NOVATRON

MACHINE CONTROL SYSTEMS

# XSITE PRO SPI 14.2

# USER MANUAL

Version 1.14.2.46

October 2018

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# 1 INTRODUCTION

This document is user manual for XSite PRO machine control system (“Product”). Read this manual carefully before any use of the product and especially observe the safety instructions. Make sure that you understand the information contained in this manual before any use of the product. Keep manual available for later use.

**System software version**
This manual applies to software version SPI 14.2

**Manufacturer's contact information**
Novatron Oy
Jasperintie 312
33960 Pirkkala, Finland
Tel: +358 (0)3-357 26 00
E-mail: sales@novatron.fi, service@novatron.fi, techsupport@novatron.fi
Web: www.novatron.fi

**Conformity to FCC rules (North America)**
This product complies with part 15 of the FCC rules.

**Disclaimer**
The manufacturer does not accept any liability for damages caused by:

- Inappropriate assembly and/or installation
- Non-observance of the User Manual
- Non-intended and improper use
- Use beyond operation limits
- Use by insufficiently qualified and trained personnel
- Use of unauthorized spare parts and accessories
- Deconstructing and/or rebuilding of the product

**Conformity to directives and regulations**
This product is in conformity with EU's EMC (2004/108/EC), RED (2014/53/EU), RoHS (2002/95/EC), and WEEE (2002/96/EC) directives and REACH (2006/1907/EC) regulation.

This product may not be disposed of together with unsorted household waste, it must be collected separately.

The product contains radio modem manufactured by Sierra Wireless.

- Sierra Wireless MC7710 or MC7304 modem (European Union)
- Sierra Wireless MC7330 modem (Eastern Asia)

Modem is used for communicating in the following networks: GSM, GPRS, EDGE, WCDMA, HSPA, HSUPA.

EU declaration of conformity for the radio modem is available at:
Sierra Wireless (UK), Limited
Lakeside House
1 Furzeground Way, Stockley Park East
Uxbridge, Middlesex
UB11 1BD
England

## Disclaimer

The manufacturer does not accept any liability and makes no warranty and representation (either implied or express) of the accuracy or completeness of the information contained in this document. The manufacturer is not liable in any circumstances for any possible loss of profit or revenue or other financial loss, including but not limited to any special, incidental, indirect or other damages. Furthermore, the manufacturer reserves the right to correct and change the contents of this document from time to time, without any obligation to inform any person of such corrections and changes.

The product shall be only used for the purpose determined in this document, and only together with such devices and parts that the manufacturer has accepted or which it recommends. The manufacturer does not warrant fitness for any particular purpose. Correct and reliable functioning of the machine requires appropriate transport, storage and installation, as well as cautious use and repair.

**The manufacturer does not accept any liability for any damages caused by:**

- Inappropriate assembly and/or installation
- Non-observance of the User Manual
- Non-intended and improper use
- Use beyond operation limits
- Use by insufficiently qualified and trained personnel
- Use of unauthorized spare parts and accessories
- Deconstructing and/or rebuilding of the product, or
- any other similar matters for which the operator is responsible for

## User Manual

The Manual contains basic information to be considered when using and maintaining the product. Observing all security instructions and guidelines given here is important for safe operation. Therefore this operator Manual must be read prior to any use of the product and applied without fail by any person assigned with working processes at the machine, such as operation, diagnostics and maintenance.

The Manual is a part of the product and must be passed on to third persons or later owners as required. It must be permanently kept at the usage site and be available for operating and maintenance personnel. All local accident prevention regulations, general safety regulations and the manufacturer’s safety regulations must be observed by the operator.

The product is available with various sensor combinations. If your system is not equipped with all sensors or other components, their description and instructions do not apply. Due to multiple possible applications, the functions of the product in this manual will be explained by an excavator installation manual.

It is the intention of the manufacturer that the Manual remains correct and up-to-date. To ensure that we keep our technological advantage it may be necessary to undertake modifications of the product and its operation without prior notice; in such cases the information in this manual may be superseded by further revisions, and your local dealer will provide you with a new manual upon your request. The manufacturer and its representatives do not accept liability for any disturbances, failures or resulting damages.

We will not be held liable for possible errors or consequences arising from this manual. Should you wish to make suggestions regarding this manual or point out possible errors, please contact your local dealer. We will gladly take your ideas and suggestions into consideration.

### Explanation of the symbols

Notices are marked with symbols in the Manual. Observe these notices at all times and proceed carefully to prevent accidents, personal injury, and material damage.

Indicates a hazardous situation. If not avoided, could result in death, serious injury, or material damages.

**Note!**

Emphasizes useful tips and recommendations as well as information referring efficient and failure-free operation.

## 1.1 Safety instructions

This chapter outlines important safety matters concerning the operating procedures necessary for ensuring optimal personnel safety. It is important that these instructions are followed because they enable users to recognize and prevent potential operating risks before they occur. All users must understand and observe these instructions prior to any use of the product.

When operating machine the operator must not solely trust the operation of the product. Operating machine solely based on the product is forbidden. The operator must observe the usage site in order to avoid risks.

**Conventional use**

The product has been exclusively designed and constructed for conventional use as described here:

- Positioning the tool of a construction machine
- Indicating the position of a measuring point to the operator
- Comparing the position of a measuring point with reference informationn

Any other use not listed here, as well as any application not complying with the technical data, is not considered conventional use. The manufacturer is not liable for any damages or consequences caused by any improper or unauthorised use of the product.

**Improper use**

The following situations, without any limitations, are considered improper use of the product

- Non-conventional use
- Exceeding the limit values given in the manual
- Use of the product without instructions
- Use of the product beyond the limits of use
- Using the product with safety equipment disabled
- Removal of labels on the product (for example, warning labels)
- Opening, taking apart, rebuilding or making alterations to the product
- Using the product in spite of obvious defects or damage
- Using the product with unauthorised accessories, devices or services from other manufacturers
- Using the product at insufficiently secured construction sites

**Alteration and rebuilding of the product**

To prevent risks and ensure optimal performance, rebuilding or making any alterations to the product may not be carried out without the manufacturer’s explicit prior permission. The manufacturer's explicit permission is also required before adding any attachments or notices to the product.

**The operator’s responsibility**

The product is used in the industrial sector. Therefore, the operator of the product is liable to the legal responsibilities for operational safety. Besides the operational safety instructions in this manual, the safety, accident prevention, and environmental protection regulations valid for the operational area of the product have to be observed by the operator

- The operator has to inform himself about the current operational safety regulations and, in a risk assessment, detect additional risks that are caused by the special working conditions at the usage site of the product. The operator must then implement these in the form of directives. These directives have to be kept near to the product and permanently be available for the persons working with it.

**Particularly applying for the operator, without any limitations:**

- The operator has to clearly define the personnel's responsibilities referring the appliance.
- The operator has to ensure that the operator Manual's content is fully understood by the operating personnel prior to any use of the product. The operating personnel must adhere to User Manual at all times when using the product.
- The statements of the User Manual have to be observed thoroughly and unrestrictedly.
- The operator has to ensure that all maintenance, inspection and assembling processes are carried out by qualified specialized personnel, which have informed themselves sufficiently by closely studying and understanding the manuals for the product's operation.
- The operator informs the manufacturer or the authorized dealer without any delay if any safety defects occur at the product or during operation.

**Special risks**

**Epilepsy warning**

Some people are susceptible to epileptic seizures or loss of consciousness when exposed to certain flashing lights or light patterns. Immediately discontinue use and consult your doctor if any of the following symptoms occur while using the product: dizziness, blurred vision, eye or muscle twitches, loss of consciousness, disorientation or any involuntary movement or convulsion.

**Risks caused by electric current**

When working close to electric systems (, for example, overhead powerlines), there is danger to life due to electric shock. Keep sufficient safety distance to electric systems.

**Moving components**

Keep persons away from the machine's and the tool's working range. Remove objects from the machine's and the tool's working range. Do not interfere with the moving components during operation.

**Overlapping machine parts**

Subsequently assembled system components (, for example, GNSS masts) can overlap the typical machine dimensions. This can lead to injuries and material damages.

**Risk of injury caused by malfunction**

Uncontrolled machine actions caused by the malfunction of a system component can lead to severe personal injuries in the machine's working range or cause material damage. Ensure that the machine is operated, controlled and inspected by a qualified and experienced operator, who has to be able to induce emergency measures, for example, an emergency stop.

**Lacking instruction**

Lacking or insufficient instruction can lead to operating errors or incorrect use. This can lead to severe personal injuries as well as severe material and environmental damages. Observe the manufacturer's safety instructions and the operator's directives.

**Risk of injury caused by insufficient safeguarding**

Insufficient safeguarding of the construction site and the component's location, for example, of the laser emitter, can lead to hazardous situations in traffic and at the construction site. Ensure sufficient safeguarding of the construction site. Ensure sufficient safeguarding of the single components' locations. Observe the country-specific safety and accident prevention regulations as well as the current road traffic regulations.

**Risks caused by faulty measurement results**

Faulty measurement results due to use of a dropped product, another illegitimate demand or an alteration can lead to severe material damages. Do not use obviously damaged products. Before reusing a dropped component, carry out a check measurement.

**Risk of injury caused by unreadable signs**

In the course of time, labels and symbols on the product can get dirty or get unrecognizable due to other events. Due to immoderate mechanical effects labels and symbols can be detached. Always keep safety, warning and operation instructions in a well readable state. Regularly check the adhesiveness of the labels and symbols on the product. Do not remove labels and symbols from the product.

**Risk of injury caused by inappropriate disposal of the product**

When burning plastic parts, toxic gases that can cause illnesses emerge. Dispose the product properly according to the current national country-specific disposal regulations. Careless disposal might also enable unauthorized persons to improperly use the product. In doing so these persons and/or third persons can be severely injured and also pollute the environment. At all times, protect the product against the access of unauthorized persons.

**Accidents and Emergencies**

**Preventive measures**

- Always be prepared for possible accidents or fire
- Keep a first aid kit within reach
- Familiarise all personnel with the location and use of first-aid equipment, accident notification procedures and procedures for alerting the emergency services
- Keep access routes clear for emergency vehicles

**In the event of an accident, proceed appropriately:**

- Shut down the equipment immediately by switching the power off
- Begin first aid measures
- Move persons out of the hazard zone
- Inform the manager of the job site
- Alert medical assistance and/or the fire brigade
- Ensure that access routes are clear for emergency vehicles

## 1.2 Product overview

Xsite PRO is a machine control system for construction machines. Xsite PRO indicates the position of the measuring point (for example, measuring point of the bucket's blade) compared to a reference level. The system can be used as a 2D (Vision) or 3D system (LandNova).

**The system can be used in the following construction machines:**

- Excavator
- Wheel loader (Machine model is different and bucket calibration is horizontal not vertical plumbline calibration)

**The system contains the following components by default:**

- Computer unit (MCC15)
- Display unit (Xsite PRO display)
- Gravitation sensors (G2 sensors)
  - Number of sensors depends on type and model of the machine
  - Excavator system contains at least bucket, stick, boom, and frame sensors
  - Wheel loader contains at least bucket, boom and frame sensors

**The system can be expanded by the following optional accessories:**

- Tilt bucket sensor
- Dual block boom sensor
- Laser receiver (EL2 not used with wheel loader)
- XD2 LED display
- GNSS equipment
- Radio modem

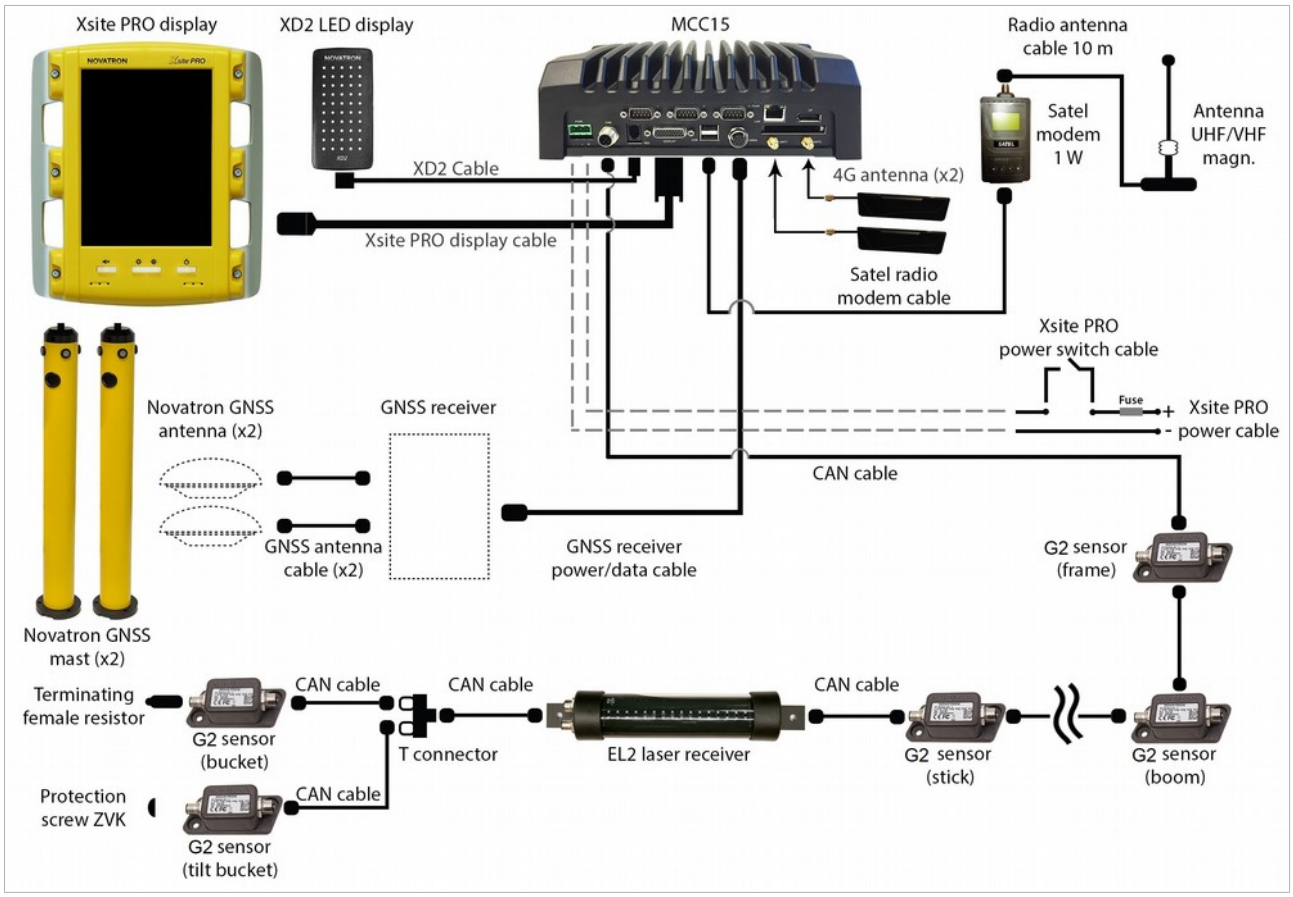



Fig. 1. System diagram

## 1.3 Handling of the system

The display cable must not be connected or disconnected when the system power is on. The cable must be connected properly before switching on the system. Incorrect use of the display cable may cause damage to the display or to the computer. See section 2.1 “Connecting the display” for more information.

The display unit is not waterproof. If the display or other components are taken away from the construction machine for any reason, a carrying case should be used. Make sure that the components are clean and dry before placing them in the carrying case. Also make sure that the carrying case is clean and dry.

Fingerprints and other dirt can be removed from the display with a soft, lint-free cloth. A cleaning liquid can also be used with the cloth. Dampen the cloth with isopropyl alcohol, water or a mixture of alcohol and water and clean the display. Do not spray the cleaning liquid directly on the screen. Do not use any corrosive chemicals on the screen.

3D features of the system require a license key which is connected to the system. The operator of the system is responsible for storing the license key.

**Note!**

If the 3D license key is lost, a new one must be purchased from the local dealer. License key is located inside of the MCC 15 computer unit.

## 1.4 Transportation and storage

When transporting the equipment to the usage site or carrying it in the field, always ensure that the product is transported in suitable, secure containers. Never transport the product loosely in a vehicle; knocks and bumps can severely harm the functioning of the product. In case of transportation by railway, plane or ship, always use the original packaging, transport containers and transport boxes. The packaging protects the product from bumps and vibration.

Store the product in a well-ventilated dry place. During storage, protect it against moisture. Use the original packaging whenever possible. Avoid extensive temperature changes during storage.

Water condensation can form gradually and may harm the functioning of the product.

## 1.5 Support and maintenance

Maintenance services are provided by the manufacturer or the authorised dealer. The installation and servicing of the product should only be carried out by trained and qualified personnel.

All settings are stored onto the internal memory device, which is backed up by the fitter after the installation. If any problems occur with the installation settings, a recovery can be made.

Only representatives of the manufacturer are allowed to open the product housings.

Remote support provides instant help desk services for machine operators (see section 7 ”Network operation”).

# 2 GETTING STARTED

This section provides information about the system hardware and the user interface.

## 2.1 Connecting the display

Don’t strain or kink the cable while connecting or disconnecting the cable. Avoiding sharp bends in the cable will keep your cable working longer. The display cable must be connected before switching on the power to the construction machine. The display cable is connected to the connector on the back of the display (Fig. 2). The cable is connected by pushing the connector and is disconnected by pulling from the connector housing.

Be sure to visually check that the cable is properly connected. An improper connection may cause damage to the display unit or to the computer. The cable must not be connected or disconnected while the system power is on because it may cause hardware damage (Fig. 3).

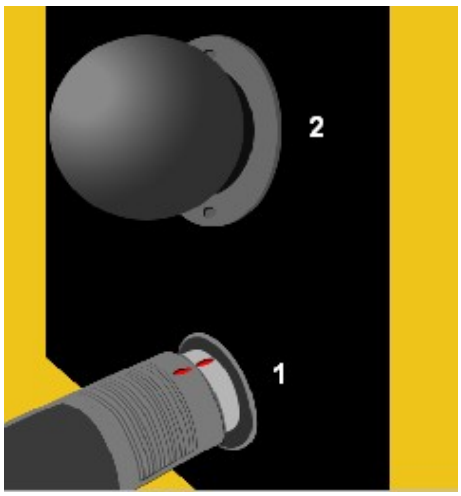



Fig. 2. Back of the display unit

(1) Display cable with connector
(2) RAM mount

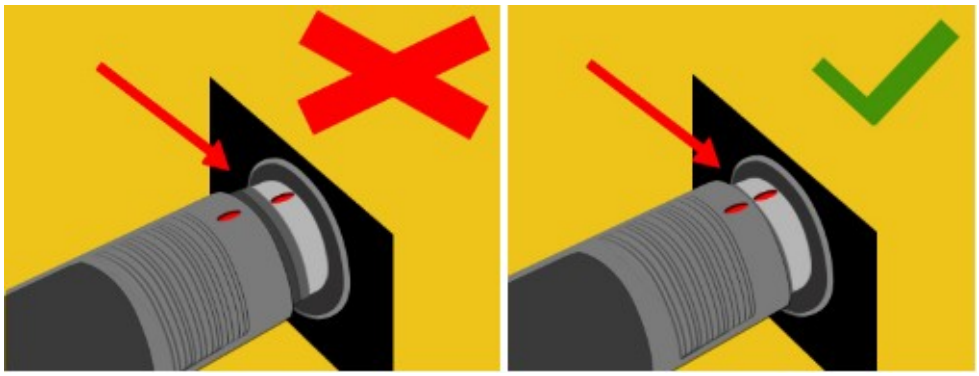


Fig. 3. Improper (left) and proper (right) connections

Make sure that the system is powered off when you connect or disconnect the cable. Make sure that the cable is properly connected before turning on the system.

When the cable is connected, the display can be mounted with the RAM mount bracket to a suitable viewing angle. Mount the display so it blocks the view as little as possible.

## 2.2 Turning on the system

To help protect system memory and prevent possible data loss when first starting the machine, it is recommended to start the machine first and then turn the system on. It is not necessary to turn the system off before restarting a warm machine. This situation may occur, for example, when restarting from an auto idle shutdown condition.

The system is turned on by pressing the power button on the display (Fig. 6). After one second, the red back lights of the buttons will turn on. When the red lights have been on for approximately 15 seconds the light will turn yellow. It takes approximately one minute for the operating system to start up.

Sensors are equipped with an internal heating system. When a machine is used below 0°C (32F) temperatures, it will take time for the sensors to warm up and provide accurate results. The recommended amount of time needed between turning the system ON and starting work is shown in Table 1 below. Users should allow for the proper warm-up time in order to ensure accurate measurement results.

