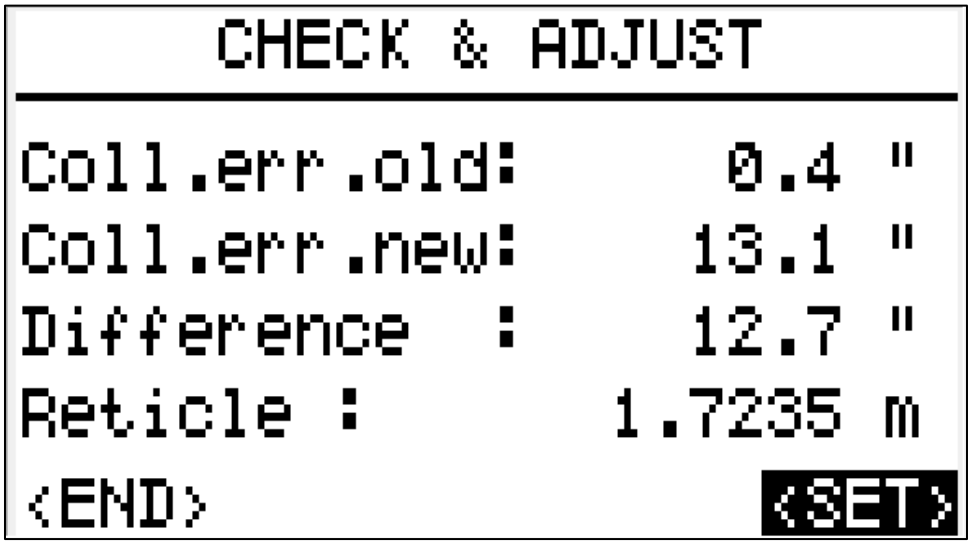

Figure 9-31. Collimation results.

When the difference is within the 15" tolerance, note all of the collimation information in the field book. Press *Enter* to set the new collimation value in the instrument. The message "New Collimation Set!" will be briefly displayed. At this point the instrument should be at the *PROGRAMS* menu.

2. A x Bx Method

Pound a 1" x 1" wooden hub or railroad spike in the ground at stations A and B. The distance between A and B is between 45 and 60 meters. When performing a two-peg test, choose a site with reasonably level terrain.

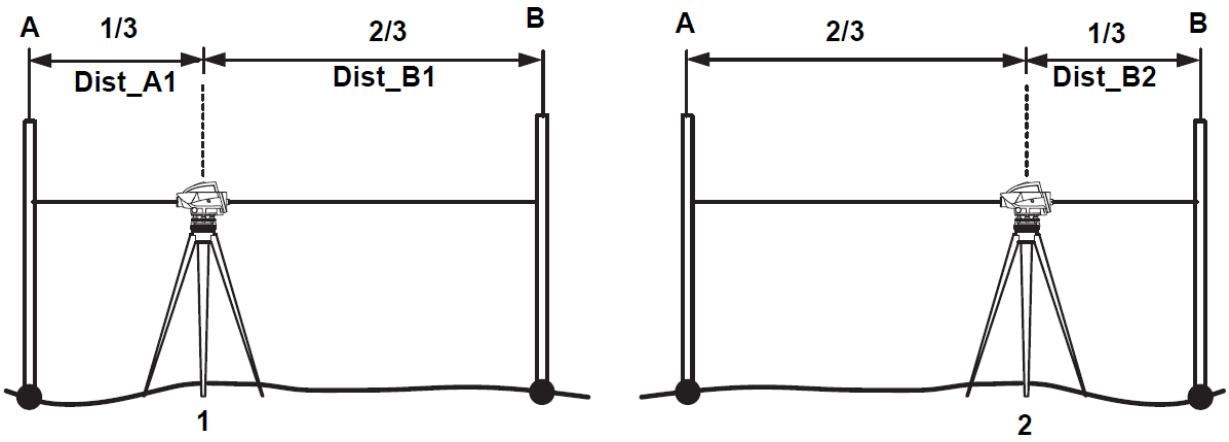

Figure 9-32. A x x B method.

In the *CHECK & ADJUST* menu, highlight option 2, *Meth.* to choose a two-peg test method then press *Enter* (see Figure 9-15). Use the left or right navigation arrow buttons to select the *A x x B* two-peg test method (see Figure 9-16). Once the two-peg test method has been selected, use the up and down navigation arrow buttons to scroll down and highlight *SET*. Leave the *Stf1* and *Stf2* lines blank. Press the *Enter* button to continue (see Figure 9-17). The message "Method Set!" will be briefly displayed. At the *CHECK & ADJUST* menu, highlight option 3, *START* and press the *Enter* button to begin the two-peg test (see Figure 9-18).

For the first set of measurements, the instrument is setup at position 1 while the level rod is set on a hub or spike at station A. At the *CHECK & ADJUST* screen, press the *Enter* button to continue.

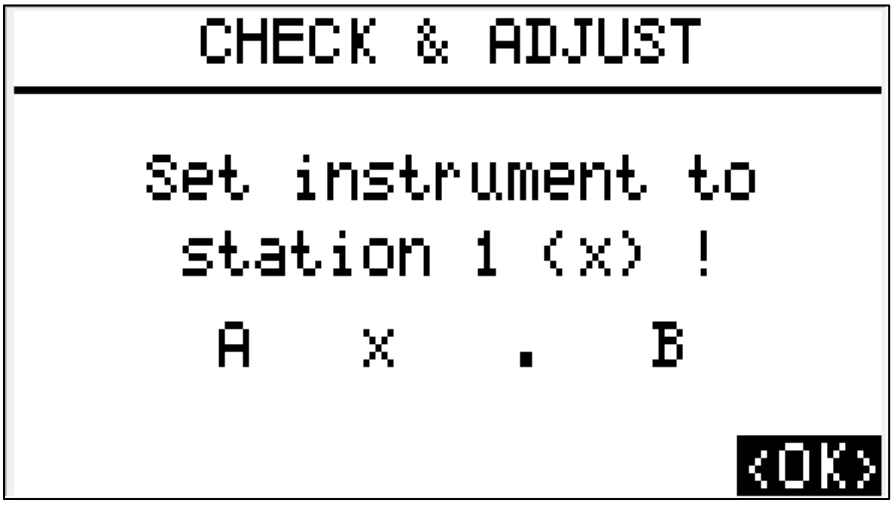

Figure 9-33. First two-peg test setup.

After the first measurement has been taken, record the rod reading and distance for A1 in the field book. Accept the measurement and continue by pressing *Enter*.

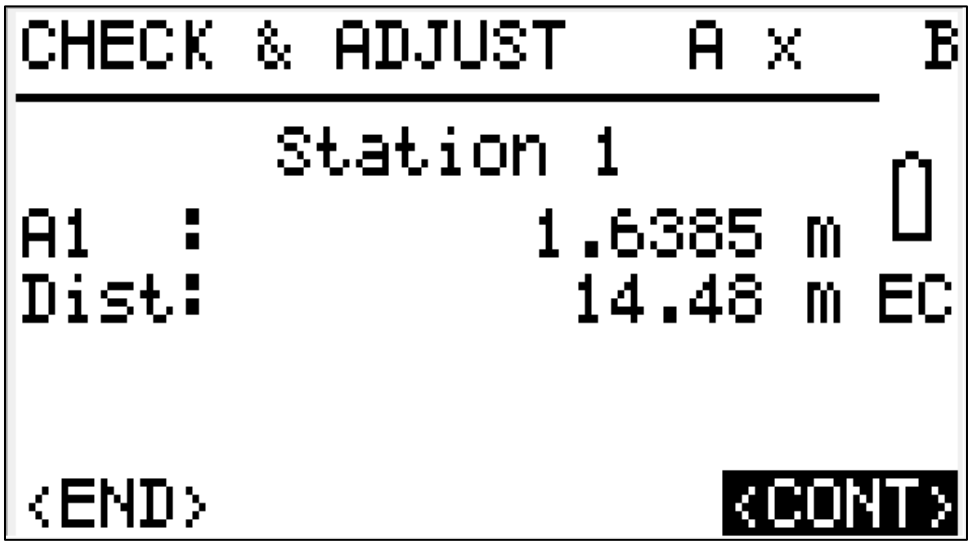

Figure 9-34. First measurement.

For the second measurement, the instrument remains at position 1 while the level rod is moved to a hub or spike at station B.

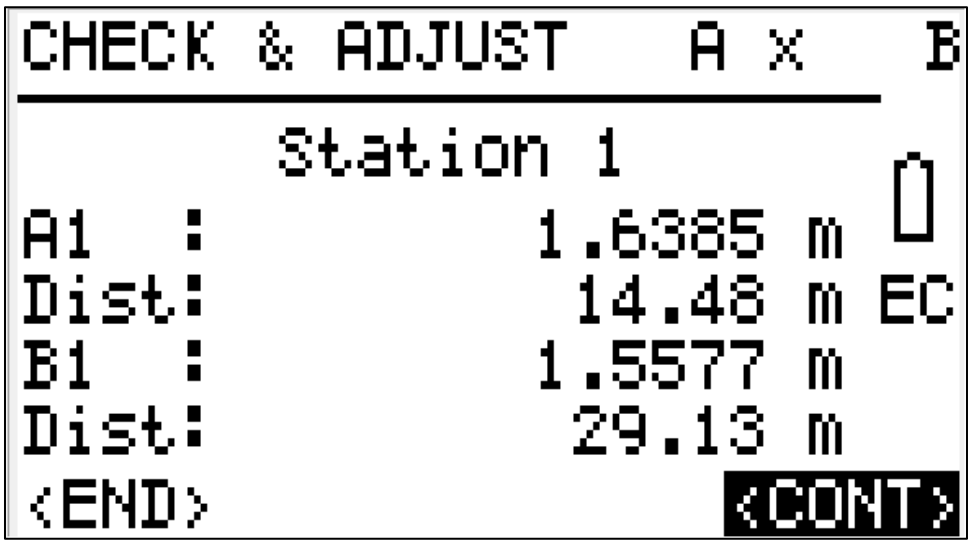

Figure 9-35. Second measurement.

After the second measurement has been taken, record the rod reading and distance for B1 in the field book. Accept the measurement and continue by pressing *Enter*.

At the *CHECK & ADJUST* screen, press the *Enter* button to continue.

