

User Guide

Spectra Precision® FOCUS® DL-15 Digital Level



Version 1.0
Revision B
January 2015



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Release Notice

This is the January 2015 release (Revision B) of the *Spectra Precision FOCUS DL-15 Digital Level User Guide*. It applies to version 1.0 of the Spectra Precision Focus DL-15 digital level.

Product Limited Warranty Information

For applicable product Limited Warranty information, please refer to the Limited Warranty Card included with this Spectra Precision product, or consult your Spectra Precision Authorized Distribution Partner.

Safety Information

For your safety, read this instruction manual carefully and thoroughly before using the Spectra Precision® FOCUS® DL-15 Digital Level. Although Spectra Precision products are designed for maximum safety, using them incorrectly or disregarding the instructions can cause personal injury or property damage.

You should also read the documentation for any other equipment that you use with a FOCUS DL-15 digital level.

Note – Always keep the manual near the instrument for easy reference.

Warnings and cautions

The following conventions are used to indicate safety instructions:



WARNING – Warnings alert you to situations that could cause death or serious injury.



CAUTION – Cautions alert you to situations that could cause injury or property damage.

Always read and follow the instructions carefully.

Safety information

Instruments and original accessories from Spectra Precision must only be used for the intended purpose.



WARNING – Operate the instrument only in the compliance with the operating conditions specified.

- Do not point the telescope directly at the sun.
 - Do not use the instrument and accessories in rooms with danger of explosion.
 - When you work with staves in the vicinity of electric plants (such as electric railways, aerial lines, transmitting stations) your life is acutely endangered. This risk exists independent of the material (e.g. aluminium or wood). In such cases it is necessary to inform the competent and authorised safety authorities and observe their instructions.
 - Protect operator and instrument sufficiently at the site of measurement (such as construction site, roads). Observe any relevant national regulations and the Road Traffic Act.
 - Do not carry out surveying work in a thunderstorm to avoid being struck by a lightning.
-



WARNING – Sighting of the sun or strong light sources *must by all means be avoided* because it would cause irreparable damage to your eyes

Nickel-metal Hydride (NiMH) batteries

This product has a built-in NiMH battery.



WARNING – Do not disassemble, mutilate, or puncture the NiMH battery. A damaged battery can cause an explosion or fire, releasing hazardous chemicals, and can result in personal injury and/or property damage.

To prevent injury or damage:

- Do not attempt to replace the battery. For a battery replacement, contact your Spectra Precision dealer. There are no serviceable parts inside.
 - Do not expose the battery to temperatures of above 60 °C (140 °F) or store the battery pack at temperatures above 60 °C (140 °F) for extended periods.
 - Do not immerse the battery in water.
 - Do not use or store the battery inside a vehicle during hot weather.
-



WARNING – If the NiMH battery is damaged or appears to be leaking, handle it with extreme care. Battery fluid is corrosive, and contact with it can result in personal injury and/or property damage.

To prevent injury or damage:

- If you come in contact with the electrolyte, wash the exposed area with soap and water.
 - If the electrolyte make contacts with your eye, immediately rinse the eye with water for 15 minutes and seek medical attention. Do not rub your eyes!
-



WARNING – Charge and use the rechargeable NiMH battery only in strict accordance with the instructions. Charging or using the battery in unauthorized equipment can cause an explosion or fire, and can result in personal injury and/or equipment damage.

To prevent injury or damage:

- Do not charge or use the battery if it appears to be damaged or leaking.
 - Do not charge the battery pack if the ambient temperature exceeds 45 °C (113 °F) or is below 0 °C (32 °F).
 - Charge the battery only in a Spectra Precision product that is specified to charge it. Ensure that you follow all instructions that are provided with the battery charger.
 - Discontinue charging a battery that gives off extreme heat or a burning odor.
 - Use the battery only in Spectra Precision equipment that is specified to use it.
 - Use the battery only for its intended use and according to the instructions in the product documentation.
-

Equipment information

 **WARNING** – Do not remove the instrument cover from the instrument. The FOCUS DL-15 digital level is designed to withstand normal electromagnetic disturbance from the environment but it contains circuits that are sensitive to static electricity. If an unauthorized person opens the instrument cover, the function of the instrument is not guaranteed and the warranty invalidated.

 **CAUTION** – Do not make any changes or repairs on the instrument and accessories. This must be done only by a service team or by authorised technical staff.

- Do not initialise the data memory without making a back up of the stored data, as the initialization will delete all stored data.
- Do tread tripod legs firmly into the ground to prevent sinking in and falling over of the instrument by wind pressure.
- Do mount the instrument to the tripod using the tripod screw immediately after you take the instrument from its case.
- Do not leave the instrument placed loosely on the tripod head. After loosening the tripod screw, immediately store the instrument in its case.
- Do check your instrument at regular intervals in order to avoid faulty measurements, especially after it has been subjected to shock or heavy punishment.
- Do not use the instrument too long when it is raining. During breaks, cover the instrument with the protective hood. Wipe the instrument and case dry in the field and let it dry completely indoors, with the case open.
- Do remove the batteries in case of unloading or a longer time without using the instrument.
- Do only recharge the batteries with the intended Spectra Precision charger.
- Do properly dispose of the batteries and equipment taking into account the applicable national regulations. Prevent improper use of the disposed instrument by proper disposal
- Do verify before every use of the instrument, that it is in perfect condition, particularly after longer transportation, fall or any other improper use. Systematically check measurements particularly before and after extensive surveying projects will help to avoid erroneous measurements.
- Do not use destroyed plugs and cables for accessories with the instrument.

 **CAUTION** – Never use strong detergents such as benzine or thinners on the instrument or the instrument case.

 **WARNING** – Residual inclinations of the line of collimation remaining after having centred the circular bubble are eliminated by means of the compensator. But it does not compensate any inclinations caused by insufficient adjustment of the circular bubble or of the line of collimation. For this reason, both adjustments must be checked.

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Introduction

In this chapter:

- [About the DL-15 digital level](#)
- [Technical assistance](#)

Thank you for purchasing the Spectra Precision® FOCUS® DL-15 digital level.

Before you operate a digital level, read this manual carefully. In particular, pay attention to the warnings and cautions that appear in the Safety section at the front of the manual.

About the DL-15 digital level

Although the principle of leveling has not changed, surveying today is no longer confined to the measurement of height differences. A demand now exists for complex measuring systems, which not only meets the increasing requirements for automatization, digital data processing, and efficiency in everyday surveying, but which also set new standards in technology and operating convenience.

The DL-15 digital level fits excellently in the complete line of the measuring equipment from Spectra Precision. Data interchange between all the instruments is ensured by a common data format and by the use of the USB memory stick.