Table 1. Recommended warm-up time.

| Temperature | Warm up time |
|---|---|
| -20°C | Approx. 20 min |
| -10°C | Approx. 10 min |
| -5°C | Approx. 5 min |

## 2.3 Installing or changing a SIM card

For network services and getting RTK correction a SIM card is needed. SIM card is installed to MCC15 computer unit, see Fig. 4.

**To insert or change a SIM card:**

1. Make sure that the system is powered off
2. Open plastic dust lid labelled as “SIM”
3. Press yellow tab to get tray out
4. Place SIM card to the tray
5. Close the tray. Card installation is now completed

Fig. 4. Inserting a SIM card in to the MCC15 computer unit.

## 2.4 Display unit, USB ports and buttons

The system works via touch screen (Fig. 6*)*. In addition to touch screen, there are separate buttons for brightness adjustment and a mute.

**Connectors**: There are two USB connectors (Fig 5) at the bottom of the display unit that can be used.


Fig. 6. Display unit

Fig 5. USB connectors bottom of the display unit

| | |
|---|---|
| Touch screen (display) |  |
| Reduce brightness |  |
| Increase brightness |  |
| Power on/off |  |
| Mute |  |

## 2.5 Turning off the system

Press shortly power button and select “Shutdown”.

The system can be turned off by pressing from start window. 

If you need to continue working with 2D application the LandNova can be closed by selecting “Project” → “Back to 2D or Exit”.

If a shut down cannot be carried out, for example, the system does not turn off after the ”Shut down” button on the touch screen has been pressed, forced shut down can be accomplished by pressing and holding the ”Power” button down for 30 seconds.

Avoid forced shutdown, it may damage the internal storage media and cause data loss. Contact local service personnel before use forced shutdown.

# 3 USING THE 2D SOFTWARE

The 2D application is named as “Vision”. When using the 2D system the height reference can be taken from laser reference (optional laser received is needed) or a stake (any physical height reference can be used). System can measure height and distance. Height reference have to be taken again when machine is relocated.

## 3.1 Getting started

When the Vision is started the Main menu is shown as in Fig. 8 below. To starting work with 2D, press “Start” button 1.


Fig. 8. Main menu of Vision

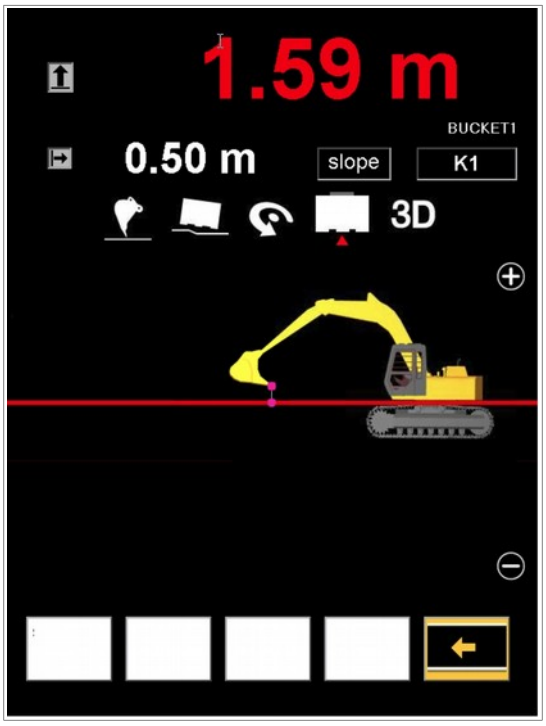



Fig. 7. Measurement / work view

**Selections** from the Main menu of the Vision (fig 8):

(1) **Start** opens “2D work view” as seen in the fig. 7
- “Measurement / work view”

(2) **Language** opens language selection
- Language of 2D software user interface can be changed.

(3) **Settings** opens 2D software settings
- For example, bucket calibration (measurements and plumbline calibration)

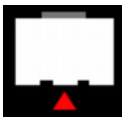
## 3.2 Measurement / work view

The fig. 7 displays software's measurement / work view. It can be used, for example, to measure depth, distance and slope. Operator can see measurements results and change view angles.

To begin work select **Main menu → “Start”**

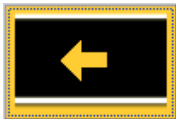
## 3.2.1 Symbols (icons) on the display while working

At “work view” the symbols are seen on top of the display (Fig. 7).

| | |
|---|---|
|  | **Height**. See section 3.4<br>When height icon is pressed, the height readout is zeroed or set to a predefined value |
|  | **Distance**. See section 3.5<br>When distance icon is pressed, the distance readout is zeroed or set to a predefined value |
| **Slope** | **Slope**: Edit slope by clicking **Slope** See section 3.7 |
| **B1..B10** | **Identifier** of the chosen bucket (B1, B2 ...) Change bucket by clicking **B1..B10** |
|  | **Side view of the bucket:**<br>• The view from the side of the bucket<br>• Zoom in / out by using the + and - icons |
|  | **Front view of the bucket:**<br>• The view from the front of the bucket<br>• Zoom in / out by using the + and - icons |
|  | **Free view**<br>• A freely adjustable view<br>• Zoom in / out by using the + and - icons<br>• Rotate by moving a finger on the screen |
|  | **Change measuring point of a bucket**<br>• Left<br>• Middle<br>• Right<br>• Automatic (Measuring from the lowest point of the buckets blade) |
|  | **Orient machine with model** (Used only with slopes)<br>• +Y (270 deg)<br>• -Y (90 deg)<br>• +X (0 deg)<br>• -Y (180 deg) |
|  | Start LandNova (The 3D application) |
|  | Zoom view in |
|  | Zoom view out |

## 3.2.2 Basic operations / buttons on the display

In work/measurement mode an operator can perform basic operations using buttons from the lower part of the display (Fig 7).

| Button | Action |
|---|---|
| Start depth and distance | Reset depth and distance readouts (Zero or set to both readings to predefined values).<br>More information:<br>"Depth settings": section 3.4<br>"Distance settings". section 3.5 |
| Start slope | **Slope** (Simple in fig. 10 / Advanced in fig. 9)<br>• Sets the depth reading and bucket tip to the start of the slope.<br>• Slope and depth values have to be defined before starting work.<br>• Profile is visualized on display (See fig 11, red line)<br>More information in 3.7 |
| Memory | **Memory function**<br>It is used for keeping height reference when relocating the excavator.<br>For more information in 3.6 |
| Menu | **Various settings** (set slope, cut depth, alerts).<br>See "Settings" 3.3 |
|  | Return to the Main menu, see Fig 8. |

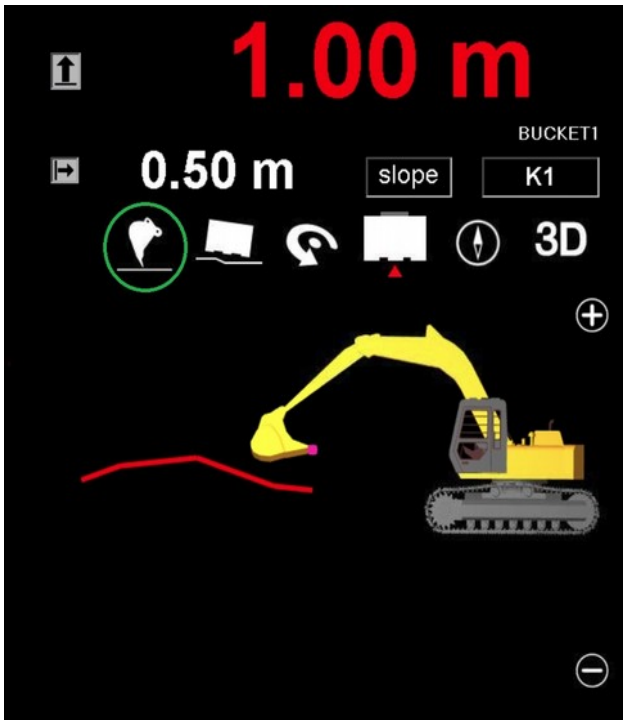



Fig. 11. "Start slope" is selected, view "Side view" is selected (green circle.)

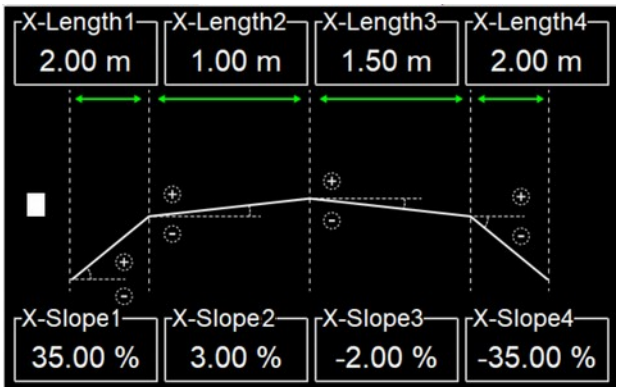


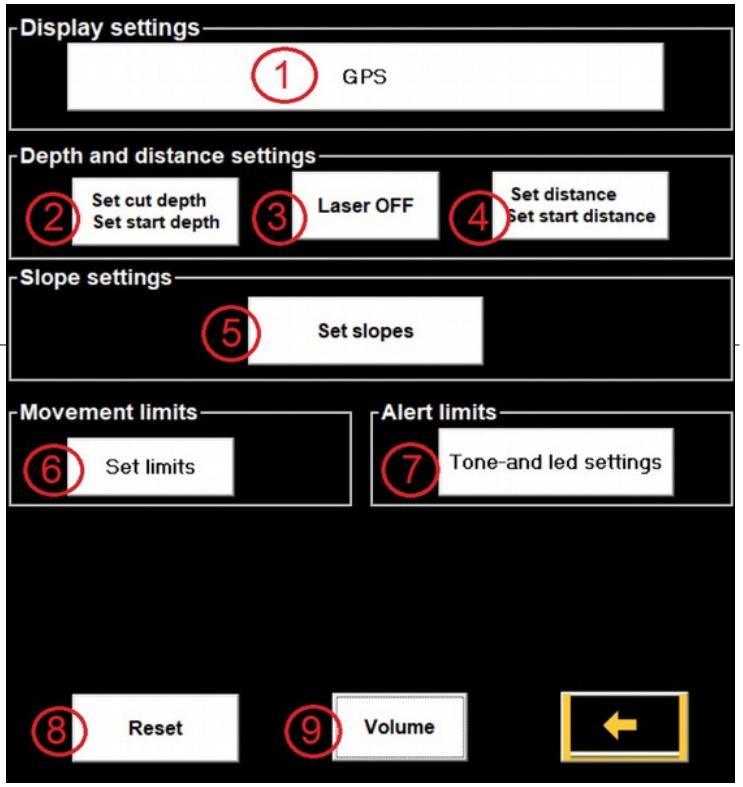

Fig. 9. Advanced slope settings


Fig 10 Simple slope

## 3.3 Settings

Enter to the settings:

**Start screen → “Start” → “Menu”**




**(1) GPS** (opens menu where you can start or stop LandNova 3D software)

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**Depth and distance settings**

**(2) Set cut depth / set start depth / Use laser as reference**
See section “Depth settings” 3.4

**(3) Laser ON / OFF**
Set laser receiver on or off

**(4) Set distance / Set start distance**
Set start distance. See section “Distance settings” 3.5

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**Slope settings**

**(5) Set slopes**
See section “Slope measurement”

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**Movement limits**

**(6) Set limits**
Warning levels can be set. The system will alert the operator if the bucket or boom crosses the warning levels. See section “Restriction of movements” 3.9.2.

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**Alert limits**

**(7) Tone and led settings**
See section “Alert limits” 3.9.1

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**(8) Reset**
Reset all settings to factory defaults.

**(9) Volume**
Increase / decrease the volume of the system.

## 3.4 Excavation using a reference height (stake)

To excavate using a reference height (for example, a stake), select:
"Main menu" → "**Start**" → "**Menu**" → "**Set cut depth** / **Set start depth**"

Note that "Use laser as reference" should not be checked when the stake is used as reference.

**Example**: Reference (stake) is at 30.0 metres and target depth is 28.2 m (1.8 m will be removed).

(1) Set target (cut) depth to 28.2 and press OK (see the below fig 13 and 12)

(2) Set laser/start depth to 30 and press OK

(3) Return to the "working / measuring mode" press ←

(4) Bring bucket to the reference and press icon to set start depth (Fig 14).

- Pressing "Start depth and distance" (yellow circle fig 14) will reset both depth and distance to predefined values.

(5) Verify that start depth is 30 meter (reading inside the green circle at the (Fig 14)

(6) Start and continue excavating until bucket is level with horizontal red (or green) line (Fig 15)

(7) Target depth is reached at 28.2m (30m - 1.8m)

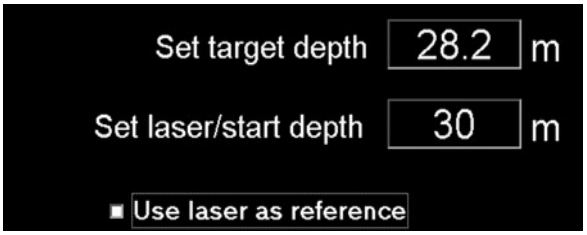



**Fig.** 12. Depth settings (predefined levels)

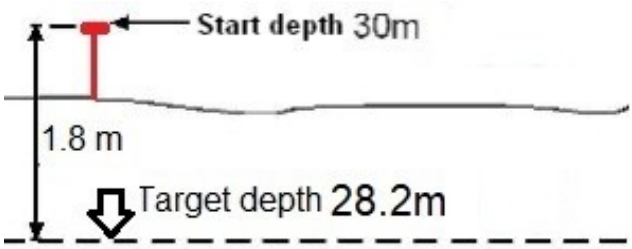



Fig. 13. Start and cut depth in a jobsite

Readout (big green circle in Fig. 14) indicates the height of the bucket. The red (or green) horizontal line shows target level (depth). Here the target is 1.8 metres below start depth.

| | |
|---|---|
| When height icon is pressed, only depth reading is set to predefined "laser/start depth" value. | |

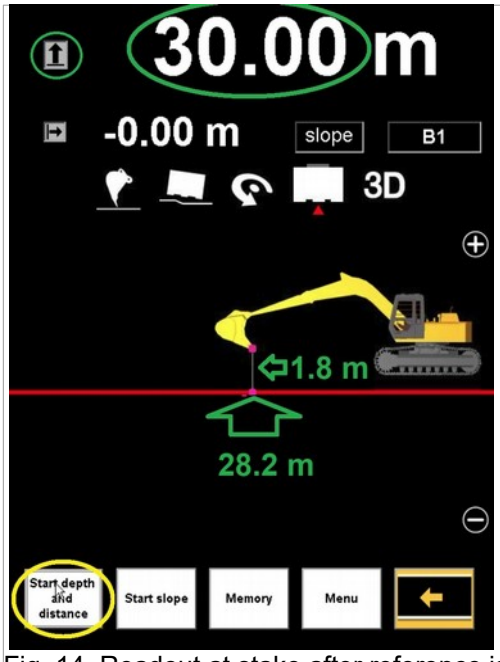



Fig. 14. Readout at stake after reference is set


Fig. 15 Target depth is reached at 28.2 metres

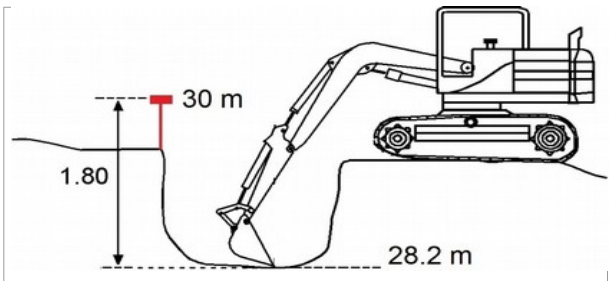



Fig. 16. Target depth reached at 28.2m.

## 3.5 Distance measurement while working

To set distance, select “Menu” →”Set distance / Set start distance”. To set depth Menu” → “Set cut depth / Set start depth”.

**Example of making a ditch:**

Excavate 2 metres long ditch from a reference point (stake) towards a machine (Fig 17)

1. Set starting distance to zero (0) (Fig. 18), if ditch starts nearer machine than stake, enter starting distance as negative value (distance between the stake and beginning of the ditch)
2. Return back to the measurement / working, press ←
3. Bring bucket to the reference (stake) and press |→ icon to set reference (Fig 18). Pressing “Start depth and distance” will reset both depth and distance to predefined values.
4. Verify that the starting distance is zero or entered distance value when bucket is at the stake. (zero in this example)


5. Start and continue working until distance is reached (2m in our example. Fig 18)
   - Reading increases when excavating towards machine.

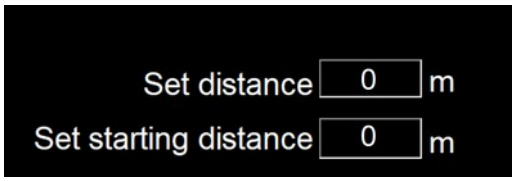



Fig. 18 Distance values

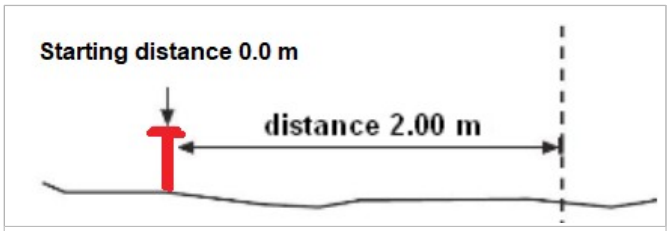



Fig. 17 Starting distance

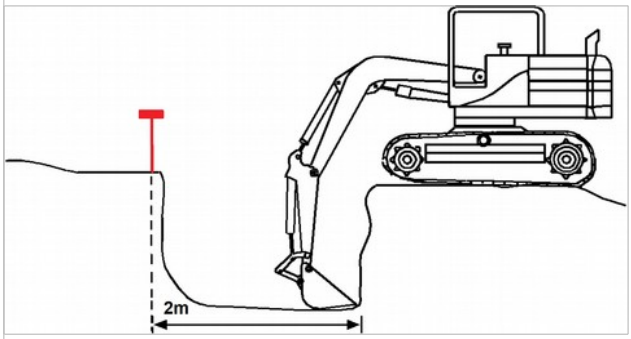




Fig. 19. Target distance / distance reading when target is reached

If distance icon is pressed, only distance reading is resetted to the predefined “Set starting distance” value.

The depth of the ditch can be set up: **Menu**” → “**Set cut depth** / **Set start depth**”, so depth and distance both can be measured and monitored while working.

**Note!**

Instead using distance and depth measurements to creating a ditch, using advanced slope for ditch may be more practical tool. See 3.7

## 3.6 Relocating the excavator by using the memory function

The excavator can be moved to another position by using the memory function. To move excavator you need an extra reference point, for example a stable rock.

**Verify the depth**

Select from the Start screen → "**Start**". Depth is measured using a reference (see Fig.20).

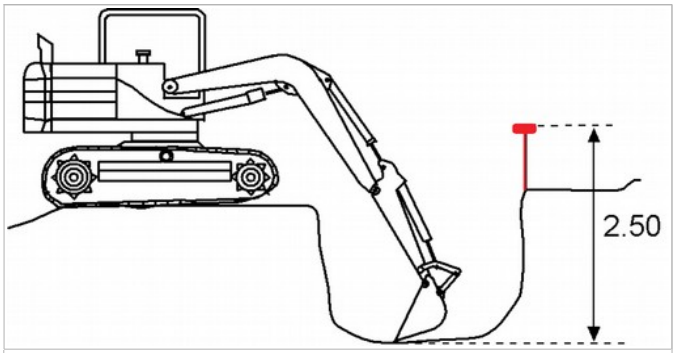



Fig. 20. Verify depth

**1. Create a memory point**

The memory point must be accessible from a new location.
Before moving the machine, choose a stable memory point. For example, a good reference is a big rock (see *fig. 21).* Bring the blade of the bucket to a memory point and press the "Memory" button and memory point is created.