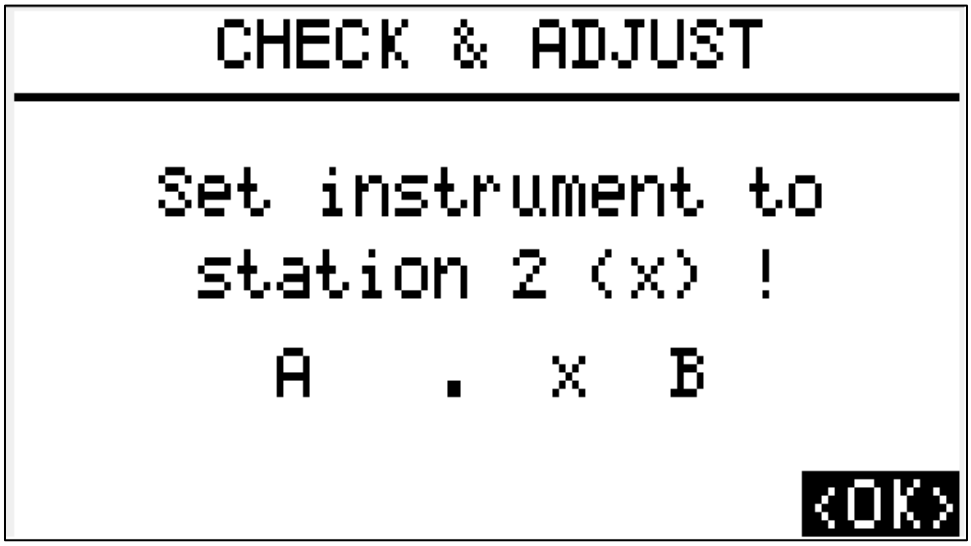

Figure 9-36. Second two-peg test setup.

For the second set of measurements, the instrument is moved to position 2 while the level rod remains at station B.

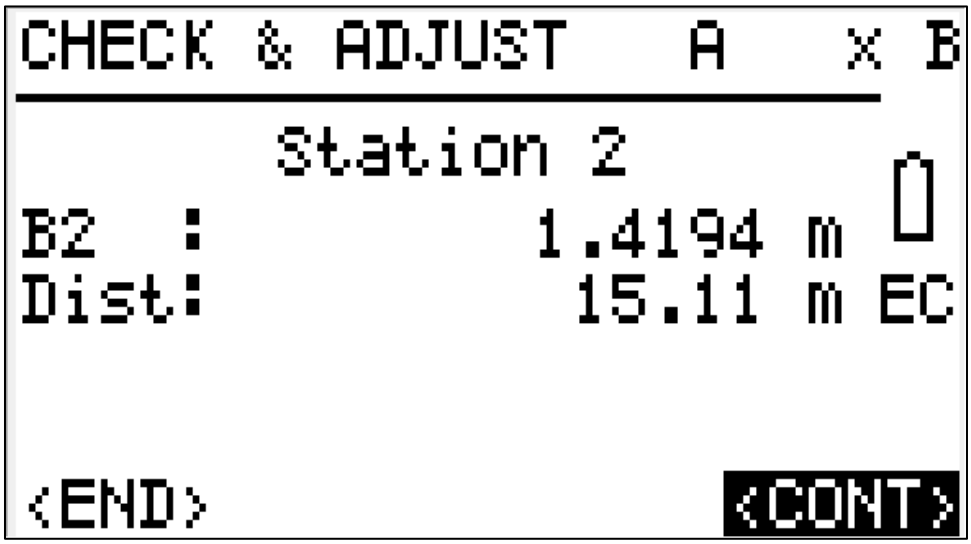

Figure 9-37. First measurement.

After the measurement has been taken, record the rod reading and distance for B2 in the field book. Accept the measurement and continue by pressing *Enter*.

For the second measurement, the instrument remains at position 2 while the level rod is moved to station A.

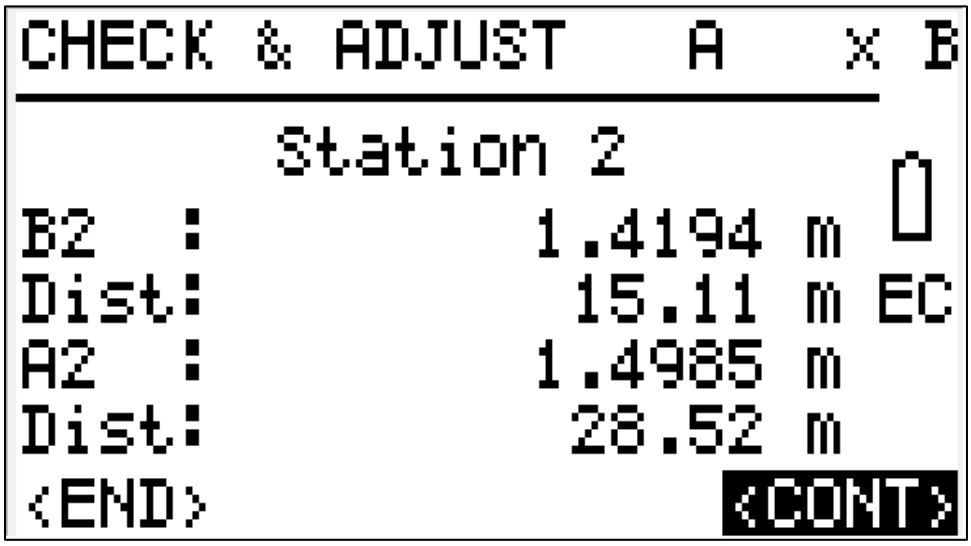

Figure 9-38. Second measurement.

After the second measurement has been taken, record the rod reading and distance for A2 in the field book. Accept the measurement and continue by pressing *Enter*.

The collimation results are computed and displayed as shown in Figure 9-39. When the collimation difference is within ± 15", press *Enter* to set the collimation value in the instrument. The message "New Collimation Set!" will be briefly displayed.

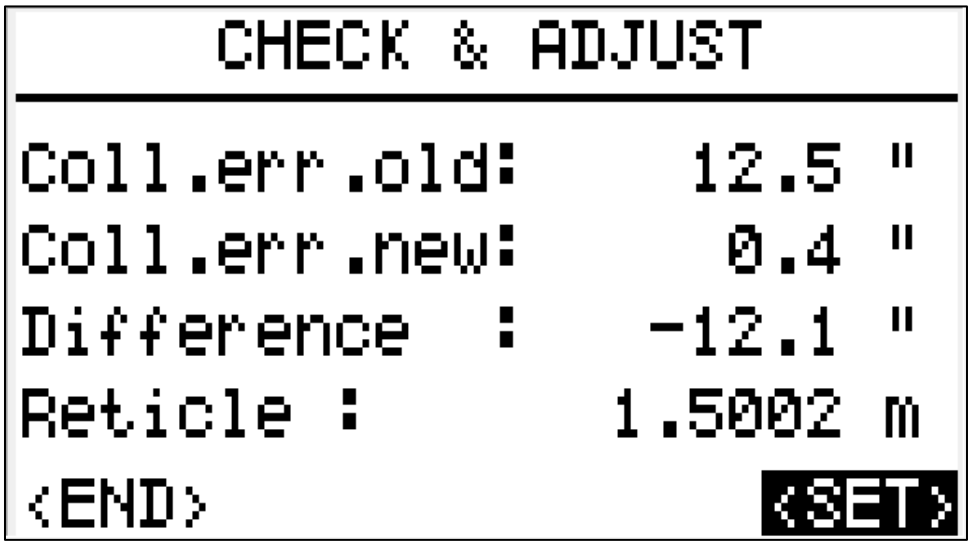

Figure 9-39. Collimation results.

F. Line Leveling

Line leveling is a series of backsight and foresight readings that is accomplished with an instrument person and a rod person. A level line is started at a point with a known elevation and runs through a series of points with unknown elevations. The line will end at another point with a known elevation. A level loop begins at a point with a known or assumed elevation, runs through a series of points with unknown elevations, and returns to the original starting point.

1. Setup

At the *PROGRAMS* menu, select option 2, *LINE LEVELLING* and press *Enter*.

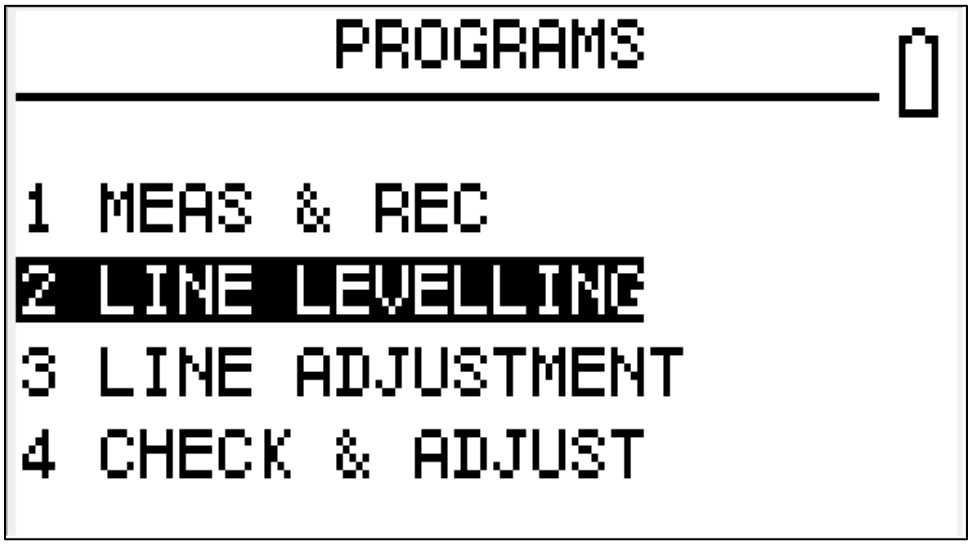

Figure 9-40. Programs menu.

The job should still be set. To create a new line, scroll down and highlight option 2, *Line* and press *Enter*.

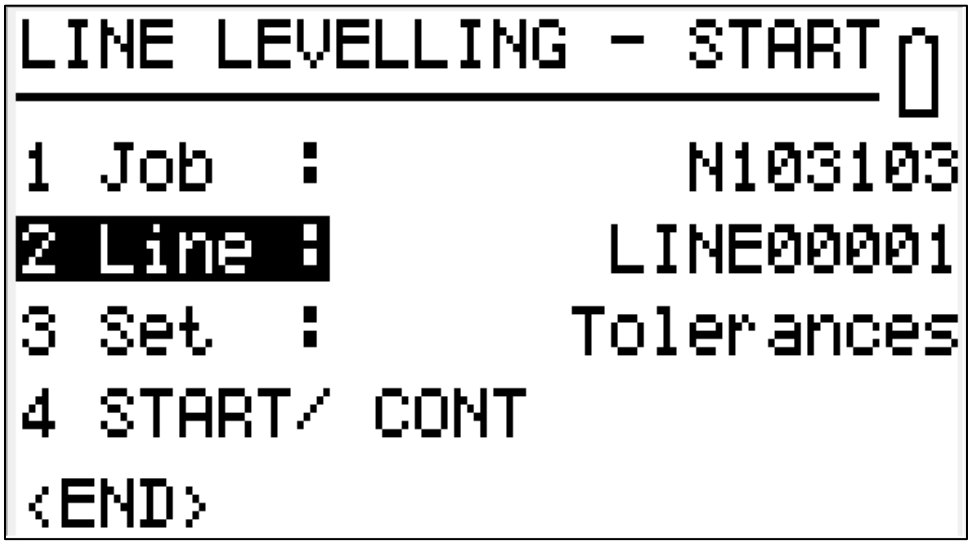

Figure 9-41. Create a new line.