Technical assistance

If you have a problem and cannot find the information you need in the product documentation, ***contact your local dealer.***

If you need to contact technical support, go to the Spectra Precision website www.spectraprecision.com/support.

Inspection, Care, and Maintenance

In this chapter:

- [Inspecting the container](#)
- [Instrument case](#)
- [Care and maintenance](#)
- [Transporting the instrument](#)
- [Servicing](#)

Inspecting the container

Inspect the shipping container. If the container arrives in poor condition, examine the equipment for visible damage. If damage is found, immediately notify the carrier and your Spectra Precision sales representative. Keep the container and the packing material for the carrier to inspect.

Instrument case

When unpacking the instrument, check that all ordered items are received. Below is an example of where all items can be placed in the instrument case.



Item	Description
1	Spectra Precision FOCUS DL-15 digital level
2	USB cable
3	Battery charger (AC adapter and cable)
4	Software CD
5	Instrument case
6	Hex key
7	Batteries (two)
8	Adjusting pins (two)
9	Rain cover (not shown)

Care and maintenance



WARNING – Do not remove the instrument cover from the instrument. The FOCUS DL-15 digital level is designed to withstand normal electromagnetic disturbance from the environment but it contains circuits that are sensitive to static electricity. If an unauthorized person opens the instrument cover, the function of the instrument is not guaranteed and the warranty invalidated.

The FOCUS DL-15 digital level is designed and tested to withstand field conditions, but like all precision instruments, it requires care and maintenance. Take the following steps to get the best results from the instrument:

- Do not subject the equipment to rough jolts or careless treatment.
- Keep the lenses clean. Use only lens paper or other material that is designed for cleaning optical equipment.
- When not in use, keep the instrument in the instrument case.
- Carry the instrument by the handle.
- When you need extremely precise measurements, make sure that the instrument has adapted to the surrounding temperature. Significant variations in instrument temperature can affect precision.

Cleaning



CAUTION – Never use strong detergents such as benzine or thinners on the instrument or the instrument case.

Be very careful when cleaning the instrument, especially when removing sand or dust from lenses and reflectors. Never use coarse or dirty cloth or hard paper. Spectra Precision recommends the use of anti-static lens wad, a cotton wad, or a lens brush.

Getting rid of moisture

If the instrument has been used in damp weather, take the instrument indoors and remove the instrument from the instrument case. Leave the instrument to dry naturally. If condensation forms on the lenses, allow the moisture to evaporate naturally.

Transporting the instrument

Always transport the instrument in a locked instrument case. For longer trips, transport the instrument in the instrument case and inside the original shipping container.

Servicing

Note – *There are no user-serviceable parts in the FOCUS DL-15 digital level.*

Spectra Precision recommends that you take the instrument to an authorized Spectra Precision service workshop for service and calibration once a year. This is to guarantee that the specified accuracies are maintained.

Instrument Description

In this chapter:

- [Battery](#)
- [Parts of the instrument](#)
- [Keyboard and display](#)

Battery

Before charging or using a battery it is important that you read and understand the battery safety and environment information.



WARNING – Do not disassemble, mutilate, or puncture the NiMH battery. A damaged battery can cause an explosion or fire, releasing hazardous chemicals, and can result in personal injury and/or property damage.

To prevent injury or damage:

- Do not attempt to replace the battery. For a battery replacement, contact your Spectra Precision dealer. There are no serviceable parts inside.
- Do not expose the battery to temperatures of above 60 °C (140 °F) or store the battery pack at temperatures above 60 °C (140 °F) for extended periods.
- Do not immerse the battery in water.
- Do not use or store the battery inside a vehicle during hot weather.



WARNING – If the NiMH battery is damaged or appears to be leaking, handle it with extreme care. Battery fluid is corrosive, and contact with it can result in personal injury and/or property damage.

To prevent injury or damage:

- If you come in contact with the electrolyte, wash the exposed area with soap and water.
- If the electrolyte make contacts with your eye, immediately rinse the eye with water for 15 minutes and seek medical attention. Do not rub your eyes!



WARNING – Charge and use the rechargeable NiMH battery only in strict accordance with the instructions. Charging or using the battery in unauthorized equipment can cause an explosion or fire, and can result in personal injury and/or equipment damage.

To prevent injury or damage:

- Do not charge or use the battery if it appears to be damaged or leaking.
- Do not charge the battery pack if the ambient temperature exceeds 45 °C (113 °F) or is below 0 °C (32 °F).
- Charge the battery only in a Spectra Precision product that is specified to charge it. Ensure that you follow all instructions that are provided with the battery charger.
- Discontinue charging a battery that gives off extreme heat or a burning odor.
- Use the battery only in Spectra Precision equipment that is specified to use it.
- Use the battery only for its intended use and according to the instructions in the product documentation.

Disposal

- Before disposal, discharge the battery.
- Dispose of the used battery in an environmentally sensitive manner, according to local and national regulations.

Charging the NiMH battery

The battery is supplied partially charged. Charge the battery completely before using it for the first time.

- To charge the battery, use only a charger that is recommended by Spectra Precision for charging the NiMH battery.
- Charge the battery before using the digital level if the equipment has been stored for longer than six months.