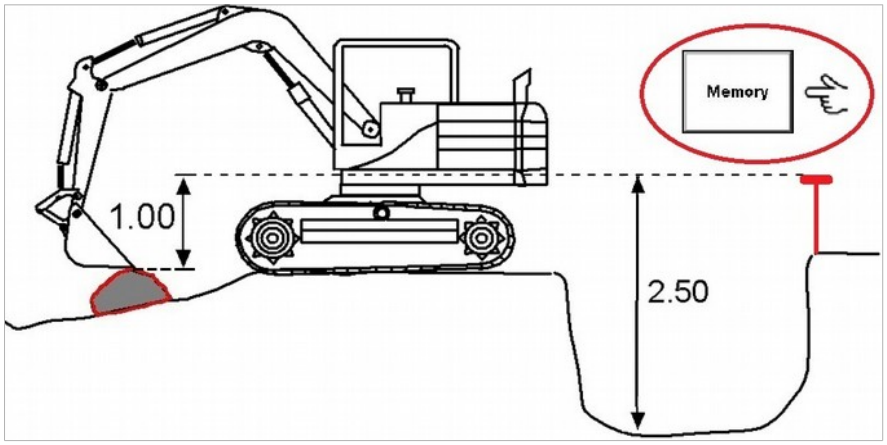



Fig. 21. Create a memory point by pressing the memory button, step 1/2

**2. Use a memory point**

After relocating the machine (see Fig. 22), bring the blade of bucket to the memory point (created at step 1) and press "Memory" button again.

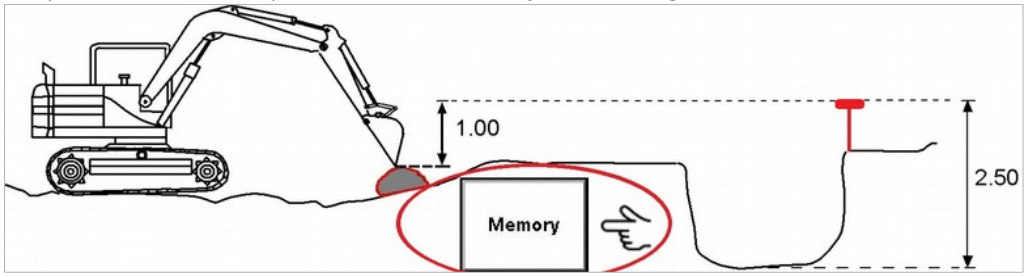



Fig. 22. Take in use the created memory point (height), step 2/2

### Continue digging from new location

The system measures a depth compared to the original reference point (stake), even though machine position and altitude has been changed (see *fig. 23).*

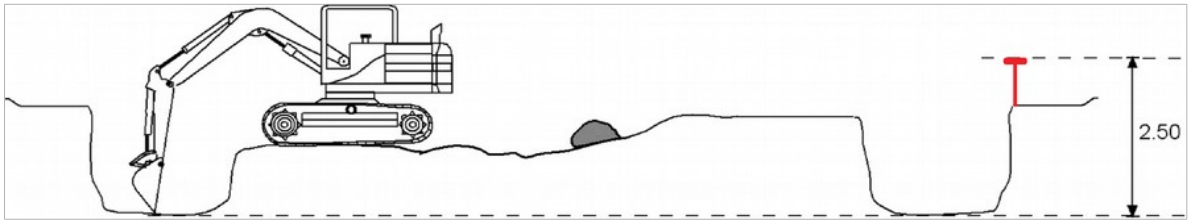



Fig. 23. Digging continues after relocating the machine

Warning: Every relocation of the machine degrade the precision whenever a new reference point is created.

## 3.7 Creating an advanced or simple slope using the system

Set slopes: Select: Start screen → **“Start”** → **“Menu”** → **“Set slopes”**

**Select slope type:**

- **A) Simple slope**
  - Enter slope value for X (usually slope is made only one direction so Y is set to zero)
- **B) Advanced slope** (Fig 24)
  - Enter values for each field. (usually slope is made only one direction so Y is set to zero )
- Return to the “work view”
- It is recommended to use “free view” mode, marked with green circle below (Fig 24b).
- Press “Start slope”

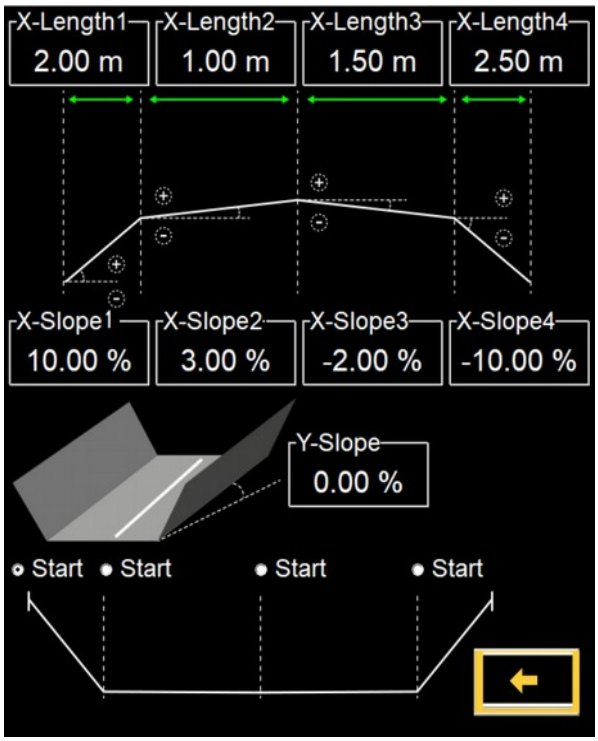


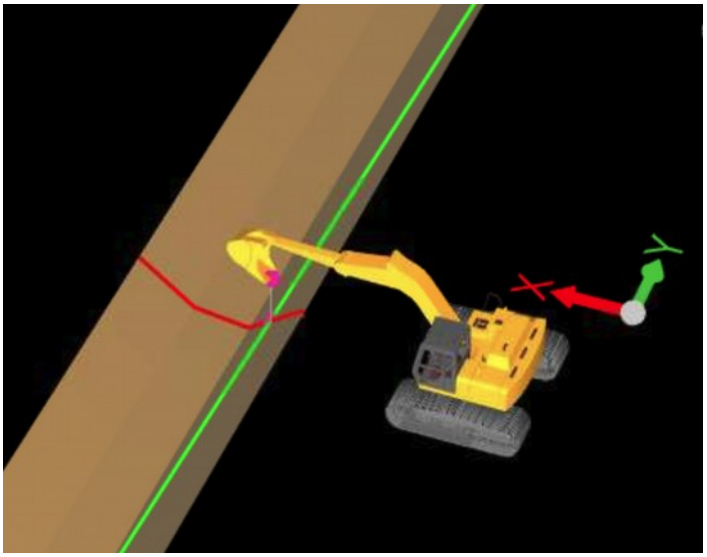

Fig. 24. Advanced slope tool, setting value


b) view while working, *freeview* selected

An advanced slope is created by setting the length and slope values for each section. Four individual sections can be defined.

Work view explained (figure in right):

- Red line shows X axis
- Green shows Y axis, blade of the bucket



## 3.8 Working with a Laser reference (with or without the stake)

Laser receiver is optional and is needed when working with rotating laser. A rotating laser has to be set to same angle as desired plane/slope.

Using a rotating or scanning laser allows to relocate a machine quite freely. Operator can easily continue working after excavator is moved to another position. Height reference can be taken to the system from a laser beam. Reference is taken by moving the boom (laser receiver) to the laser beam.

Laser and stake can be used together. Actual height reference is taken from the stake and laser beam just allows excavator to be moved away from the stake. The laser assist the system to keep track to the height reference. Rotating laser can be set at any altitude (pay attention to visibility of the laser beam at a jobsite).

**When stake is used with the laser**, the option "Use laser as reference" must be disabled (not checked). Menu → "Set cut depth" → "Use laser as reference"

| | |
|---|---|
| **When the laser is used** (without a stake) as height reference, the option "Use laser as reference" must be enabled (checked). | ☑ Use laser as reference |

Move the boom until the laser beam hits the laser receiver. The laser receiver icon indicates that the receiver has hit. The green signal light (with a sound) indicates that the hit has been accepted. The laser receiver will accept the beam when the stick is ±60 degrees from the vertical line.

**Using stake as reference with laser assistance**

1. Bring laser receiver to beam, system gives audible note with visualization.
2. Place measurement point of the bucket to the stake
3. Press "Start depth and distance"
4. System use the stake as a height reference
5. If excavator's altitude is changed bring the receiver to the beam again.
6. You can continue working using the original stake's height reference.

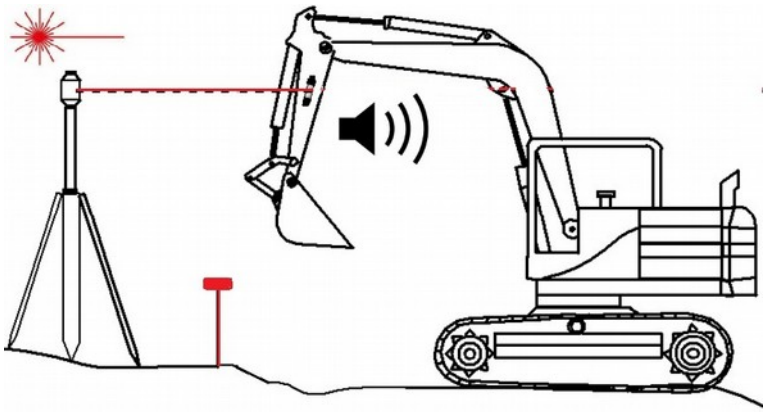


Fig. 25. Using the laser receiver to maintain stake's height reference.

**Note!** If the height of the machine is changed, bring laser receiver to the laser beam to get correct height reference. Height reference is valid until height of the machine is altered. A rotating laser has to be set to same angle as desired plane/slope.

Place measurement point of the bucket to the stake.

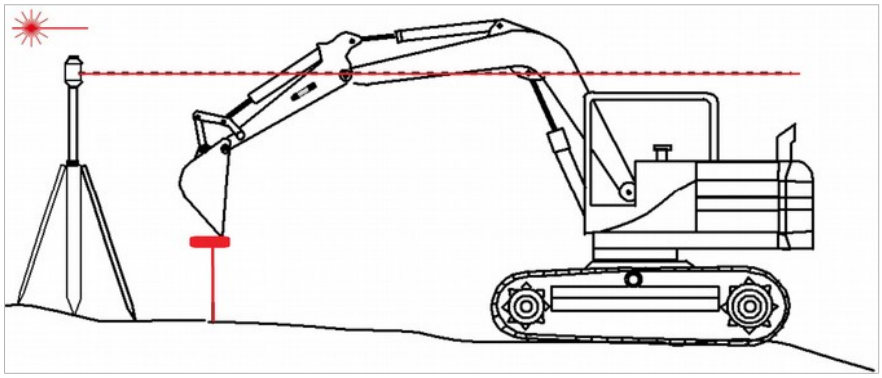


Fig. 26. Measuring depth, reference is taken from a stake (or from another reference)

If excavator’s altitude is changed bring the receiver to the beam again.

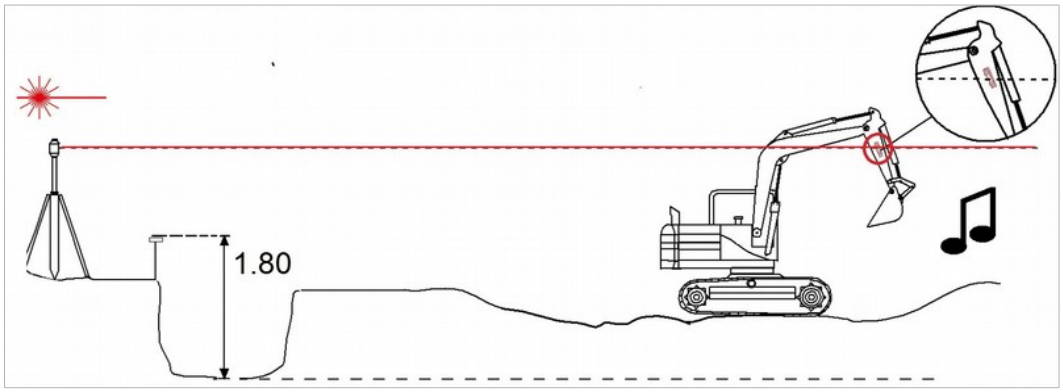



Fig. 27. Move the boom to the laser beam until audible note is given

In this example the target (cut) depth has been set to 1.80 m below “start depth”.

## 3.8.1 Automatic height update to a laser reference while working

When the “Use laser as reference” has been enabled and laser beam hits once to the receiver, system shows height of the measuring point of the bucket. If an altitude of the machine changes, bring the laser receiver to the beam again (Fig 28).

**Using laser reference without a stake:**

1. Enter “Set laser/start depth” same as jobsite laser height (in this example 90.0 metres)
2. Enter “Set target depth” (in this example 87.0 metres)
3. Select (tick): Menu → Set target depth → “Use laser as reference”
4. Continue excavating until target level is reached (horizontal red line on the display can be seen)
   - In this example the target height is 87.0 metres (90.0 m – 3.0 m)

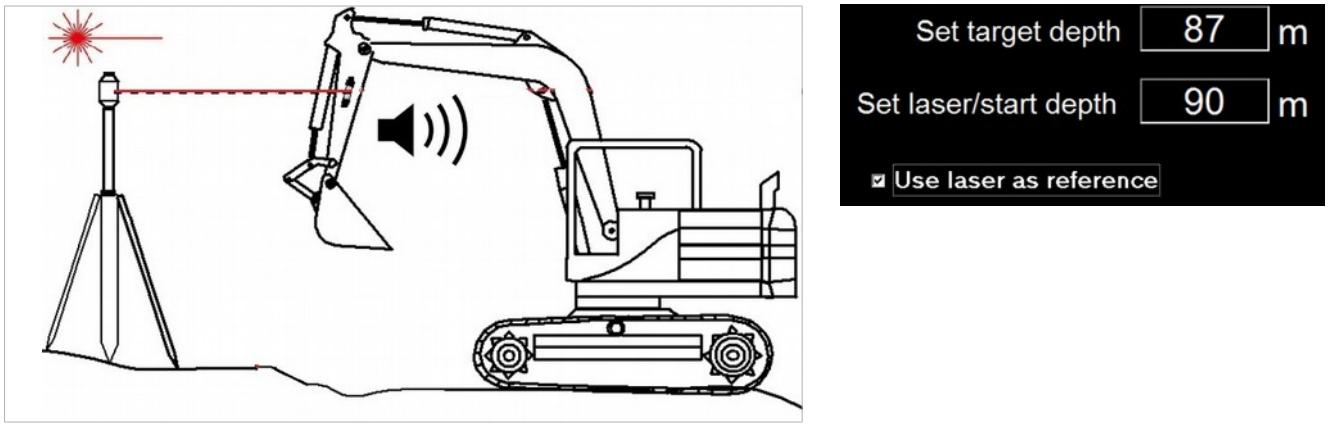



Fig. 28. Moving the receiver to the laser beam (height reference is fed in to the system)

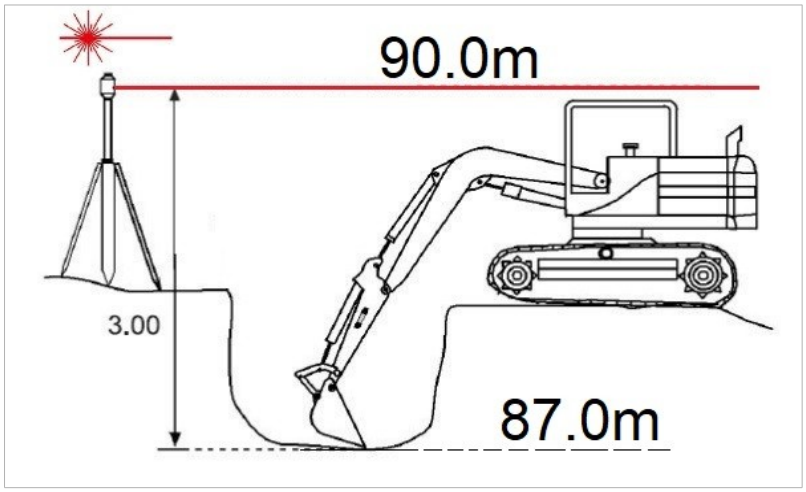



Fig. 29. Measure depth using the measurement point of the bucket.

## 3.9 Special settings

### 3.9.1 Alert limits and XD2 LED display

Select: Start Screen → **Start** → **Menu** → **“Tone and led settings”**

The symbols with an audible signal assist the operator at work. Alert tolerances are adjustable. operator can adjust levels for all levels (**Level1** defines tolerance for “Ongrade” so there is the same tolerance below grade and above grade).

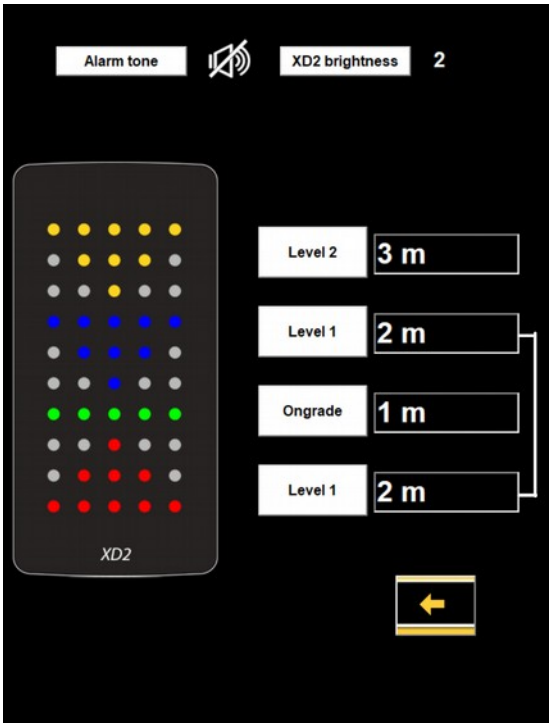



Fig. 30. Tone, tolerances and led settings

| **Colour of the XD2 level indicator (*Fig.* 31)** | |
|---|---|
| **Colour** | **Height (Tolerance settings see Fig. 30)** |
| **Yellow** | Above on grade level (Level 2 setting) |
| **Blue** | Above on grade level (Level 1 setting) |
| **Green** | On grade |
| **Red** | Below grade (Level 1 setting) |

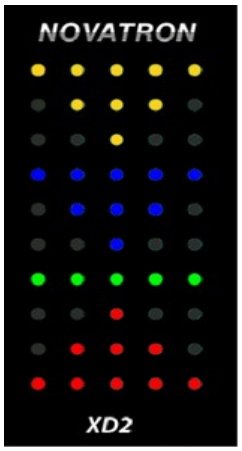



Fig. 31 Optional XD2 level indicator

## 3.9.2 Warning limits for boom movements

Set limits (audible warnings) for boom movements.

Select from the **Main menu → Start → Menu →"Set limits"**

Move booms to wanted position and press Set button 1, 2, 3 or 5.

The system measures height and distance of boom pins, not from the highest point of the boom. The system does not prevent the movement, it only gives a warning.

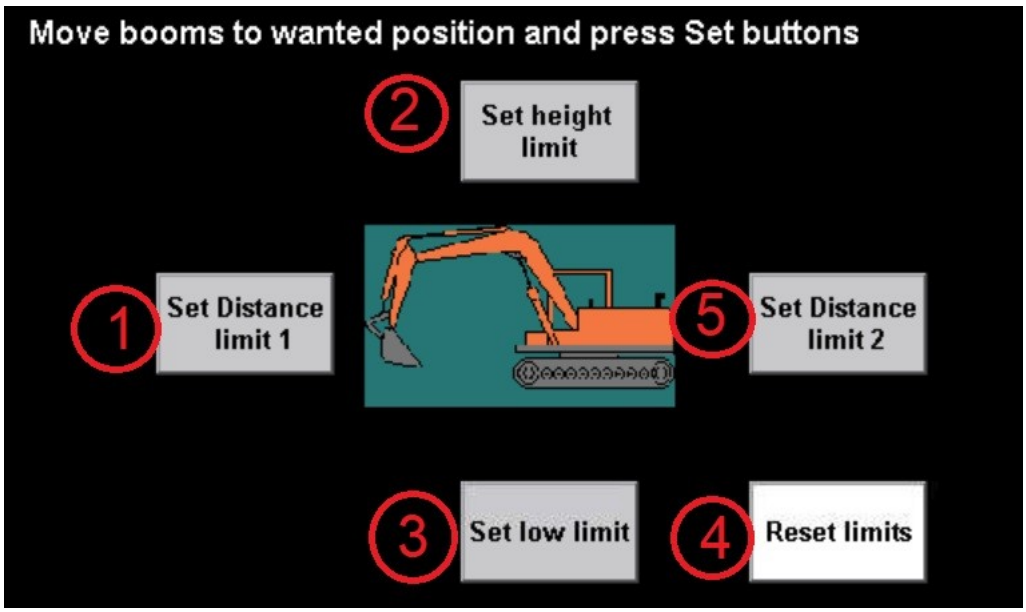



Fig. 32 Warning limits for boom movements

**Explanations for the buttons:**

(1) Set distance limit 1
(2) Set height limit
(3) Set low limit
(4) Reset limits
(5) Set distance limit 2

## 3.10 Worn or new Bucket calibration

If the bucket is worn badly (accurate measuring is not possible) it should be recalibrated. Ten individual buckets can be calibrated.