A line name of up to 16 characters can be entered. Once the line name has been typed in, press *Enter*. The *Meth* line should always read *BF* (a backsight shot followed by a foresight shot). Enter a point name in the *Pt ID* line. This is the point that the level run is starting from and may be a benchmark, project control monument, or flight line target. Examples of point names are LABS 01, LACC 83A, WYDOT 03, or B 67.

Point names with numbers less than ten should be entered into the instrument with a leading zero (e.g. LACC 01, LACC 02, LACC 03, etc.). The instrument will then correctly sort these point names in numerical order when the point list includes numbers higher than ten (e.g. LACC 10, LACC 11, LACC 12, etc.). The *Pt ID* line only allows eight characters. Point names with eight or more characters will have to be abbreviated or spaces may have to be omitted (e.g. LNAS125A, A67Reset).

After the *Pt ID* line has been typed in, press the *Enter* button. The *H0* line will then be highlighted. The *H0* line is the elevation (in meters) at the starting point. If assuming an elevation, use "1000.000" m. Scroll down until *SET* is highlighted and press the *Enter* button. The message "Line Set!" will be briefly displayed.

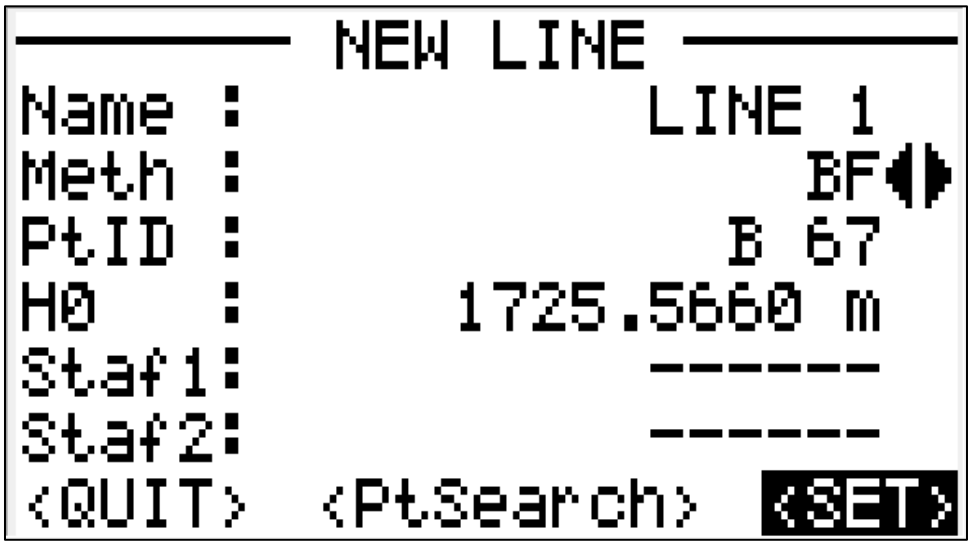

Figure 9-42. Set a new line.

From the *LINE LEVELLING* menu, select option 3, *Set*, and press the *Enter* button.

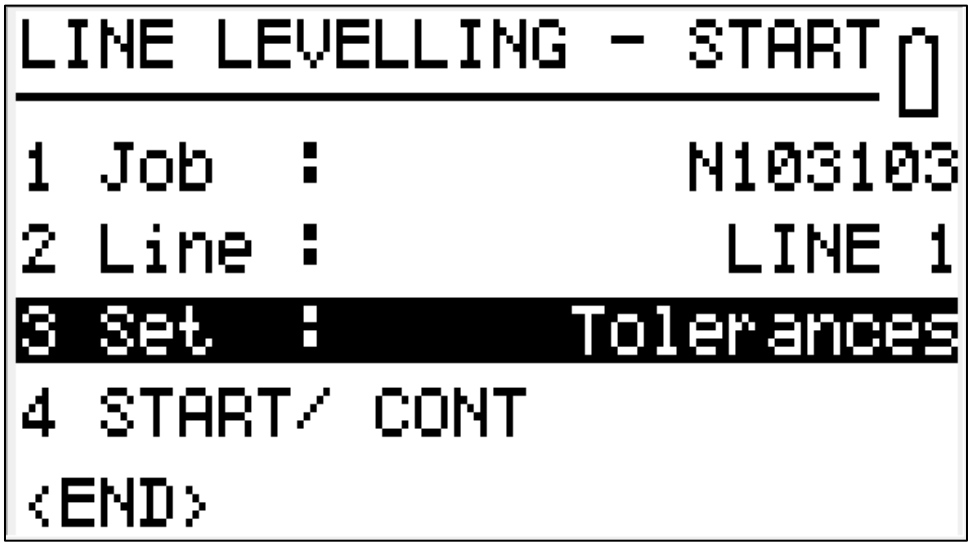

Figure 9-43. Set tolerances.

Use the navigation buttons to set the *Precise* line to *Off* and the other lines to *On*. Scroll down and highlight *LIMITS* and press the *Enter* button.

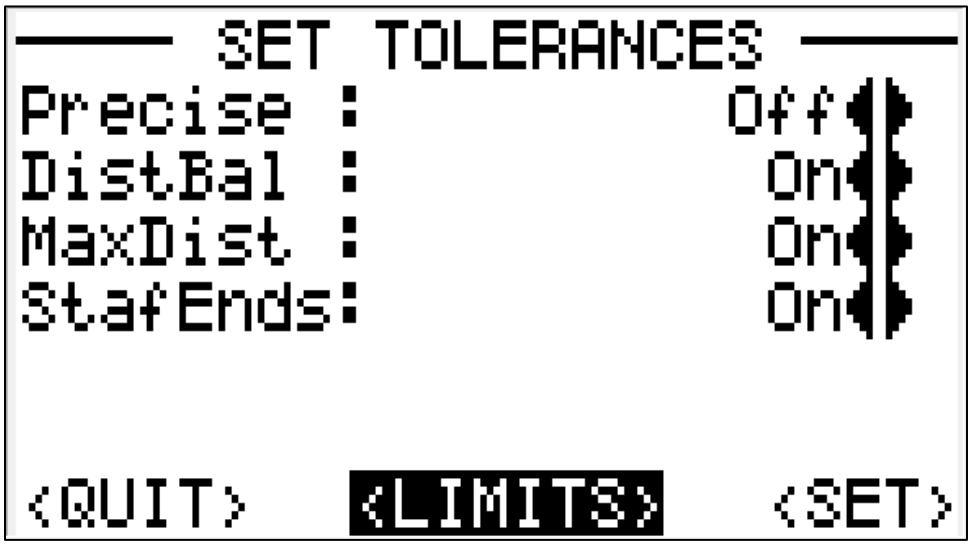

Figure 9- 44. Tolerance settings.

At the *ENTER TOLERANCES* screen, change the tolerances to the values shown in Figure 9-45. Scroll down and highlight *SET* and press the *Enter* button. Select *SET* one more time at the *SET TOLERANCES* screen and press *Enter* to accept the changes. The message "Tolerances Set!" will be briefly displayed.

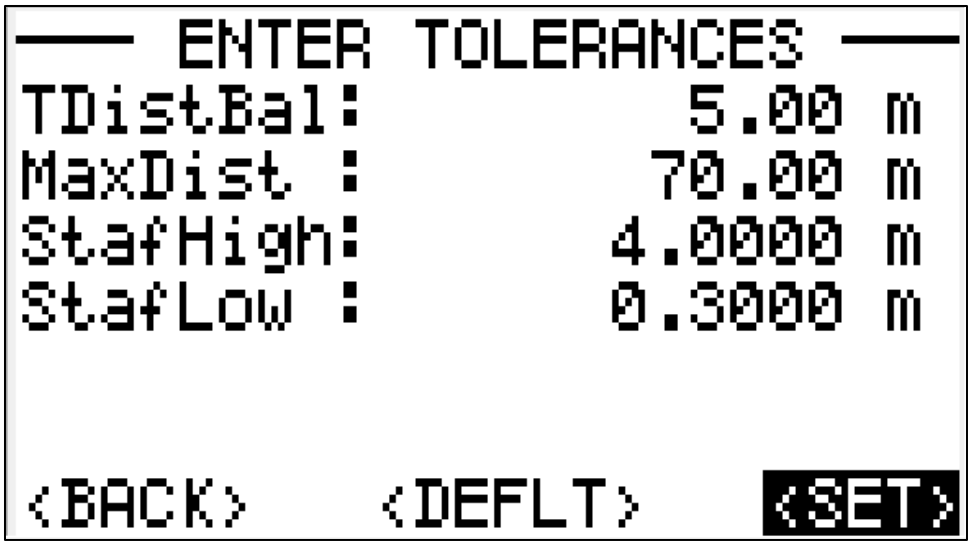

Figure 9-45. Tolerance values.

At the *LINE LEVELLING* menu, the *START/ CONT* line will be highlighted, press the *Enter* button to begin the level run.

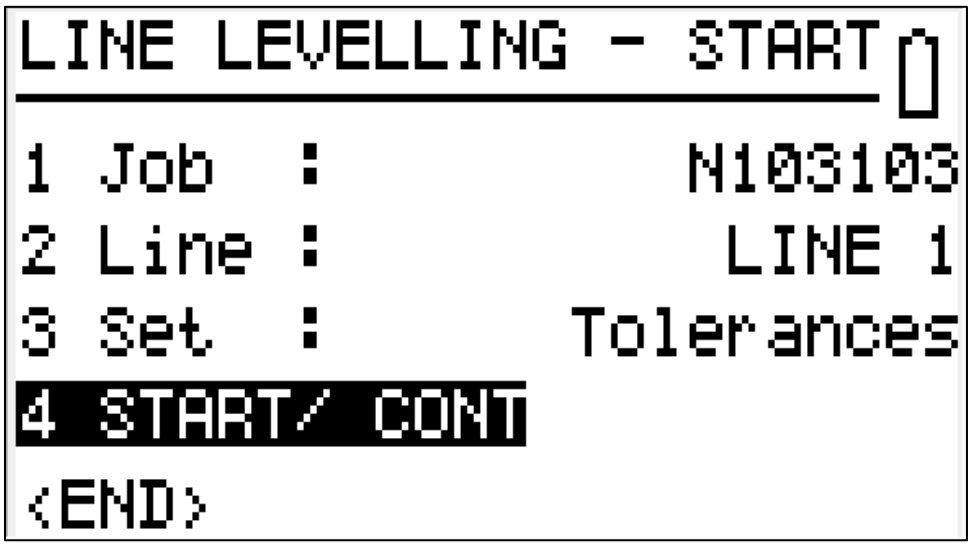

Figure 9-46. Start leveling.

Before the new line is started, the *CHECK LIST* menu will be displayed. Verify that the settings are the same as shown in Figure 9-47. If these values need to be edited, press the *MODE* button (red oval in Figure 9-48).