Battery capacity

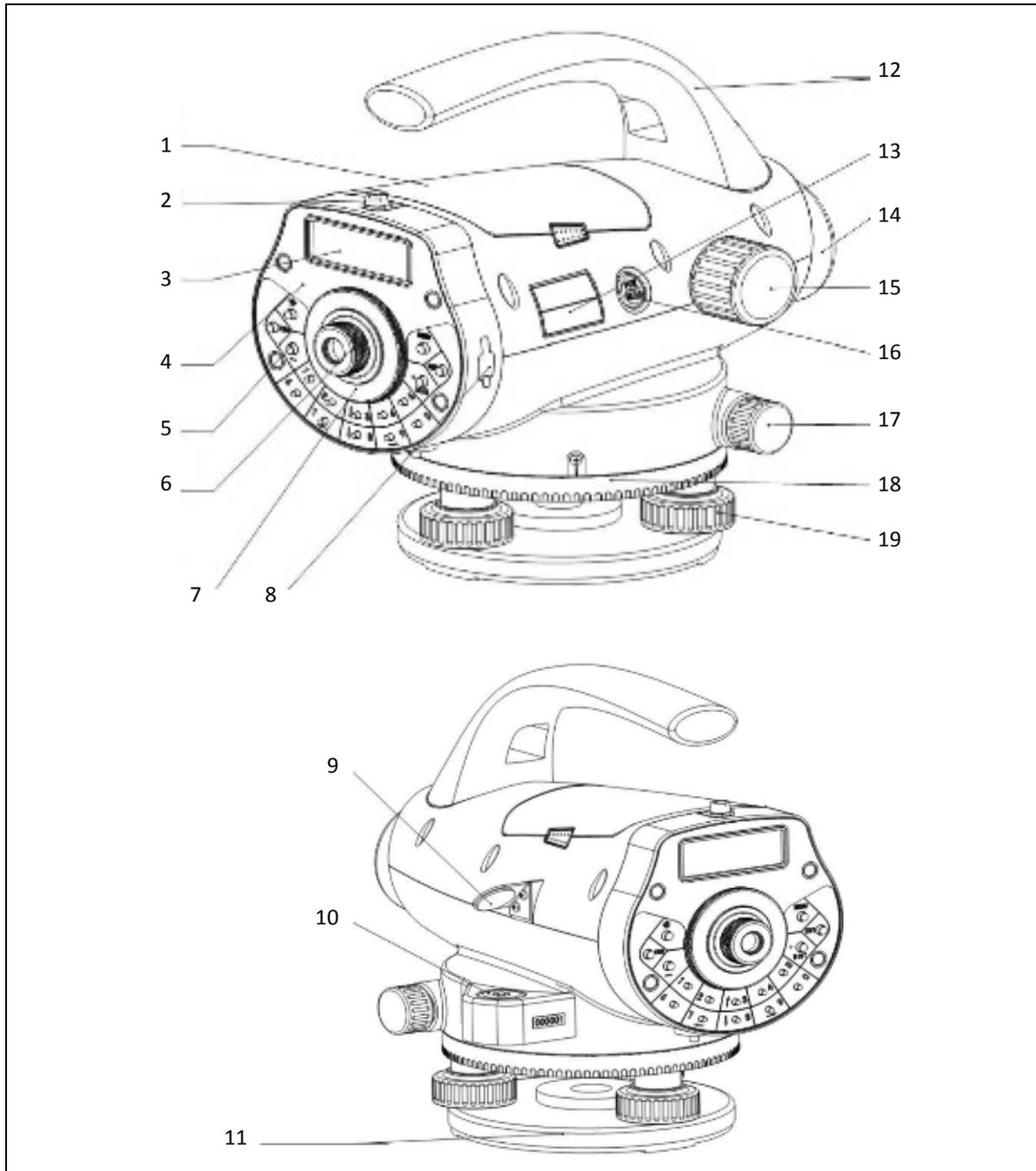
Due to the implemented power management and the liquid-crystal graphic display, the DL-15 digital level uses very little energy. Depending on the age and condition of the battery, a charged battery lasts for about three days working time without illumination.

Remaining battery display

The battery symbol indicates the remaining battery:

	Full
	Sufficient
	Half
	Low. Please change the battery or charge the battery.
	Unable to Measure. The power will soon be cut off. Immediately change the battery.

Parts of the instrument



Item	Description
1	Battery.
2	Coarse sight.
3	LCD display.
4	Keyboard panel.
5	Keys.
6	Eyepieces. Used to adjust the definition of the crosshair.
7	Protective cover for eyepiece. By releasing this cover, the mechanical adjustment of the reticle can be implemented to correct the optical collimation line error.
8	Data transfer port. Used to connect to a computer.
9	Circular vial reflector.
10	Circular vial.
11	Tribrach.
12	Lifting handle.
13	Model label.
14	Objective lens.
15	Focusing hand wheel. Used to focus the digital staff.
16	Power/Measure key. Used to turn the instrument on/off, and to measure.
17	Horizontal tangent hand wheel.
18	Horizontal dial. Used to set the horizontal direction value of the sighting direction to 0 or other required values.
19	Leveling screws of the tribrach.

Keyboard and display



Figure 3.1 Control and display unit of the DL-15 digital level

Key	Description	Comment
	POW / MEAS	Power ON/OFF, and start to measure. <ul style="list-style-type: none"> To power ON, press once. To power OFF, hold for two seconds.
	MENU	Return to the main menu.
	DIST	Measure to the distance and then display the distance.
	ENT	Confirm the parameters or input data.
	ESC	Escape from current setting mode.

Key	Description	Comment
	Illumination	Turn the illumination ON/OFF.
	-	Use to set inverse staff.
	Up	Move the selection up.
	Down	Move the selection up.
	Right	Move the selection right.
	Left	Move the selection left.
	Numbers	Enter numbers.

Setup

In this chapter:

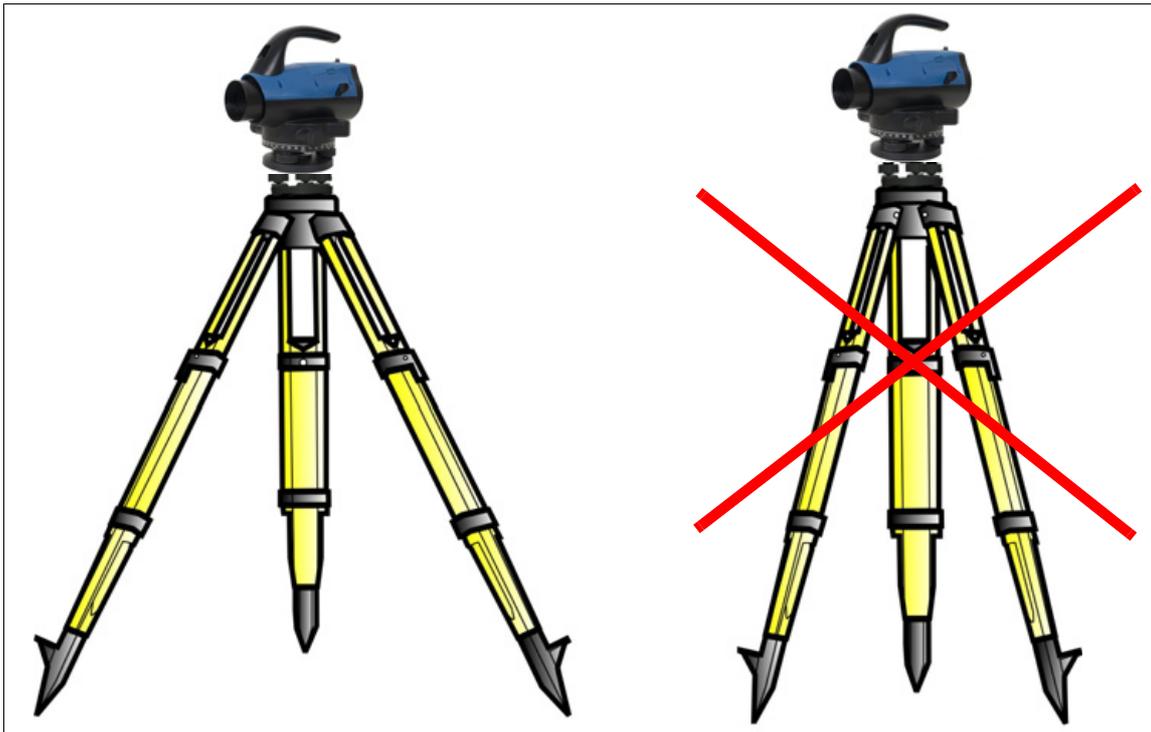
- [Setup stability](#)
- [Ambient temperature](#)
- [Setup and centering](#)
- [Telescope focusing](#)
- [Switching the instrument on and off](#)

An instrument setup with good measuring stability will increase the precision in the measurement result and enable the measurement precision of the DL-15 digital level to be used to its full extent.