**To calibrate bucket:**

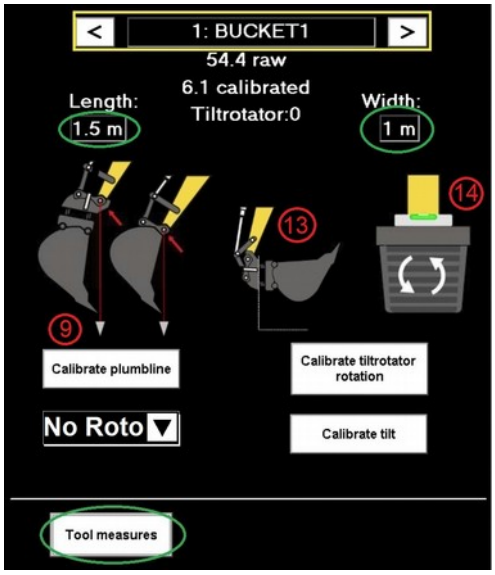



Fig. 34. Bucket calibration

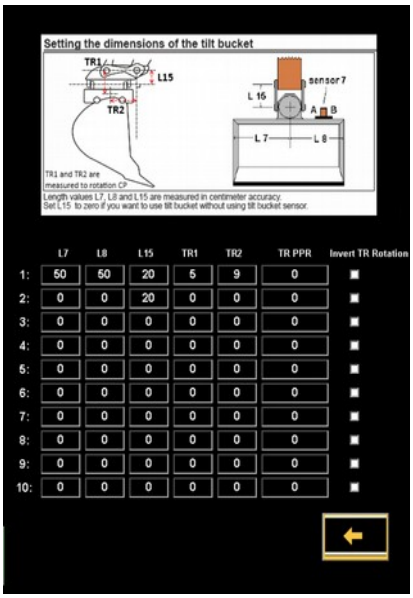



Fig. 33. Tool measures.

Select: Start screen → Settings → “Bucket calibration”.

**Enter measurements:**

1. Choose the bucket to be calibrated (Use “ < > ”) ( yellow rectangle in Fig 34)
2. Measure the length of the bucket from the lowest pin of the dipper stick to the tip of bucket.
3. Enter length and press ”OK”. (Press “Length” value)
4. Measure the width of the bucket
5. Enter width and press ”OK”. (Press “Width” value)
6. Bucket name can be changed by pressing the “bucket name”.

**Calibrate plumbline:**

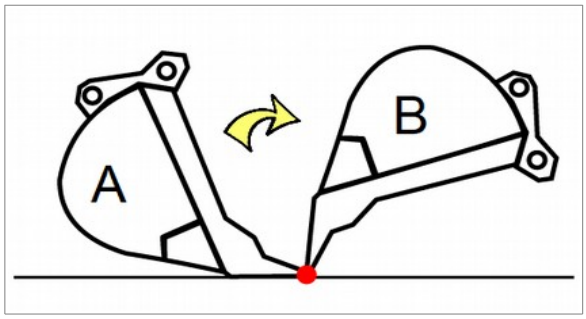
7. Set provided magnet with plumb on the lowest pin of the dipper stick.
8. Turn the bucket slowly towards the plumb line until it barely touches the line.
9. Press “Calibrate plumbline”

**If rotator or tilting unit is installed calibration is needed (Usually done while installation):**

10. Select tilt rotator communication protocol (No Roto / Engcon / SVAB / CANopen)
11. Press “Tool measures” see Fig 33 and 34
12. Enter: L15, TR1 and TR2 measurements.
    - L15 is tilting axis difference from center of the lowest pin of stick
    - TR1 is for visualization, rough measurement is sufficient.
    - TR2 is precise measurement from rotation axes to center of lowest pin of stick. Use same value which was measured while installation.
13. Turn tilting axis vertically
14. Rotate tiltrotator until bucket blade is horizontal. Use spirit level
15. Press “Calibrate tiltrotator rotation”

### 3.10.1 Checking the bucket calibration

You need a reference point for checking calibration. Reference point must be stable to get reliable measurements.




**Check calibration:**

1. Place the bucket's measurement point (blade) on a reference point (point marked with red in picture above)
2. Press "Start depth and distance" button to reset the height and distance readings.
3. Turn the bucket (without tilting it sideways) to a different position (from position A to position B) and keep bucket's measurement point on the same point.
4. Verify that the depth and distance readings are within ±1 cm compared the resetted (step 2) values

| | |
|---|---|
| **Note!** | It is important to test the accuracy of the bucket after calibration. If the accuracy is off by more than ±1 cm, recalibrate the bucket. Double check measurements and perform also a plumbline calibration. |

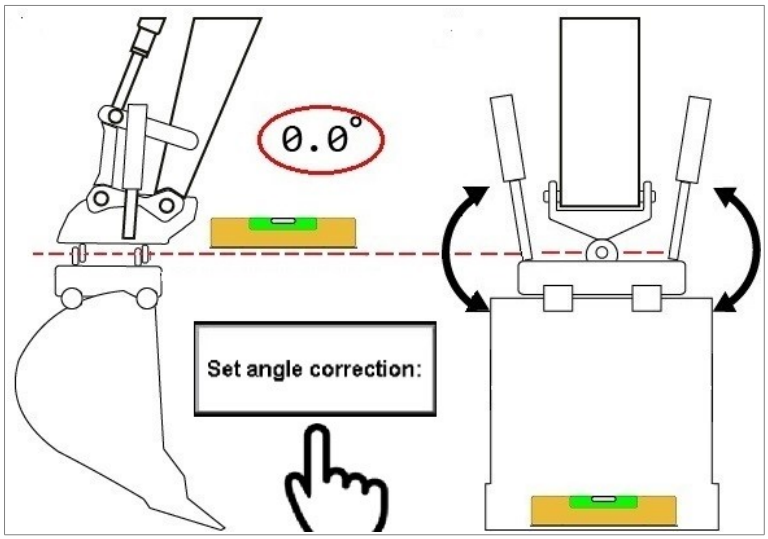
## 3.10.2 Tilt bucket calibration (tilt sensor is optional)

Calibration is needed to ensure precise measurements.

**Note!** Spirit level is needed in calibration.

### Calibration

1. Make sure that width of the bucket and L15 (tilting axis difference from center of the lowest pin of stick) values are correct (take measurements as accurate as possible).
2. Tilt axis calibration: Tilt axis calibration is needed if tilt sensor is installed:
   - Enter to bucket calibration: Start screen → “Settings” → “Bucket calibration”.
   - Press the “Calibrate tilt” button.
   - Rotate the excavator until Chassis roll value is close to zero (green background)
   - Align the red tilt axis to the horizontal level by using the spirit level
   - Align the blade of the bucket to the horizontal level.
   - Press “Set angle correction”.




3. Align the tilt bucket with the horizontal level by using a spirit level.
4. Turn bucket to position A
5. Select “Automatic” (Fig 36)
6. Turn bucket slowly and smoothly from position A to position B. Continue movement with stick and boom until bucket cannot be turned more.
   - During the calibration, correction data is gathered from several bucket positions. Note, the bucket have to be moved through its whole movement area as illustrated in the Fig. 35.
   - All calibration fields must have green background after calibration. Fields are highlighted by yellow rectangle (Fig 36).
7. After calibration is completed, unselect ”Automatic”.
8. The calibrated bucket tilt reading must be close to “0” degrees (blue rectangle), otherwise recalibrate the tilt bucket.

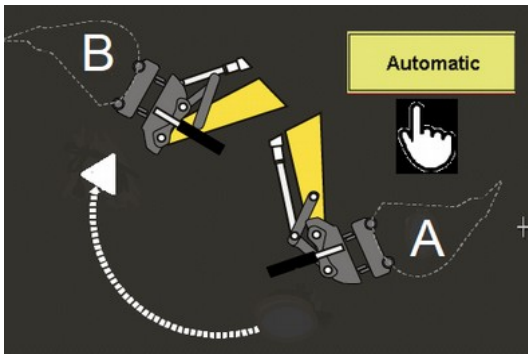



Fig. 35 Turn bucket A to B

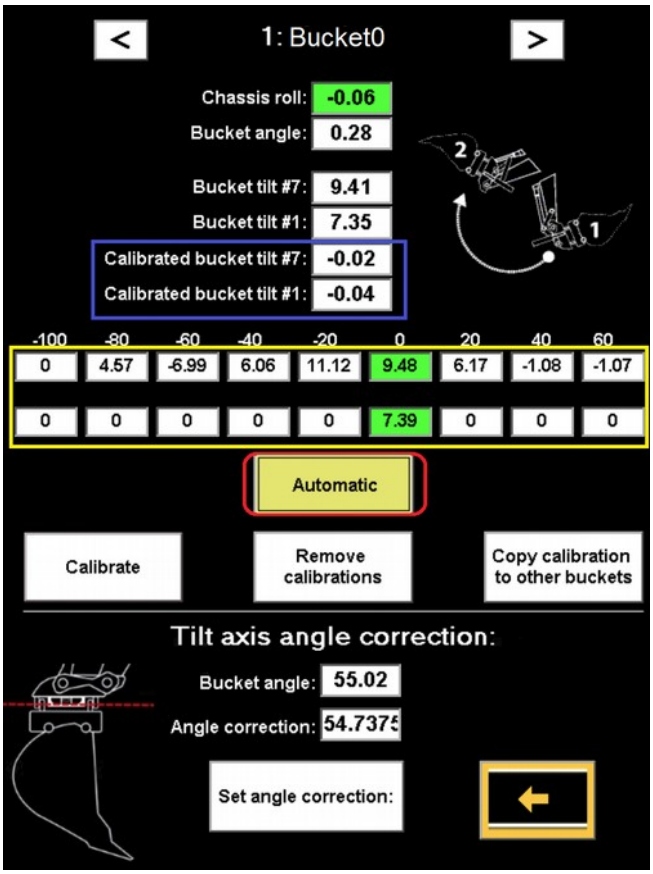


Fig. 36 Tilt bucket calibration

# 4 WORKING USING POSITIONING (3D / LANDNOVA)

**When using the positioning (using the 3D):**

- GNSS receiver with antennas are needed
- RTK correction is needed.
- 3D project have to be imported.
- The coordinates of the bucket are known. The machine can be moved in the jobsite without the need for physical reference points or lasers.
  - **Benefit**: Physical reference points or laser transmitter are not needed.

Press “3D” icon from the Vision to start LandNova. 


Hint! LandNova can be auto started by selecting “Autostart LandNova”:

Start screen → Settings → GPS Settings → “Autostart LandNova” (Code required, contact local dealer)

Before starting work, the operator must check accuracy of the system. The following points have a significant impact on quality and accuracy of work. Procedures in the Table 2 have to be carried out.

Table 2. Procedures before working

| Action | Description |
|---|---|
| RTK correction connection | Establish a connection to a base station or a base station network. SIM card (or alternatively UHF radio) is needed for receiving RTK correction. |
| Coordinate system selection | Select the correct coordinate system and make sure that the coordinate offsets are correct |
| Geoid selection | Select the correct Geoid Model or alternatively, adjust the Z coordinate offset |
| GNSS accuracy test | Check the accuracy of the system on known calibration point(s). |

While working, direction calculation and quality of positioning have to be monitored, see table 3. If these parameters are not monitored, measurements can be inaccurate.

Table 3. Accuracy and quality of positioning

| Accuracy / quality | Description | View on status bar |
|---|---|---|
| Direction calculation accuracy | When using a single antenna GNSS system, activate direction calculation by rotating the machine at least 90 degrees. Verify that background colour of heading (**D**) is green |   |
| Quality of positioning | Verify that the “RTK correction” is in FIX state, background of number of the satellites is green. See “Quality of positioning” 6.4 |   |

**Note!**

The manufacturer or dealer is not responsible for inaccurate or faulty measurements. Check the accuracy of the system before starting work and frequently during the work (see section 6.8 'GNSS accuracy test').

## 4.1 License key and access rights for optional modules

Optional modules (features) can be enabled by ordering appropriate licence from retailer. License key is installed to the system at factory. License key (HASP) reserves one USB port from the system and shall not normally be removed.

## 4.2 Opening a project

Before using the system a project have to be opened.

Project can be imported to the system from USB-memory stick / FTP / or using third party services like Infrakit. Select “**Project**” → Import from: (FTP / USB)

**How to open a project:**

1. Open project from the main view “**Project** → “**Open Project Folder**”.
2. Select project from the list.
3. Press “Read folder” to finalize selection.
    - System start loading the project and will give estimation about remaining time.
    - Opening a very large project and generating graphics may take few minutes to complete.

## 4.3 Object selector (object selection method)

Objects such as points, lines, centerlines, surfaces and slopes can be selected from the display.

Selection can be made

- Project → Read File (Lists all measurable objects: *Line*, *Centerline*, *Point, Surface and Slope*). (Fig. 37)
- “Longhold” Press display awhile from desired area (Lists only measurable objects from this area)

**Autosnap**: Measuring to a object (for example, line or point) when “autosnap” is selected (Fig. 38).

- Blue dot indicates which object or group is selected for measurement.
  - If group is selected, the nearest object from this group is taken for measurement.

**Multiple objects can be selected at the same time:**

- Line: line objects that can be measured, for example, in pipe installation.
- Centerline: line objects suitable for center-line. Center-line defines the station number and cross section.
- Point: imported point objects, for example, in installation of manhole or light-pole standing.
- Surface: surface model layers. When layer is selected all surfaces in that layer are visible. For example, used in a sub-grade of a pavement.
- Slope: slope tab lists line objects that have known slope. Such lines exists in road lines. Line slope can be locked for measurement by selecting it in this tab. Note! Stringline model and module 4 (Road) is needed.

Choose object and press “Select”. To exit without changes, press “Cancel”.

You can unselect object(s) by pressing the blue dot:

- “No line/surface/point/centerline selected for measure”

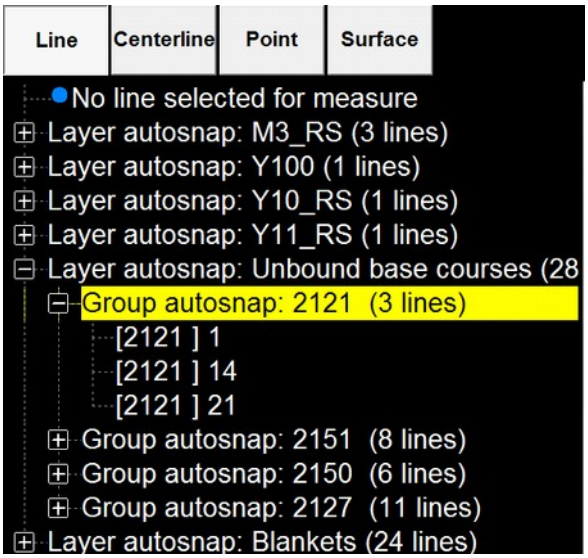


Fig. 38. Object selector, autosnap

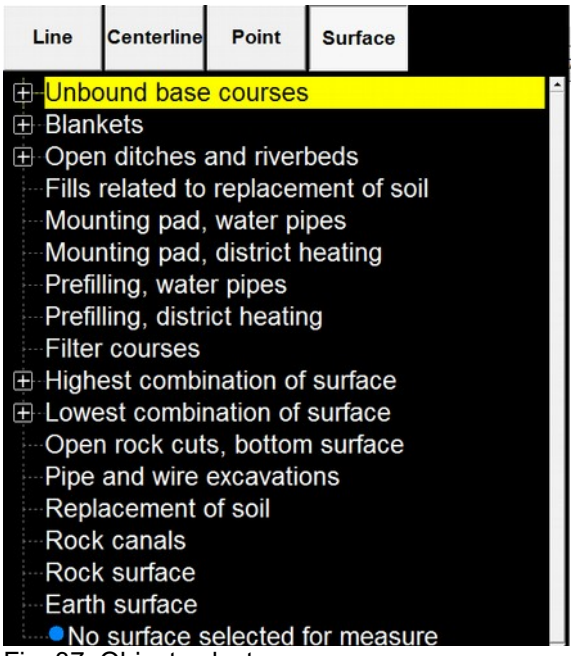


Fig. 37. Object selector

## 4.4 User interface

User interface of the LandNova is shown in Fig 39 (“Terrain” tab is selected). View icons, “Information bar” and the “Sub bar” are described in this section.

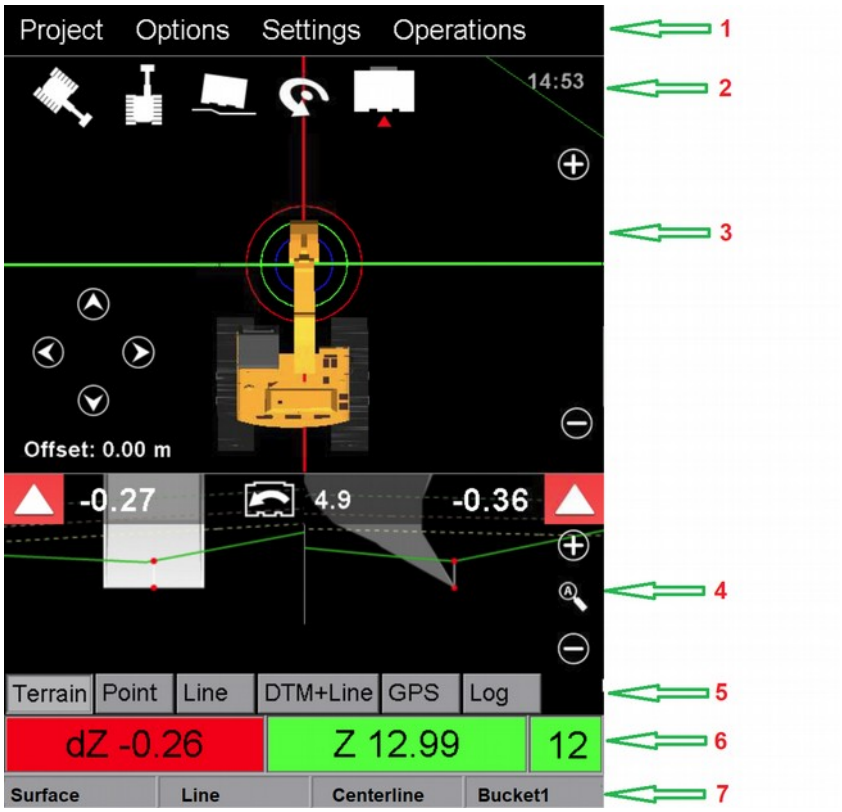
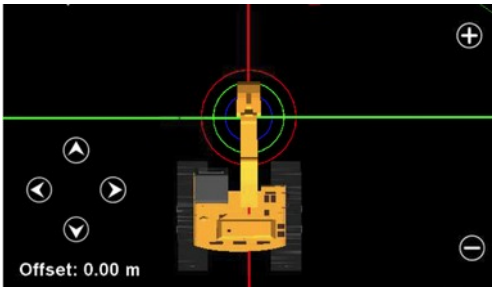


Fig. 39. Main view of the LandNova with profile and cross view sections

**(1)** Drop down menu. Features are available from the drop down menu (see section 5.1 “Menu structure”)


**(2)** View icons and measuring point selection. Operator can change to another view by pressing the view icons. Select the most suitable view for the ongoing work. (See section 4.4.1)

**(3)** Main view. Zoom view in by (+), zoom view out by (-)



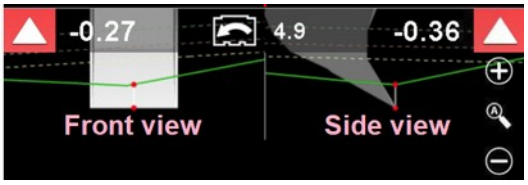
**(4)** Profile and cross-section.

Additional view is an optional (height can be adjusted). Possible additional views are:

a) Side view only

b) Front view only

c) Front view with side view




**(5)** Measurement (Terrain, Point, Line And DTM+Line) and information (GPS and Log) TABs


**(6)** Information bar (information depends about selected TAB)


**(7)** Sub bar

## 4.4.1 How to change view or change active layer / line

View icons are located on the top of the screen (Fig. 41). Icons are normally hidden. Touching the screen brings icons into sight for few seconds (value can be changed from: Settings → Installation settings → User interface “Hide view controls with HUD”).

Selected measurement point can be seen from the bucket icon (Fig. 40). The measurement point can be changed (toggled) by touching the bucket icon (Left / Center / Right / Automatic).