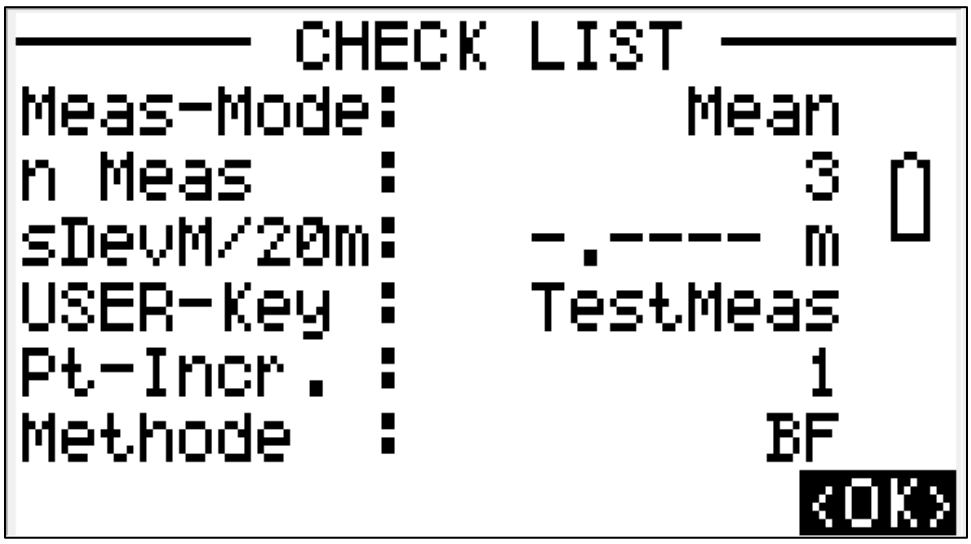

Figure 9-47. Check list settings.

Figure 9-48. Mode button.

Change the necessary settings in the *MEASURE MODE* menu and press the *Enter* button when *SET* is highlighted.

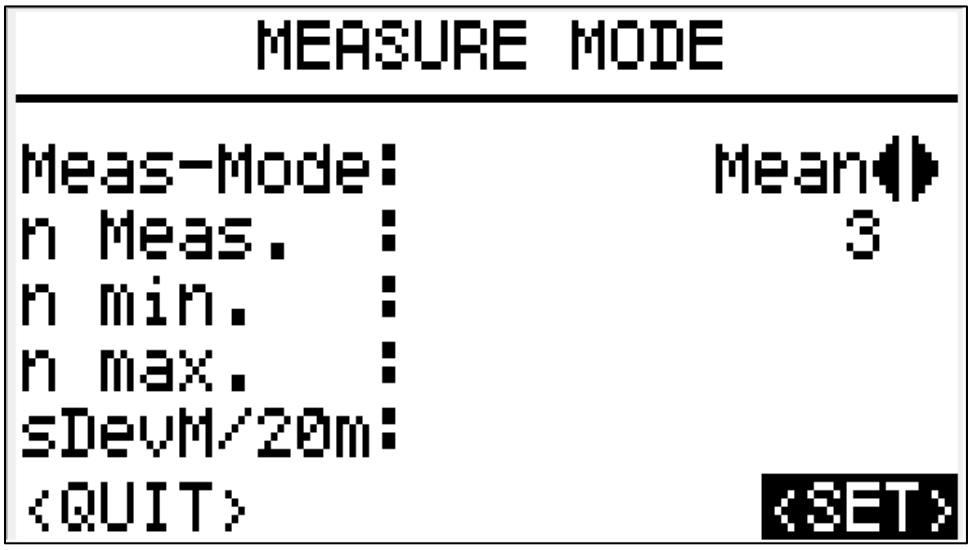

Figure 9-49. Measure mode menu.

2. Starting the Run

Figure 9-50 is the first screen of the level run. The point name is the benchmark, project control point, or flight line target at the start of the run. Always enter the point designation in the *Pt ID* line instead of the *Rem* line. The *H* line is the elevation entered in Figure 9-42.

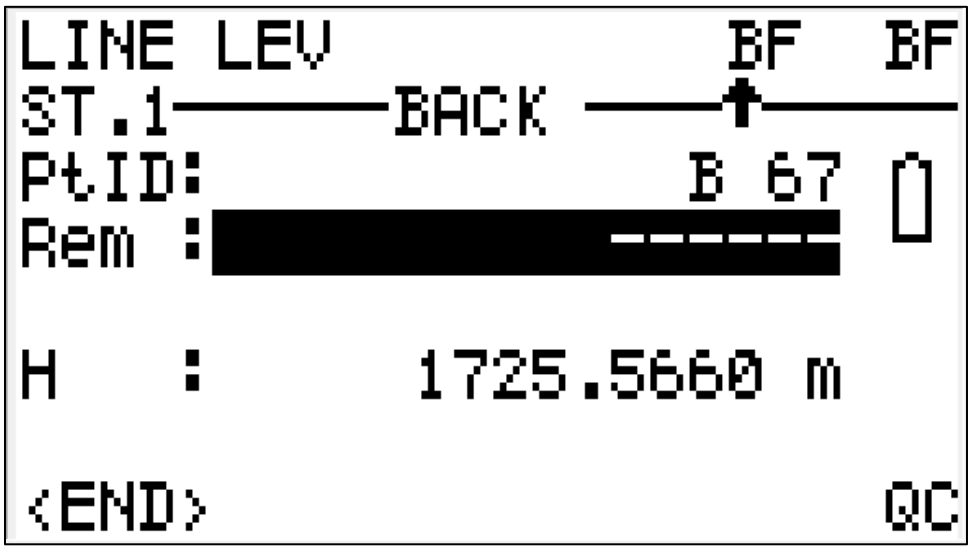

Figure 9-50. Line leveling screen.

To begin the run, the rod person will place the level rod on the starting point. The instrument person will start pacing towards the next point in the run. The instrument should be placed as far from the starting point as possible to minimize the number of turns without exceeding the 70 m maximum distance. The instrument person must also consider the requirements of sighting below the top of the level rod and a minimum of 0.3 m above the bottom of the rod.

This is particularly important when performing a level run in rolling terrain. On a 2% slope, the maximum backsight distance is limited to approximately 65 m (for a minimum backsight reading of 0.3 m). On a 3% slope, the maximum backsight distance is limited to approximately 45 m.

Once the DNA 10 has been setup for the first measurement, aim the instrument toward the level rod on the starting point. Focus on the level rod and press the measure button. Once the measurement is taken, the DNA 10 will store the backsight reading and is now ready for the foresight reading.

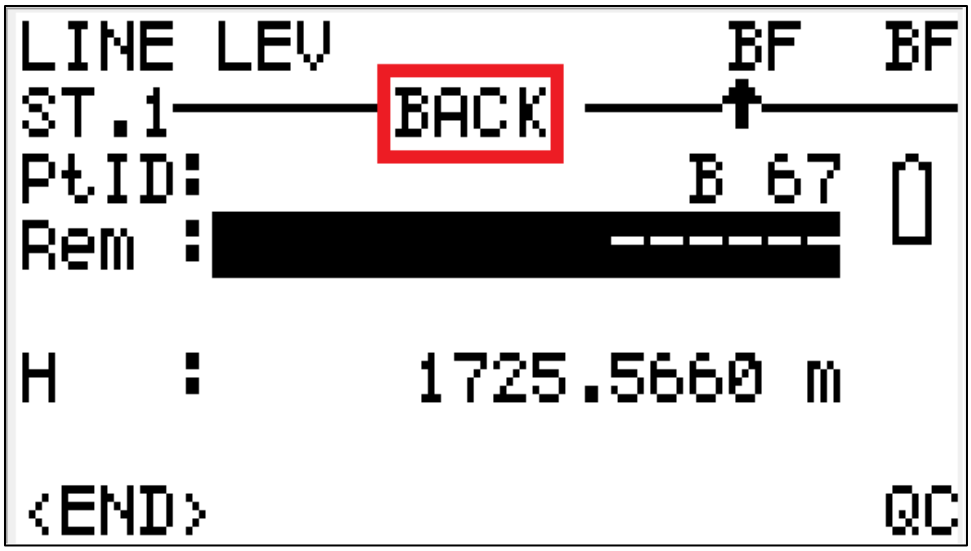

Figure 9-51. First backsight measurement.

The instrument person will remain in the same location as the rod person paces the distance to the instrument. The rod person will then place the turning plate (turtle) the same distance past the instrument. After the foresight measurement is taken, the rod person will stay in the same position without picking up the turtle. The instrument person will move past the rod person to setup the instrument and take the next backsight shot. This "leap frog" procedure continues until the level run is complete.

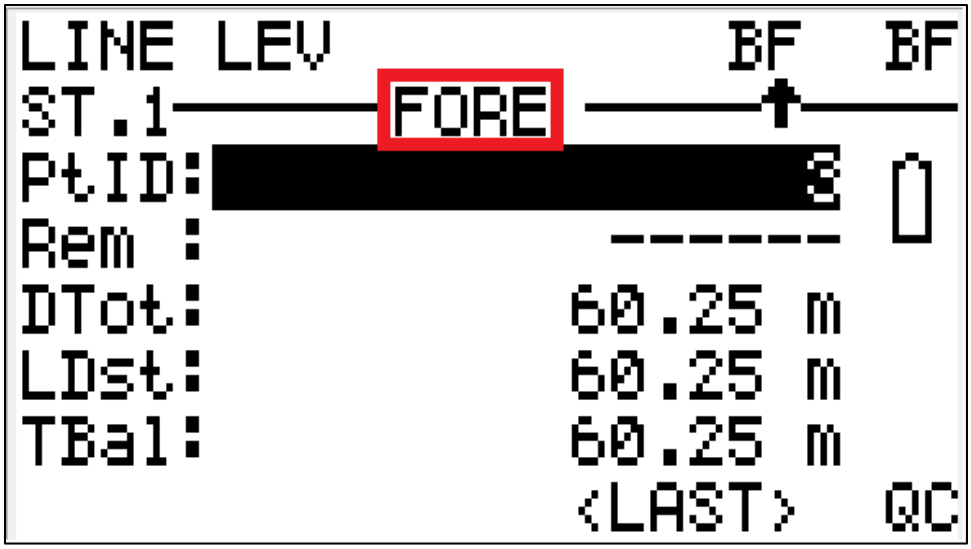

Figure 9-52. First foresight measurement.

Balancing the backsight and foresight distances is referred to as the distance balance. The distance balance is calculated by the DNA 10 for each backsight/foresight combination. A running total of the distance balance is computed by subtracting the foresight distance(s) from the backsight distance(s). This distance balance should not exceed 5 m and should be kept as close to zero as possible for each backsight/foresight combination and for the cumulative backsight/foresight distances. Keeping the sight distances balanced reduces earth curvature and atmospheric refraction errors. Additionally, it minimizes errors due to the instrument's line of sight differing from a true horizontal line. These line of sight errors are caused by internal instrument mis-adjustments and imperfectly leveled instrument setups. The distance balance should be corrected by the rod person on the foresight measurement only. After the foresight measurement is taken, the *TBal* line will show a distance balance value, see Figure 9-56. If the distance balance is less than the set tolerance value, then the instrument person can move to the next setup.