Setup stability

When a level is setup it is important to consider the following:

1. Set tripod legs wide apart to increase the stability of the setup. A setup where one leg is placed on e.g asphalt and the other two on soil will still be a stable setup provided that the tripod legs are set wide enough. If it is not possible to set the tripod legs wide apart due to obstacles, then the tripod can be lowered to increase stability.



2. Make sure that all the screws on the tripod and/or tribrach are tightened to avoid any play.
3. Any survey quality tripod can be used. However, Spectra Precision strongly recommends the use of tripod heads made of steel, aluminium or similar material. Tripod heads of fiberglass or other composite materials are not recommended.

Ambient temperature

Take into account that a digital level requires sufficient time to adjust to the ambient temperature. The following rule-of-thumb for a high precision measurement applies: Temperature difference in degree Celsius ($^{\circ}\text{C}$) $\times 2 =$ duration in minutes required for the instrument to adjust to the new temperature. Avoid sighting across fields with intense irradiation by sun light, e.g. at noon.

Setup and centering

To guarantee the stability of measurement, it is recommended that a Spectra Precision tripod is used.



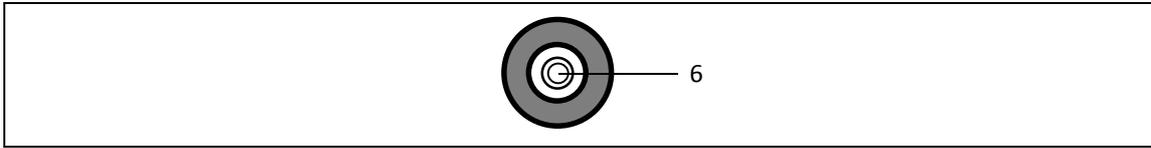
Setup

Extend the tripod legs (1) to a comfortable height for observation and fix them using the tripod locking screws (or clamps) (2). Screw the instrument centrally to the tripod head plate (3). The tribrach screws (4) should be in mid-position.

Coarse centering (only when required)

1. Set up the tripod roughly above the station point (ground mark). The tripod head plate (3) should be approximately horizontal.
2. Hook the plumb line (5) into the retaining screw and set up the tripod roughly centred above the ground mark.

- Level the circular bubble (6) by adjusting the length of the tripod legs (1).



Precision leveling



- Align the control unit parallel with the imaginary connecting line between the two tribrach screws.
- Level the instrument in the telescope axis (1) and perpendicular to it (2) by means of the tribrach screws.
- For checking, turn the instrument round the vertical axis in the opposite direction. The residual inclination should be within the working range of the compensator ($\pm 12'$) after having centred the circular bubble.

Fine centering (only when required)

Shift the tribrach on the tripod head plate until the plumb line is hanging directly above the ground mark; repeat the leveling process as many times as necessary.

Telescope focusing

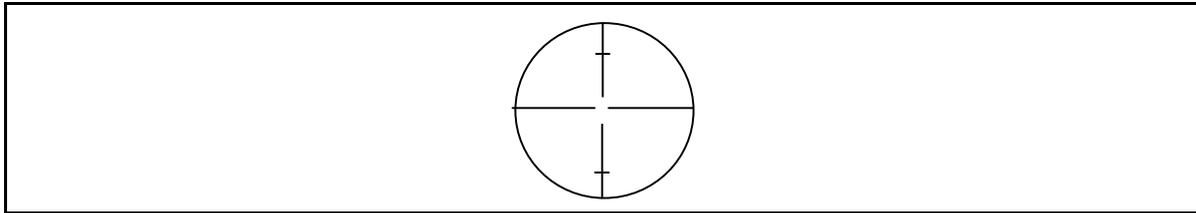


Figure 4.1 Visual field DL-15 digital level

Focusing the cross hairs

Sight a bright, evenly colored surface and turn the telescope eyepiece until the line pattern is sharply defined.



WARNING – Sighting of the sun or strong light sources *must by all means be avoided* because it would cause irreparable damage to your eyes.

Focusing the target point

Turn the telescope focusing control unit until the target point is sharply defined.



Tip – Check the telescope parallax: If you move your head slightly whilst looking through the eyepiece, there must be no relative movement between the cross hairs and the target; check focusing, if necessary.



WARNING – Residual inclinations of the line of sight remaining after having centred the circular bubble are eliminated by means of the compensator. But this does not compensate for any inclination caused by insufficient adjustment of the circular bubble or of the line of sight. For this reason, both adjustments must be checked.

Switching the instrument on and off

To switch the instrument on or off, press the POW/MEAS key.

Operating the OFF function unintentionally does not lead to a loss of measurement data. The system will ask in certain functions, but generally, all current data (line leveling) is saved in the non-volatile working memory.

Measurement

In this chapter:

- [Measure mode](#)
- [Stake out](#)
- [Leveling](#)

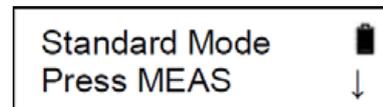
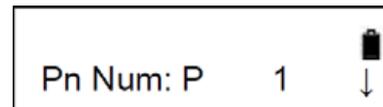
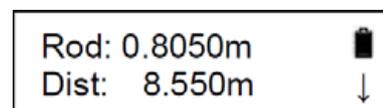
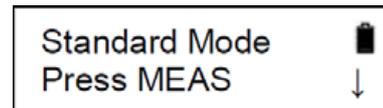
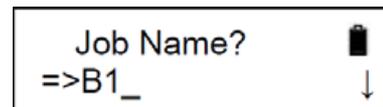
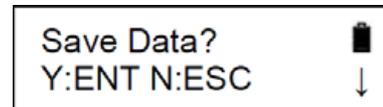
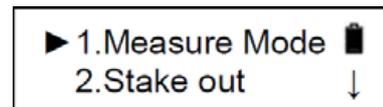
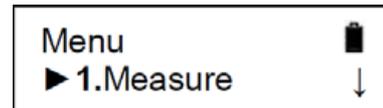
Measure mode

Use this mode to measure the staff reading and distance without calculating the height.