**How to center the machine or a map**: Press “View icon” again.

Fig. 41. View icons

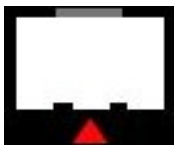


Fig. 40. Bucket’s measurement point

Arrow icons

| Icons | Action |
|---|---|
|  | **Change active layer**<br>Change active surface layer by pressing arrows |
|  | **Change active line**<br>Change line to next or previous line in the same group. Autosnap cannot be used with this function. |

**Map view**

Select map view by pressing icon marked with green circle in Fig. 42.

View is from above of the machine. In this view the north is always at the top of the screen; project files remain orientated with north at the top of the screen regardless of changes in the direction of the machine.

Panning of the map can be done by swipe action. Zoom controls '**+** and **-**' are available in all views (highlighted by yellow circles in Fig. 42 and 43).

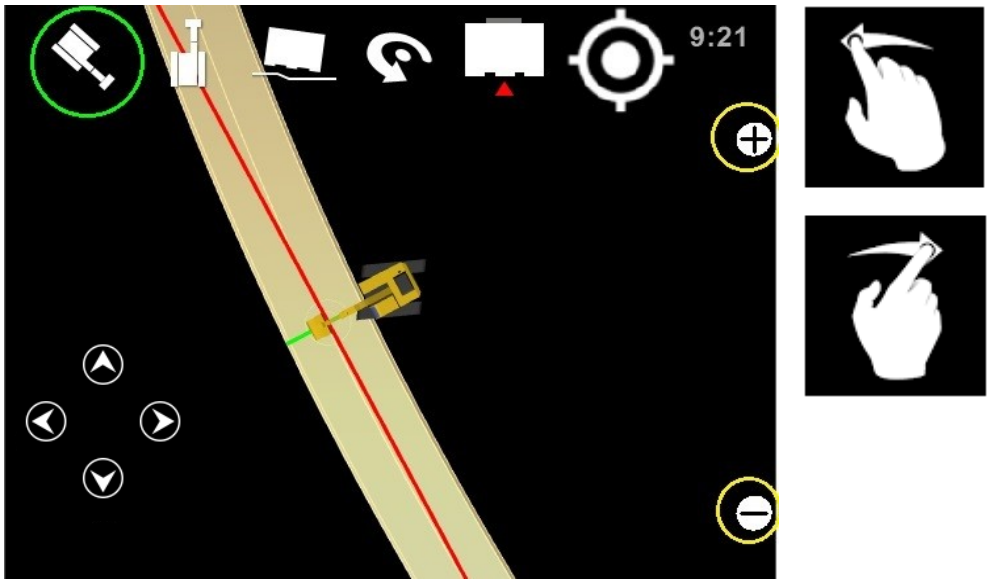



Fig. 42. Map view

**Top view** (icon is circled by green top view according to a machine Fig. 43)

In this view the machine is always static, boom is pointing to the top of the screen and the map rotates.

Map can also be dragged (moved) by swipe action. Machine can be centered by pressing "Top view" icon again.

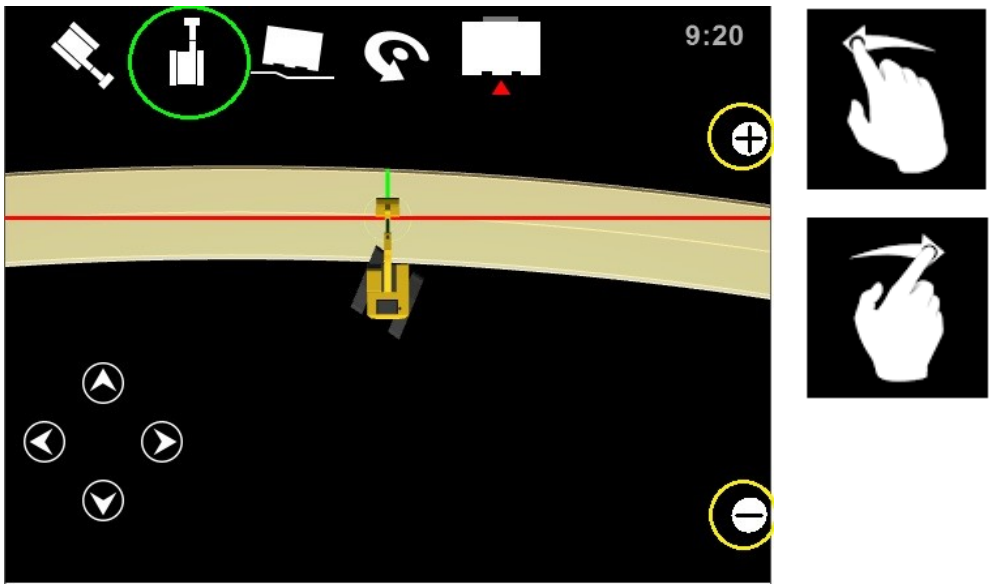



Fig. 43. Top view according to a machine

### Cabin view

Select the “cabin view” by pressing the icon (marked by the green circle in the Fig. 44)

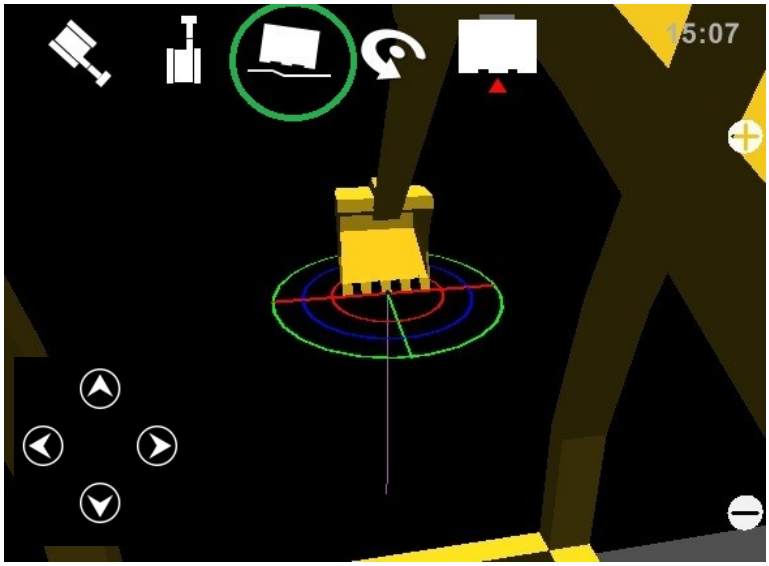



Fig. 44. Cabin view

### 3D view

It is possible to view 3D map from a chosen direction by selecting 3D map by pressing the icon (marked by green circle in Fig. 45). The point of view can be changed with a swiping action, for example swiping left to right or up to down.

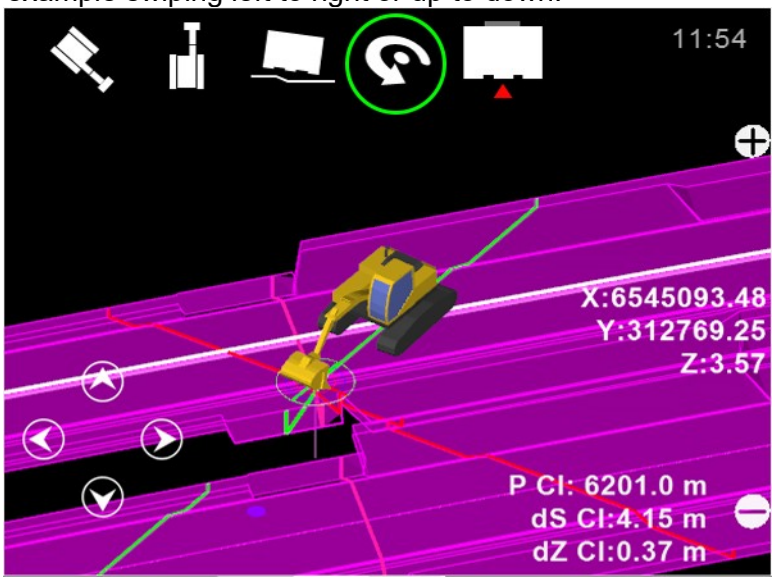
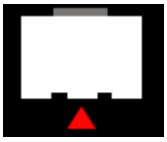



Fig. 45. 3D view

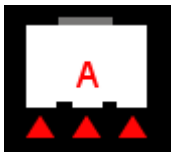
**Measurement point of the bucket**

Select the measurement point which will be used for measurement, otherwise the system may seem to give incorrect information.



**Pressing the measurement point icon** toggles between

center → right → left → automatic. The red triangle below the icon shows the measurement point.




**When automatic measurement point is selected:**

- The system selects the lowest point of the bucket blade as the measuring point.
- When the bucket blade is tilted less than 3 degrees, the system selects the centre point of the bucket blade as the measuring point.

**Note!**

Service technician can enable confirmation dialog to avoid unintended measuring point changes.

## 4.4.2 Additional views, profile and cross-section

Additional views can be added onto the display (Fig. 48):

**To add profile view, select:**

- "**Options**"
  - "Profile / crossection"
    - "Enabled" (Profile view(s) are visible / hidden)
    - "Cut inactive layers" (Show all surfaces on the profile view)
    - "Show zoom controls" (Zoom control icons are visible)
    - "Cut lines / pipes" (Cut line and pipes are indicated with 'X')
    - "Bucket angles" (angles of two axes are displayed in additional profile views)


    - "Model Z" (Z value is shown)


    - Breaklines for active DTM
    - Bucket arrow indicators


**To insert more information to the profile view, select**:

- "**Options**"
  - "Misc GUI items"
    - "Model offset". Height offset of model is shown. Change with double tapping the value on screen. (Fig 47)
    - "Measuring point coordinates" (X, Y and Z coordinates of the bucket measuring point are shown on the screen Fig. 46)
    - Positioning on/off button
    - Line guidance indicator

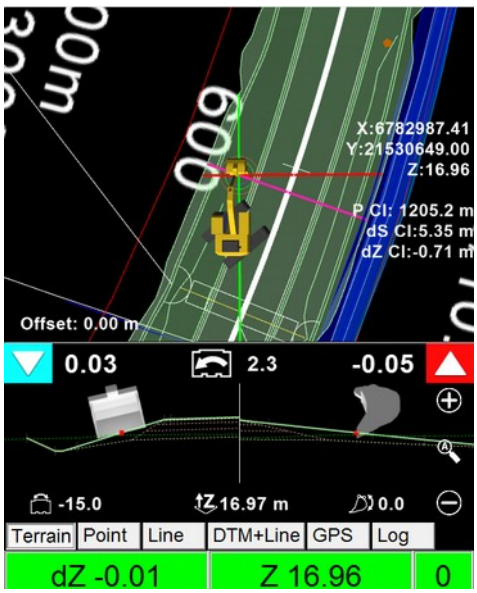



Fig. 48. Profile / crossection

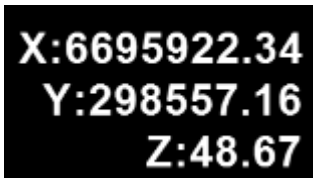



Fig. 46. Measuring point offsets


Fig. 47. "Model offset" value

## 4.4.2.1 Additional profile views detailed

Profile / front view **(1)** presents bucket from the front. Cross section / side view **(2)**

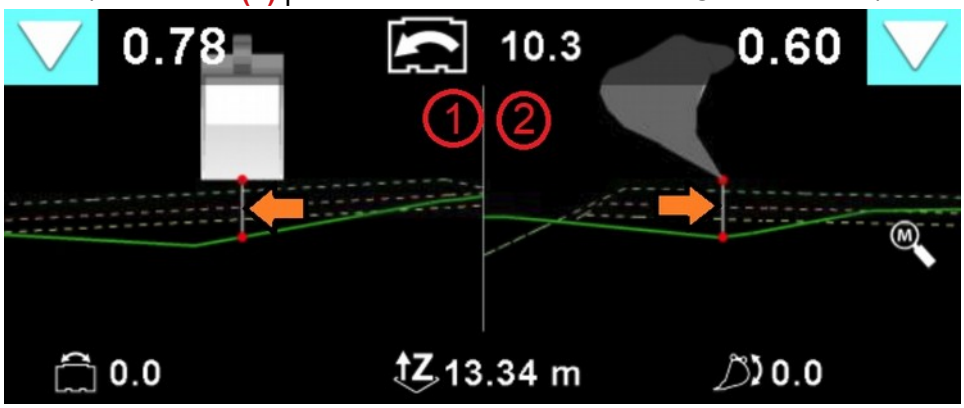



Fig. 49. Profile / crossection detailed.

Orange arrows at Fig. 49 highlights the measurement line. Line starts from the measurement point of the bucket and ends to an active surface.

Active (to be measured) surface is presented as bold solid line.

**Possible views are following:** (Tapping the profile view area toggles between different views)

(1) Bucket is shown from front (Fig. 49 )
(2) Bucket is shown from side (Fig. 49 )
(3) Combination of views 1 and 2. Bucket is shown from the front in left window and from side in right window (Fig 50)
(4) Cross section view (Fig 51. Center line measuring is needed, because cross-section view is drawn by using that centerline)

Symbols in optional profile and cross view section

| | |
|---|---|
|  | Tilt of the bucket |
|  | Height (sea-level) of the selected surface. |
|  | Angle of the bucket |

Icon in upper left corner indicates height of the measuring point compared to target level. The value indicates height difference between selected surface and buckets left corner (Fig 50). Icon and the value in the upper right corner indicates height difference between selected surface and buckets right corner.

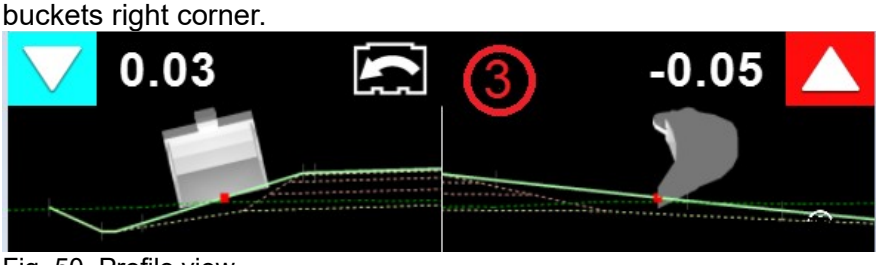



Fig. 50. Profile view

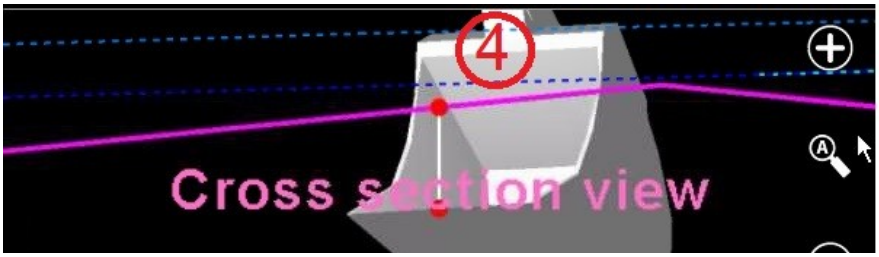


Fig. 51. Cross section view

Icon in the profile view.

| Icon | Description |
|---|---|
|  | The measuring point is at the target level |
|  | The measuring point is above the target level |
|  | The measuring point is below the target level |

**Tolerance** can be changed from:
“Settings” → ”Installation settings” → “User Interface” → “Accuracy tolerances / Height difference”.

## 4.4.3 Information bar

The information bar is divided to six different tabs for presenting relevant information about current work. Content of the information bar changes depending on which tab is selected.

Fig. 52. Information bar with Tab (Terrain is selected)

## 4.4.3.1 Terrain

Height difference to the selected surface and height of the sea-level are shown. Gives useful information when working with digital terrain models (DTM).


Fig. 53. Terrain tab

| | |
|---|---|
| **dZ height difference**<br>Difference between a selected DTM and the measuring point of bucket. | dZ 1.60 |

Background colour in the "**dZ**" field indicates height offset of the measurement point.

| | |
|---|---|
| **Blue** | Bucket is above the target level |
| **Green** | At the target level within set tolerance.<br>"Settings" → "Installation settings" → "User Interface" → "Accuracy tolerances / Height difference". |
| **Red** | Bucket is below the target level |

| | |
|---|---|
| **Z height** (absolute height, height from the sea-level) | Z 16.98 |

- Field indicates absolute height **Z**.

| | |
|---|---|
| **Number of satellites which are used to positioning with RTK correction.** | 16 |

- Shows the count of available satellites. The background colour indicates the state of the RTK correction. For best accuracy this must be in the FIX state (see Quality of positioning – FIX, FLOAT and SPS states).
- For some GNSS receivers GPS and GLONASS satellites are separated, for example "12 + 6". In that case the overall number of satellites is 18.
- "As-built" data point is stored by pressing the satellite count panel (Fig.53, red circle).

"As-built" points are always stored to the current layer. For example, if you are working with the DTM model and the model / layer name is the "Final surface" then all points are stored to the "Final surface" layer. This can also be seen in the "as-built" data file when it is exported from the system.

## 4.4.3.2 Point

From this tab a height, distance and direction to the selected point is shown with the sea-level height. Tab is also used for locating points.

**How to select object**: See section 4.3 “Object selector “

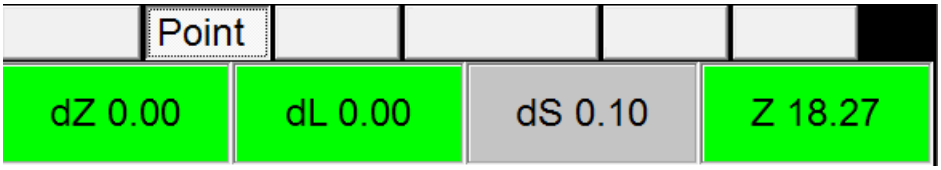



Fig. 54. Point tab is selected

**dZ** (height difference)
Shows the height difference between the selected point and the measuring point.

**dL** (distance, see the Fig 55)
Shows the distance between the selected point and the measuring point in boom line direction.

**dS** (distance, see the Fig 55)
Shows the distance between the selected point and the measuring point against boom line direction.

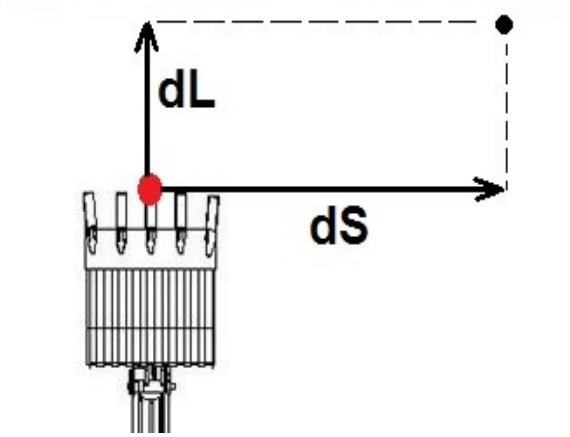



Fig. 55. **dL** and **dS** measurements explained

**Z** (Absolute height, height from the sea-level)

- Background colour indicates status of the heading:
  - **RED** Heading cannot be defined. (Accuracy is not sufficient).
  - **YELLOW** Heading has inaccuracy. (Accuracy is not sufficient).
  - **GREEN** Heading is defined. (Heading is as accurate as possible).

## 4.4.3.3 Line

Tab shows height difference, distance and station number to the selected line. Used with the line models.

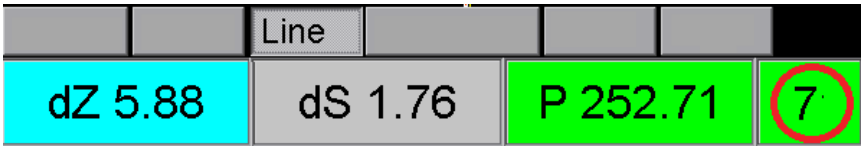



Fig. 56. Line tab and information bar

**dZ** height difference
Shows the height difference from the measuring point to the selected line.

**dS** distance
Distance from the measuring point to the selected line object.

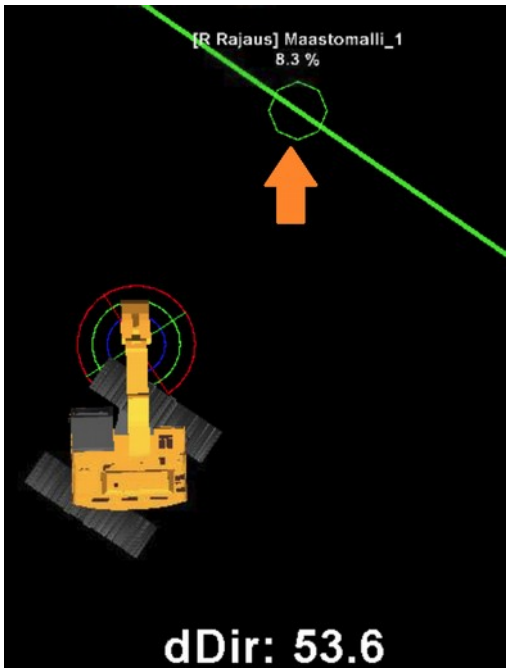



Fig. 57 Measuring point

Orange arrow points the circle that indicates the measuring point of the line. Name of the line is shown at the top of the point. Slope (%) is seen also.

dDir is “Line guidance indicator”, zero means that boom-line is parallel to selected line. This option can be activated: “Options” → “Misc GUI items” → “Line guidance indicator”.