Important: If the instrument is disturbed before the foresight shot has been taken and the backsight is not available, the run will need to be restarted. If the turning point is disturbed before the backsight measurement has been taken, the run will also need to be restarted. A new level line will need to be created when starting over at the last benchmark, control point, or flight line target. Any problems encountered during the level run should be noted in the field book.

A useful function of the DNA 10 is the test measurement mode. Measurements can be taken in this mode without storing the data. This mode is intended to optimize target distances. Test measurements are always single measurements regardless of the current measuring mode.

To set the test measurement mode, press the *SHIFT* button, then the *USER* button to access the *FUNCTIONS* menu.

Figure 9-53. User button.

At the *FUNCTIONS* menu, select option 1, *Test Measurement*.

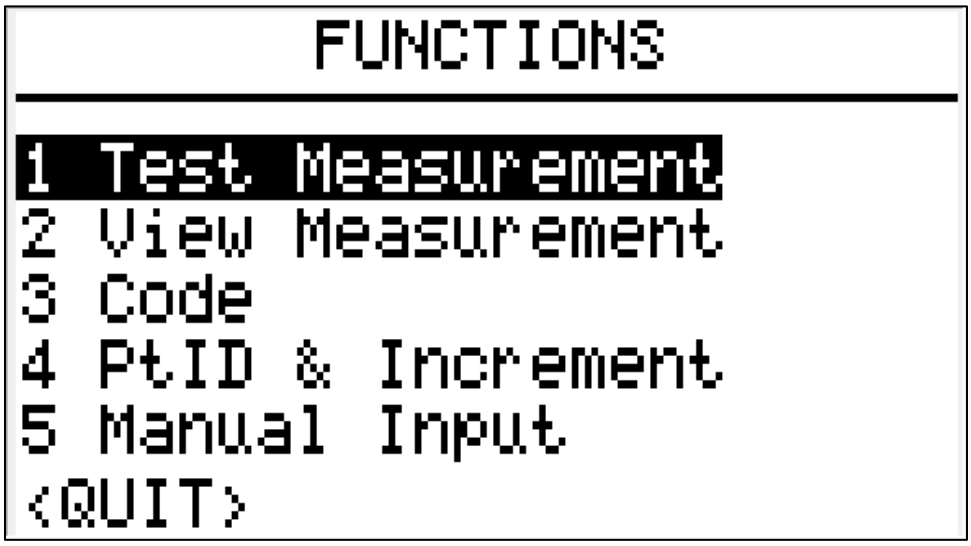

Figure 9-54. Functions menu.

Once the measurement has been taken, the display will show the rod reading and the distance to the rod. Any number of test measurements can be made and the results viewed. When the optimum distance is achieved, use the navigation arrows to highlight *QUIT* and press *Enter*. The display screen will go back to the *LINE LEV* screen to resume the level run.

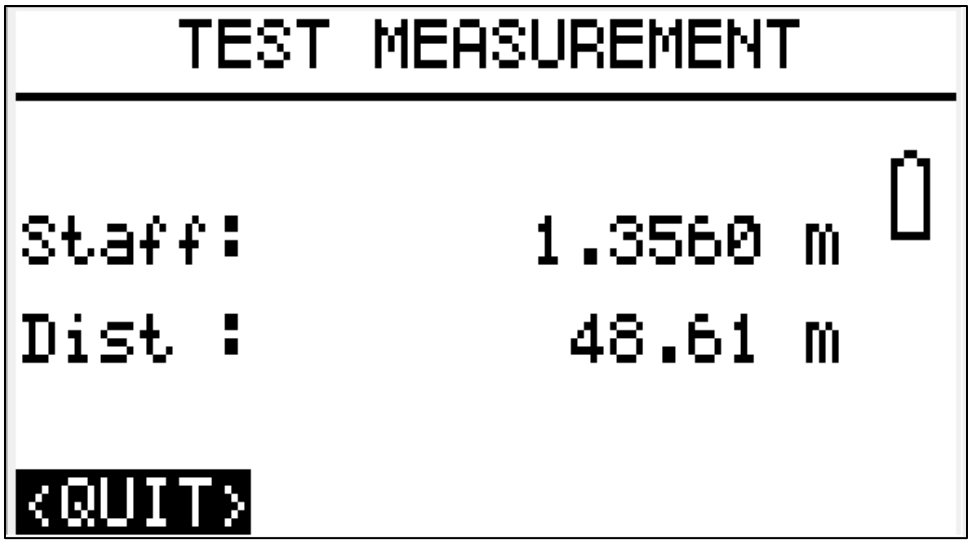

Figure 9-55. Test measurement screen.

Figure 9-56 is the *LINE LEV* screen for a backsight measurement. This screen shows several important values of the current run. The *dH T* value is the difference in elevation from the start of the run to the last foresight location. The *H* value is the elevation at the last foresight location. The *TBal* value is the difference in the cumulative backsight and foresight distances.

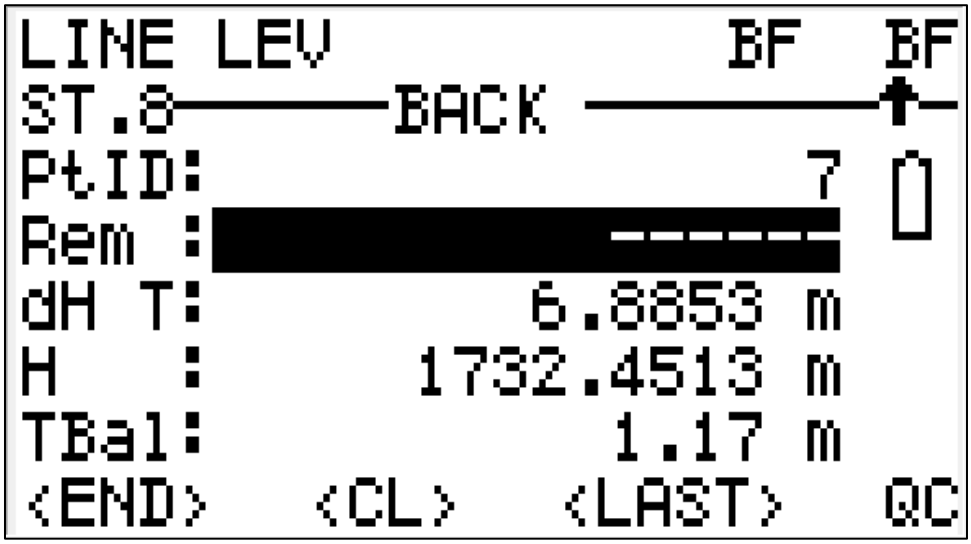

Figure 9-56. Backsight measurement.

Figure 9-57 is the *LINE LEV* screen for a foresight measurement. This screen also shows several important values of the current run. *DTot* is the distance of the current run. The *LDst* value is the distance of the last backsight measurement. The *TBal* value is the distance required for the foresight measurement to balance the cumulative backsight and foresight distances. The *TBal* value is the sum of the *LDst* and the *TBal* value from the backsight screen (Figure 9-56).

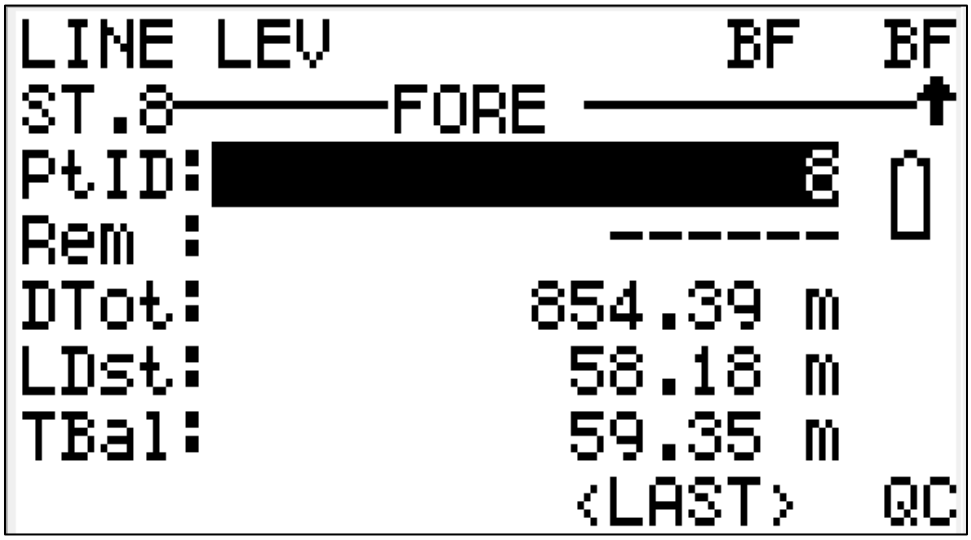

Figure 9- 57. Foresight measurement.

Figure 9-58 is the *LINE LEV* screen before the foresight measurement is taken when approaching a benchmark, project control point, or flight line target. As mentioned earlier, the designation should be entered in the *Pt ID* line.

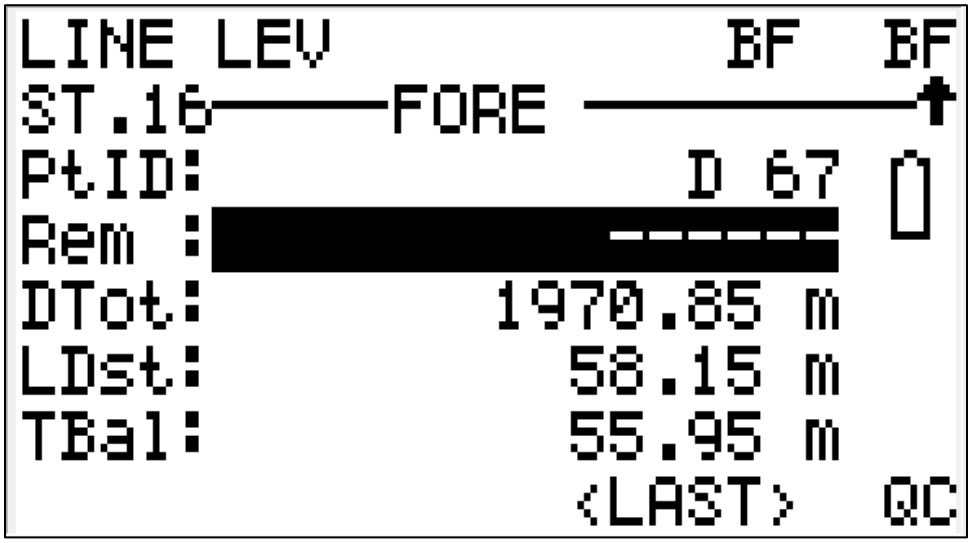

Figure 9-58. Entering a point ID.

Once the foresight shot on a benchmark or control point has been stored, continue the line toward the next point or complete the loop by returning to the starting point. The instrument person will move to a new location to take a backsight while the rod person stays at the benchmark or control point.

3. Check Shots

While on the way back to close the loop, perform check shots on control points or flight line targets that were collected on the first leg of the run. These check shots are also referred to as intermediate shots or side shots. The purpose of the check shot is to verify that a level "bust" has not occurred somewhere along the run. When the instrument is ready for the foresight reading, the rod person will set the rod on the check point. After the check shot has been taken, continue with the run by taking the next foresight.