To set the measure times, see [Setting the number of times for an average measurement, page 42](#).

Using an average value based on several measurements can improve accuracy.

1. Press **[ENT]**.
2. Press **[^]** or **[v]** to select *Measure Mode* and then press **[ENT]**.
3. If Save mode is set to Auto save or Manual save, press **[ENT]** again.
4. Enter the job name and then press **[ENT]**.
5. Sight the staff, focus until clear and then press **MEAS**. The last value after several measurements have been taken is the average value. When using continuous measurement, press **[ESC]** to stop and record.
6. Press **[^]** or **[v]** to view the point. After saving, the point number increases automatically.
7. Press **[ENT]** to confirm or press **[ESC]** to quit.
8. In any process, press **[ESC]** continuously to return to the main menu.



Stake out

Stake out Ground Height (S.O GH)

In this mode, points can be staked out by entering the Ground Heights (GH) of the backsight point and the stakeout point.

1. Press **ENT**.
2. Press **^** or **v** to select *Stake out* and then press **ENT**.
3. Select S.O GH and then press **ENT**.
4. Enter the ground height of the backsight point and then press **ENT**.
5. Enter the ground height of the stakeout point and then press **ENT**.
6. Sight the staff on the backsight point until clear and then press **MEAS**.
7. The backsight staff/rod reading and distance are displayed. Press **MEAS** to measure continuously, press **ENT** to go to next step, or press **ESC** to quit.
8. Sight the staff on the stakeout point until clear and then press **MEAS**.
9. The stakeout rod reading and the distance are displayed. Press **ENT** to display the height and the value to fill or cut, where "-" is fill and "+" is cut.

```
Menu
▶ 1.Measure
```

```
1.Measure Mode
▶ 2.Stake out
```

```
▶ 1.S.O GH
2.S.O HD
```

```
BS GH?
=100_ m
```

```
SO GH?
=101_ m
```

```
Meas BS Pt
Press MEAS
```

```
BRod: 0.8050m
BDist: 8.550m
```

```
Meas SO Pt
Press MEAS
```

```
SRod: 0.6540m
SDist: 7.633m
```

```
GH: 1.0300m
HD: -3.9705m
```

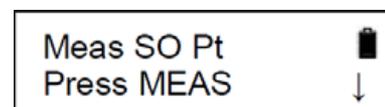
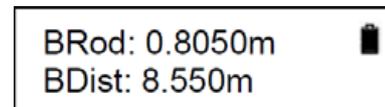
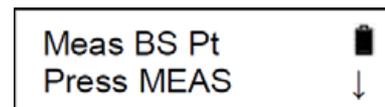
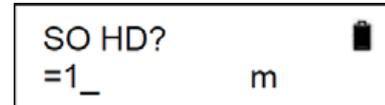
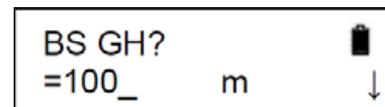
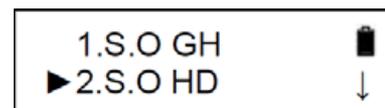
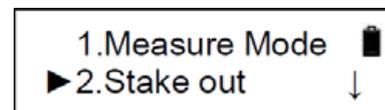
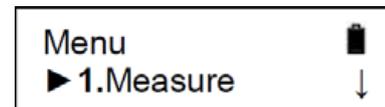
10. Press **[ENT]** to continue stakeout or press **[ESC]** to quit.
11. In any process, press **[ESC]** continuously to return to the main menu.



Stake out Height Difference (S.O HD)

Points can be staked out by entering the HDs (height differences) of the backsight point and the stakeout point.

1. Press **[ENT]**.
2. Press **[^]** or **[v]** to select *Stake out* and then press **[ENT]**.
3. Select S.O HD and then press **[ENT]**.
4. Enter the GH (ground height) of the backsight point and then press **[ENT]**.
5. Enter the HD (height difference) of the stakeout point and then press **[ENT]**.
6. Sight the staff on the backsight point until clear and then press **MEAS**.
7. The backsight rod reading and distance are displayed. Press **MEAS** to measure continuously, press **[ENT]** to go to next step, or press **[ESC]** to quit.
8. Sight the staff on the stakeout point until clear and then press **MEAS**.



9. The stakeout rod reading and the distance are displayed. Press **ENT** to display the height and the value to fill or cut, where "-" is fill and "+" is cut.

SRod: 0.6540m	
SDist: 7.633m	↓

10. Press **ENT** to continue stakeout or press **ESC** to quit.

GH: 1.0300m	
HD: -3.9705m	↓

11. In any process, press **ESC** continuously to return to the main menu.

ENT: Continue	
ESC: New Meas	↓

Stake out Distance (S.O Dist)

To stake out a point by entering the distance:

- Press **ENT**.
- Press **^** or **v** to select Stake out and then press **ENT**.
- Select S.O Dist and then press **ENT**.
- Enter the Input Dist of the stakeout point and then press **ENT**.
- Sight the staff until clear and then press **MEAS**.
- The distance and the distance difference are displayed.
Press **MEAS** to measure continuously, press **ENT** to go to next step, or press **ESC** to quit.
When the Δ Rod is positive, move the rod outward; when it is negative, move the rod inward.
- In any process, press **ESC** continuously to return to the main menu.

Menu	
▶ 1.Measure	↓

1.Measure Mode	
▶ 2.Stake out	↓

▶ 3.S.O Dist	
	↓

Input Dist?	
=50_ m	

S.O Dist	
Press MEAS	

Dist: 30.00m	
Δ Rod : 20.00m	

Leveling

In Leveling mode, the Save mode should be set to Auto or Manual Save. In this example, it is set to Auto Save.

1. Press **ENT**.
2. Press **^** or **v** to select *Leveling* and then press **ENT**.
3. Enter the job name and then press **ENT**.
4. Enter the point number of the backsight and then press **ENT**.
5. Select whether to use the existing data.
6. Sight the staff until clear and then press **MEAS**.
7. The backsight rod reading and distance are displayed.
Press **MEAS** to measure continuously, press **ENT** to go to next step, or press **ESC** to quit.
8. Press **<** or **>** to select to measure a FS (foresight) point or an intermediate point (Int.Pt).
9. Select FS, enter the point number of the FS point and then press **ENT**.

```
Menu
▶ 1.Measure ↓
```

```
▶ 3.Leveling
  4.GH&HD ↓
```

```
Job Name?
=>L54_
```

```
BS PN
=>P1_
```

```
Load data?
Y: ENT  N: ESC
```

```
▶ T01
  T02
```

```
G.H:0.00m
Y:ENT  N:ESC
```

```
Meas the BS Pt
PN:    P1
```

```
BRod: 1.2125m
BDist: 8.575m
```

```
SelectPtType
▶ FS      Int
```

```
FS PN
=>P2_
```

10. Sight the staff until clear and then press MEAS.
 - The foresight rod reading and distance are displayed.
 - Press MEAS to measure continuously, press **ENT** to go to the next step.