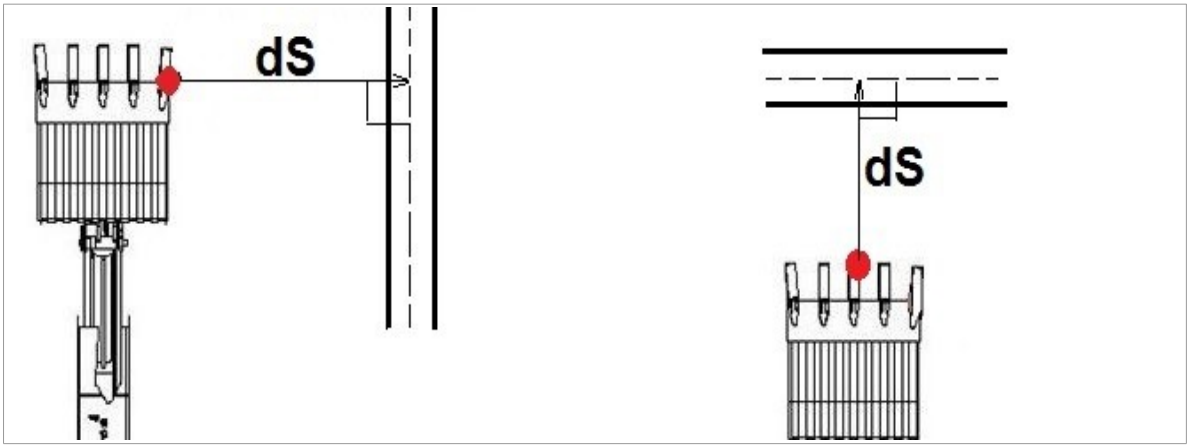


Fig. 58 Distance to the selected line.

**P**, Station number
Station number represents the distance which is measured from the start of a line model along the centre line. Distance can be defined to begin, for example, at 100 metres. When undefined, “P” displays the distance in metres from beginning of the line.

**Satellite count** (here are 7 active satellites. Marked with red circle in Fig. 56)
The background colour of the field indicates the state of the RTK correction. State have to be “FIX” (field is green) for most accurate work. More information about accuracy is in section “GNSS accuracy test”.

- Satellite panel tapping stores the point (as-built data) to the selected surface.

“As-built” points are always stored to current layer. For example, if you are working with DTM model and the model / layer name is "Final surface" then all points are store to “Final surface” layer. This can also be seen in the “as-built” data file when it is exported from the system.

## 4.4.3.4 DTM + Line

Combination of the “Terrain” and the “Line” information. Height deviation to the selected surface and height deviation and distance to the selected line is seen.

Select surface and line from “**Project**” → “**Read File**”.

Fig. 59. DTM+Line

**Information on the display:**

- **dZ** – Height deviation from the selected surface (red background warning “too deep cutting”)
- **dZl** – Height deviation from the selected line
- **dSl** - Distance from the measuring point to the selected line.
- **Satellites** – Count of satellites / “As-built” data store button
    - Allows to see measurement results (model and line) simultaneously. On road construction worksite the “As-built” data is collected and stored from breakline points. In that way a driver does not have to change between the line and DTM views. “As-built” data can also be stored by pressing the “satellite count number”.

“As-built” points are always stored to current layer. For example, if you are working with DTM model and the selected surface name is "Final surface" then all points are store to “Final surface” layer. This can also be seen in the “as-built” data file when it is exported from the system.

## 4.4.3.5 GPS

Shows the status of the positioning device. Information may vary with different receivers. Background colour has the same meaning as background colour of the “satellite count” field.

HDop value represents positioning quality (receiver calculates the estimate), the lower value is, the better is positioning status. The default HDop value is 1.5 (above 1.5 the background colour changes to yellow which indicates poor accuracy).

HDop value can be changed by technical support personnel/technician.

See section 6.4 Quality of positioning for details.

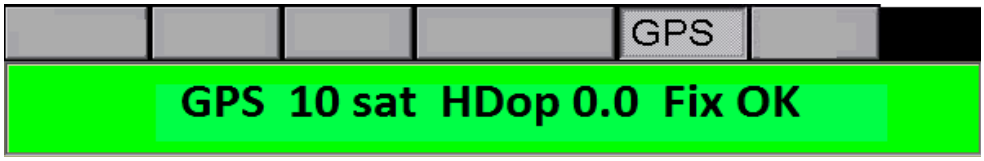


Fig. 60. GPS tab

## 4.4.3.6 Log

Tab is used for changing the code of the stored log point. Log tab is also used for saving log points.

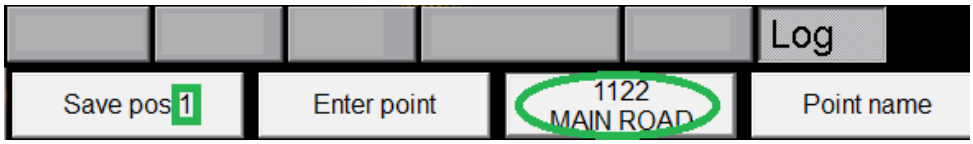



Fig. 61. Log tab

**Save pos**: (1...∞), green rectangle highlights the running number of a stored point.

- Button saves the position with a selected code. Code is shown in the ”Code” button (marked with green circle).
- If position can't be determined accurately the application shows the dialog ”*Bad accuracy, are you sure?*”

**Enter point** (Points can also be entered manually to the system.)

When pressing the ”Enter point” button coordinate input dialogue appears.

- **Coordinates**:
  - **X**, **Y** and **Z** can be entered manually
  - “Get from the receiver”
  - “Measuring point using **A**(L), **B**(S) and **dZ”** (operator enter the data)
- Finally press “Save point”.
- Press “Close” to exit dialog.
- Point is named (coded) by selected / entered code.

Coordinates can be entered manually or can be taken from the positioning device. Positioning device coordinates (positioning antenna) are read by pressing the ”Get from the Receiver”. Point is stored with current code by pressing ”Save point”.

**Enter Code / Name** (Fig 61 green circle)
Saved points can be categorized by using different codes. Codes to be used are usually determined by the surveyor (of the job site). The proper code can be entered by pressing the button.

- When button is pressed the “feature code list”-dialog opens and code can be entered, or code can be selected from list (codelist has to be imported).
  - Default Codelist can be taken in use: “**Settings**” → “**Installation settings**” → “**FCL**”: select proper codelist and press “Import”. Codelist can be included in the project by adding codelist file to project root.
- Last used code is shown in the button.

**Point name (description)**

- Button can be used for giving additional personal notes when storing points.
- This additional name is given just once with the next point.
- Information is used only for the operator

**Coordinates** (Fig. 62)
Values X, Y and Z on the bottom of screen are the coordinates of the point to be saved. The background colour of the field indicates the status of positioning system.

For detailed information see section 6.4 “Quality of positioning”  FIX, FLOAT and SPS states.

Fig. 62. Coordinates

Background colour in the “Coordinates” field (Fig 62) indicates measurement accuracy.

| Background colour / state | Description |
|---|---|
| **FIX** | Accuracy is approximately ±3 cm (X, Y and Z) |
| **Float** | One or more components of the RTK correction is insufficient. Accuracy is most of the time better than one meter. |
| **SPS** | The RTK correction cannot be used (standard GPS accuracy is few metres) |

**Codelist**
Codes are used to identify objects such as lightpoles, pipes and points (Fig 63). Numeric codes in the left column are translated to text form (at the right column).

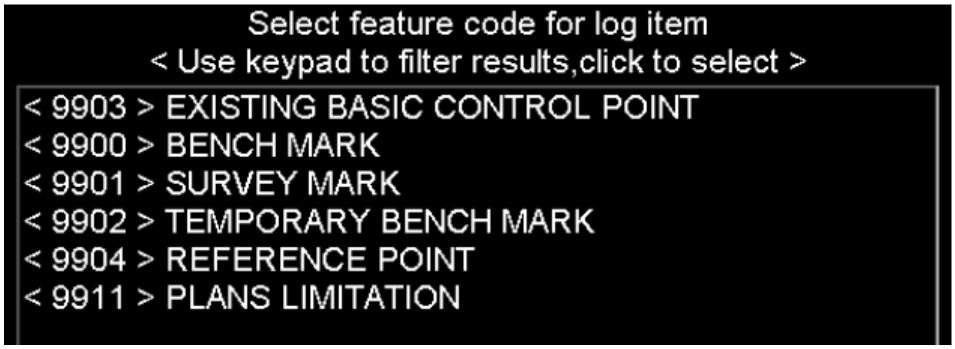


Fig. 63. Feature Codelist

Open the Codelist by selecting: “**Settings**” → “**Installation settings**” → “**FCL**”, and press close

**If needed code is not available in the list**:

- Code can be entered (inserted) manually
- It is also possible to import pre-defined codelists for measuring purposes.
  - Import codelist: Select “**Settings**” → “**Installation settings**” → “**FCL**” → “**Import**”

You can select proper code from the code list (Fig. 63). Dialog opens when pressing code button (Fig. 64 green circle).

If needed code is missing from the list, the code can be entered manually on the codelist dialog and its used next time when point is stored.

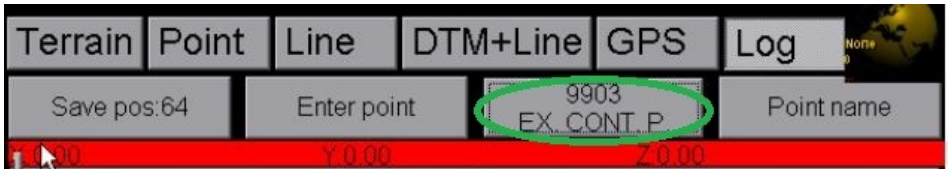


Fig. 64. Select proper code for object.

# 5 MENU

## 5.1 Menu structure

Main menu structure of the LandNova 3D application. Some features are limited to be used by support personnel.

**Project**

- Open Project Folder
  - Select project for the jobsite.
- Read File
  - Line, Centerline, Point, Surface and Slope can be selected.
- Import from FTP
  - Import Project from FTP server
- Import from USB
  - Import Project from USB memory stick
- Export Collected Points
  - Logged objects are exported to Project or to USB memory stick or by FTP upload
- Undo last log point
  - Last log point is deleted
- Project changelog
  - Project changelog can be used to synchronize projects either from the Xsite Office or from the Infrakit.
  - Project changelog shows all the changes that are made by the worksite staff (for example, Surveyors, site managers).
- About
  - Information about application, software licenses and currently loaded project
- Exit
  - Leave 3D application and return to the 2D “Vision” application.

## 5.2 Options menu

**Options**

- Terrain type
  - Select appearance of a terrain model / surface: *Hidden*, *Wireframe*, *Wireframe & fill 50% transparency*, *Wireframe & fill 80% transparency , Filled 50% transparency, Filled 80% transparency.*
- Point Size
  - Size of points in the display: *Small*, *Normal*, *Huge*
- Active point attributes
  - *Group, Position, Sequence number, Code, Description, Navigation arrow*
- Machine visibility
  - Appearance of machine: *Solid*, *Transparent 30%, Transparent 70%*, *Hidden*
- Machine parts
  - Select visibility of parts of the machine, *Bucket*, *Boom*, *Chassis*, *Bucket Axes*
- Profile / crosssection
  - Appearance: *Enabled*, *Cut inactive layers, Show zoom controls, Cut lines / pipes, Bucket angles, Model Z, Breaklines for active DTM*, *Bucket arrow indicators*
- Misc GUI items
  - *Model offset*, *Measuring point coordinates,*
  - *Positioning button ON / OFF (button is visible or hidden)* 
  - *Line guidance indicator*
- Logging
  - Require shift height: System asks “height shift” value when storing points
- Window Settings
  - *Restore defaults*: Default settings are restored
- Color Settings (change colour and visibility)
  - LandNova adjusts the layer colours automatically. If you are not satisfied with LandNova's preferences, it is possible to change colours. Select “**Options**” → “**Color settings**”
  - LandNova is using colours from files and layers if possible (For example DXF files include colour support but XML don't).
  - If colours can not be used from files/layers, then LandNova is adjusting colours automatically.
  - Menu can also be used for file/layer visibility, by using the light bulb icons on the left side.

Colour settings detailed:

| | |
|---|---|
|  | File/layer is used as an background map |
|  | File/layer is always visible, even when layer is not selected |
|  | File/layer is always invisible, even if layer is selected |
|  | File/Layer is only visible when layer is selected |

**Note!** It is recommended to have surfaces in *automatic* mode, Lines and Points always as visible. Background maps as visible when needed.

## 5.3 Settings

**Settings**

- Coordinate System
  - *Load coordinate transformation*, *Edit coordinate offsets*, *Load geoid model*
- GPS control
  - *Novatron GNSS, RTK corrections*
- Installation settings
  - Various settings: *Positioning, Machine Control, Measures, File import, Data log, Language, FCL, User Interface, LibConverter config*
- Show Antenna (For service personnel only)
- Show status
  - Status of GPS and COM ports, Geoid Model, global coordinate system
- Open ini file (For service personnel only)
- Flat bucket calibration
  - In general, a flat bucket is used for levelling a surface. After performing a flat bucket calibration the buckets bottom real angle can be seen on the display. Calibration also changes the graphical view to match the real position of the flat bucket.
  - **How to calibrate flat bucket:**
    - Select “Settings” → “Flat bucket calibration”.
    - Move the bucket to the horizontal plane.
    - When the bucket is aligned, press OK.
- Tool Settings (only graphical, not affecting to any measurements)
  - Select tool, for example, a different bucket
  - Enter or change dimensions of the bucket which is used.

### 5.3.1 User interface

Select:

**Settings** → "**Installation settings**" → "user **Interface**"

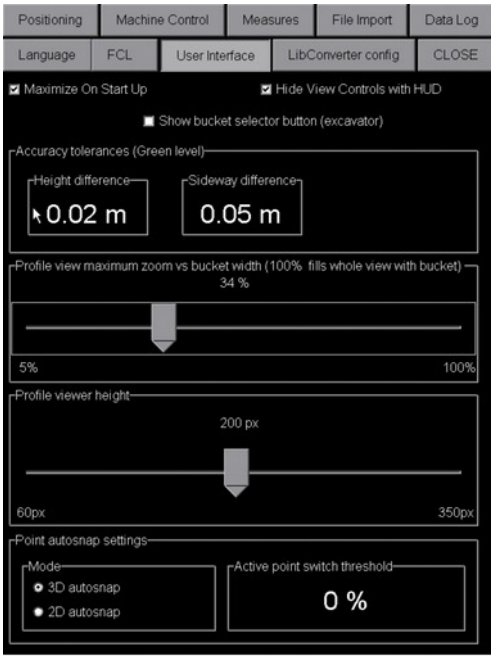


Fig. 65: User interface

Accuracy tolerances (Green level)

- Height difference: *Surface*, *Point* and *line* dZ and DTM+Line dSl "Green level" tolerance
- Sideway difference: DTM+Line dSl, Line dS and Point dS/dL "Green level" tolerances

Profile view maximum zoom vs. bucket width (selecting 100% → the bucket fills whole screen)

Profile viewer height → select suitable height for the profile view (60px...350px, 200px is the default)

Point autosnap settings: Mode

- 3D autosnap: Closest object in autosnap mode is calculated in XYZ
- 2D autosnap: Closest object in autosnap mode is calculated in XY
- Active point switch threshold: How many percent closer a new object needs to be before autosnap function is changing to nearest object (0% is the default)

**Installation settings → File import → Drawing distance**

Setting the **Drawing distance** (10 metres to 10 kilometres) affects how far from the measurement point the map is drawn. Smaller value gives better performance (map will be updated faster on the display).

## 5.4 Operations

**Operations**

- Create reference line (See section 5.4.1)
- Accuracy control: Optional feature, contact support for detailed information.
  - (Compare measurement point to the known reference point. Can be activated by a service personnel.)
- Drilling plan creator: (See section 5.4.2)

## 5.4.1 Create reference line

Select “**Operations**” → “**Create reference line**”

Reference line creation is used to form simple models of the terrain between two points. It is useful in situations where the actual terrain model is not available. It can be used, for example, foundations of buildings.

**Reference line creation:**

1. **Define two points** (there is three different ways to define these points)

- Press “List” and select points
- **Or** enter coordinates for the points(X, Y and Z)
- **Or** choose the points from the work site view selecting “Pick”
- Slope, distance and heading:
  - You can modify reference line slope, distance and heading by using buttons.
    Note! Point2 coordinates are modified automatically so that desired slope/distance/heading is achieved. Point1 coordinates are fixed.

2. Optional: **Name the surface** (If an automatic naming is improper)

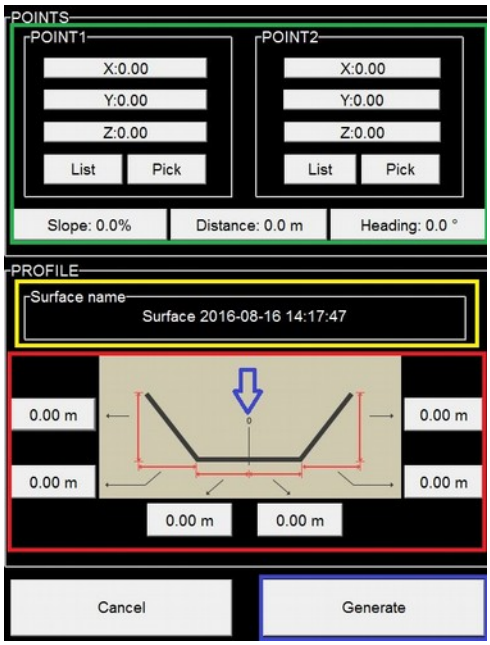
- Click the name and edit.
- Surfaces with the same name are combined to same surface automatically.

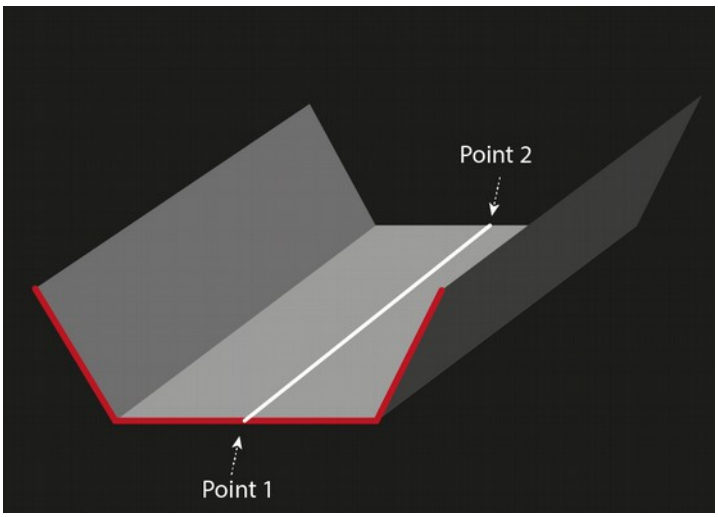
3. **Profile**

- Define values for a model cross section which are used during in the terrain model creation. You can leave some fields empty. Values are inserted in metres. (Blue arrow points to the center-line)

4. **Generate**

- The system creates a model to the active project folder.
- Note: The blue arrow in the picture shows the center-line, “0”. Point1 is closer to operator



## 5.4.2 Drilling plan creator

With creator you can define field by entering the number of rows and columns.