When making a side shot measurement, make sure the low and high staff readings are within set tolerances. Since the check shot will not affect the distance balance, the distance to the side shot does not matter as long as it is less than the maximum distance. To perform a side shot press the *INT* button (red oval).

Figure 9-59. Intermediate button.

At the *INTERMEDIATE* screen, type in the point name in the *Next* line then press the *Enter* button.

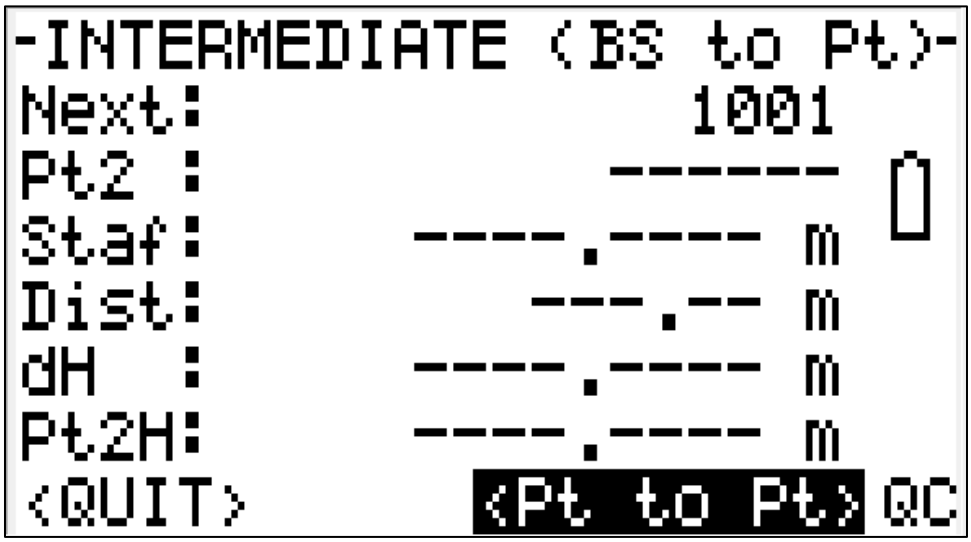

Figure 9-60. Intermediate menu.

After the shot has been taken, the rod reading, distance from the instrument to the rod, and the check point elevation will be given. The point elevation on the screen should be recorded in the field book along with a brief explanation of the shot. Once the values have been noted, and *QUIT* is highlighted, press the *Enter* button. The instrument will return to the line leveling screen. The rod person can then move to the next foresight shot.

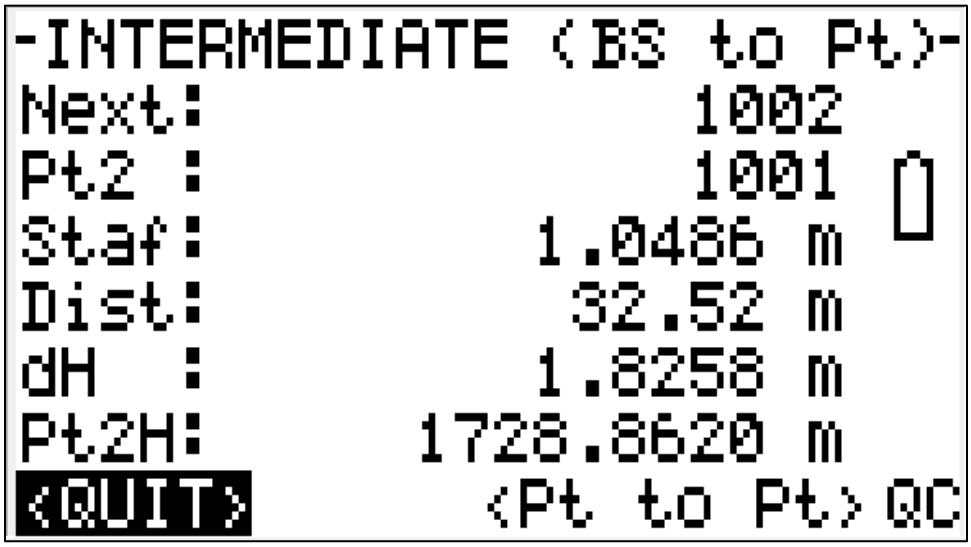

Figure 9-61. Intermediate (side shot) measurement.

Continue taking backsight and foresight shots until the end of the level line or the starting point of the level loop is reached. On the last instrument setup, the instrument person will pace the distance from the rod person to the ending benchmark or control point. The instrument person should then split this distance for the final setup. Minor adjustments may have to be made to keep the cumulative distance balance under the 5.0 m tolerance limit. After the final backsight has been taken, type in the ending point name. When the foresight measurement has been taken, record the elevation of the ending point in the field book. To end the level loop, scroll down to highlight *END* and press the *Enter* button.

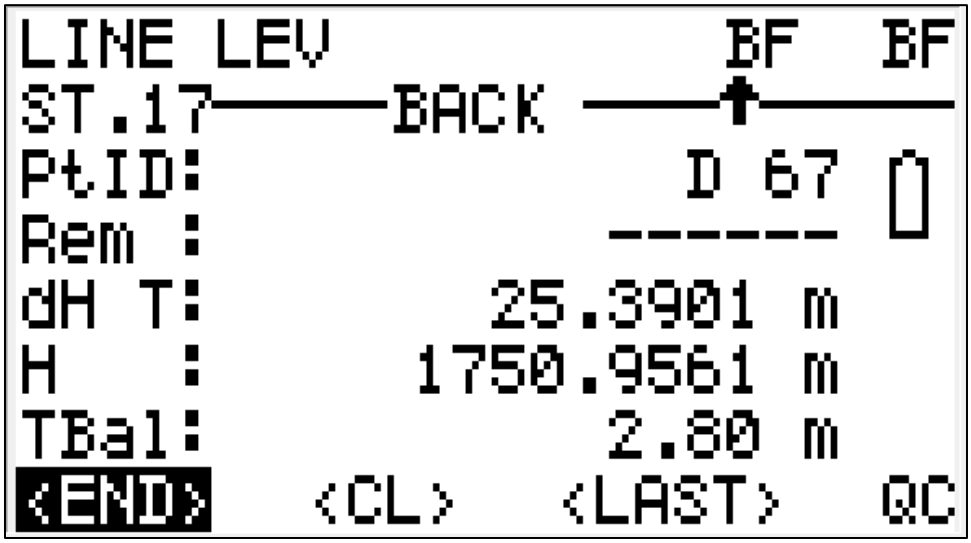

Figure 9-62. Ending the level run.

G. Allowable Misclosure

Based on the total distance of the loop, the allowable misclosure is calculated to determine if the level loop misclosure is acceptable. To view the total distance of the completed line, press the *DATA* button (red oval in Figure 9-63).

Figure 9-63. DATA button.

At the *DATA MANAGER* menu, select option 1, *VIEW / EDIT DATA*.

Figure 9-64. Data manager menu.

At the *VIEW / EDIT DATA* menu, select option 1, *MEASUREMENTS*.

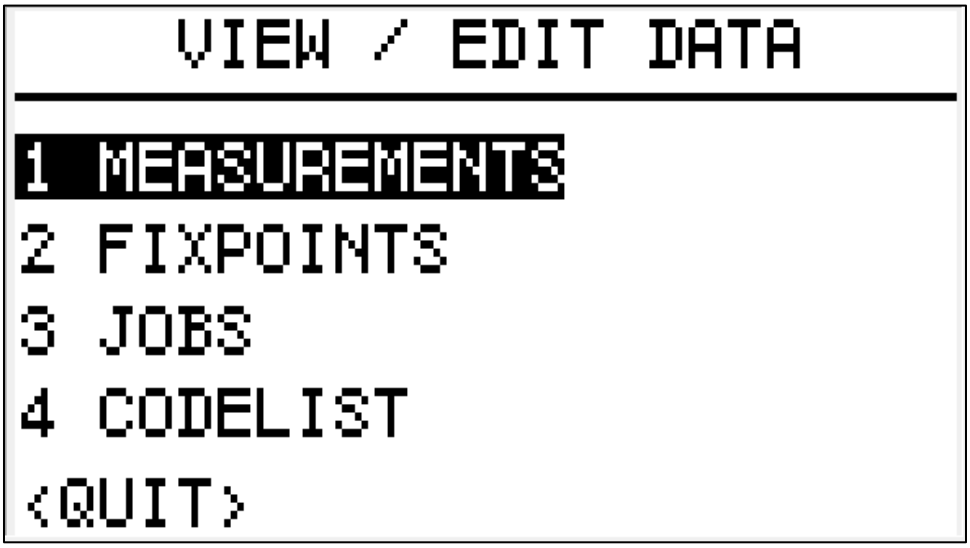

Figure 9-65. View/edit data menu.

Use the navigation buttons to select the current job and level line. When these have been selected, highlight *VIEW* and press *Enter* to load the line data.

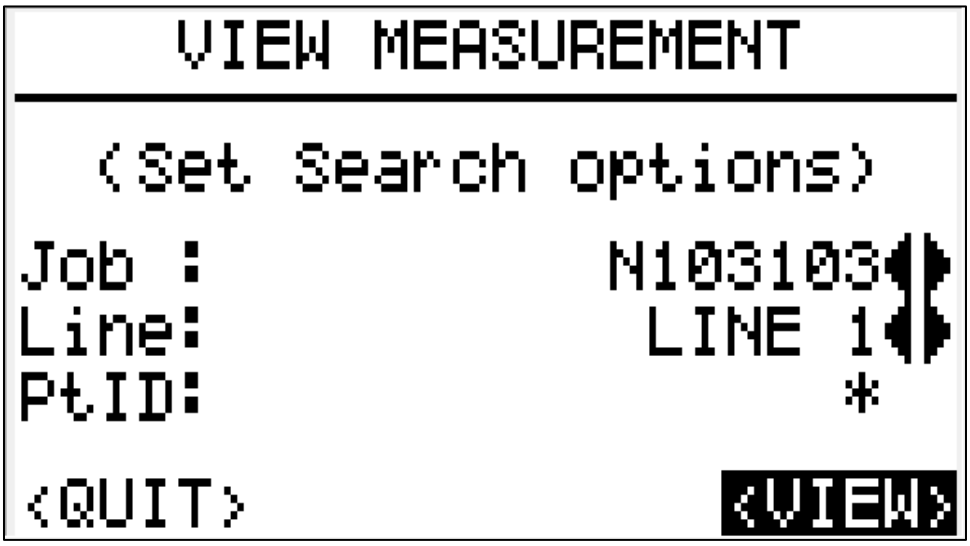

Figure 9-66. View measurement screen.

In the upper right corner of the screen is a page number. This number is the first page of the level line.