11. Press **←** or **→** to select to measure a BS (backsight) point or an intermediate point (Int.Pt).

12. Select intermediate point, enter the point number of the IntPt and then press **ENT**.

13. Sight the staff until clear and then press MEAS.
 - The intermediate rod reading and distance are displayed.

14. Press **ESC** and **ENT** to quit.

Meas the FS Pt
PN: P2

FRod: 0.9550m
FDist: 8.486m

SelectPtType
BS ► Int

Int Pn
=>I2

Meas the Int Pt
PN: I1

IRod: 0.7395m
IDist: 8.501m

ENT: Continue
ESC: New Meas

Notes

After measuring the backsight (BS) point, press **▲** or **▼** to display the following data:

<p>BRod: 1.022m BDist: 15.07m</p>	<p>Measurement value of backsight point</p>
<p>G H: 21.555m PN: P01</p>	<p>Ground Height of backsight point Point Number of backsight point</p>

When the foresight (FS) measurement is complete, press \square^{\wedge} or \square^{\vee} to display the following screen:

FRod: 1.032m  FDist: 15.07m	Measurement value of Foresight point
G H: 22.555m  PN: P05	Ground Height of Foresight point Point Number of Foresight point
H D: 0.532m  Σ : 25.003m	Height Distance of this station Total length

When the measurement of the intermediate (Int) point is complete, press \square^{\wedge} or \square^{\vee} to display the following screen:

IRod: 1.022m  IDist: 15.07m	Measurement value of Intermediate point
G H: 21.555m  PN: P01	Ground Height of Intermediate point Point Number of Intermediate point

Note – Prior to Foresight measurement, you can change the point number. The Point Number starts with P and has five numbers following it, which are increased. Point numbers that are used can be used again.

Ground Height or Height Difference (GH & HD)

In this mode, the GH (Ground Height) or HD (Height Difference) of the Backsight point can be measured before starting other measurements. In the GH&HD mode, the Save mode should be set to Auto or Manual save. In this example, it is set to Auto Save.

1. Press **ENT**.
2. Press **^** or **v** to select *GH&HD* and then press **ENT**.
3. Press **ENT** to save the data.
4. Enter the job name and then press **ENT**.
5. Press **ENT**. Enter the GH of the backsight and then press **ENT**.
6. Sight the staff until clear and then press **MEAS**.
7. The backsight rod reading and distance are displayed. Press **MEAS** to measure continuously or press **ENT** to measure the next point.

```
Menu
▶ 1.Measure
```

```
3.Leveling
▶ 4.GH&HD
```

```
Save Data?
Y: ENT  N:ESC
```

```
Job Name?
=>H5_
```

```
Input BS GH?
Y:ENT  N:ESC
```

```
BS GH?
=168.680m
```

```
Meas BS Pt
Press MEAS
```

```
BRod: 0.841m
BDist: 10.005m
```

8. Sight the staff on the foresight point until clear and then press MEAS.

The Foresight rod reading, distance, Ground Height, and Height Difference are displayed.

Meas FS Pt Press MEAS	
--------------------------	---

FRod: 0.841m FDist: 10.005m	
--------------------------------	---

GH: 168.479m HD: -0.001m	
-----------------------------	---

9. Press **ESC** to restart the measurement.

Exit? Y:ENT N:ESC	
----------------------	---

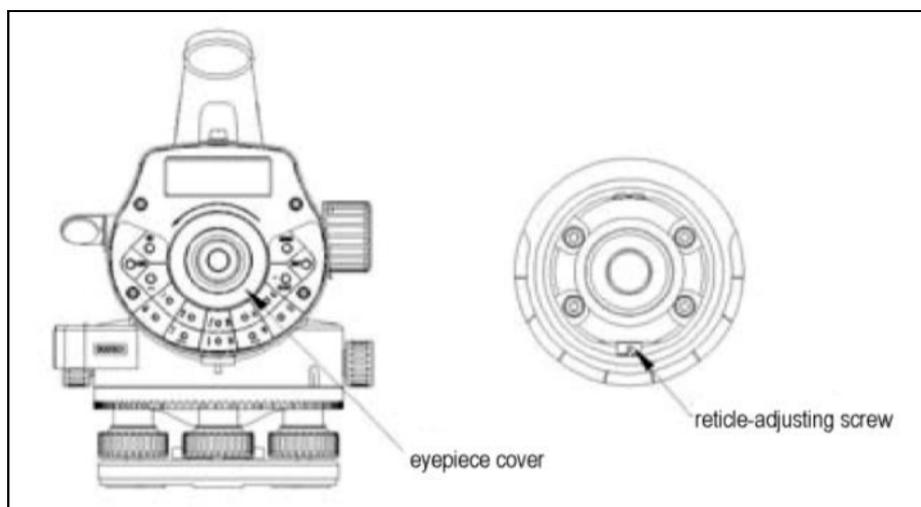
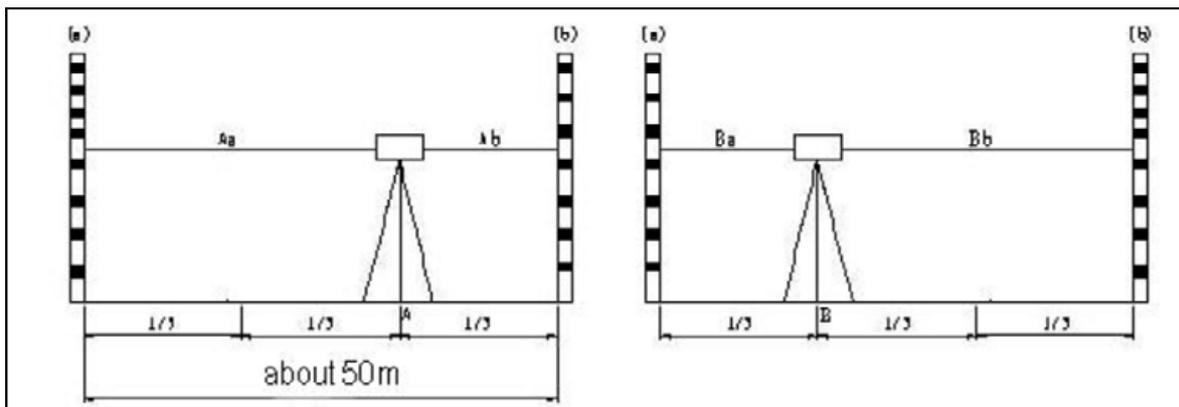
Adjustments

In this chapter:

- [Adjusting the line of sight](#)
- [Adjusting the circular vial](#)

Adjusting the line of sight

The instrument adjustment defines the necessary corrections for the line sight of the DL-15 digital level, which are required to ensure optimum measuring accuracy. Increased strain placed on the instrument by extreme measuring conditions, transportation, prolonged storage, and major changes in temperature may lead to misalignment of the instrument and faulty measurement results, particularly in the case of different distances from the instrument to the staff. Adjusting the line of sight and defined measurement methods eliminates these errors.