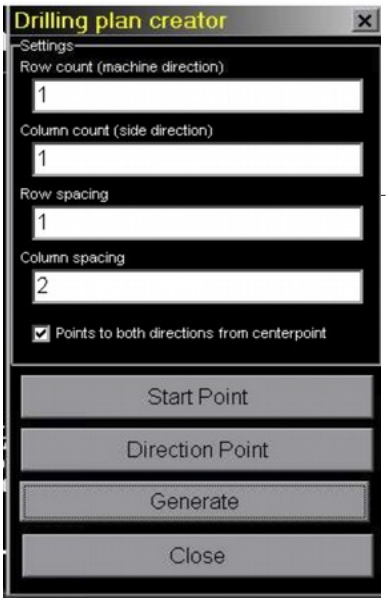


Fig. 66 Drilling plan creator

### How to create "Drilling plan"

1. Select "**Operations**" → "**Drilling plan creator**"
2. Enter:
   a) Row count
   b) Column count
   c) Row spacing (in metres)
   d) Column spacing (in metres)
3. Place bucket's measurement point to the starting point **(1)** of the field and press Start Point
4. Place bucket's measurement point to the direction point **(2)** of the field and press Direction Point
5. Press Generate to create field with rows and columns
   a) Note: Generating field takes few seconds

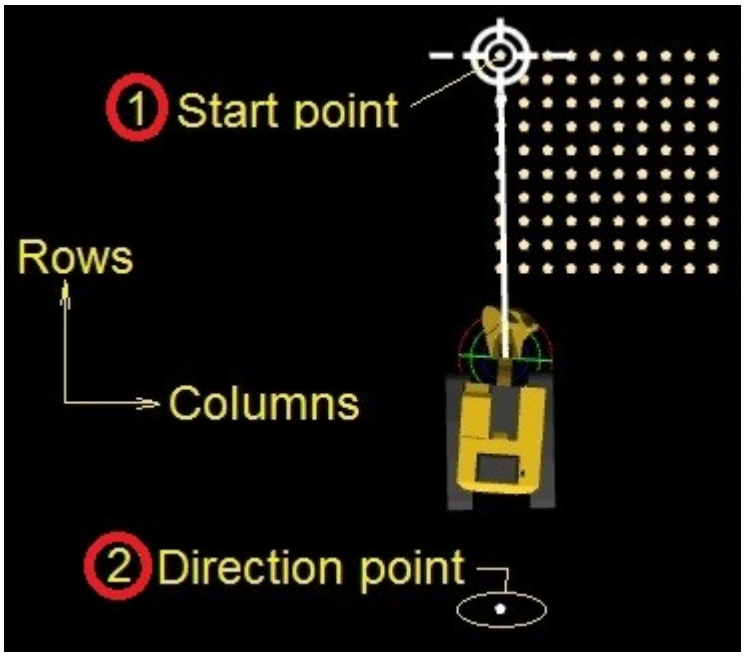


Fig. 67 Completed "Drilling Plan"

## 5.4.3 Importing project data to the system

With the LandNova, an operator can start work by opening the appropriate project. Import the project folder with all of its files and sub folders into the system.

**For experienced operator**:

Verify the project files by checking them at your desktop version of LandNova. Find the existing folder named “**road**” and create a sub folder there. Name of the sub folder should be descriptive (consider using the name or the stage of the project).


**Control keys for desktop Landnova:**

- **A**, **D**: Rotate machine on the map
- **W**, **S**: Drive machine on the map.
- **R, F**: Up / Down (Z axis, height)
- Keeping the “Shift” pressed with (W, S, A, D) the movement is faster (maximum speed)

Copy project files to the sub folder just created. Open the folder using the LandNova software: Select “**Project**” → “**Open Project Folder**”.

Verify that all files can be seen and are usable. If you are missing project files in the view, check the coordinate system of the file with your CAD system

**Files can be imported from**

- A network server (FTP)
- A memory stick (USB).

## 5.4.4 Importing the project from FTP

You can request FTP account from your local dealer or use your own FTP server.

Server settings are entered from “**Settings**” → “**Installation settings**” → “**Data log**”.

**Enter:**

- Server address
- Username
- Password
- Machine ID: Do not use the default ”MyExcavator”

**Importing from FTP:**

1. From the main view, choose “**Project**” → “**Import from FTP**”. This opens a new window.
2. Project folders on the server are displayed in the column. When a project is selected its contents are displayed.
3. When contents of the folder are visible select ”Import”.
4. The loading status is shown on the screen.
5. After a successful download the project is automatically taken in use.

## 5.4.5 Importing the project from USB memory stick

**Note!** Note that all the files need to be in a folder on USB memory stick. Folder name is going be the project name

When using a USB memory stick, the memory stick should be scanned for viruses / malware before being used in the system.

**Importing project from USB:**

1. Insert a memory stick to the USB port (on the display unit)
2. In the main menu, choose ”**Project**” → ”**Import from USB**”.
3. Choose the appropriate project (folder) from the list.
4. Press “Import”.
5. The project folder and files are copied to the system. Once copied, the project folder can be accessed in “Project” → “Open folder”.

USB ports in the display unit

## 5.5 Example projects

### 5.5.1 Digital terrain models

**Description**:

Digital terrain model (DTM) is a common convention to represent the height and location of the job site. DTM should be in Triangulated Irregular Network (TIN) format. Terms such as *triangulated model*, *terrain model* or *surface* are often used as synonyms for DTM. DTM is easy to read and don't require much interpretation of the target.

**Troubleshooting:**

Depending on the CAD software some errors may happen in the triangulation process of the DTM. These errors may show up as holes or flawed slopes in the model. Such defects have to be fixed in the CAD software before transferring DTM to the LandNova.

**Different formats:**

DTM/TIN can be imported to the LandNova in DXF or LandXML format. In DXF format it is crucial to export 3DFACE objects from CAD. In LandXML format DTM/TIN should be a surface object.

**How different layers are shown on the display:**

Multiple files in DXF or LandXML format can be imported to single project folder, which allows the so-called layer management. Each layer can be given a descriptive name and a distinct colour. The visibility of each layer can also be adjusted from the Main view “Options” → “Color settings”.

**Note!**

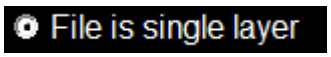
The naming of the surface model should be done so that it is easy to understand, because the operator sees models by name.
- **DXF**: name of the layer is shown
- **LandXML**: name of the surface(s) / element is shown

**Note!**

Compatibility mode which supports SPI 13.5 “*file name defines surface*” is available.

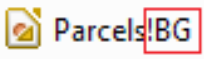
To enable “SPI 13.5 compatibility mode” tick “**Settings**” → “**Installation settings**” → “**LibConverter config**” → “**File is single layer**”

“File is single layer” mode forces file name to be used as a layer name regardless of the layer or surface original name.



## 5.5.1.1 Background maps in projects

When using projects with background map, you can add “**!BG**” to the file name. When !BG is added to file name, drawing limit is not effecting to it.




Background maps can be used with *DXF* and *LandXML* files. When “**!BG**” is added to the file name, all measuring functions are disabled and handling of the background map is much faster.

For example, rename file ”City_base_map.dxf” to ”City_base_map**!BG**.dxf”.

Example of a background map is shown in Fig. 68.

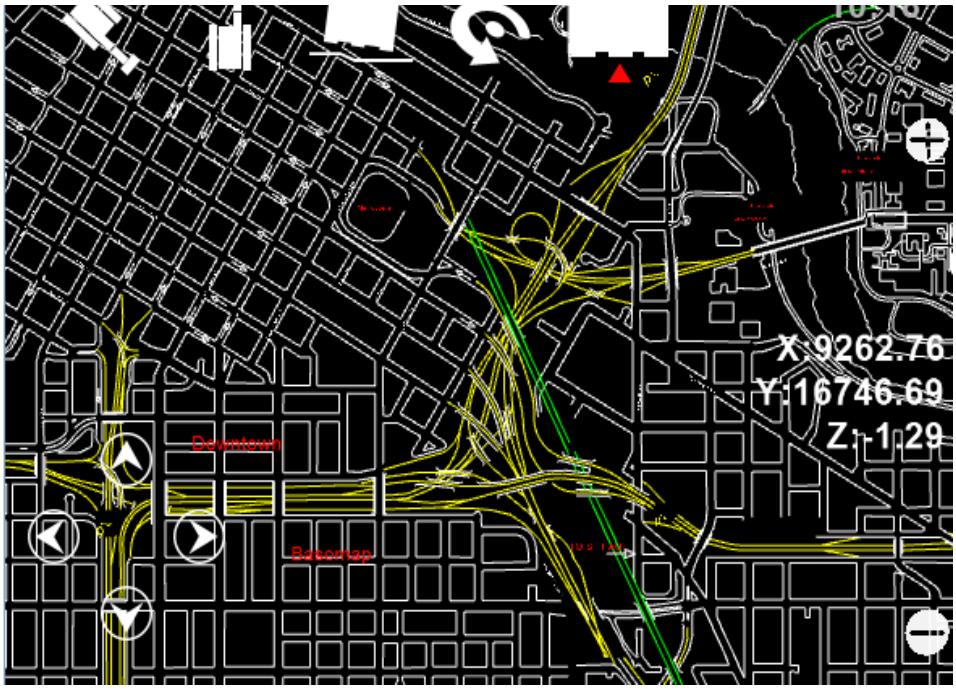



Fig. 68 Background map in project

## 5.5.1.2 Line model

The line model is an effective tool when tracking long continuous targets such as pipelines, road lines or trenches. When line model is used the system can display height difference, station number and side measurement against the line model.

With these features the model can be applied to describe variable targets, due height remains the same in the target, even when the position is changed.

Lines can be imported in DXF, LandXML, PXY, GT, and KOF formats

As an example, some practical methods for illustrating pipe grooves are:

- Preparing geometry lines for pipes
- Using different colours and descriptive naming to separate lines

Both functions above the measurement tab's are the same:

| | |
|---|---|
| **dZ** | Height difference between the bucket's measuring point and the selected line |
| **dS** | Sideways distance from the measuring point on the selected line |
| **P** | Station number, which in this case is calculated from beginning point of the line. Distance can be defined to begin, for example, at 500 metres. When undefined it displays the distance in metres from beginning of the line. (Fig 69) |

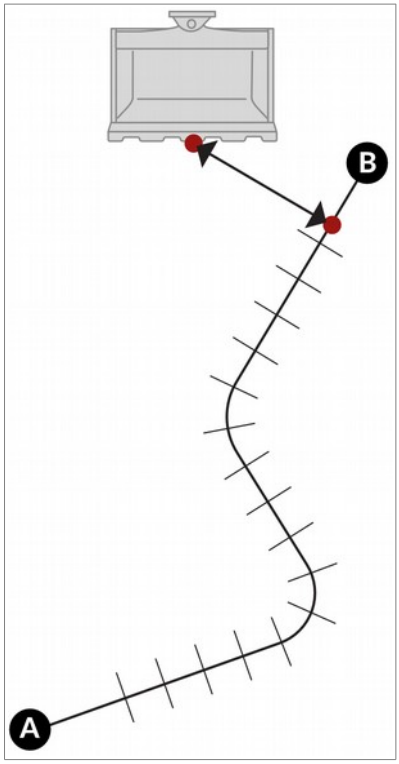



Fig. 69 Station number

A is the starting point of the line and the B is the point on the line that is nearest to the bucket measuring point. The station number is the distance between A and B along the line

## 5.5.1.3 2D / 3D object proximity alarm

When using the “proximity alarm”, the system gives warning when measurement point of the bucket is closer to object than pre-defined value. Object is a line or a point.

The proximity alarm can be used with

- LandXML
- DXF

Take proximity alarm to use by adding “**!W=X**” to a file name, “X” stands for a warning distance given in centimetres.

**Example of the proximity alarm of one meter (100 cm)**:

Rename file “Road_one.xml” to “Road_one**!W=100**.xml”.

The system gives warning with 2D or 3D objects just depending on the Z coordinate of the object.

If the Z coordinate is zero then the functionality is automatically in 2D mode.

With 3D objects the alarm can be used for avoiding damaging existing pipes or cables, for example.

Fig. 70 displays a 3D warning level when working near an existing heating network. Warning level is set to 100 (equals 100 centimetres).

NOTE! In reality, as small as one metre warning level should not be used due possible damage for cables or pipelines. Needed warning distance depends on numerous things (accuracy of the map, is cable still at place where it was placed, and so on)

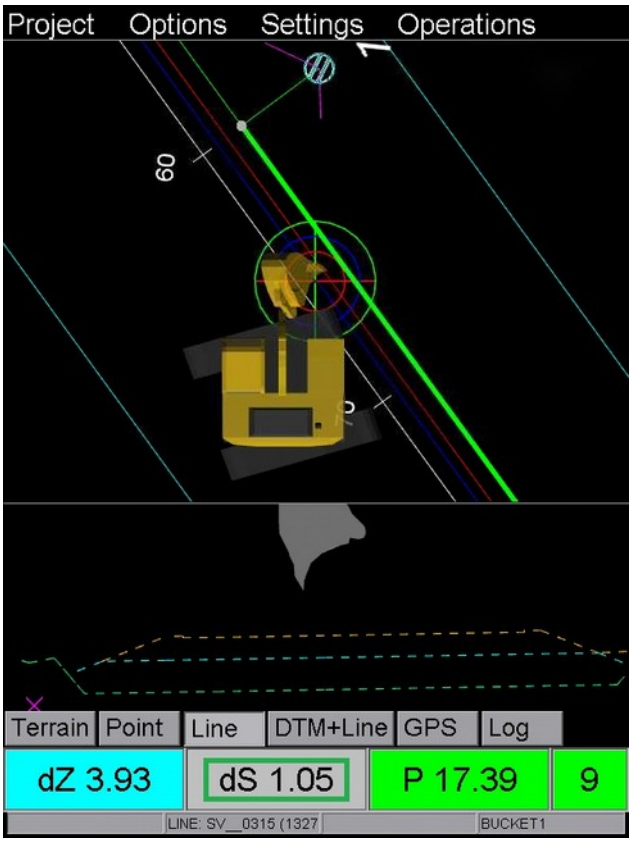



Fig. 71. Line measurement. dS > warning level

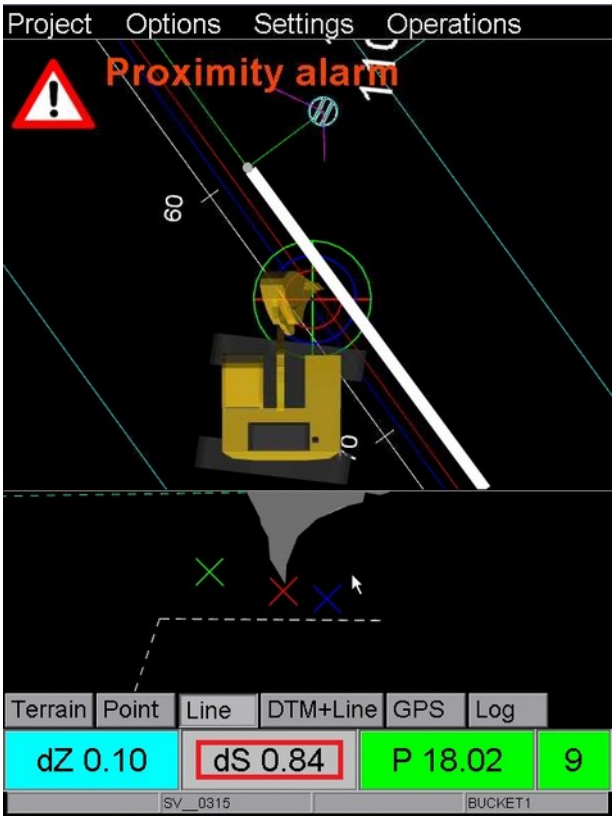



Fig. 70 3D warning level is activated and Proximity Alarm is given (dS is less than a warning level)

## 5.5.2 Additional files for digital terrain models and line models

More value can be added to projects with digital terrain models or line models by adding informational elements, such as text labels and background maps, into the project folder.

### 5.5.2.1 Point files

Point files are useful for representing the position of a simple object, for example, a well or a lamp post. Points can be imported as DXF, LandXML, PXY, GT, and KOF formats. When importing points, coding can be used to differentiate points from each other. For example, the number of the well can be attached to the code property.

A single point can be activated for point measurement. Point measurement mode is described in section 4.4.3.2 'Point'

**Note!** DXF points do not support the “point code” property.

# 6 ACCURACY TEST

The accuracy of the system should always be checked before starting work. Following procedures provide an easy way to ensure the accuracy of the system.

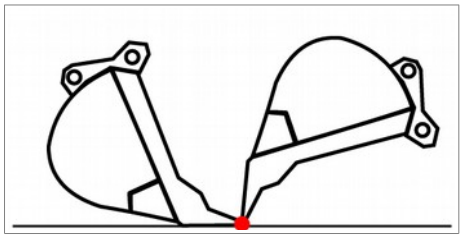
Close “LandNova” (Project → Exit) and continue with the “Vision” to perform tests.

**Note!** During the tests, all machine parts (bucket, stick, boom) should move to get most reliable measurement results.

## 6.1 Depth and distance accuracy test 1

**Accuracy test 1**

1. Place the bucket on a reference point and zero the measurement value.
2. Turn the bucket (without tilting it sideways) to a different position and place it on the same point.
3. The height and lengthwise distance readings should be close to zero in every position (an accuracy tolerance of ±1 cm is allowed).

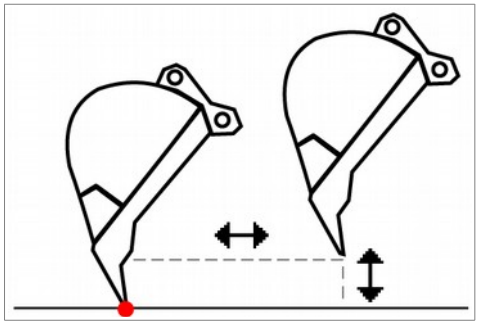


Bucket accuracy test 1

## 6.2 Depth and distance accuracy test 2

**Accuracy test 2**

1. Place the bucket on the ground and zero the measurement reading.
2. Move the bucket and use a tape measure to measure the height and lengthwise distance difference between the bucket measuring point and the starting point.
3. The system should indicate the same readings (an accuracy tolerance of ±1 cm is allowed).

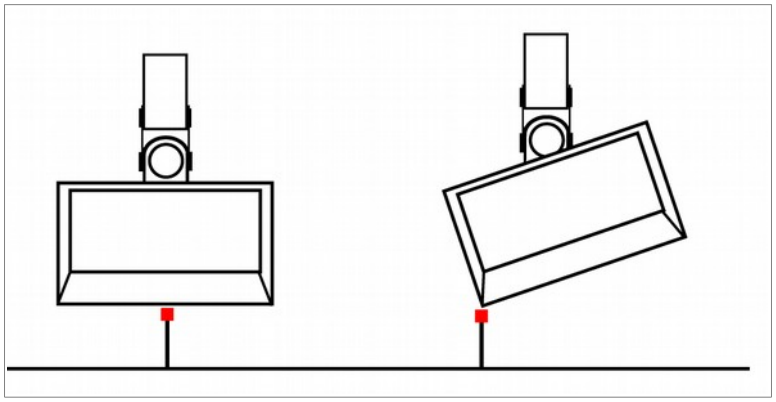


Bucket accuracy test 2

## 6.3 Tilting bucket accuracy test

**When using the tilt function, test the accuracy of the bucket edges.**

1. Straighten the tilt rotator (if the machine is equipped with one)
2. Switch the measuring point to “Center”
3. Set the bucket blade on a horizontal level and move the centre of the bucket to the reference point. Zero the measurement readings
4. Tilt the bucket and put the left corner on the reference point
5. Height and lengthwise distance readings should be as close to “0.00” as possible in every position
6. Repeat this accuracy test with the other corner of the bucket
7. If the accuracy is off by more than ±2 cm recalibrate the bucket. See section 3.10.2 “Tilt bucket calibration”.



Tilt bucket accuracy test

## 6.4 Quality of positioning

The system determines its position accurately by using RTK correction, which is based on a satellite navigation method. System applies positional corrections using a base station.

Table 4 lists things that have an influence on the quality and accuracy of the GNSS positioning. The RTK positioning state is described in table 5.

Table 4. Positioning quality (accuracy)

| Positioning quality depends on | Description |
|---|---|
| Number of satellites | More satellites lead to better accuracy. RTK initialization demands that at least 5 common satellites must be tracked at base and rover sites. Once initialization has been gained, a minimum of 4 continuously tracked satellites must be maintained to produce an RTK solution. |
| Satellite geometry (Fig 72) | Satellite geometry describes the position of the satellites from the view of the observer. Positioning is more accurate if satellites are widely and evenly spaced throughout the sky. |
| Baseline | Increasing the distance between the machine and the base station weakens positioning accuracy |
| Location of base station | Machine and base station must have access to the same satellites |
| Communication between machine and base station | Weak radio link or network may cause latency in data transmission |

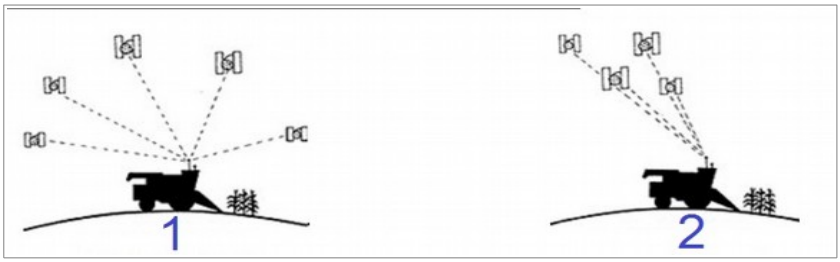



Fig. 72 Satellite geometry.