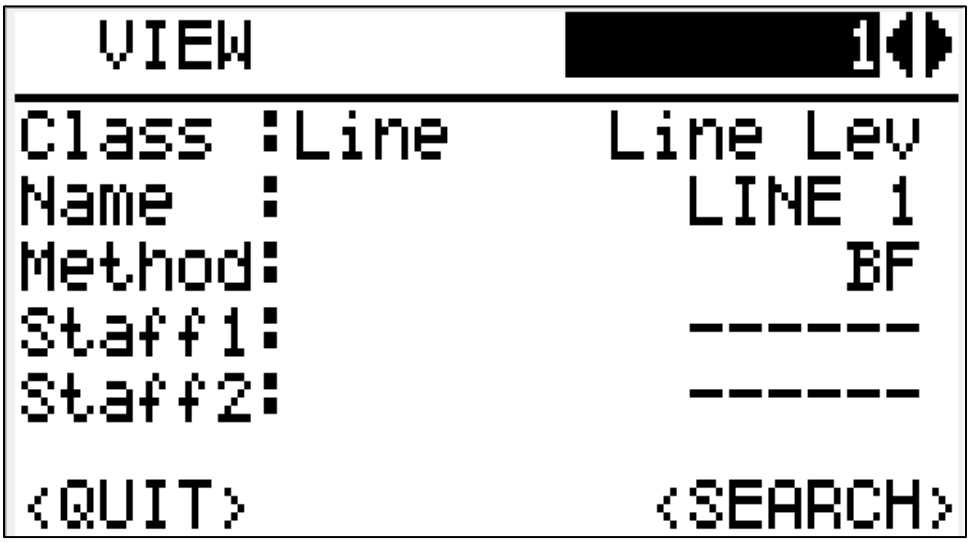

Figure 9-67. First page of the level line.

Press the left navigation button to scroll to the last page. There are several parameters listed on this page. The *DTot* value is the total distance for the entire line. This is the distance value used to compute the allowable misclosure.

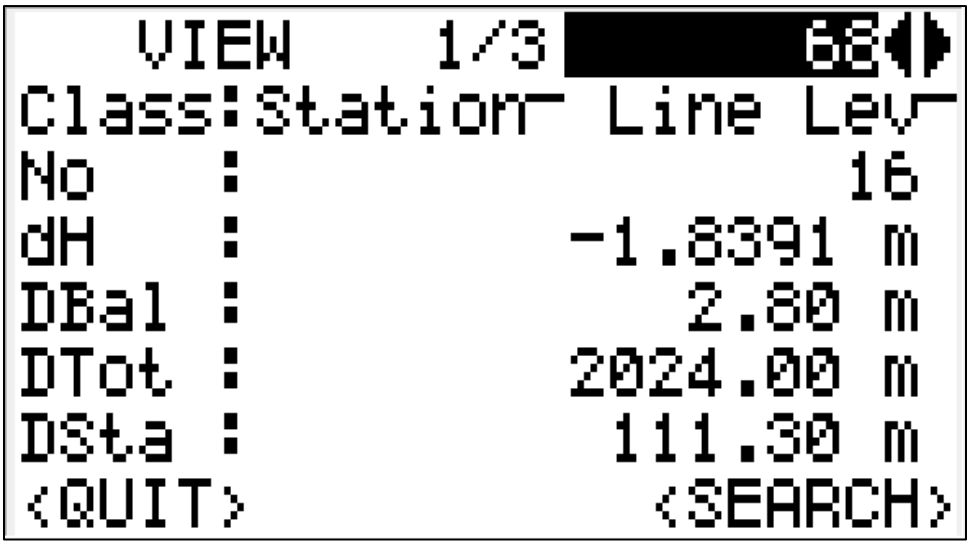

Figure 9-68. Last page of the level line.

Use the following equation to calculate the allowable misclosure for the loop or line:

- $allowable\ misclosure\ (meters) = 0.008\ m * \sqrt{(total\ distance\ in\ kilometers)}$

Example: A level loop is performed that starts and ends at control point CRHA 22. The starting elevation is 995.509 m and the ending elevation after closing the loop is 995.515 m. The total distance of the level loop is 1831.119 m.

Convert the distance to kilometers:

- $1831.119\ m/(1000\ m/km) = 1.831\ km$

Allowable misclosure (meters):

- $= 0.008\ m * \sqrt{(1.831)}$
- $= 0.008\ m * 1.353$
- $= 0.011\ m$

Since the allowable misclosure for this level loop is 0.0108 m and the difference between the starting and ending elevations is 0.006 m ($995.509\ m - 995.515\ m = 0.006\ m$), then the level loop closed within the allowable misclosure. If the level loop did not close within the acceptable tolerance, then the entire loop would need to be rerun until the misclosure is within the acceptable tolerance.

H. Transferring Data

Upon completion of a level loop or line, transfer the job to the memory card where it can be saved to a desktop computer or laptop.

I. Warning Messages

When a warning message is displayed, it is usually due to one of the preset tolerances being exceeded. Use the navigation buttons to scroll down and highlight *IGNORE*, then press the *Enter* button. This accepts the error and enables the operator to correct it. Press the *SHIFT* button and then the *Back* navigation button to retake the measurement, see Figure 9-70.

If the *REMEAS* option is selected, the instrument will disregard the last measurement taken. If the last measurement was a backsight and the turning point is no longer available (i.e. the turtle has been moved) the run will need to be restarted at the last benchmark, control point, or photo target. Always select the *IGNORE* option when a measurement needs to be retaken.

Note: When performing a check shot, no warning messages will be displayed. However, when these measurements are taken, the preset tolerance values should not be exceeded. Refer to Figure 9-45 for these values.

1. Meas. below limit!

This warning message is an indication that the rod reading is below the tolerance set for a low staff reading. When this message is displayed, highlight *IGNORE* and press *Enter*. Press the *SHIFT* button (red oval in Figure 9-70) then press the *Back* navigation button (blue oval).

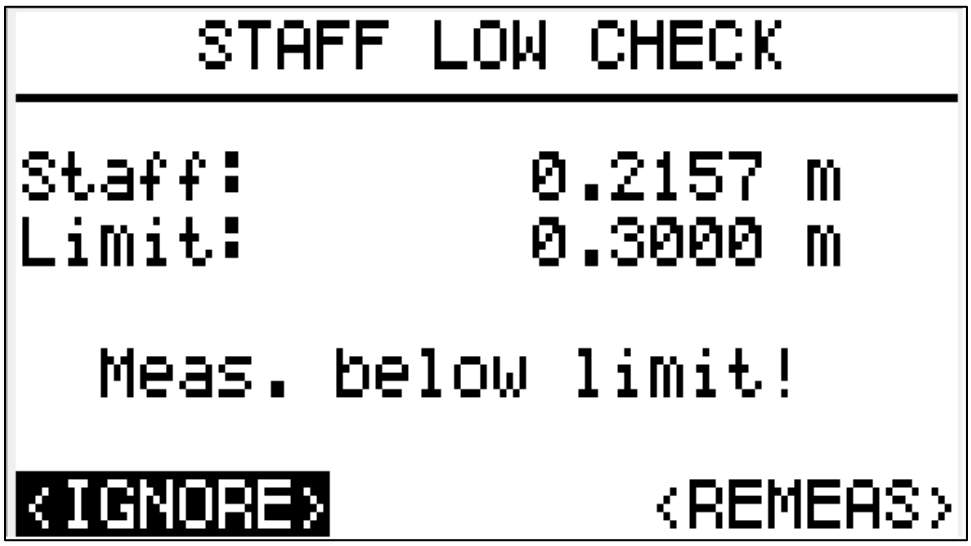

Figure 9-69. Warning message.

Figure 9-70. Shift and back buttons.

The DNA 10 level will display a "Remeasure Back?" or "Remeasure Fore?" message with the point name. Press *Enter* while *YES* is highlighted. Make the appropriate adjustment to the instrument for a backsight or the turning point for a foresight and take the measurement again. The instrument may be moved to correct an error whenever the *Remeasure Back?* message is displayed.

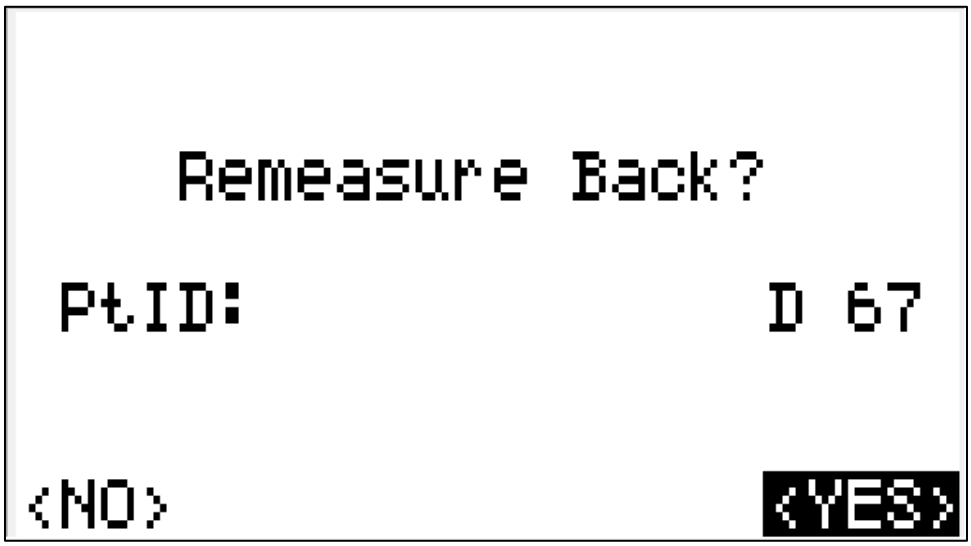

Figure 9-71. Remeasure backsight.

The turning plate (turtle) may be moved to correct an error whenever the *Remeasure Fore?* message is displayed.

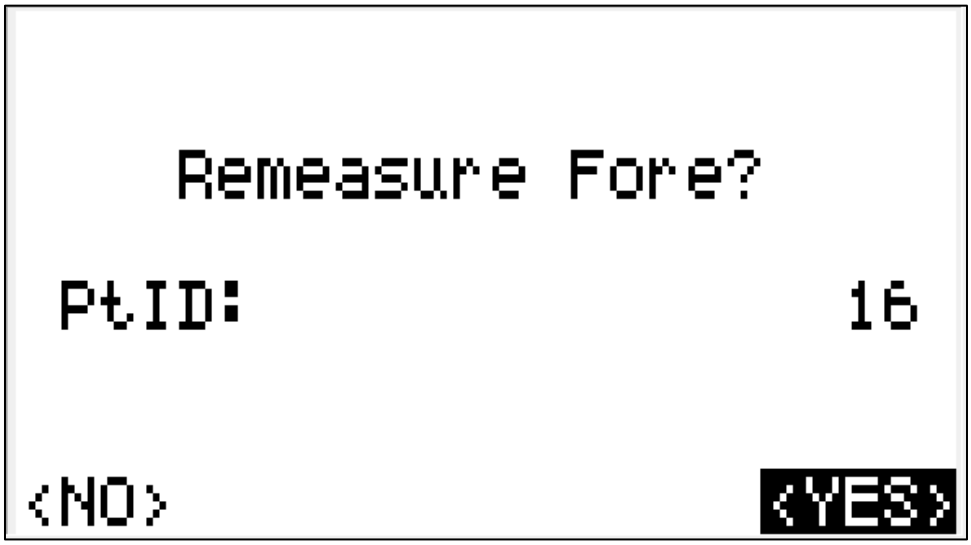

Figure 9-72. Remeasure foresight.