To inspect the line of sight (i angle) of the instrument:

1. Mount the instrument on a tripod between two staves (**a** and **b**) which are 50 m apart from each other. Divide this distance into three equal sections.
2. Level the instrument.
3. Use the adjustment process on the instrument as below.

1. In the Menu screen, press \uparrow or \downarrow to select *Adjust* and then press ENT .
2. With the instrument set up at **A**, sight the staff at **a** and press MEAS .
The rod reading at **a** is displayed.
3. Press ENT .
4. With the instrument still set up at **A**, sight the staff at **b** and press MEAS .
The rod reading at **b** is displayed.
5. Press ENT .
6. Turn off the instrument and move it.
Move the instrument setup from **A** to **B**.
7. With the instrument set up at **B**, sight the staff at **a** and press MEAS .
The rod reading at **a** is displayed.
8. Press ENT .
9. With the instrument still set up at **B**, sight the staff at **b** and press MEAS .
The rod reading at **b** is displayed.
10. Press ENT .
11. Press \uparrow or \downarrow and then press ENT .
12. Press ENT .
The line-of-sight adjustment is complete.

► 2.Adjust
3.Set

Adjust
a< ----A-----b

Adjust
Aa Rod:0.801m

Adjust
a ----A----- >b

Adjust
Ab Rod:1.023m

Relocate
A----- >B

Adjust
a< ----B-----b

Adjust
Ba Rod:0.808m

Adjust
a ----B----- >b

Adjust
Bb Rod:1.030m

0.0000m
0"

Adjusting the circular vial

1. Mount the instrument on a tripod. Center the circular vial precisely by rotating the three tribrach screws.
2. Rotate the instrument by 180°. If the bubble is not in the center, calibrate the circular vial:
 - a. Identify the bubble movement direction, and adjust the corresponding screws to move the bubble half of the offset.
 - b. Level the circular vial with the three tribrach screws again.
 - c. Rotate the instrument around again to check that the bubble is centered in every direction. If not, repeat [Step a](#) through [Step b](#) until the bubble is centered.

Parameter Settings

In this chapter:

- Parameters
- Setting the number of times for an average measurement

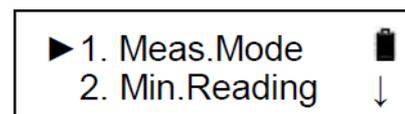
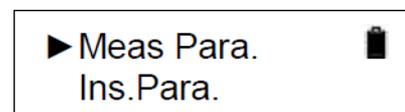
Parameters

To view the parameter settings, from the Menu screen, select *Set*.

Meas Para.	Meas.Mode	N Times Continuous
	Min.Reading	1 mm 0.5 mm
	InverseMode	Not Use Use
	Display Unit	m (meter) ft (US. ft)
	Save Mode	OFF Auto save Manual save
Ins.Para.	Auto OFF	On Off
	Contrast	1~9
	Backlight	Off On
	Ins.Info	Date SN#
	Regis.Info	

Setting the number of times for an average measurement

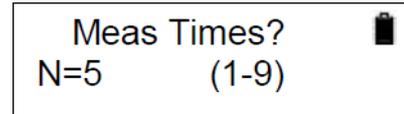
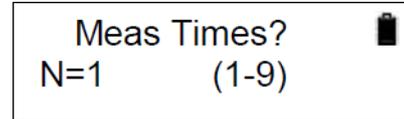
- In the Menu screen, press \uparrow or \downarrow to select *Set* and then press ENT .
- Press \uparrow or \downarrow to select *Meas Para* and then press ENT .
- Press ENT to select *Meas Mode*.



4. Press \uparrow or \downarrow to select *N Times* and then press ENT .



5. Enter the number of times to measure before averaging and then press ENT .



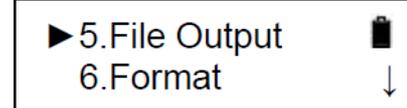
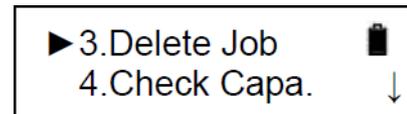
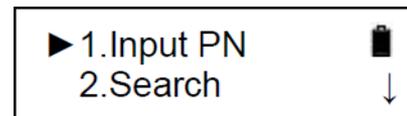
Data Management and Other Functions

In this chapter:

- [Data management](#)
- [Other functions](#)

Data management

1. In the Menu screen, press \uparrow or \downarrow to select *Data Manage* and then press ENT .
2. Press \uparrow or \downarrow to scroll to the required option and then press ENT to select it.



The options are:

Option	Description								
Input PN	The point number and height can be entered to search for the base point in the leveling measurement.								
Search	Search for the input point, standard measurement data, leveling measurement data, and GH/HD data.								
Delete Job	Delete input point, standard measurement data, leveling measurement data, and GH/HD data.								
Check Capa.	Check the capacity of the internal memory.								
File Output	Export the input point, standard measurement data, leveling measurement data and GH/HD data to the computer. (Baud rate: 9600, data length: 8, stop: 1, no parity) File types should be assigned extensions in accordance with the following conventions: <table data-bbox="443 1361 817 1527" style="margin-left: 20px; border: none;"> <tr> <td>.L</td> <td>Leveling data</td> </tr> <tr> <td>.M</td> <td>Measurement data</td> </tr> <tr> <td>.H</td> <td>GH/HD data</td> </tr> <tr> <td>.T</td> <td>Input point data</td> </tr> </table>	.L	Leveling data	.M	Measurement data	.H	GH/HD data	.T	Input point data
.L	Leveling data								
.M	Measurement data								
.H	GH/HD data								
.T	Input point data								
Format	Format the internal memory.								

Other functions

Distance Display [DIST]

Use the **[DIST]** key to measure the distance before surveying to make sure the distances between the foresight and backsight are the same.