**Satellite geometry:**

1. Good geometry
2. Poor geometry (accuracy is not best possible)

Table 5. State of RTK correction

| RTK state | Description |
|---|---|
| **FIX** | RTK correction is used. Accuracy is best possible |
| **Float** | One or more components of the RTK correction is insufficient. Accuracy is most of the time better than one meter.<br>NOTE! Accuracy is insufficient to be used with LandNova. |
| **SPS** | The RTK correction is not available. Standard GPS accuracy is used instead<br>NOTE! Accuracy is insufficient to be used with LandNova. |

Operator should monitor that the RTK correction is in the FIX state. The background of the reading at the right bottom corner is green when the RTK receiver is in the FIX state (Fig. 73)  Background area is highlighted by white rectangle.

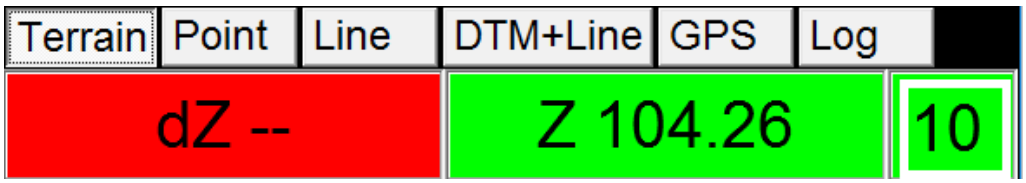



Fig. 73. FIX: The background of available satellites and sea-level indicators are green, also direction calculation is activated.

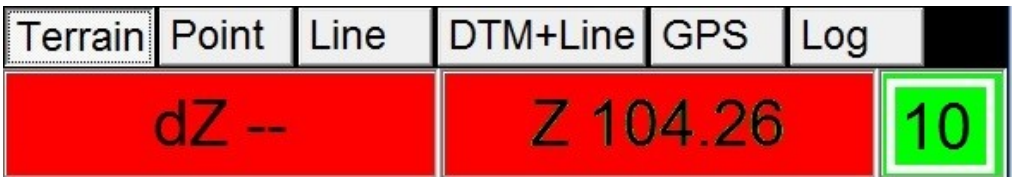



Fig. 74. Float or SPS: The background of sea-level indicator is red. Direction calculation is not activated.

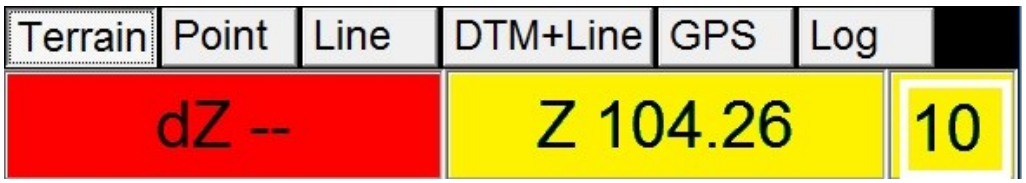


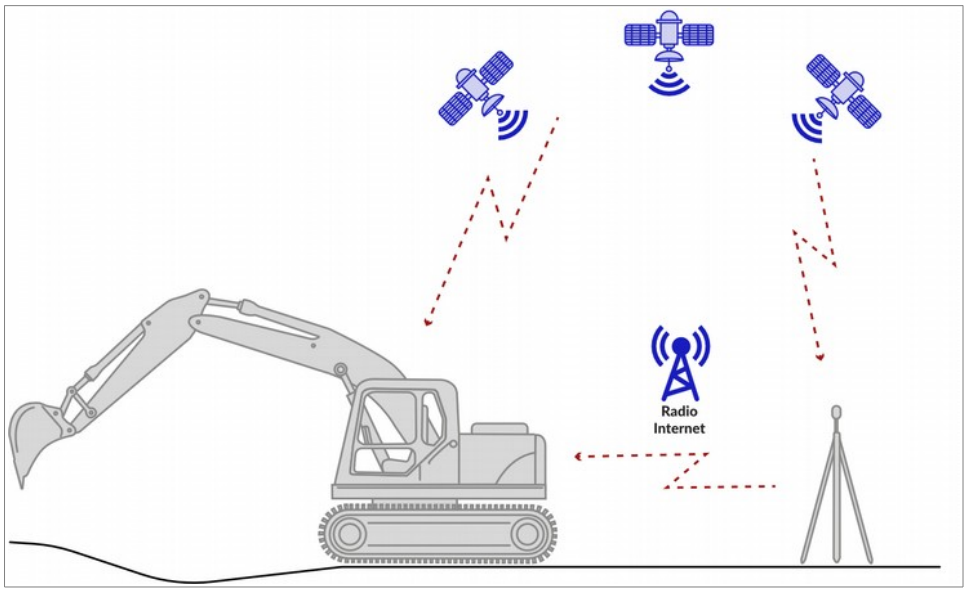

Fig. 75. FIX: The background of available satellites and sea-level indicators are yellow, accuracy is not acceptable (HDop value is outside a predefined value)

# 6.5 GNSS positioning, RTK correction and localisation

An explanation the basics of GNSS positioning, coordinate systems, and Geoid models and positioning quality.

**RTK correction**

3D machine control applications for excavators are typically based on Real Time Kinematic (RTK) GNSS technology. Centimetre-level positioning accuracy can be achieved by using a base station that provides a correction data to the machine. A correction signal is transferred to the machine by radio or wireless Internet connection




**UHF Radio**

The operating radius of a base station that is equipped with a UHF radio transmitter can be up to 5 km. The operating radius depends on transmission power, antenna type, antenna cables and a landscape (trees, buildings and hills can block correction data). Check for your local policy for radio equipment.

**The Internet**

When using the Internet for streaming the correction data, the operating radius of a base station can be extended up to 30 km. However, the longer the distance between the machine and the base station, the poorer the positioning accuracy. Increasing the distance by one kilometre weakens the positioning accuracy by approximately 1 mm vertically and 0.5 mm horizontally.

The reference station can be a single base station or a base station network (a base station network consists of several base stations). Connection to a base station network is established by wireless Internet. Depending on the type of network, the correction data can be received from a single base station, for example the one that is closest to the jobsite, or data from several base stations can be used to calculate a virtual reference station. The availability of base station networks varies by country and area.

## 6.6 Coordinate systems and transformations

GNSS systems use a WGS84 coordinate system for positioning. WGS84 is a geodetic coordinate system where a position is specified as latitude, longitude, and altitude. Latitude is expressed as an angle from the equator (Fig. 76). Longitude is expressed as an angle from the prime meridian (Greenwich meridian). Altitude is height compared to the WGS84 reference ellipsoid (Fig. 77). An ellipsoid can be seen as a simplified presentation of the surface of the Earth.

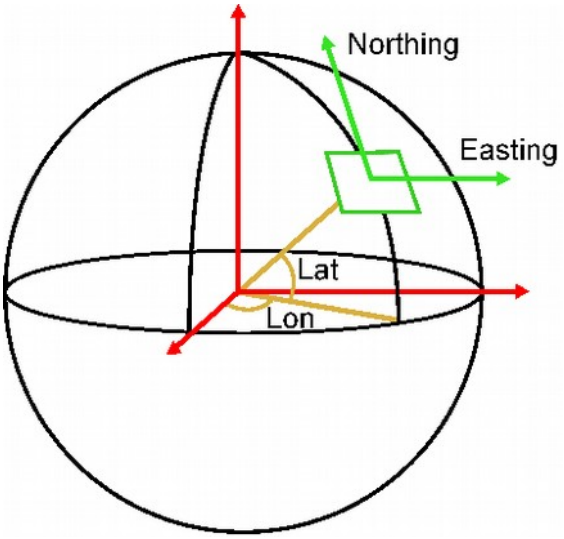


Fig. 76. Geodetic coordinates

Project files, for example Digital Terrain Models (DTM), use Cartesian coordinate systems. This means that a transformation from a geodetic system to a Cartesian system has to be carried out. When transforming geodetic coordinates to Cartesian coordinates, geodetic coordinates are projected from an ellipsoid onto a plane.

A Cartesian coordinate system specifies a position by using metric units instead of angles. The coordinates that specify a point on a plane are typically called northing and easting (Fig. 76), or X and Y. The Cartesian X, Y, and Z coordinates in the system are the result of coordinate transformation, offset parameters, and the Geoid Model that has been selected.

**Note!**

Using the correct coordinate system is very important when working with tasks (project files) that have absolute coordinates. When working with tasks without absolute coordinates (for example if only the height offset to a stake has been defined), any coordinate system that is suitable for the working area can be used.

There are two ways to carry out coordinate transformations.

1. Use national or regional coordinate systems.
2. Create a local coordinate system for each jobsite

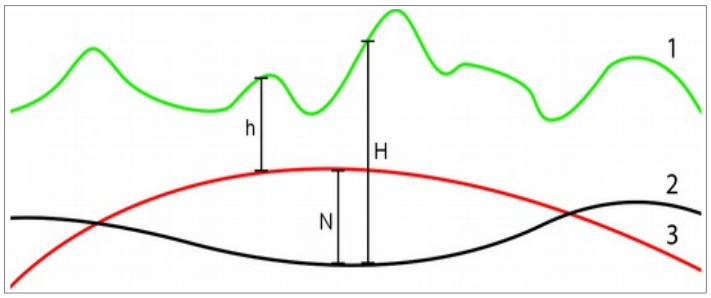


Fig. 77. Geoid Model

## 6.7 Geoid Model

The site to be used for the height of the system shall normally be based on the findings made with respect to the Earth's surface gravity. The gravitational field isn't everywhere the same, because the planet's density varies depending on the mountains, deep seas and other forms depending on the surface.

Differences in the height of the ellipsoidal system can be corrected by using the Geoid Model (Fig. 77). Geoid Model is a "net" which contains the needed correction data.

If the height difference between the Geoid and ellipsoid is significant, height of the ellipsoid needs to be corrected. If Geoid Model is not available, the height of the ellipsoid can be corrected by using a coordinate offset values.

## 6.8 GNSS accuracy test

When using the GNSS positioning, it is recommended to check its accuracy daily.

A known fixed checkpoint is required for the accuracy check. If there is no surveyor available to measure the fixed point, the measurement can be done by using the GNSS receiver of the machine.

**Note!**

If the checkpoint is measured with the GNSS receiver of the machine, only calibration of the machine can be verified. A checkpoint measured by a surveyor is needed for verification of the coordinate system.

**The way to check accuracy is to enter the known coordinates of the checkpoint into the system.**

1. Enter the known X, Y, and Z coordinates of the checkpoint into the system using "Log" tab
2. Select point tab
3. Choose the point that has been created
4. If there is single GNSS receiver, rotate the machine 360 degrees
5. Confirm that the system has an accurate RTK FIX status (when the background colour of the status bar is green )
6. Place the bucket on the checkpoint
7. Confirm that the correct bucket measuring point is selected
8. The "Height deviation", "Sideways distance", and "Lengthwise distance" values on the point tab should be close to zero. Typically the deviation should be no more than 2 cm vertically and 3 cm horizontally (however, the accuracy required depends on the type of work and type of machine)
9. If the accuracy is not satisfactory, check the calibration of the bucket and the machine. Also see section 6.4 "Quality of positioning".

# 7 NETWORK OPERATION

**Note!** SIM card is needed when network services are used.

Xsite PRO system has a built-in modem, which enables the use of network features when a SIM card is installed in to the MCC15 computer unit. See installation of SIM card from section 2.3 “Getting started”

Some of the features can be used through the quick menu of the system. The menu can be accessed by pushing both brightness buttons on the display unit simultaneously. “Headset” Icon will appear on the screen and double tapping it will open PCBg menu. “Request help” and “Web links” buttons are discussed in following section “Remote support“ (Fig. 78).

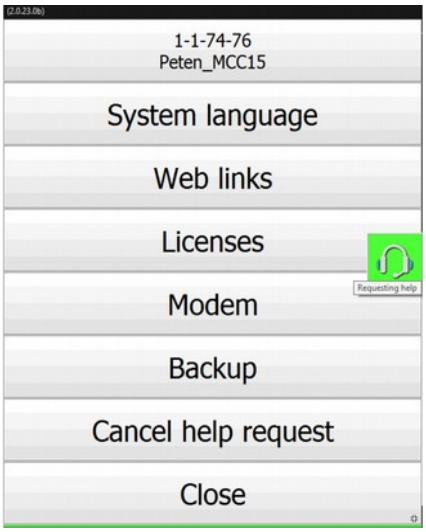


Fig. 78. PCBg

## 7.1 Remote support

If you need guidance the remote support connection allow technical support to give assistance. Remember to call your local support. Press both brightness buttons from the display unit simultaneously then remote connection opens and “Headset” icon appear on the screen. Double clicking the “Headset” icon and selecting “Cancel help request” will close the connection.

Closing the menu does not disconnect the remote connection.

If remote support has been allowed then a support person can offer help without a request. When support is offered the window “Remote assistance available” appears. By clicking “Yes”, the remote connection is opened.

| Button label | Status of the connection | icon | When button is pressed |
|---|---|---|---|
| Request help | Connection is closed. |  | Help is requested and finally connection is opened. |
| Requesting help... | Connection is being prepared and should be available in a few seconds. |  | No action. |
| Cancel help request | Support person is currently using the remote connection. |  | Connection is closed. |

| Icon | Description |
|---|---|
|  | Support person is online. |
|  | Connection is available for support. |
|  | Connection is prepared. If icon stays red then connection cannot be established. |

# 8 TECHNICAL SPECIFICATIONS

| MCC15 computer unit | |
|---|---|
| Processor | AMD GX-411GA / 1.1 GHz Quad core |
| RAM | 2 GB |
| Operating system | Windows Embedded Standard |
| Wireless communication | GSM / GPRS / EDGE / WCDMA / UMTS / HSPA / HSUPA / LTE |
| Data transfer rates | Download 100 Mbps (max), upload 50 Mbps (max) |
| Input voltage | 10 to 36 VDC |
| Power consumption | 10 W |
| IP classification | IP20 |
| Operating temperature | -20 to +50 °C |
| Dimensions | 250 x 160 x 90 mm |
| Weight | 2.5 kg |
| Connections | CAN, CAN (XD2 LED display), Display (Xsite Pro), 3x USB 2.0, 5x RS232, 2x GSM antenna, SIM, CFast, DisplayPort, Ethernet, PWR |

| Xsite Pro display | |
|---|---|
| Display type | Transflective TFT LCD |
| Touch screen type | Capacitive |
| Size | 8.4” |
| Resolution | 600 x 800 pixels (SVGA) |
| Luminance | 800 cd/m2 |
| Contrast | 900:1 |
| Power consumption | 5 W |
| IP classification | IP33 |
| Operating temperature | -20 to +60 °C |
| Dimensions | 263 x 237 x 65 mm without RAM mount |
| Weight | 1.7 kg |

| G2 Sensor | |
|---|---|
| Measuring axis | X, Y, Z (three-axis) |
| Power consumption | 2.5 W when the heating is on. 1 W without heating |
| IP classification | IP67 |
| Operating temperature | -40 to +85 °C |
| Dimensions | 98 x 41 x 33 mm |
| I/O | CAN |

| EL2 laser receiver | |
|---|---|
| Receiving angle | 150° |
| Receiving area | 150 mm |
| Resolution | 1 mm (precision is 5 mm) |
| Operating voltage | 10 to 36 VDC |
| Power consumption | 2.5 W |
| IP classification | IP67 |
| Operating temperature | -20 to +60 °C |
| Dimensions | 315 x 96 x 55 mm |
| Weight | 0.7 kg |
| I/O | CAN, RS-232 |
| Compatible lasers | All rotating lasers with visible or infra-red light: wavelength 600-800nm, rotating speed 120-1200 revolutions per minute. |

| XD2 LED display | |
|---|---|
| LED type | RGB |
| Number of LEDs | 50 pcs |
| Operating voltage | 10 to 36 VDC |
| Power consumption | ~ 2 W typically |
| IP classification | IP43 |
| Operating temperature | -20 to +50 °C |
| Dimensions | 120 x 60 x 25 mm without RAM mount |
| Weight | 130 g |
| I/O | 2 x CAN |

NOVATRON
MACHINE CONTROL SYSTEMS



# EC Declaration of Conformity

We, the undersigned,

| | |
|---|---|
| Manufacturer: | Novatron Oy |
| Address: | Myllyhaantie 6 E, 33960 Pirkkala, Finland |
| Phone number: | +358-3-357 2600 |

certify and declare under our sole responsibility that the following equipment,

| | |
|---|---|
| Name: | **Xsite PRO** |
| Components: | 150016 MCC15 computer w/o cellular module<br>850001 Xsite PRO display<br>130192 G1 sensor<br>100008 EL2 laser receiver<br>100065 XD2 LED display |

is in conformity with the EMC directive 2004/108/EC. The following standards have been applied.

| | |
|---|---|
| Safety | EN 60950-1:2005+A1:2009+A1:2010+A12:2011 |
| EMC | EN 13309:2010, ISO 7637-2:2004 |

| | |
|---|---|
| Place of issue: | Pirkkala, Finland |
| Date of issue: | 8 April 2015 |

Jukka Tervahauta
Managing Director
Novatron Oy

NOVATRON
MACHINE CONTROL SYSTEMS



# EC Declaration of Conformity

We, the undersigned,

Manufacturer: Novatron Oy
Address: Jasperintie 312, 33960 Pirkkala, Finland
Phone number: +358-3-357 2600

certify and declare under our sole responsibility that the following equipment,

Name: **Xsite PRO**
Components: 150015 MCC15
850001 Xsite PRO display
130193 G2 sensor
100008 EL2 laser receiver
100065 XD2 LED display

are in conformity with the requirements of R&TTE directive 1999/5/EC. The following standards have been applied.

EMC EN 13309:2010, ISO 7637-2:2004

MCC15 contains an RF module by Sierra Wireless (MC7304 modem). Declaration of Conformity for the RF module is available for viewing at the following location in the EU community: Sierra Wireless (UK) Limited, Lakeside House, 1 Furzeground Way, Stockley Park East, Uxbridge, Middlesex, UB11 1BD, England.

Place of issue: Pirkkala, Finland
Date of issue: 16 January 2018

Jukka Tervahauta
Managing Director
Novatron Oy

NOVATRON
MACHINE CONTROL SYSTEMS



# FCC Declaration of Conformity

We, the undersigned,

| | |
|---|---|
| Manufacturer: | Novatron Oy |
| Address: | Myllyhaantie 6 E, 33960 Pirkkala, Finland |
| Phone number: | +358-3-357 2600 |

certify and declare under our sole responsibility that the fcllowing equipment,

| | |
|---|---|
| Trade name: | **Xsite PRO** |
| Model numbers: | 150016 MCC15 computer w/o cellular module |
| | 850001 Xsite PRO display |
| | 130192 G1 sensor |
| | 100008 EL2 laser receiver |
| | 100065 XD2 LED display |

complies with part 15 of the FCC rules.

Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

| | |
|---|---|
| Place of issue: | Pirkkala, Finland |
| Date of issue: | 31 August 2016 |

Jukka Tervahauta
Managing Director
Novatron Oy

Novatron Oy | Myllyhaantie 6E, 33960 Pirkkala, Finland | +358 (0)3 357 2600 | sales@novatron.fi | www.novatron.eu

# FCC Declaration of Conformity

We, the undersigned,

| | |
|---|---|
| Manufacturer: | Novatron Oy |
| Address: | Myllyhaantie 6 E, 33960 Pirkkala, Finland |
| Phone number: | +358-3-357 2600 |

certify and declare under our sole responsibility that the following equipment,

| | |
|---|---|
| Trade name: | **Xsite PRO** |
| Model numbers: | 04-80-00125 MCC15 |
| | 850001 Xsite PRO display |
| | 130192 G1 sensor |
| | 100008 EL2 laser receiver |
| | 100065 XD2 LED display |

complies with part 15 of the FCC rules.

Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

| | |
|---|---|
| Place of issue: | Pirkkala, Finland |
| Date of issue: | 7 September 2016 |

Jukka Tervahauta
Managing Director
Novatron Oy

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