2. Distance Bal. too big!

This warning message is an indication that the cumulative backsight/foresight distance balance is larger than the total distance balance tolerance setting. If the value is positive then the cumulative backsight distances are greater than the cumulative foresight distances. If the value is negative then the cumulative foresight distances are greater than the cumulative backsight distances. To correct the error, highlight *IGNORE* and press *Enter*. Press the *SHIFT* button then press the *Back* navigation button.

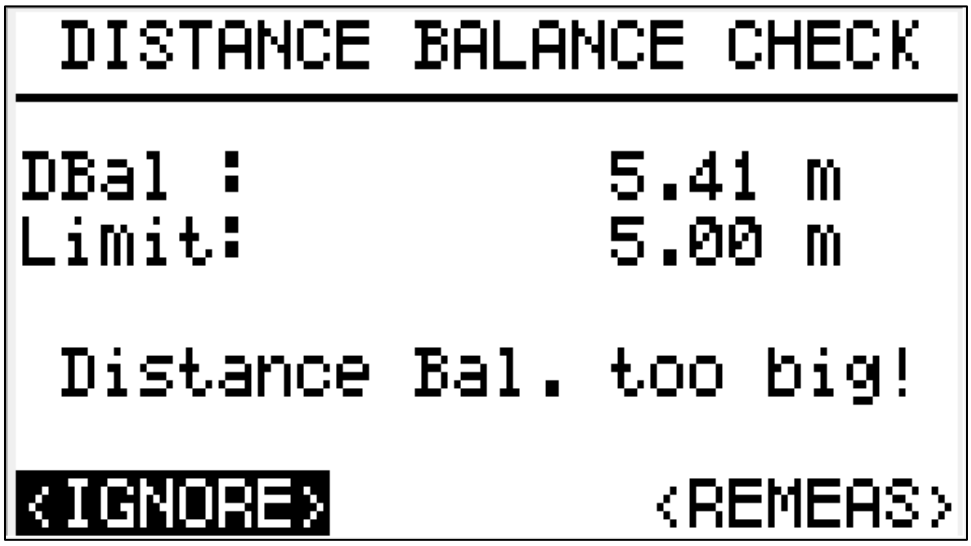

Figure 9-73. Warning message.

Prior to beginning the level run, the maximum *TBal* distance is set to 5 m. This may be exceeded with a positive or negative value. If the value is positive then the cumulative backsight distances are greater than the cumulative foresight distances. If the value is negative then the cumulative foresight distances are greater than the cumulative backsights.

Any adjustments to the distance balance should be made when the instrument is ready for a foresight. If the *TBal* is a negative value, the rod person should move closer to the instrument, thereby reducing the foresight distance. If the *TBal* is a positive value, the rod person should move away from the instrument, thereby increasing the foresight distance. As long as the backsight and foresight distances remain within the 5 m tolerance, the level run may continue.

An acceptable value for the cumulative backsight/foresight distances (*TBal* line in the red box).

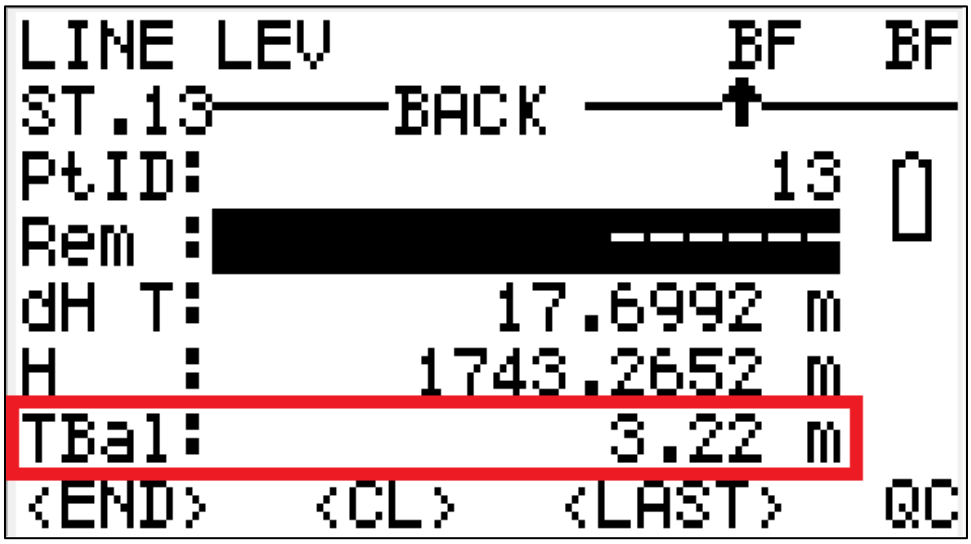

Figure 9-74. Acceptable distance balance.

3. Meas. Dist too big!

This warning message is an indication that the measured distance is larger than the tolerance set for the maximum allowable distance. When this message is displayed, highlight *IGNORE* and press *Enter*. Press the *SHIFT* button then press the *Back* navigation button. To correct this error, move the instrument closer to the rod for a backsight shot or move the rod closer to the instrument for a foresight shot.

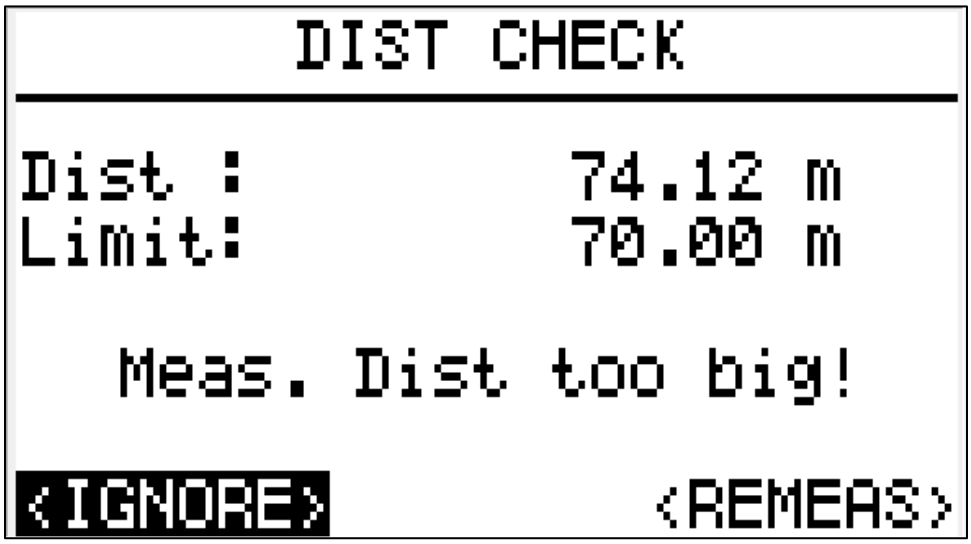

Figure 9-75. Warning message.

The warning messages in Figures 9-76 and 9-77 occur only if the *Precise* tolerance mode is set to *On*. The shot does not need to be re-taken, select *IGNORE* then press the *Enter* button. The Precise tolerance mode should be switched to *Off* before continuing with the run.

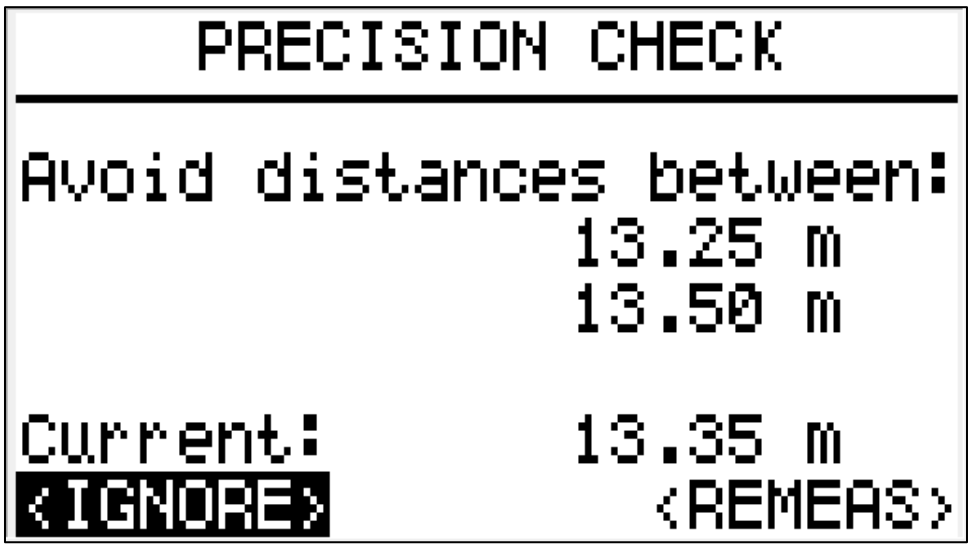

Figure 9-76. Precision mode warning message.

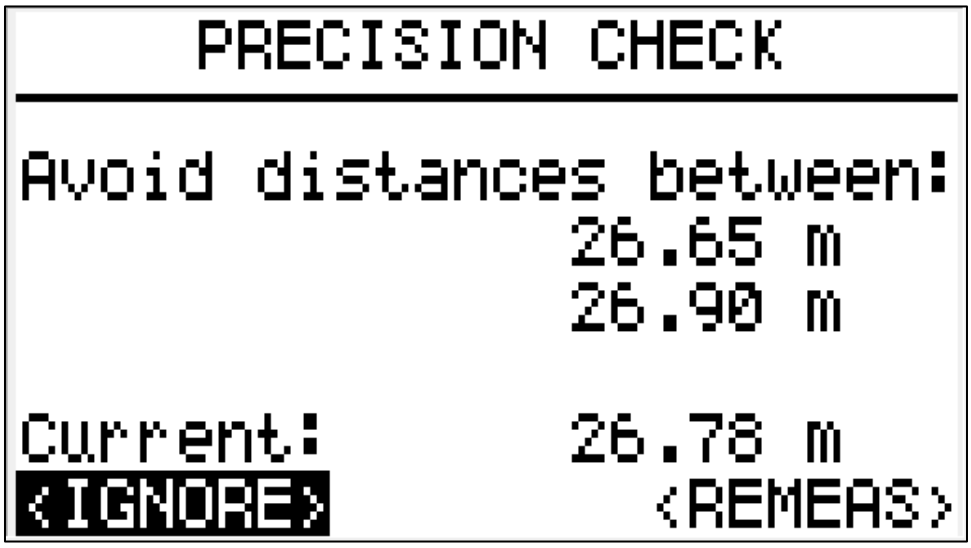

Figure 9-77. Precision mode warning message.