Inverse Staff mode [-]

In this mode, the staff can be inverted for measurements from the ceiling. To do this:

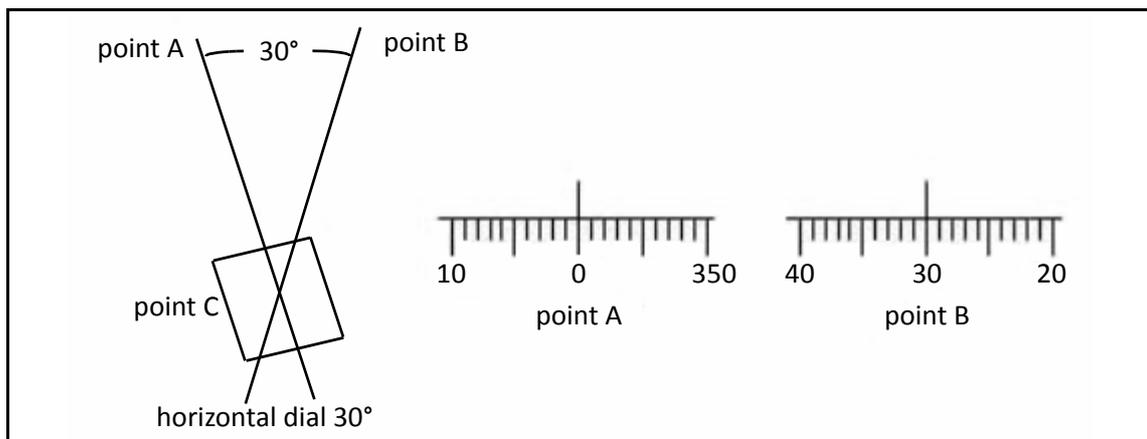
1. Set the Inverse Mode to *Use* in the Meas.Para. setting.
2. Before pressing **MEAS** press the **[]** button. The battery symbol and symbol **I** appears alternately in the upper right corner of the screen, which indicates that the Inverse Mode is activated.

Horizontal angle measurement

This instrument is equipped with a graduated horizontal circle that can be used for horizontal angle measurement. This circle is graduated every 1° and labeled every 10° from 0° to 350° in a clockwise direction.

To set the horizontal angle measurement:

1. Set up and level the instrument at start point **C**.
2. Sight the backsight point **A**, and rotate the horizontal tangent screw until the crosshair is accurately on the staff at point **A**. Rotate the horizontal circle to the 0° symbol.
3. Sight the foresight point **B**, and adjust the horizontal tangent until the crosshair is accurately on the staff at point **B**. The angle reading is the angle between point **A** and point **B**, that is **<ACB**.



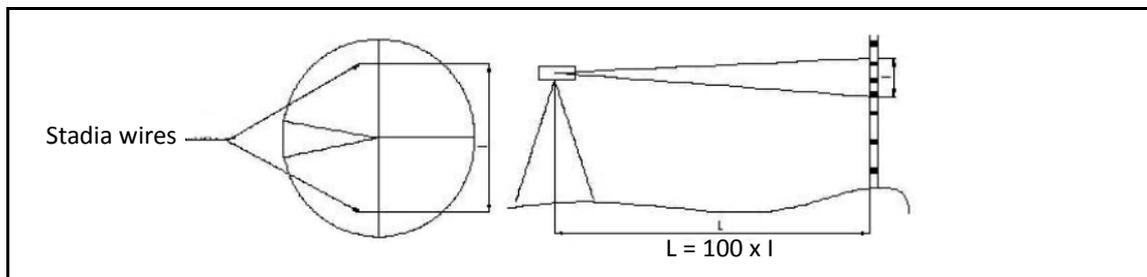
Optical distance measurement

Using the stadia wires of the instrument and the graduations on the staff, a distance can be measured easily. This distance is the stadia interval on the staff multiplied by the stadia constant of 100.

The stadia interval is the interval between the upper wire and the lower wire on the reticle.

1. Set up the staff on the target point.
2. Set up and level the instrument.
3. Sight the telescope to the staff. Record the stadia interval between the upper and lower wire as I .

The distance " L " between the instrument and the staff is $L = 100 \times I$.



Specifications

In this chapter:

- [Performance](#)
- [General](#)

Performance

Height accuracy¹	
Electronic measurement	1.5 mm (0.005 ft)
Optical measurement	2.0 mm (0.007 ft)
Distance accuracy	
Distance (D) ≤ 10 m (32.80 ft)	10 mm (0.033 ft)
Distance (D) >10 m (32.80 ft)	D*0.001 mm/ft
Range	
Electronic measurement	1.5 m to 100 m (4.92 ft to 328.08 ft)
Electronic measurement	
Resolution height measurement	1 mm / 0.5 mm
Resolution distance measurement	0.1 m / 0.01 m
Measurement time	3 sec
Horizontal circle	
Graduation	360°
Graduation interval	1°
Estimation to	0.1°
Environmental	
Operating temperature	-20 °C to +50 °C (-4 °F to +122 °F)
Dust and water proofing	IP54

¹(DIN 18723, standard deviation height measuring per 1 km (3,280.84 ft) of double leveling).

General

Telescope	
Objective aperture	45 mm (0.148 ft)
Magnification	32x
Resolving power	3"
Field of view	1°30'
Stadia constant	100
Compensator	
Type	Magnetic damping
Compensation range	±12'
Setting accuracy	±0.3"
Circular level sensitivity	8'/2 mm
Display	Dot matrix LCD, 128 x 32 dpi with illumination
Keyboard	16-key numeric including 4-way navigation arrows
Onboard programs	Elevation Height difference Cut & Fill stakeout Distance stakeout Height measurement
Data storage	
Internal	16 MB >100,000 points
Point number	Increasing
Interface	Mini-USB
Dimensions (L x W x H)	230 mm x 150 mm x 210 mm (9.0 in x 5.9 in x 8.3 in)
Weight	2.5 kg (5.5 lb) (including battery)
Power supply	
Internal battery (x2)	Rechargeable NiMH 4.8 V, 2100 mAh
Operating time	~20 hours
Charging time	~5 hours

Graphics/header_template.png 1
Graphics/CT Spectra Precision_3D_NoDropShadow_CMYK.tiff 1
Graphics/DL-15_QTR Right_Back.jpg @ 210 dpi 1
Graphics/DL-15_In Case with Notes.jpg @ 150 dpi 11
Graphics/Battery_Full.bmp @ 100 dpi 16
Graphics/Battery_Sufficient.png @ 100 dpi 16
Graphics/Battery_Half.png @ 100 dpi 16
Graphics/Battery_Low.png @ 100 dpi 16
Graphics/Battery_Unable.png @ 100 dpi 16
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Graphics/POW-MEAS.PNG @ 100 dpi 19
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Graphics/Measure1.png @ 200 dpi 29
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Graphics/level2.png @ 200 dpi 31
Graphics/Level3.png @ 200 dpi 31
Graphics/Level4.png @ 200 dpi 31
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